



# NEWS

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



University of Victoria

February 2007

NEWSLETTER

Volume 4, Number 1

CONTENTS:		New Science Initiatives	4
Message from Project Director	1	New Science Initiatives Shifting into High Gear	5
Engineering Report	2	DMAS Team Architecture Progress	6
DMAS Update	3	ORION News	7
New Associate Director Science	3	VENUS News/Oceans Forum Feb 21—22, 2007	8

## Message from Project Director

by Chris Barnes, Project Director



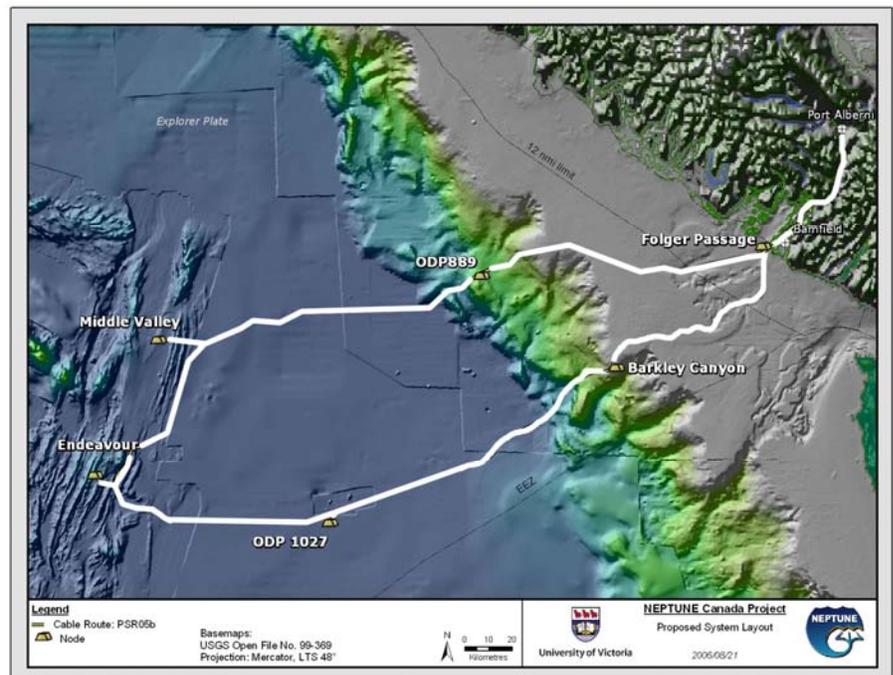
The additional \$20M of funding announced in the fall of 2006 has allowed the NEPTUNE Canada array to expand from a two- to a five-instrumented node system. \$4M of the \$20M was in-kind support—if it can be secured as cash, a sixth node will be installed at Middle Valley. Most of this new funding will go to provide new nodes, junction boxes, secondary cables, and instruments; no new backbone cable is required. This substantially increases the number and diversity of experiments, sensors and participating scientists, along with facilitating some experiments that will embrace the full regional extent of the 800km cabled array on the northern part of the Juan de Fuca tectonic plate. More details of this substantially increased scope and scientific impact are presented in the Engineering and Science reports.

The expanded network has required NEPTUNE Canada and Alcatel Submarine Networks (the principal contractor) to re-evaluate the design, manufacturing and installation schedule. The cable may be installed in fall 2007 with the nodes and instruments deployed in mid-2008. This should not affect the anticipated transition into full-time operations, which remains as fall 2008. UVic's Board of Governors approved these contractual changes at their recent January meeting.

We have adjusted the senior management staff, partly to accommodate the departure of Kim Juniper as Co-Chief Scientist to a research chair appointment at UVic, and partly to respond to the expanded science program. Mairi Best was appointed the new Associate Director, Science (profiled on page 3) at the end of January, with Brian Bornhold continuing as half-time Project Scientist. Together, they are working on a new set of Science Agreements to complete the development and acquisition of the new set of instruments.

Arrangements are being concluded, following a recent RFP, to add the services of a local consortium of specialist companies to assist with marine equipment testing and qualifications of most of the instruments. New space has been acquired for NEPTUNE Canada at UVic's Marine Technology Centre to conduct most of these activities and a new marine engineering testing facility is being developed at the VENUS Saanich Inlet node nearby.

UVic is establishing a wholly owned, not-for-profit company to manage the NEPTUNE Canada and VENUS cabled ocean observatories, effective July 2007. The founding President and CEO will be Dr. Martin Taylor, who will move from his present position as UVic's Vice President Research. Martin has been intimately involved with both projects since their inception.



Discussions at several levels with federal agencies have been accelerated in recent months to seek the necessary operating funds that will be required by early 2009. A National Science Facilities meeting was held in Saskatoon in January to work towards a new organizational framework that can evaluate new Major Science Initiatives and consider requests for operating funds for established national facilities.

# Engineering Report

by Peter Phibbs, Associate Director, Engineering & Operations



The additional money announced in September 2006 has allowed us to take up some of the options included in the Alcatel supply contract – node modules at the two ODP sites that previously only had bases for nodes, a full node at the near shore Folger Passage site and a branching unit and node base for future expansion at Middle Valley. Access to these additional and varied sites has greatly increased the range of science that can be undertaken using the network, and adds to everyone's excitement at being involved in the construction of this observatory.

The technology used for NEPTUNE Canada is a pure optical backbone ring, with optical amplifiers in line, and branches off to nodes where the signals are converted from optical to electrical. This technology has proved very versatile when it comes to scope changes such as this one, since additional branches to nodes can be placed anywhere on the optical ring without worrying about the distance between signal regenerators (although Alcatel's optical line designers in Villarceaux might suggest that it is not THAT easy...).

Alcatel completed the optical line demonstration and the Internet protocol equipment demonstration for NEPTUNE Canada on their optical line test bed in Villarceaux in December 2006. These demonstrations were successful – and exceeded our expectations in some areas. The system has proven to be robust, and easier to maintain than had been anticipated.

The power converter that changes 10,000 volts direct current into 400 volts direct current in the node continues to be a challenge. A demonstration of the entire power system including cable and branching units is scheduled for March 2007 at Alcatel's Greenwich facility, and all indications are that the last remaining problems will be ironed out by then. We are pleased to have delegated responsibility for the system to Alcatel, since they have the resources and experience necessary to overcome these very significant challenges.

Moving out from the node, following an RFP process we are now starting to negotiate a contract with L3 MariPro for supply of junction boxes. These devices will allow multiple instruments to plug into a single node port, and will have significant monitoring, power and data transmission capabilities. As it turns out, now that scientists have been able to study the areas around the nodes and consider their experiments in detail, nearly all instruments will connect to nodes through junction boxes rather than directly to node ports. This increased reliance on junction boxes reinforces the need for them to be dependable and to have a long life in order to maximise instrument availability and keep down maintenance costs.

In addition to junction boxes, scientists have identified a need for a low cost, low power, low data rate "dumb" device to multiplex several adjacent instruments together. NEPTUNE Canada and its consultants are currently working with researchers from Institute of Ocean Scientists in Sidney, BC to evaluate the feasibility of such a device.

The NGK Ocean division of Nichiyu Giken Kogyo Co., Ltd. of Tokyo, Japan was selected as the preferred proponent for supply of a vertical profiler for the Barkley Canyon site following an RFP process. Contract negotiations will start shortly.

Spring 2007 will continue to be busy, as we finalize arrangements with the contractors supplying the junction boxes and vertical profiler, continue to manage the Alcatel contract, and start preparing the Port Alberni shore station for the Alcatel equipment installation.



*Above, ROV serviceable science node being lowered into trawl resistant frame*

*Left, Alcatel crew have floated the cable from the cable ship to the beach manhole, and*

# DMAS Update

by Benoît Pirenne,



Since the last edition of this Newsletter, the DMAS group has continued to expand, slowly reaching its plateau. Consequently, work on our system has progressed fairly well: the CANARIE project was completed and its outcome will now be turned into a production-quality system for gradual integration into the operational DMAS over the next few months. To find out more about this project, please read Eric Guillemot's article on the DMAS Team Architecture Development.

DMAS continues to support VENUS: last November's cruise was supported and preparation has been on-going for the present one, which will see two new instruments deployed in the Saanich Inlet. New functionality to access imaging, acoustic and video data or navigate the observatory components will soon be released on the web site. Keep watching <http://dmas.uvic.ca/> for those features.

As a technology demonstration, DMAS has also invested in MBARI's Automated Visual Event Detection (AVED) software, which will be used to automatically detect features in underwater video material, perform a classification, and return results for inclusion as new metadata in our database. While AVED will be linked to DMAS through web services, it is anticipated that it will be run on GRID nodes outside of the NEPTUNE Canada's direct IT infrastructure. A first implementation/adaptation of AVED should be installed within the next few months.

A significant event in November 2006 was the "DMAS Vision" workshop that gathered a number of scientists as well as NEPTUNE and VENUS staff at the Institute of Ocean Sciences, in Sidney, BC. The purpose of the workshop was to collect vision statements from scientists as to how they see the observatory infrastructure being used over the next few years. Of immediate relevance is of course the question of the role of the software system connecting the infrastructure and the user and how it should be crafted to enable that vision. The workshop started with presentations from the DMAS staff, they highlighted the expected capabilities of the system. These initial presentations were designed to generate thoughts, ideas or criticism from the audience.

Among the highlights of the meeting, it is worth mentioning the need to keep up the transformative nature of the observatories, to foster data exchange and a collaborative spirit between scientists, by publicizing who is working on what data and also to reach out to -and be compatible with- other related experiments taking place elsewhere. More practical examples of suggested software features include the ability to subscribe to data streams of selected sensors, the detection of user-specified "events", the precise time-tagging of measurements, the ability to interact directly with instruments, to program instruments to react to scheduled or unscheduled activities, the ability to accurately report issues with instruments, to provide pre-processed data (e.g., hourly or daily averages), to provide a geographical interface (GIS) access to the data and to support links to other databases. A second meeting is planned at a later stage as the user base grows, use case scenarios are developed and tested, and the experience with data and DMAS tools evolves.

## Mairi Best, NEW Associate Director Science



Mairi is a marine scientist with interests in the biological, physical, and chemical factors that control the preservation (taphonomy) of calcium carbonate skeletons (e.g. shells): these are our main source of paleo-biological information and the primary way carbon is transferred from the atmosphere-ocean to the earth's crust in the carbon cycle.

After completing her B.Sc. in Geology from Laurentian University, including a scuba-based undergraduate thesis on reefal sediments in St. Lucia, Mairi then worked on the taphonomy of fossil and modern reefs in Papua New Guinea through the Australian Institute of Marine Science. From there she did a PhD at the University of Chicago and the Smithsonian Tropical Research Institute on the cycling of biogenic carbonate in the tropics. After a short post-doc at the University of Toronto in geomicrobiology, she became an Assistant Professor at McGill University, where she continued to expand her NSERC-funded research program into collaborative projects across latitudes and disciplines, including experiments deployed in Saanich Inlet through VENUS.

Mairi currently manages 13 national and 13 international collaborations across 14 multidisciplinary projects (taphonomy, sedimentary geology, (paleo) biology, geochemistry, geomicrobiology, geography, and benthic ecology). Appointed as Associate Director, Science with NEPTUNE Canada in January, Mairi will guide the development and integration of the many community scientific experiments within the expanded science program of NEPTUNE Canada.

# New Science Initiatives

by Brian Bornhold, Project Scientist



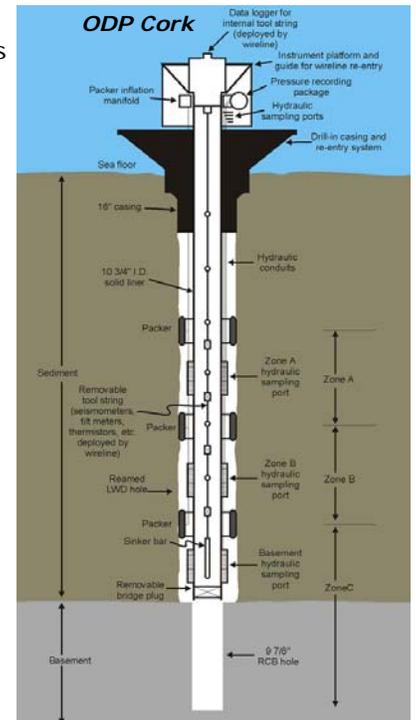
On November 13, 14, and 15, 2006 scientific workshops were held in Victoria and Sidney, British Columbia to develop the research initiatives for three new sites on the NEPTUNE Stage I observatory. The scientific proposals were ones that had been highly ranked by the technical review committee in 2005 but there was insufficient funding at that time for those nodes. With the new resources we are now able to install nodes and associated infrastructure to support science at sites that are designated ODP 1027, ODP 889 and Folger Passage. As well, it has enabled us to expand other programs, such as the seismic and tsunami arrays, to the scope that was originally envisaged so that they cover more of the northern Juan de Fuca Plate.

At **Site ODP1027**, on the abyssal plain in 2660 m water depth, the principal focus is on connecting existing Ocean Drilling Program borehole monitoring systems to the observatory. Circulation obviation retrofit kits (CORKs) were instrumented at two holes in 1996 and an additional two holes in 2002; the holes extend tens to hundreds of metres into the igneous seafloor through a sediment cover of a few hundred metres. The objectives of this program are to monitor changes in crustal temperature and pressure particularly as they relate to events such as earthquakes, hydrothermal convection or regional plate strain. It is planned to connect two CORKs to NEPTUNE Stage I.

In addition, a triangular array of very sensitive bottom pressure recorders (BPRs) will be deployed in the area of ODP 1027 as part of the tsunami array that will include BPRs at most of the science locations. This array will extend 10 km on each side and will allow determination of open ocean tsunami amplitudes, propagation direction and speed. The NEPTUNE tsunami array will complement other information from buoy sensors and coastal tide gauges around the North Pacific, and contribute to our knowledge about how tsunamis (and similar large waves) behave, as well as providing real-time monitoring of the phenomena.

Nearby, at Baby Bare, a small outcrop of igneous seafloor, we plan to install a broadband seismometer with associated hydrophone and single-point current meter. Close by, a benthic ecology program, consisting of high-resolution still cameras, rotary sidescan sonars, an acoustic doppler current profiler (ADCP) and a CTD will be installed. Baby Bare is a site of slow fluid venting from the seafloor and, as such, may prove to be biologically of great interest located within this expanse of broad flat abyssal plain sediments.

**Site ODP 889** is located on the continental slope in about 1250 m water depth in a well-studied area characterized by shallowly buried gas hydrates. Initially most instruments will be deployed in the Bull's Eye area and will consist of several suites of geophysical instruments, including a controlled source electromagnetic (CSEM) system and receiver, a seafloor compliance system (gravimeter) and a geophone array. The objectives of this investigation are to monitor changes in the hydrate distribution, depth, structure and properties, particularly in relation to earthquakes and regional plate motions. A broadband seismometer, and associated hydrophone and single-point current sensor will be also located nearby. At present the remaining ODP boreholes in the area are not equipped with CORKs; it is hoped that in the future, with the additional drilling that is planned for the area, CORKs connected to the network can be installed to complement these other studies of gas hydrates and fluid fluxes on the continental margin.



*Right, Broadband Seismometer*

The **Folger Passage** site is located near the entrance to Barkley Sound, not far from the Bamfield Marine Science Centre. The site will consist of two installations, one in about 95 m water depth and another near the summit of a rocky pinnacle in about 15 m depth. The overall objectives of the scientific initiatives at this near shore location are to: identify the factors that control biological productivity, both within the water column and at the seafloor; evaluate the effects that marine processes have on fish and marine mammals; and to provide learning opportunities for students, researchers and the public.

The deep-water instrument package will consist of an ADCP, a multi-frequency bioacoustic sensor, an oxygen sensor, and a temperature/salinity sensor. A hydrophone will be installed at this location to detect and characterize marine mammals in the region. The pinnacle instruments will include an array of cameras, upward- and downward-looking high-frequency ADCPs and a light sensor. The Folger Passage site will be complementary to the water column site on the continental slope in about 400 m water depth where a vertical profiler will collect a variety of water property and biological data. Close proximity to the Bamfield Marine Science Centre will allow regional oceanographic information to be collected on a regular basis near the Folger Passage instrument arrays.



*Above, Benthic Community at Folger Passage*



*Left, Wolf Eel at Hornby Rocks, Folger Passage*

## New Science Initiatives—Shifting into High Gear

by Mairi Best, Associate Director, Science



With the excellent news of additional funds, and the dynamic science workshops of November 2006, we are now shifting into high gear in order to complete agreements and instrument acquisition, development, adaptation, and testing within 2007. In order to guide this process, I have come on board as a full time Associate Director, Science, while Brian Bornhold will continue half-time as Project Scientist. Kim Juniper will continue to contribute to outreach, as well as scramble with the rest of the NEPTUNE science community to make sure his own projects are on track.

As is perhaps inevitable when getting down to brass tacks on an untested project, we are now looking at higher connectivity costs than expected. This is partly due to a higher demand for connection ports on junction boxes, and higher costs than expected of the junction boxes and cables themselves. We are scouring the NEPTUNE Canada budget for savings that can be applied to this shortfall, with significant success. However some part of the savings will have to come from the science awards themselves. We will be contacting all PIs for help in finding some savings within the science budget; some have already come forward with suggestions. This will of necessity be a quick process so that we can move forward with contracts and acquisitions, so we will really appreciate your help.

Meanwhile, we are following up on the November workshops with scopes of work from PIs and requests for bids on larger instrument and connectivity orders. Plans for both dry and wet testing facilities are moving forward, and the DMAS team is expecting a steady stream of instruments for their compatibility and driver development. Remember the more information given this team about the nature of the instruments' data streams, the better.

In all, 2007 promises to be a demanding yet exciting year as we gear up to deployment in 2008. Then, we need to prepare for the firehose of data when the network is turned on!

# DMAS Team Architecture Development

By Eric Guillemot, Manager, Software Development

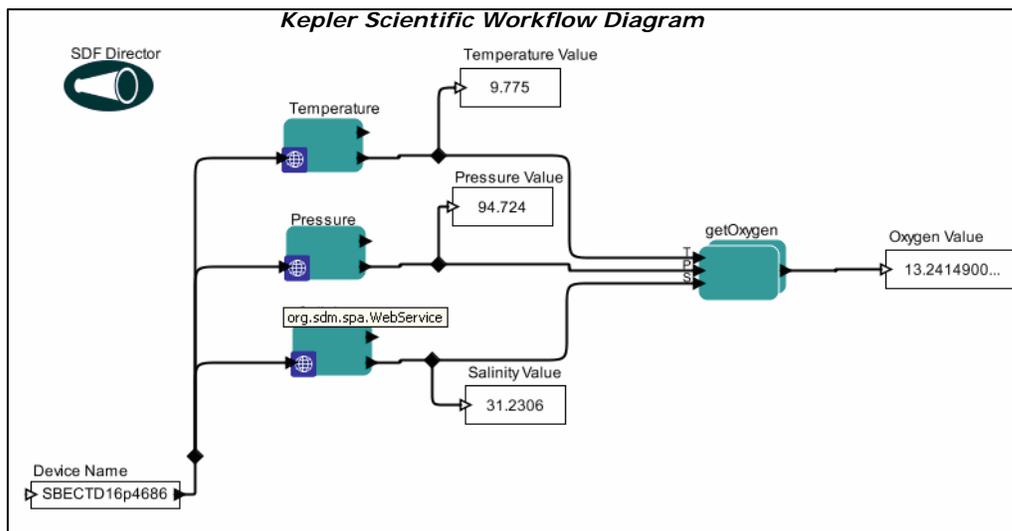


In September 2005, DMAS was awarded a grant from the CANARIE Intelligent Infrastructure Program (CIIP) for a project called: "Toward a Service Oriented Architecture and Workflow Management for VENUS and NEPTUNE". The goals of this project were to provide these two high profile Canadian Cabled Ocean Observatories with an integrated scientific instruments management system, the capability to deliver event information to users, as well as integrated access to distributed compute and data resources through the use of innovative technologies.

The initial draft of the Service-Oriented Architecture (SOA) was proposed by IBM Canada, one of the largest R&D investors in Canada. This architecture was later refined by the Data Management Archive System (DMAS) team. It is worth mentioning that this is also the approach taken by Alcatel for the interaction with the NEPTUNE backbone. This style of information systems architecture enables the NEPTUNE Canada and VENUS DMAS to be built by combining loosely coupled and interoperable services. The IBM Enterprise Service Bus (ESB) with its underlying message system WebSphere MQ provides the features such as point-to-point data delivery and message publish-and-subscribe to implement the DMAS SOA.

A wide range of Web Services has been developed by the DMAS team and it will continue to add more, especially in the area of instrument control and monitoring. One of the most interesting Web Services offered is the device service which allows remote interaction with the instruments under water using either a web page on the NEPTUNE Canada web site or custom applications written by scientists or engineers. The Science Instrument Interface Modules (SIIM) - now called Junction Boxes- can be controlled from a simple web interface allowing authorized engineers to open or close a port to which instruments are connected. Other Web Services deliver observatory metadata or sample data to users.

Over the last few months, the DMAS team has developed a number of new features, some of which are already in production while others are still in the 'incubator' and will be released in the coming weeks. Karen Tang, one of the DMAS developers, has built an example of scientific workflow using the Kepler software, a product built on top of the Ptolemy II system of the University of California, Berkeley. The example, illustrated below, performs an oxygen sensor data analysis using DMAS Web Services. Darry Bidulock, another team member, has just completed the new gallery to show the VENUS camera images and the hydrophone data. This allows scientists around the world to view pictures, movies and spectra, or listen to sound taken by instruments with a delay of just a few minutes. The user interface 'à la You tube' is very easy to use and will be the basis for all displayable products of NEPTUNE Canada and VENUS. These products will also soon be available using RSS feeds.



Yigal Rachman, our data acquisition developer, is now working on a top of the line data acquisition framework (DAF) which should be in place this summer. The DAF presents a range of new challenges such as the support for thousands of sensors and the direct access by engineers and scientists using Web Services.

All these new features would not have been possible without the support of the CANARIE project, which helped us build the underlying infrastructure. As a result of CANARIE's support, the newest technologies available in the IT world, and the work accomplished in 2005–06 NEPTUNE Canada will establish a leading position in the Big Science World.

# ORION News

by Kendra Daly, Director, ORION Program



The ORION Program Office and advisory committee members have been working on tasks in preparation for a Preliminary Design Review (PDR) for the Ocean Observatories Initiative (OOI), scheduled for early December 2007. The PDR is one of the major milestones for the program on the road to final approval of funding by the National Science Foundation (NSF).

The Science and Technology Advisory Committee (STAC) and the Cyberinfrastructure Committee met in late October and early November 2006 to discuss revisions to the Conceptual Network Design that stay within anticipated inflation and operations and maintenance constraints. The Observatory Steering Committee then met Jan. 30-Feb. 1, 2007 in Washington, DC to review the STAC recommendations for the revised network design. The changes in the design reflect the budget targets given by NSF and ensure that the high-priority science questions are addressed by the OOI infrastructure. The revised design will be posted on the ORION website in February.

In budget news, the White House recently announced budget increases of more than \$140 million for ocean priorities in Fiscal Year 2008. In addition, the request for the Ocean Observatories Initiative includes \$30.99M for 2008 and proposes an increase to \$331.11M total funding. The Ocean Observatories Initiative was listed among the high priority activities for advancing ocean science and research. (Visit the ORION website for the complete news release.)

The government budget for Fiscal Year 2007, including the funding status of OOI, has not yet been resolved. Congress is currently working to complete a spending bill for 2007. On January 31, the House passed a bill that funds most programs at FY 2006 funding levels, but includes a 6% increase for the National Science Foundation. The bill needs passage by the Senate before current funding expires on February 15. The specific activities that would be funded under the increases have not been determined.

In December, the ORION booth was on display at the annual American Geophysical Union Fall Meeting in San Francisco. ORION also hosted a Town Hall event to update the community on recent program activities, which included remarks from Margaret Leinen, NSF Assistant Director for Geosciences, Jim Yoder, WHOI Vice President for Academic Programs and Chair of the ORION Observatory Steering Committee, Kendra Daly, Director of the ORION Program, and Bob Gagosian, former President of WHOI.



ORION has also recently published a new brochure. Requests to receive the brochure can be sent to [orion@joiscience.org](mailto:orion@joiscience.org). Please continue to visit the ORION website for news updates and information.

The Joint Oceanographic Institutions (JOI) has announced that the final of three Implementing Organization (IO) Request for Proposals (RFPs) will be released shortly to support the development and operation of the Ocean Observatories Initiative (OOI), a key component of the broader Ocean Research Interactive Observatory Network (ORION). This RFP will lead to a contract for the continued evolution of the design, procurement and operation of the Global Scale Observatory (GSO) and Coastal Scale Observatory (CSO), critical components of the OOI.

Kendra Daly  
Director, ORION Program



ORION visit: [www.orionprogram.org](http://www.orionprogram.org)  
Newsletters are available at [www.orionocean.org/news/newsletter.html](http://www.orionocean.org/news/newsletter.html)

The VENUS Project includes two interactive laboratories, one currently installed and operational in Saanich Inlet and a second in the Strait of Georgia to be installed later in 2007.

## VENUS – Saanich Inlet Operations

VENUS is fulfilling its primary mandate of providing a real-time interactive ocean observatory for researchers in Canada and abroad.

One year ago on February 8, 2006, VENUS plugged the first instruments into the Saanich Inlet node and data began to flow. As at February 8, 2007, we have data coming from 31 sensors on 15 instruments in Saanich Inlet. We have 132 registered users from at least 10 countries and an archive containing nearly half a terabyte of data.

The shore station equipment, fibre optic cable and node have proven to be very robust and reliable. The Science Instrument Interface Module (SIIM) power has been redesigned to improve its overall performance and reliability. These redesigns will be included in the Strait of Georgia design and will later replace the existing Saanich Inlet SIIM.

A cruise in late January 2007 allowed VENUS to conduct regular maintenance on Saanich Inlet, install additional instruments, and collect additional survey information on the Strait of Georgia.

## VENUS – Fraser Delta

An agreement to manage the Fraser Delta project was signed between VENUS and Natural Resources Canada in April 2006. Progress has been made on two components that make up the VENUS Fraser Delta: the Delta Dynamics Laboratory (DDL) and the Seismic Liquefaction In-situ Piezometer (SLIP) array. Power and communications will reach the DDL through a 5 km fibre optic cable connected to the eastern VENUS node in the Strait of Georgia. The SLIP array will then connect directly to the DDL. Current installation is scheduled for later this year.

For more information check: [www.venus.uvic.ca](http://www.venus.uvic.ca)



## University of Victoria—RSC: The Academies Forum

To kick off the forum on February 21, Dr. Daniel Pauly, Director of the Fisheries Centre, University of British Columbia, and winner of the International Cosmos Prize 2005 and the Volvo Prize 2006, will deliver a public lecture on "Are We Past the Point of No Return in Mining Fish From the Sea?" The lecture takes place at 7:30 p.m. in the University Centre Farquhar Auditorium. It is free and open to the public, but tickets are required. Call 250-721-8480 or visit [www.auditorium.uvic.ca](http://www.auditorium.uvic.ca).

On February 22, experts from countries including Canada, Chile, Germany, Scotland and the United States will address such issues as climate change, global aquaculture, ocean acidification and dead zones, coastal communities and fisheries policies, and offshore petroleum resource development. Sessions take place from 8:30 a.m. to 6 p.m. in room 123 of the Engineering/Computer Science Building. Registration for the forum is \$100; the first 50 students to sign up get in free. For details and registration information visit [www.uvic.ca/research/oceansforum](http://www.uvic.ca/research/oceansforum) or call 250-472-4747.



**NEPTUNE Canada**  
University of Victoria  
PO Box 1700 STN CSC  
Victoria, BC Canada V8W 2Y2

**Phone:** (250) 472-5400  
**Fax:** (250) 472-5370  
**E-mail:** [neptune@uvic.ca](mailto:neptune@uvic.ca)  
**www.neptunecanada.ca**



University of Victoria