NEWS

North-**E**ast **P**acific **T**ime-series **U**ndersea **N**etwork **E**xperiments (Canada)

University of Victoria

March 2006 **NEWSLETTER** **Volume 3, Number 1**

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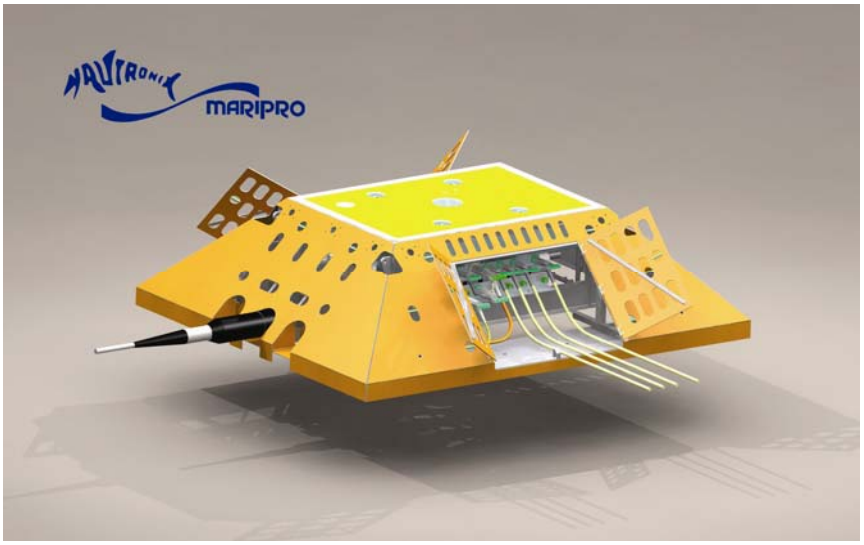
Message from Project Director

by Chris Barnes, Project Director

As reported in the last Newsletter, NEPTUNE Canada is trying to secure additional funds since the project is under-funded by $20M to achieve the full scope that was requested in the original applications to the funding agencies (CFI/BCKDF). Applications were recently submitted to both agencies. Following an Expert Panel review in mid-January, the Board of the Canada Foundation for Innovation made a conditional award to UVic of $8M in early March, together with some additional conditional funds toward initial operating costs. One CFI condition was that matching support be secured; the results of our separate $8M request to the BC Knowledge Development Fund should be known within the next two months. We continue to seek external support from other sources for the remaining $4M. This additional funding would allow the array to have six instrumented nodes as opposed to the two currently funded at Endeavour and Barkley Canyon, the two unpopulated branching units at ODP sites 889 and 1027. Following this positive news from CFI, NEPTUNE Canada will start a more detailed examination of the expansion of the array, while awaiting news from BCKDF. We hope to provide full results of funding requests and the imposed conditions in the next Newsletter.



Cabled Observatory Node

Other important funding support has been received with two awards from the CANARIE Intelligent Infrastructure Program. The first project, funded at $1.5M, will promote the development of leading edge technologies in software design and architecture, facilitating scientific use of the NEPTUNE data. IBM is an industrial partner with an interest in the application of web services into the ocean and other sectors. Benoît Pirenne, NEPTUNE Canada's Assistant Director for Information Technology, will be leading the project that will employ leading edge Web Services technology to implement a Service Oriented Architecture in its data management system. Workflow Management tool will further enrich the capability of a software system supporting a variety of deep-sea environmental sensors. Funded at $1.3M, the second project is led by John Roston, Director of Instructional Multimedia Services at McGill University, making use of web services technology to operationally control subsea high-definition TV cameras using cabled high bandwidth communications (www.canarie.mcgill.ca/project_ciip_index.html). Colin Bradley, Director of the Laboratory for Automation, Communication and Information Systems Research at UVic and President of FlexMet Technologies Inc, will provide engineering and robotic development for the subsea deployment of the HDTV cameras. The challenge is to minimize latency to enable camera control input, such as panning and zooming, in reaction to camera responses observed in the transmitted video stream.

As partly noted below, good progress is being made on several fronts, including: issuing formal agreements with science experiments PIs; working through the initial milestones in the contract with Alcatel Submarine Networks; developing a major report for use in any environmental assessment process; and assisting VENUS staff with their initial deployment of Saanich Inlet array (www.venus.uvic.ca) in February, particularly with the iDMAS. NEPTUNE Canada hosted a visit from the French Ambassador to Canada, Daniel Jouanneau, and several staff on 1 March, followed by a meeting with the Embassy's Counselor for Science and Technology, Mr. Marini, on 20 March. This builds not only on the wet plant contract with Alcatel, but also with Ifremer that is the current lead institution for the European ESONET cabled observatory project. NEPTUNE Canada and VENUS also hosted a visit from Rear Admiral Dick West, President and CEO of the Consortium for Oceanographic Research and Education on 15 March; both Dalhousie and UVic have recently joined CORE as it expands from its US membership focus.

Engineering Report

by Peter Phibbs, Associate Director, Engineering & Operations

In the December 2005 newsletter, we reported that review of scientist's goals had led the project team to consider changing from 10/100 Ethernet over copper connectors on the nodes to hybrid copper and fibre optic connectors, to allow increased reach of extensions using standard Ethernet protocols. We have met with our contractor, Alcatel, and determined that, while there are some technical issues related to the change, overall the benefits to the system design if the change is implemented would include: improved reliability, network expandability, and greater geographic area accessibility. For users, the change would allow Gigabit Ethernet to be extended close to the sites of the scientific instruments, and provide more accurate time signal delivery. The final decision on a design change such as this, which has both commercial and technical implications, will be made by the NEPTUNE Canada Executive, in consultation with the UVic senior administration. However, we are well aware that there may be negative issues that we have not considered -- if you have any concerns about how this or other decisions are made, or have input, please send us an email at neptune@uvic.ca.

RFP replies have been received for wet mate connectors, cable terminations, and data backhaul from the shore station in Port Alberni to UVic. Each RFP helps to finalise project costs, and is another step towards completion.

The survey data for cable routing has been reviewed, and a detailed route engineering session was held by Alcatel and NEPTUNE Canada in January. The next steps to solicit input from other seabed users so that the cable route can be finalized.

In February, we held a Preliminary Design Review (PDR) of the backbone equipment with Alcatel in Villarceaux, France. As always, a few issues requiring resolution came up, but in general from a user perspective the results were favourable, with Alcatel proposing some innovative solutions which should increase accessible bandwidth and improve reliability. The PDR for the node equipment is scheduled for May 2006.

We are currently working with our colleagues in the VENUS project team to prepare an RFP to select a supplier for two vertical profilers, one for VENUS and one for NEPTUNE Stage 1. As a first step towards that RFP document, a draft requirements document is being circulated to the principal investigators for their comments. We see provision of a successful vertical profiler as being a significant challenge. If you have had experience in this area, positive or otherwise, please send us your advice to neptune@uvic.ca.

NEPTUNE Canada has abandoned the use of the acronym SIIM as it applies to the various junction boxes on the NEPTUNE Stage I system (VENUS will still use it). Henceforth, major junction boxes connected to the node will be called primary junction boxes, and others associated with groups of instruments will be called secondary junction boxes. If the decision is made to go with fibre optic connectors, Gigabit Ethernet will extend to the primary junction boxes. We expect to issue a RFP to select a contractor for the secondary junction boxes by early April 2006.

The next couple of months will be busy as we select the connectors for use on the node, finalise the cable route, select suppliers for wet mate connectors, cable terminations and backhaul, and issue RFP's for both the primary junction boxes and the vertical profilers.

Science Report

by Brian Bornhold and S. Kim Juniper, Co-Chief Scientists

Agreement Progress

Since the workshops held in November 2005, NEPTUNE Canada's administrative personnel have been working with researchers to outline the Agreements that will guide the construction of the first series of community science experiments. These comprehensive Agreements will set milestones and specify the contributions and responsibilities of researchers and NEPTUNE Canada to all aspects of this important process, including development, acquisition, testing and deployment of sensors and sensor packages, the provision of extension cables and connectivity, and the detailed location and layout of observing systems. Paul Hansen, Quality Assurance Manager for NEPTUNE Canada, has been applying an engineer's love of detail to the visions of the funded science proposals to create detailed scope documents as part of these Agreements. The Agreements must also address Intellectual Property issues related to development of sensors, in a way that is acceptable to the IP policies of researchers' institutions. Priority is being given to experiments that will be deployed in 2007, and to those requiring long lead times for the manufacturing of sensors. We anticipate finalizing a first series of Agreements by the end of March.

ORION Observatory Steering Committee meeting in Victoria

NEPTUNE Canada will host the next meeting of the ORION Observatory Steering Committee (OSC) in Victoria from May 31 to June 2, 2006. The OSC is charged with oversight of the entire ORION observatory program. NEPTUNE Canada Co-Chief Scientist Kim Juniper represents Canada on the ORION OSC.

VENUS Launched
Saanich Inlet, British Columbia

The Victoria Experimental Network Under the Sea (VENUS:www.venus.uvic.ca) was officially launched in Saanich Inlet at 4:45am on Wednesday, February 8, 2006.

On February 5th Global Marine Systems cable laying vessel *CS Wave Venture* entered Saanich Inlet and carried the VENUS armoured fibre optic cable, VENUS node, (which represents the socket for observatory instruments), and the VENUS Instrument Platform (VIP). The node was lowered to a designated site within the VENUS observatory permit area to a depth of approximately 100m in Saanich Inlet. The 3km cable was pulled ashore to the VENUS observatory shore station located at the Institute of Ocean Sciences in Patricia Bay. The shore station provides the power and a back-haul connection to the Internet. The electronics housed in the Node distributes 400 VDC and 100 MB Ethernet communications to up to 8 wet-matable instrument ports.

The first suite of VENUS oceanographic instruments were attached to the VIP and deployed using the remotely operated vehicle ROPOS. The VIP was then plugged into Node port 1 and power was brought up, signifying the official launch of the VENUS Observatory.

Ocean Works then monitored system performance and the VENUS Team finalized the testing of data retrieval from the shore station and storage on the UVic servers, as well as the automatic data plots and data products.

CS Wave Venture Laying Cable

Aboard the John P. Tully on February 20 – 26, 2006 the hydrophone array and digital stills camera were deployed.

Hydrophone Array

Digital Stills Camera Photo

More live data and image samples will follow in the next few weeks, check the website in April at **www.venus.uvic.ca**

DMAS Corner

by Benoît Pirenne, Assistant Director, Information Technology and TEAM

NEPTUNE Canada Data Management & Archiving System (DMAS) Team

Back Row (left to right)
Benoît Pirenne, Bevan Thistlewaite, Yigal Rachman, Don Moffatt, Eric Guillemot

Front Row (left to right)
Daisy Qi, Martin Hofmann, Kerry Underdown

In this issue we will describe some of the concepts behind the Data Management and Archive System (DMAS) and invite you to try for yourself some of the features of the intermediate version currently serving the VENUS observatory.

History

DMAS is as old as the NEPTUNE and VENUS projects: the need for such a facility was identified early on in the conceptualization phase by the visionaries who first conceived the Regional Cabled Observatory idea. Studies were subsequently commissioned and performed by the Herzberg Institute for Astrophysics and its Canadian Astronomy Data Centre group (National Research Council of Canada) as well as by Barrodale Inc. Reports providing lists of requirements, early concepts, and studies were delivered in 2003 and 2004. These concepts were put together and a prototype was built, see:

http://www.neptunecanada.ca/PDF/DMAS/2005NEPTUNECanadaLetter3DMASrev.pdf

The prototype helped provide a view of an infrastructure composed of:

- An undersea network of nodes, science instrument interface modules or junction boxes, and instruments.
- A shore station with power feed and network concentration equipment
- A “backhaul” line to relay data from the shore station to the data centre and to the public
- data centre with the archive and user access to the data

The prototype also helped identify user and system requirements and allowed us to experiment with operation concepts and science exploitation scenarios. It also naturally led to planning for the VENUS deployment.

Some of the high-level user requirements

To guide the iDMAS (interim DMAS) design that is serving the VENUS observatory and in preparation for NEPTUNE's needs, the following user requirements have been considered:

- The system shall be able to receive data from all instruments
- The system shall archive all incoming data
- A simple (e.g., web) interface to scientific users shall be available to view and/or download real-time and archived data
- Research teams shall have direct interaction with instruments to, for example, change sampling rates, activate lights and pumps, and collect samples
- Resource intensive activities (e.g., needing significant power) will be screened and checked for their impact on the local and overall power situation of the observatory
- In case of resource use conflict, a priority scheme shall be invoked, presumably based on the pre-agreed scientific priority of the experiment
- In order to guarantee the maximum scientific return from the real-time nature of the infrastructure, the system shall support:
  - the setup of automatic, scheduled routine survey work by instruments (e.g., a rotary camera shall take a panorama of its environment every hour),
  - autonomous software agents prepared by --or under the guidance of-- scientists. The software agent will detect and react to "events" by comparing real-time, incoming data with predefined thresholds, patterns, averages of past measurements or simultaneous input from multiple sensors. Reaction can include commanding of one or more instruments, alerting the scientist, etc. Such scripted programs shall be allowed to run in the instrument itself, at the shore station, at the data centre or at the user's location, depending on the required reaction time. The "agents", in a 24/7/365 duty watch on behalf of the scientists shall be easily programmable.
- The system shall allow its users to define procedures (or work flows) to extract new information from imaging and acoustic data streams using supervised or unsupervised feature classification to run on grid computing facilities anywhere.

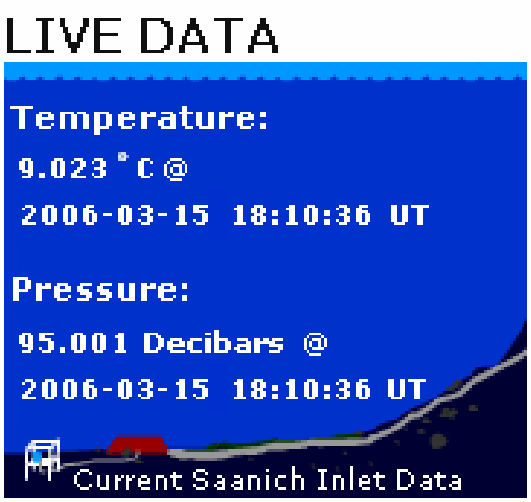
Design of a system

To support the requirements and consider the operational environment of the observatory, the choices for VENUS include the following key elements:

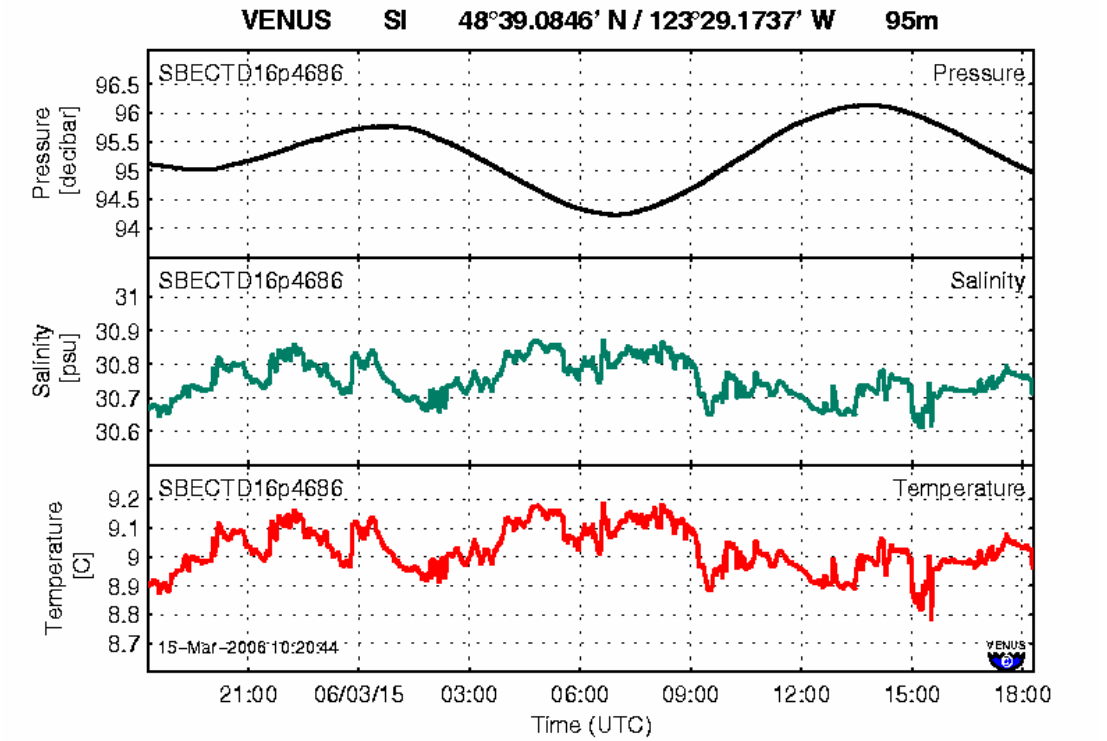
- For each underwater instrument, a software "driver" will run at the shore station and interact with its instrument. It will perform instrument initialization, data acquisition and transmit the commands received from the user (interactively or through the "software agent" mentioned previously).
- The instrument software driver will make the data acquired available for immediate consumption by subscribers such as the archiving component, the event detection agents etc.
- As the backhaul component of the observatory is a single point of failure and may not have the same capacity/reliability as the underwater network, it will be necessary to implement a data buffer at the shore station. Top priority autonomous experiments and event detection programs will therefore have to be hosted at the shore station or underwater to avoid loss of connectivity with the rest of the world.
- As power at any particular point in the undersea network will be limited, a key software element of the system will have to acknowledge/authorize any request for the use of underwater resource. It will have to base its decisions on:
  - the instantaneous power situation overall and at the immediate neighbourhood of the location where it is requested,
  - a list of scientific or technical priorities to be respected in case of a resource access conflict,
  - the amount of resources requested.
- The existence of national security concerns with underwater experiments, in particular in what concerns the immediate or defered availability of acoustic data to the public at large, implies that the signal from some instruments may be temporarily diverted by the military authorities. US Navy or DND equipment will be inserted at the shore station between the instruments and their instrument drivers where appropriate. This imposes strict physical and logical security requirements on the shore station and on the undersea network. This can be solved by the use of fully private networks, VLANs and access restriction to any of the underwater and shore assets.
- Privileged users will have the ability to access their instrument and perform interactive work with it, in respect of the resources available and of the security requirements (e.g., after proper authentication).

Acknowledgements
Enhanced DMAS work is made possible thanks to the participation and funding by CANARIE.

Try it out
We recommend that you bookmark http://www.venus.uvic.ca/ and check out the live data.



A typical view of the live data (screenshot from 15 March 2006) on the VENUS homepage



Data plots of pressure, salinity, and temperature for 24 hours (screenshot from 15 March 2006) collected by the Seabird 16 plus CTD (conductivity, temperature, and depth)

More live data and image samples will follow in the next few weeks, check the VENUS website in April at **www.venus.uvic.ca**

ORION Update

by Richard A. Jahnke, Principal Investigator

The ORION Program continues to gain momentum and successfully pass project milestones. Significantly, the Ocean Observatories Initiative (OOI), the centerpiece of the ORION Program, was included in the President's proposed FY2007 NSF budget, released on February 6th, as a new start in the Major Research Equipment & Facilities Construction (MREFC) account. The OOI is slated to receive $309.5M over 6 years to "construct an integrated observatory network that will provide the oceanographic research and education communities with continuous, interactive access to the ocean."

The OOI will have three elements: 1) a global-scale array of relocatable deep-sea buoys, 2) a regional-scale cabled observatory (RCO) network consisting of interconnected sites on the seafloor, and 3) an expanded network of coastal observatories. These three elements will be connected by a system-wide cyberinfrastructure that will provide continuous, interactive access to the sensor network. NEPTUNE Canada and the ORION RCO are envisioned to be two phases of a fully integrated, interoperable cabled regional observatory. Because of the time offset in the anticipated implementation of these two phases, it is not yet clear whether their integration will be made through a physical connection or through an integrated data management system.

To meet the increasing demands for planning and implementation, the ORION Project Office has been expanding. Recently, Dr. Kendra Daly, University of South Florida, has been successfully recruited as Director of the ORION Program. In May, she will relocate to Washington D. C. and assume her fulltime duties in the Project Office. Mr. Stuart Williams also was recently hired as the OOI Director and Project Manager. Stu comes to the ORION office with many years of project management experience in such diverse areas as ship construction and the installation of weather satellite networks. He will be responsible for the development of the Project Execution Plan and other documents required by the MREFC program and overseeing the systems engineering and design development. The Project Office is currently soliciting applications for Assistant and Associate Directors to assist each of these positions. In addition, a contract with the Jet Propulsion Laboratory has recently been finalized to provide system engineering assistance to the Project Office.

While inclusion in the President's proposed FY07 budget represents a major step forward, there is much more to do. It will be crucial over the next few months for the ocean sciences community to express its strong support for the OOI and for us to let our representatives in Congress know how important the OOI is to the future of ocean science. The ORION Program Office will be working with community organizations like CORE and JOI to develop a very proactive advocacy plan for OOI.

Additionally, a Conceptual Network Design (CND) must be developed in the coming months, which identifies the science user and functional requirements for the observatory network, including the location of observatory nodes and the infrastructure required at those nodes. Over the past few months the ORION advisory committees, comprised of more than 80 community members, have been working closely with the ORION Program Office and NSF to develop a preliminary CND. Input to the development of this design has come from the Request for Assistance proposals solicited last year by the ORION Program Office, as well as previous workshop reports and community planning efforts (e.g. CoOP, OceanSites, ION, NEPTUNE) http://www.orionprogram.org). A draft of this conceptual plan will be presented to the ocean community at the ORION Design and Implementation Workshop (27 - 30 March, 2006) in Salt Lake City. Comments, suggestions and recommendations arising from this workshop will be passed to the ORION committees and Project Office and used to refine the CND.

ORION visit: www.orionprogram.org or www.orionocean.org/RFA/
Newsletters are available at www.orionocean.org/news/newsletter.html

Staff Updates

Eric Guillemot, Senior Web Services Architect

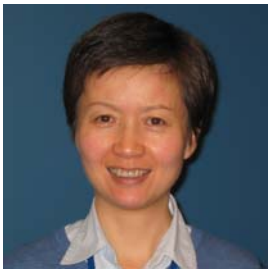
Eric joined NEPTUNE Canada in December 2005 as the Senior Web Services Architect.

Eric graduated from Le Havre University in France with a BSc in Electrical Engineering. He spent 2 years working in the Sultanat of Oman as a Seismic Topographer before immigrating to Canada. He received a B. Comp. Sc. (Hon.) from the University of Manitoba. As part of his master's program, he specialised in software engineering, graph theory and theoretical computing.

Eric has more than 20 years experience developing large software projects for both the public and private sectors as project manager, software architect and software engineer. Projects included e-commerce applications, accounting-related packages, computer graphics packages and research projects.

Eric's role with NEPTUNE Canada will be to propose and implement the architecture for the DMAS software. The primary objective is to provide accessibility of the oceanographic data to the international scientific community. The architecture will rely on cutting-edge technology such as Web services, messaging systems, ESB and Workflow Orchestration.

Daisy Qi, Software Librarian



Daisy Qi joined NEPTUNE Canada in January 2005 as the Software Librarian. Daisy is responsible for the testing and deployment of software, as well as version and document control.

After being awarded her Bachelor of Computer Science degree from the University of National Defence Science and Technology, China in 1992, she spent more than 10 years in software quality assurance testing and technical support. She worked on multiple hardware architecture, interfacing with production, development groups, and was responsible for installation, configuration, testing, maintenance and ongoing support in the enterprise UNIX/Linux environment.

In 2003 – 2004 she worked as a software testing engineer in IBM China's Software Development Lab for Tivoli Software doing integration and certification. Most recently she was software engineer in China's HP Linux Lab where she setup and maintained the software testing environment based on HP PC server, SAN and Linux.

Kerry Underdown, Research Assistant

Kerry joined NEPTUNE Canada in October of 2005 as a Research Assistant to concentrate on Web Content. She will be working with the web specialist to create exciting and current web content.

Kerry graduated from the University of Plymouth in May 2005 with a BSc (with honours) in Earth Science. Her second year was done at the University of Victoria as part of an exchange program.

Kerry has experience working on offshore and onshore oil rigs in Wales, the North Sea and Portugal where she was involved in geological analysis using sediment samples. This experience (together with her passion of SCUBA diving) gave her a great deal of experience and appreciation for ocean systems and ecology.

NEPTUNE Canada Staff

Chris Barnes, Project Director
Brian Bornhold, Co-Chief Scientist
Paul Hansen, Manager, Project Quality Assurance
Martin Hofmann, Development Systems Manager
Barbara Liang, Manager, Finance & Administration
Kim Juniper, Co-Chief Scientist
Cheryl Katnick, Manager, Permits & Rights of Way
Leslie Elliott, Program Assistant
Eric Guillemot, Senior Web Services Architect
Don Moffatt, Web Specialist
Peter Phibbs, Associate Director, Engineering & Operations
Benoît Pirenne, Assistant Director, Information Technology
Daisy Qi, Software Librarian
Yigal Rachman, Instrument Data Acquisition Developer
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