The Ocean Networks Canada Observatory
Science, Industry and Society

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Global challenges of ocean events, processes and change

- Profound impacts of physical and human forcing factors
  - Ecosystem impacts of ocean and climate change (acidification, hypoxia, loss of biodiversity)
  - Ocean hazards (earthquakes, tsunamis, slope failures)
  - Sea level rise and coastal zone management
  - Depletion of biological resources
  - Risks of natural resource extraction (oil and gas R&D)
  - Challenges of offshore energy development

- Power of signal events
  - Deepwater Horizon
  - Japanese earthquake and tsunami
  - Arctic ice cover retreat
Challenges as strategic drivers of research and technological innovation

• Studying and understanding oceans as complex systems
• Addressing the problems of under-sampling in time, space, and process
• Developing enhanced and advanced ocean monitoring capability
• Investing in a mix of fixed and mobile assets
• Integration of EOS and OOS
• Integration of observational and modeling capabilities
Canada as an ocean research nation

University-based research infrastructure and expertise in Canada’s ocean research universities including:

• Memorial Dalhousie
• Laval Rimouski
• UBC Victoria

Government labs and facilities

• Department of Fisheries and Oceans
• Natural Resources Canada
• Department of National Defense
• National Research Council

Ocean industry R&D

• St. John’s cluster
• Halifax-Bedford cluster
• Victoria-Vancouver cluster
Investments in innovative research platforms in Canada

- **ArcticNet**
  - $140M to consolidate national and international collaborations in the study of the Canadian Arctic

- **Ocean Tracking Network**
  - $168 M international scientific collaboration for sonic telemetry on a global scale to track marine animals

- **Ocean Networks Canada**
  - $188M investment in the world leading VENUS and NC cabled ocean networks in coastal and deep ocean settings in the NE Pacific to support transformative science and technology development by international research teams and partner agencies

- **Marine Environment Observation, Prediction and Response**
  - $25M to fund a new federal network of centres of excellence to provide enhanced observational and modeling capability for the study of extreme events

- **Canadian Healthy Ocean Network**
  - NSERC Strategic Research Network to study marine biodiversity
ONC Observatory
VENUS and NEPTUNE Canada

• Power and the internet to the ocean
  – Continuous measurement
  – Regional scale - coast to deep ocean
  – Remote operation
  – Real time and legacy data streams
  – Suite of concurrent measurements
  – Enabling international collaborative system science
Power and internet to the deep sea

10 kV, 4 Gbps/node

130 instruments
(>40 types)
>300 sensors

Networks

- seismic
- tsunami
- chemical
- fluid dynamics
- visual
- audio
Ocean Networks Canada
Strategic and Management Plan
2011-16
Strategic Goals

Enabling research excellence

• Support discovery through novel research approaches
• Inspire and build a new generation of scientists and engineers
• Cultivate interdisciplinary communities of ocean and earth systems researchers
• Attract international involvement in research in Canadian waters
• Connect discovery to applications

Deriving benefits for Canada

• Increase understanding of oceans in areas important to Canada including climate change, natural resources & natural hazards
• Increase industry capacity in advanced technologies
• Augment international recognition of Canadian marine technical capabilities
• Catalyze advances in public policy
• Excite & engage educators and the public
Enabling Research

- Climate & Marine Biota
- Seafloor processes
- Ecosystems
- Coastal Processes
- Earthquake dynamics
- Engineering & IT

Ocean Networks Canada
Exploration • Innovation • Action
for a Changing Planet
A University of Victoria Initiative
Leading research programs to date

- Seismic and sub-seafloor geophysics (G. Spence)
- Long-term borehole hydrologic monitoring: Applications to oceanography, seismology, and geodynamics (E. Davis)
- Internet-controlled mobile seafloor observations on temporal and spatial variations around gas hydrates (L. Thomsen)
- Sediment dynamics (A. Hay)
- Tsunamis, ocean circulation, hydrothermal venting, and climate change (R. Thomson)
- Benthic community dynamics (A. Metaxas)
- Biodiversity and ecosystem functioning (P. Snelgrove)
- Sonar imaging of plankton and fish populations (L. Zedel)
- Ocean soundscapes and marine mammals (M. André)
A key goal for VENUS

Provide an observatory and laboratory situated in an ocean representative of coastal seas under stress in many parts of the world

Come to BC for innovative approaches to coastal issues:
- research models
- ecosystem approaches
- technology
- observing methodologies

Visit us: www.venus.uvic.ca
Finding Nemo

Sept 4 in the evening, VENUS echosounder sees dense fish: Pacific Salmon Commission tracks the migration into the Fraser where about 700,000 fish appear two days later (pink and sockeye)

Echosounder descending to 110m
Canada’s first coastal radar station as part of VENUS Network to deliver current and wave information in the Strait.

At Westshore Terminals in Tsawwassen
Growing the Network

Genetic profiling subsea!
NEPTUNE Canada Science Plan 2012-2017

• **Long-term observatory science**
  – Natural climate and ecosystem oscillations and anthropogenic impacts
  – Tectonic and volcanic processes and geohazards

• **Process-based and experiment science**
  – Air-sea interaction and upper ocean processes
  – Water column and seabed oceanographic and ecosystem processes
  – Geo-engineering and ocean energy research

• **Expanding technical capabilities**
  – Observatory sensors and platforms
  – Extended telemetry and power transmission
  – Visualization and processing large datasets
  – Remote experimental manipulation

• **Expanding observatory research community**
  – Training future observatory scientists
  – Collaboration with ocean engineering and instrument sectors
Tsunami Array
Life in Extreme Environments

- Collaboration with French science team (IFREMER)
- Module to study hydrothermal vent communities
- Video, temperature, oxygen, and iron sensors
- Coordinated antifouling system
- 4 month test deployment on VENUS in 2008
- Deployed at MEF in September 2011
Deployed at Endeavor Vent Field in September 2011
• Study the impacts of physical changes on dynamics of hydrothermal vent communities:

- Using sensors to measure oxygen, iron (nutrients), and temperature

- High definition camera to measure biota behaviour, biodiversity, colonization, reproduction, & activity
• Real-time temperature data from Grotto Hydrothermal Vent
• 48 bottles x 500mL samples
ONC Centre for Enterprise and Engagement

Technology for Commercial applications

- Technology developed in partnership with VENUS
- BC company, OceanWorks
- Commercial product - OOS in Med, O&G in Brazil
ONCCEE

Technology demonstrations

• Identify current/future needs of ONC science teams
• Identify matching new Canadian technologies in development
• Help industry complete tech development to meet science needs
• Examples: pH, CO2, digital hydrophones
ONCCEE

Leverage ONC Technology to benefit Canada

• Help emerging OOS projects obtain funding through proposal support or studies
• Provide DMAS ICT solutions, leverage Canadian infrastructure
• Example – FORCE project
ONCCEE

“Big data” technology applications

• Partnership with IBM Canada to apply novel ICT technologies to complex data such as live video

• International team of researchers (including UVic students)

• UVic students won top award at recent conference
Arctic Observatory Study

- INAC asked ONC to prepare study on application of ONC observatory technologies in Arctic
- Team of Canadian partners to address feasibility
- Three types of systems addressed based on infrastructure
- Continue to consult as Arctic science plans develop
An Exciting Future

- Support transformative ocean research
- Help build a new generation of observatory scientists
- Serve as a research driver for innovative technology development
- Promote knowledge translation to inform science policy and decision-making for building global resilience
- Expand ocean education & outreach

World Leader in Ocean Observations

We provide real-time access to over 2700 users
In Closing

- Ocean events, processes and change lead to big questions requiring bold scientific and technological responses from the international research community
- Enhanced spatial and temporal monitoring of ocean processes and change is a key requirement
- Canadian S&T in the forefront of addressing these challenges and opportunities through investments in innovative research platforms for ocean observation
- KT for advancing ocean-science policy and technological innovation is a strategic goal and operational priority for ONC