Canadian Ocean Science and the Role of AOPS

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Unclassified

Opinions are my own and do not necessarily represent the views of our tenants and sponsors

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COVE's mandate is to sustainably grow the Canadian ocean economy through the commercial use of science & technology

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70+ Tenant Organizations

8 Acre Waterfront Ocean Tech Hub on former CCG Site in Dartmouth Nova Scotia

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IRVING

HALIFAX SHIPYARD

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Canada: Big Ocean – Small Population Challenge

- Canada - longest coastline of any country - 202,000 km, of which 162,000 or 80%, is surrounding more than 36,000 islands in the Arctic archipelago and the Arctic mainland.
- Canada has the 7th largest EEZ with 5.7 million km^2
- Canada' population is about 38 million; the 38^{th} largest
- Canada's GDP is about $1.7 Trillion US; 10^{th} largest behind Brazil.

Ocean Science in Canada: Meeting the Challenge, Seizing the Opportunity –

CCA Report – November 2013

- Canada ranks among top countries ocean science output but this position is at risk.
- Canada has several world-class systems for ocean observation and monitoring but ***problems exist achieving geographical coverage*** and in data management.
- Canada has a ***substantial but aging research fleet***.
- Although funding for ocean science in Canadian universities is increasing, trends in total funding are unclear.
- The state of human capacity in ocean science cannot be determined because of data limitations.

Navy's Historical Role in Understanding our Oceans

CGS / HMCS Cartier

The navies of the world - including the RCN - have always played a key role in advancing the understanding of our oceans

HMS Beagle

CSS / HMCS Acadia

HMS Challenger

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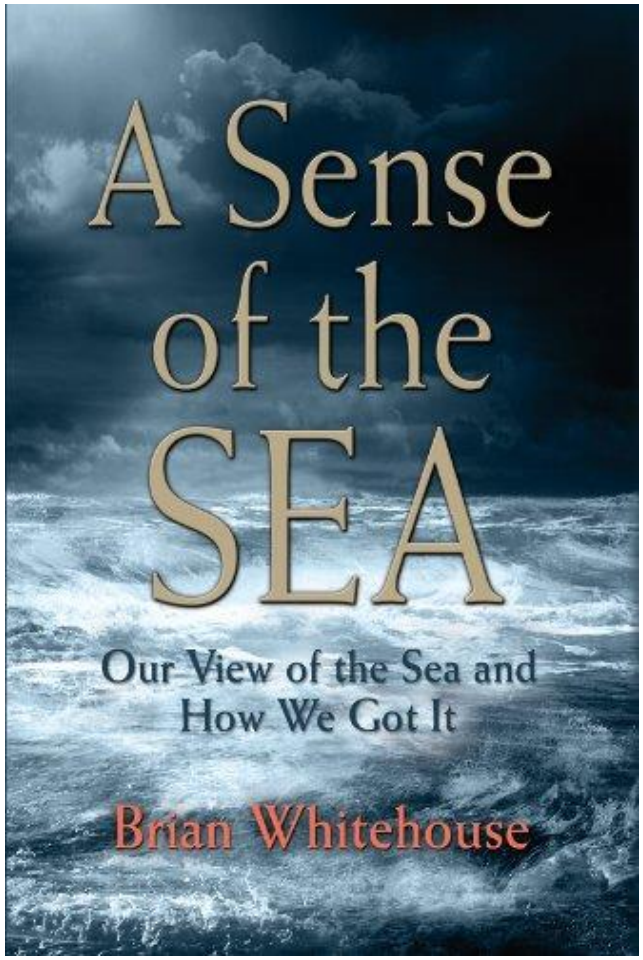

"The naval influence [on ocean science] was so great that our present view of the sea would not exist if World War II and the Cold War had not occurred." Dr. Brian Whitehouse

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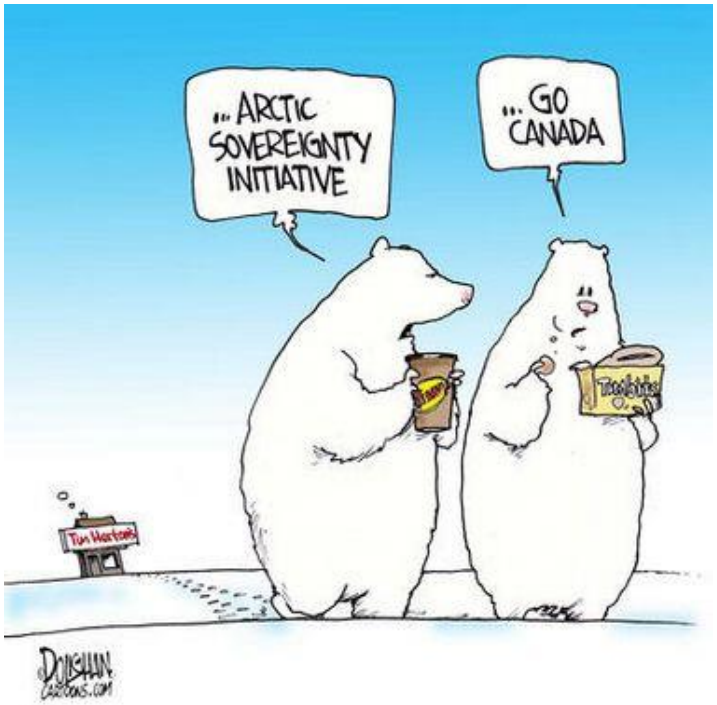
Arctic Sovereignty is Important to Canadians

- Munk School of Global Affairs at the University of Toronto survey circa 2011:
  - Just over half of Canadians said that the Arctic region should be the most important element of Canada's foreign policy and that the country's military presence in the region should be beefed up, even if it means doing less elsewhere in the world

Science as an expression of sovereignty and the need for sovereign science capability

- UNCLOS – diplomacy through international science collaboration
- COVID-19 (e.g. recent situation with RV Merian, RV Neil Armstrong)



AOPS as an “All of Government” Asset

- Multiple roles – Military, Constabulary, Surveillance, SAR....***and science?***

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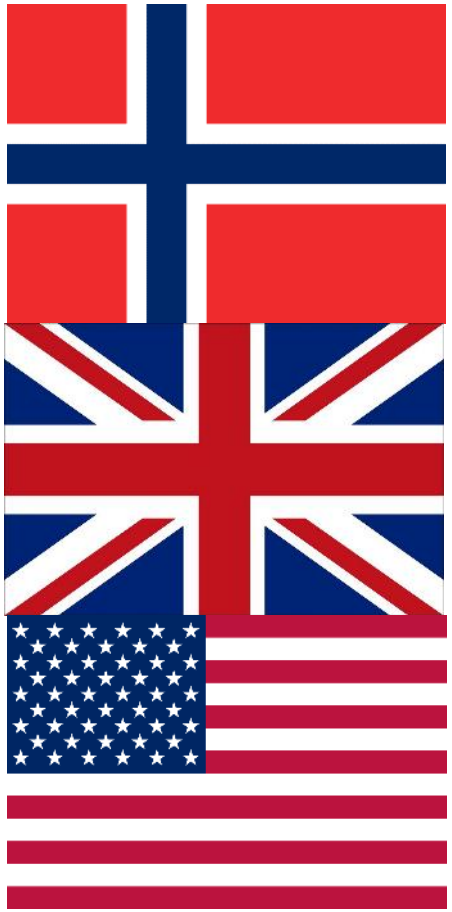
Other Nations' Approaches

- Norway - KV Svalbard
- UK – HMS Protector
- US – USN GAPV Study



KV Svalbard

In September 2013 the Nansen Environmental and Remote Sensing Center (NERSC) coordinated and lead a scientific cruise with the Norwegian coast guard ship ***KV Svalbard***. Seven institutions from Norway, USA, Israel and France participated in the fourteen day long cruise.

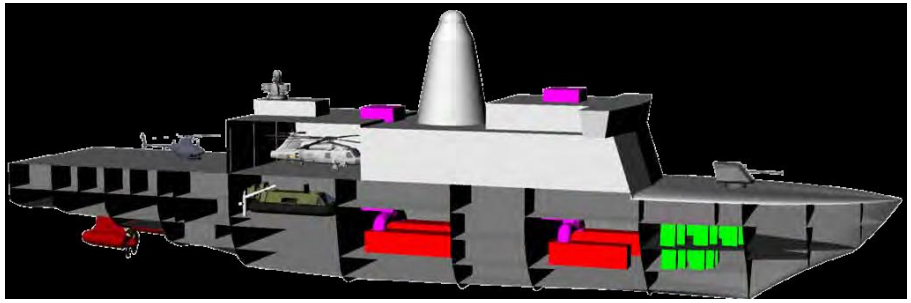
HMS Protector

- MISSION:
  - To provide a UK sovereign presence in the British Antarctic Territory, South Georgia and the South Sandwich Islands and their surrounding maritime areas, to underpin their security and good governance; and meet the UK treaty obligations and exercise rights under the Antarctic Treaty System through inspections, ***hydrographic charting and support to scientific research***

USN Green Arctic Patrol Vessel Design

"Further understanding of Arctic operating conditions and requirements will result from Arctic presence by the USN and support for ***scientific***, commercial and USCG operations.

"The most critical deficiencies identified by the USN include provision of ***environmental information***, safe maneuvering on the sea surface and the conduct of training, exercise and education in the Arctic"



NSWC Carderock, 2011

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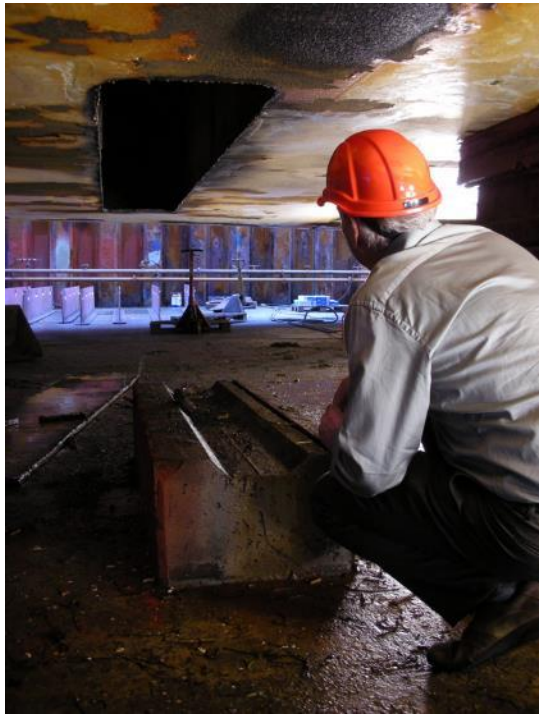
Potential AOPS Science Activities

- Hydrographic Survey – single beam vs. multibeam sonar
- Support for Autonomous Data Collection Platforms
- Met Data – Automatic Weather Observing System (AWAS)
- SST
- ADCP
- XBT / CTD / SVP
- Ocean Light & Colour
- Water Sampling
  - Chemistry
  - Biology
- Wildlife Survey – MANOPS / Bird Radar / Geo-tagged photos
- Classroom at Sea

Kongsberg Multibeam Installation on Swedish Icebreaker Oden

8 m long x 1 m wide EM120 transmitting array mounted longitudinally on hull of Oden protected from ice by titanium / polyurethane window



Support for Autonomous Data Collection Platforms

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HMCS Yellowknife embarks a HUGIN AUV

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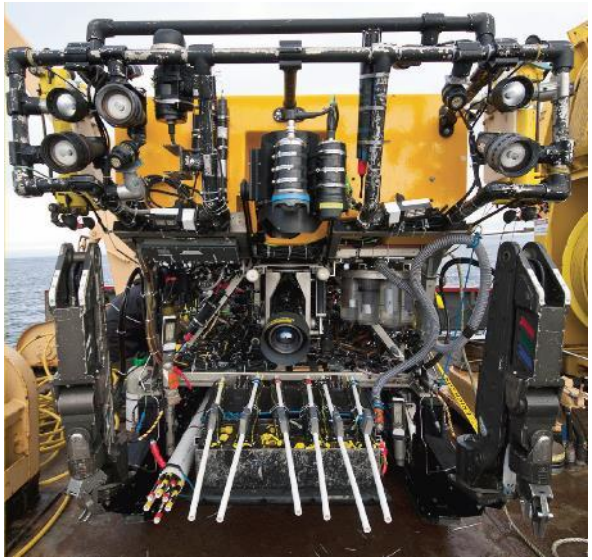
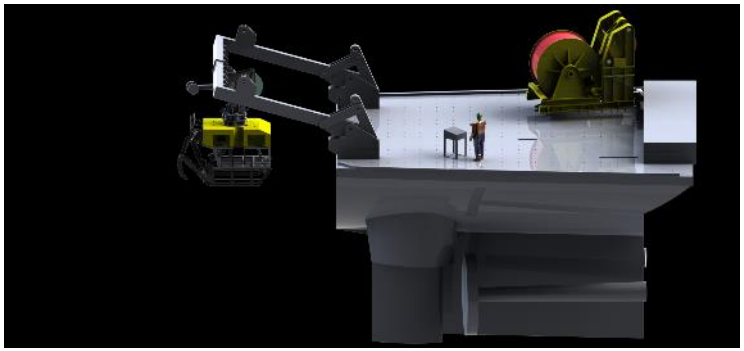
ROPOS

Remotely Operated Vehicle for Ocean Sciences
3400 kg 5,000 m work class ROV

Operated by Canadian Scientific Submersible Facility





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Ocean Colour Sensor

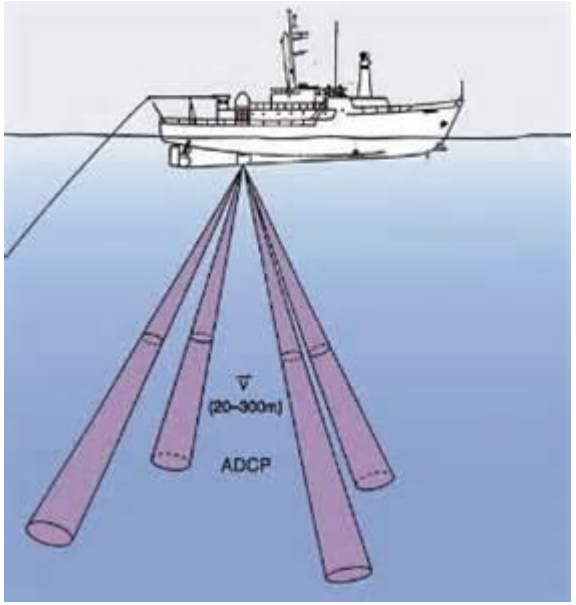
Indicates biological health of the ocean

Shipboard Air Sampling

Air Samples are automatically drawn into gas analysers and tagged with GPS time and location of sample

Acoustic Doppler Current Profiler (ADCP)

- Needs through-hull installation; similar to DVL
- Provides 3-D water current information

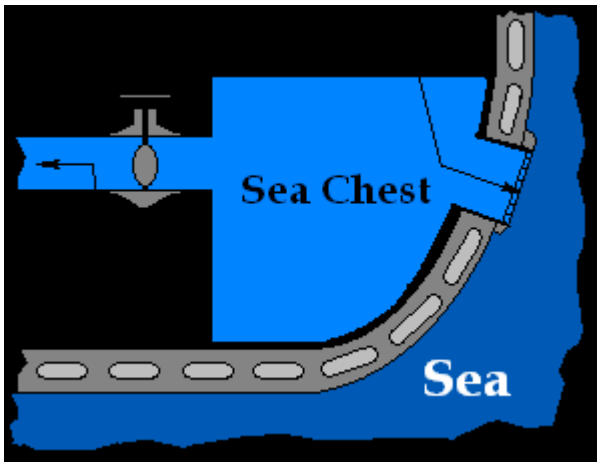


XBT / XSV

Traditionally collected as part of Navy operations

Water Sampling and Analysis from Sea Chest

- Marine Chemistry and Biology Analysers automatically draw water from the ship's water intake
- Data is time and location tagged



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ISO Shipping Container Laboratory

- Move to ocean science laboratories built in ISO Shipping Containers
- MEPAR at Dal Supports these.
- Complex experiments can be pre-staged prior to loading
- Can support Classroom at Sea concept
- AOPS supports up to six 20 ft ISO containers

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Moving Vessel Profiler – MVP

Developed by Brooke Ocean Technology & BIO
Currently manufactured and supported by AML

Provides continuous automatic underway water column measurements

Comparison of Various Ocean Science Vessels to AOPS

	AOPS	CCGS Hudson	OFSV	OOSV	RSS James Cook	RV Armstrong	RV Merian	RV Celtic Explorer	REV Ocean
Displacement	6615 T	3444 T	3212 T	4483 T	5401 T	3043 T	4493 T	2425 T	17440 T
Length	103.6 m	90.4 m	63 m	86 m	89.2 m	73 m	95 m	65.5 m	183 m
Beam	19.0 m	15.4 m	16 m	16 m	18.6 m	15 m	19.2 m	15 m	22 m

Issues & Mitigation

- Mostly “Plumbing & Wiring” issues
  - Only take on low impact sensor systems
  - Use off-board sensors when needed (e.g. MVP & robots)
  - Ensure safety & battle over-rides on all systems
  - Keep data and power systems separate from ship’s systems
  - Store data and forward when in port to eliminate data costs & maintain security
- Some limitations; but still workable!
  - Limited winches
  - Lack of full DP
  - Non-exclusive science use

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Key Advantages

- Bolsters ongoing support for the AOPS program
- Makes full use of AOPS modular concept
- Provides high-profile “charismatic” role for RCN & adds to CCG capability
- Enhances career engagement for RCN personnel
- Collects valuable information about Canada’s EEZ

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Thanks!