Advancing Research in the Arctic

Presentation to
The Centre for Foreign Policy Studies, Dalhousie University
Maritime Security Workshop Series
June 5, 2015

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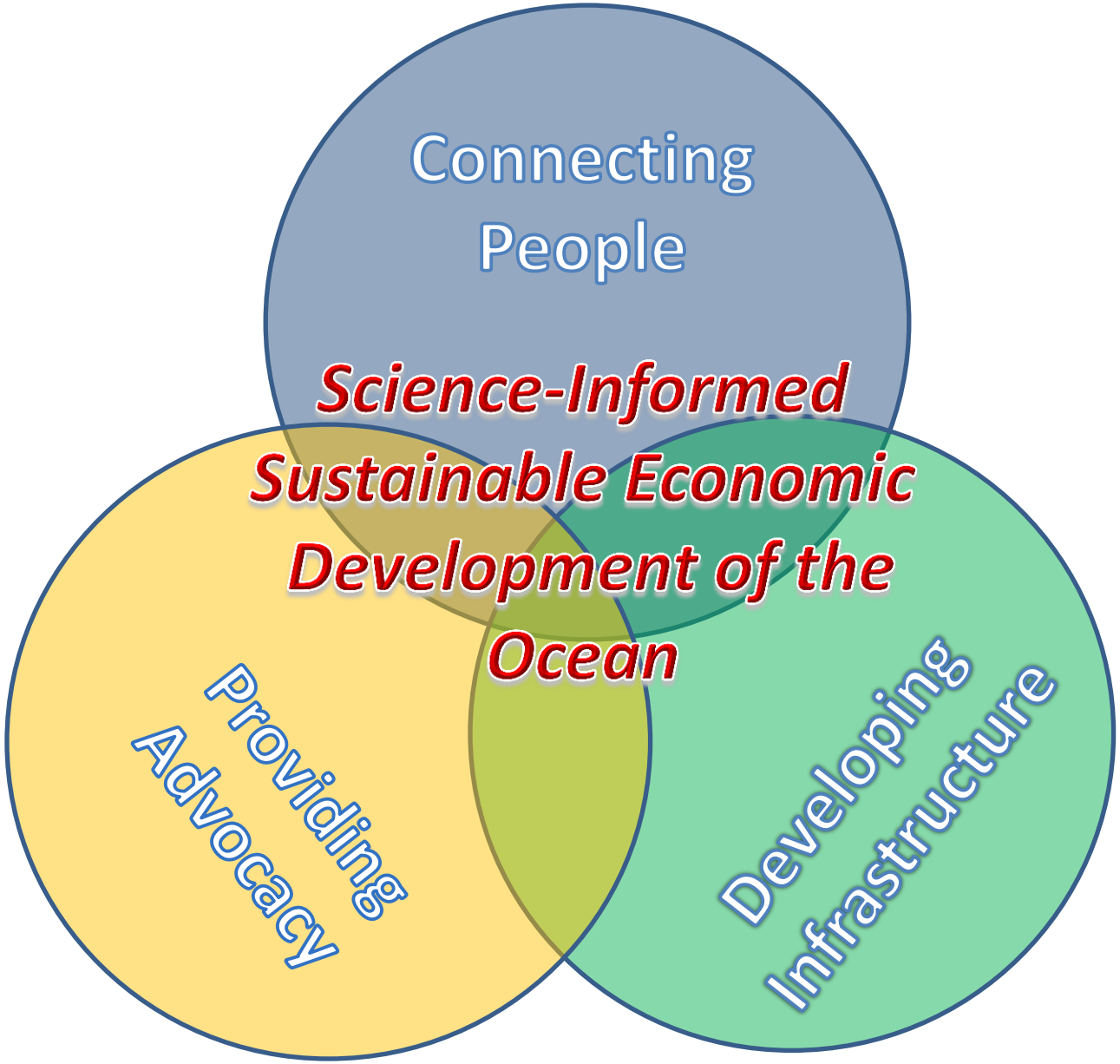

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The Arctic Ocean

- Canada has the Longest Coastline in the World; 60% of which is Arctic Coastline; Canada's shorefront is the Arctic
- The Arctic is the shallowest, freshest and most complexly stratified Ocean Basin
- The Arctic is the fastest changing part of the natural world

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The Arctic Science Questions

- Bathymetry – One of the least charted regions of the world –more hydrographic data & more bottom imagery is needed
- Geology – Arctic estimated to hold 13% of the world's oil reserves & 30% of the world's gas reserves; but basic geological information is lacking
- Melting Ice, changing fresh water mix and temperature are altering ocean circulation and nutrient flow, not just in the Arctic, but flowing into the Atlantic and Pacific.
- Arctic is the "freshest" of the oceans & so it's most susceptible to acidification, driven by higher CO_2 levels in the atmosphere and by organics in increased meltwater; pH change will occur first in the Arctic and will be more rapid and extreme than in other ocean basins.

The Arctic Science Questions

- Biology – Changes in ice cover are impacting phytoplankton biomass and will have knock-on impacts on higher level food chains. Will there be more harvestable fish in the Arctic & less in the North Atlantic?

- And so we need to understand:
  - What animals are currently present, where are they found (habitat uses), and what are their movements?
  - What are the biological and physical environmental drivers of animal distributions/abundances, how are they changing (e.g., due to climate shifts) and what are the impacts of the changes?
  - How do we develop a sustainable use of these animals that is equitable and respects the needs of northern communities?

The Challenge

- Big Ocean, Small Economy - Canada has the longest coastline but the 11 largest economy
- Logistics and Communications are Challenging
- Mandates need clarification and alignment – RCN & CCG/DFO & Universities & Industry & International Partners
- Need optimal, coordinated use of limited resources; no room for silos.

Science as a Tool for Sovereignty

- Traditional hydrography was 3D; (how deep where? Maybe some tides and currents)
- New ocean visualization is multi-dimensional – physical, geological, chemical, biological & social – a true geo-referenced view of the ocean
- Since the ocean is dynamic, this information needs to be understood over space ***& time past and future***
- This will be how countries express marine sovereignty going forward

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How Could AOPS Help?

- Hosting containerized science labs
- Hosting automatic water sampling equipment
- Conducting automatic atmospheric sampling & atmospheric sonde release
- Hosting ADCPs and multi-beam sonar
- Providing an instrument winch for CTD, penetrometer and other profiling instruments
- Launching expendables, like ARGO floats & XBTs

How Could AOPS Help?

- Deploying, interrogating and recovering bottom-mounted OTN receivers
- Deploying research ROVs like Ropos (modular winch and handling equipment required)
- Deploying and recovering AUV's like WaveGlider, Slocum gliders, Explorer, IVERS and maybe Dolphin/Dorado
- Deploying SeaCycler
- Hosting science teams & students
- Training ship's crew to be science observers (every RCN sailor gets basic ocean science training??)

AOPS Could be…

A significant “harvester” of ocean information that is a clear expression of Canadian sovereignty

A test-bed for Canadian science and technology that can lead the world

Not a ***replacement for*** dedicated research vessels, but a valuable vessel of opportunity ***in addition*** to those vessels

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Value to Canada

- For every nautical mile traversed, AOPS can generate a nautical mile of new information about Canada's ocean; without significant impact on primary missions. (Automation & Robotics)
- Would make the sailors of the RCN among the world's leading professionals in ocean data collection
- Helps us to claim our proper place as THE lead nation in Arctic science and technology