Cooperative Mapping of the Arctic Ocean for Science and for Sovereignty

International scientific collaboration and changing legal regimes in the Arctic Ocean

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The 1st Bathymetric Map of the Arctic Ocean
Logistics Dictates Arctic Opportunities
no single platform is adequate

- Drifting Stations
  Fram, T-3, North Pole 1-45, Alpha
- Ice Breakers
  Polar Sea, Polar Star, Polarstern, Oden, Healy
- Planes
  Naval Research Laboratory’s P-3
- Submarines
  Nautilus, Skate and SCICEX
- Satellites
Bathymetric Data Sources

Ice Islands
Icebreakers
Submarines
International Bathymetric Chart of the Arctic Ocean (IBCAO)
Arctic Science Cooperation
opportunity and necessity

1998 SHEBA - Surface Heat Budget of the Arctic
  Canadian icebreaker Louis St Laurent used as an ice camp
2001 AMORE - Arctic Mid-ocean Ridge Experiment
  USCG Healy and Polarstern on Gakkel Ridge
2003 CATS - Canadian Arctic Throughflow Study
  USCG Healy transit of the NW passage
2004 ACEX - Arctic Coring Expedition
  Vidar Viking, Swedish Icebreaker Oden and Sovetskiy Soyuz
2005 HOTRAX - Healy-Oden Trans-Arctic Experiment
  USCG Healy and the Swedish Icebreaker Oden
2007 AGAVE - Arctic Gakkel Vents Expedition
  US researchers on Oden
2007 LOMROG - Lomonosov Ridge off Greenland
  Joint Danish-Swedish Program with the “50 Years of Victory”
True or False?

1) A “land” grab is under way in the Arctic Ocean.

FALSE - A process for establishing territorial limits based on data collected in the oceans is being pursued.

2) The circum-Arctic states are in conflict due to the resources that are available beneath Arctic Ocean waters.

FALSE - These states are cooperating to acquire the data necessary to establish their territorial claims.

3) Planting a Russian flag on the seafloor at the North Pole has consequences for any territorial claims in the Arctic Ocean.

FALSE - We live in the 21st century, not the 17th. The Law of the Sea dictates how Extended EEZs are described and verified.
Law of the Sea

- Distinguishes the seabed from Extended Continental Shelves (ECS).
  - based on “natural prolongation”

  The “area” belongs to humanity.
  Ownership creates incentives for management
  Applies to the seabed and resources below it

- Claims established by mapping

  Observing these features; 2500 m; FOS, sediment thickness
  Evaluated and validated by the Technical Commission

- Distinguishes the juridical from the physiographic shelf
Geophysical Data Sets for ECS Determination

Swath Bathymetry
- 2500 meter isobath
- Foot of Slope

Swath Backscatter
- Seafloor texture/composition

Gravity Anomaly
- Sediment Thickness/Crustal Structure

Multi-Channel Seismic Reflection (MCS)
- Sediment Thickness and Crustal Structure
- Scaled in Two-way Time (thickness/sound velocity)

Wide Angle Seismic Refraction
- Sound Velocity as a function of depth
- Needed to re-scale MCS data into depth (for 1% rule)
This data used for this image were collected in ice-free waters from USCG Healy.
Canadian-Danish ECS Program

Despite conflict over Hans Island

Cooperation is ongoing

Lomonosov Ridge Test of Appurtenance (LORITA)
Established Ice Camps
Collected seismic reflection and refraction data
Joint cruise to the North Pole in 2009

Canadian - US Cooperation

Despite unresolved mutual boundary in the Beaufort Sea

Utilizing the USCGC Healy in 2008 and 2009 to support seismic reflection data acquisition for the Canadian icebreaker, the Louis St Laurent.
This claim, the 1st submission to the technical commission, was returned due to a lack of supporting data.
Estimated Remaining International Waters

From Ron Macnab - Geologic Survey of Canada (retired)
Cooperation?

Arctic Cooperation is driven by necessity and opportunity.

Self interest has already caused the circum-Arctic states to jointly collect and share data sets.

This self-interested cooperation could be the basis for a joint submission on the Arctic Ocean. The cooperating nations could:

- Sidestep boundary disputes
- Maximize the enclosed area

Could this be a basis for circum-Arctic scientific cooperation?