

**Application for Consent to Conduct Marine Scientific Research
in Areas Under National Jurisdiction of
ICELAND, GREENLAND/DENMARK
(name of coastal state)
And for Port Call Clearance in Iceland**

Date: 12 February 2008

1. General Information

1.1 Cruise name and/or #:	Research Vessel Knorr
1.2 Sponsoring Institution:	
Name:	Woods Hole Oceanographic Institution
Address:	Woods Hole, MA 02543 USA
Name of Director:	Dr. Susan Avery, Acting Director
1.3 Scientist in charge of the project (include CV and passport photo):	
Name:	Robert S. Pickart
Address:	Mail Stop 21 WHOI Woods Hole, MA 02543 USA
Telephone:	508-289-2858
Fax:	508-457-2181
Email:	rpickart@whoi.edu

CV:

Robert S. Pickart

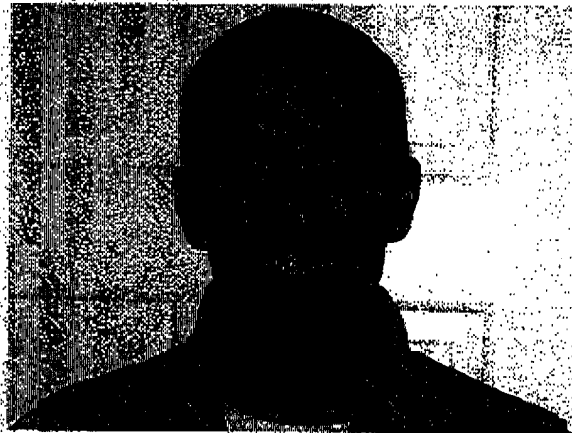
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B. S., Susquehanna University, 1981 (Physics and Mathematics). Ph. D., Massachusetts Institute of Technology and Woods Hole Oceanographic Institution, 1987 (Physical Oceanography).

Senior Scientist, 2003-present; Associate Scientist, 1994-2003; tenure awarded, 1998; Assistant Scientist, 1990-1994; Woods Hole Oceanographic Institution. Assistant Marine Scientist, September 1987-March 1990; Postdoctoral position, January 1987; Graduate School of Oceanography, University of Rhode Island. Summer Student Fellow, 1980, Woods Hole Oceanographic Institution.

Publications Since 2007

- Pickart, R. S. and M. A. Spall, 2007. Impact of Labrador Sea convection on the North Atlantic meridional overturning circulation. *Journal of Physical Oceanography*, **37**, 2207-2227.
- Mathis, J.T., R.S. Pickart, D.A. Hansell, D. Kadko, and N.R. Bates, 2007. Eddy transport of organic carbon and nutrients from the Chukchi shelf into the deep Arctic basin. *Journal of Geophysical Research*, **112**, c05011, doi:10.1029/2006JC003899.
- Baklanov, F., S. Hameed, and R.S. Pickart, 2007. Influence of the Icelandic low latitude on the frequency of Greenland tip jet events: Implications for Irminger Sea convection. *Journal of Geophysical Research*, **112**, C04020, doi:10.1029/2006JC003807.
- Fratantoni, P. S., and R. S. Pickart, 2007. The western North Atlantic shelfbreak current system in summer. *Journal of Physical Oceanography*, **37**, 2509-2533.
- Pickart, R.S., K. Våge, G.W.K. Moore, I.A. Renfrew, M.H. Ribergaard, and H.C. Davies. Convection in the western North Atlantic subpolar gyre: Do small-scale wind events matter? *Arctic-Subarctic Ocean Fluxes: Defining the role of the Northern Seas in Climate*. Springer-Verlag, in press.
- Våge, K., R.S. Pickart, G.W.K. Moore, and M. Ribergaard. Winter mixed-layer development in the central Irminger Sea: The effect of strong, intermittent wind events. *Journal of Physical Oceanography*, in press.
- Kadko, D., R.S. Pickart, and J. Mathis. Age characteristics of a shelf-break eddy in the western Arctic Ocean and implications for shelf-basin exchange. *Journal of Geophysical Research*, in press.
- Sutherland, D.A. and R.S. Pickart. The East Greenland Coastal Current: Structure, variability, and forcing. *Progress in Oceanography*, accepted.
- Llinas, L., R.S. Pickart, J.T. Mathis, and S.L. Smith. Zooplankton inside an Arctic cold-core eddy: Probable origin and fate. *Deep-Sea Research II*, accepted.
- Nikolopoulos, A., R.S. Pickart, P.S. Fratantoni, K. Shimada, D.J. Torres, and E.P. Jones. The western Arctic boundary current at 152°W: Structure, variability, and transport. *Deep-Sea Research II*, accepted.
- Spall, M.A., R.S. Pickart, P.S. Fratantoni, and A.J. Plueddemann. Western Arctic shelfbreak eddies: Formation and transport. *Journal of Physical Oceanography*, accepted.
- Bracco, A., J. Pedlosky, and R.S. Pickart. Eddy formation near the west coast of Greenland. *Journal of Physical Oceanography*, submitted.
- Pickart, R.S., G.W.K. Moore, A.M. Macdonald, J.E. Walsh, and W.S. Kessler. Seasonal evolution of Aleutian low-pressure systems: Implications for the North Pacific subpolar circulation. *Journal of Physical Oceanography*, submitted.



Robert S. Pickart

1.4 Scientist(s) from coastal state involved in the planning of the project:	
Name(s):	Dr. Hedinn Valdimarsson (Iceland) Dr. Erik Buch (Denmark)
Address:	Háfrannsknastofnunin Reykjavik, Iceland Danmarks Meteorologiske Institut Copenhagen, Denmark

1.5 Submitting officer:	
Name and address:	Elizabeth Caporelli, Marine Operations Coordinator Woods Hole Oceanographic Institution 38 Water Street, Mail Stop #37 Woods Hole, MA 02543 USA
Nationality:	USA
Telephone:	508-289-2277
Fax:	508-457-2185
Email:	ecaporelli@whoi.edu

2. Description of Project (Attach additional pages as necessary)

2.1 Nature and objectives of the project:
<p>1. Project Description and Objectives</p> <p>In September, 2007 a mooring array was deployed across the continental shelfbreak approximately 250 km downstream of Denmark Strait, where Arctic-origin water first meets the open North Atlantic. The sharp front that forms here between the cold, fresh out-flowing Arctic water and the warm, salty recirculating Atlantic water appears to be leaky, but historical measurements from ships have been too coarse to determine why this might be or how much water and biogenic material is exchanged. The array will be deployed for 13 months, from September 2007 to October 2008, spanning the combined East Greenland/Irminger Current and Spill Jet. Profiling conductivity/temperature/depth (CTD) instruments, acoustic Doppler</p>

current profilers (ADCPs), and acoustic current meters (ACMs) will sample over most of the pertinent part of the water column, with the use of iceberg-resistant extensions to sample the near-surface freshwater component. This configuration will yield two high-resolution vertical sections per day of hydrographic properties, velocity, and acoustic backscatter (zooplankton proxy) over the span of one complete annual cycle. After recovering the array in 2008, a hydrographic survey will be conducted in the region of the array and in the waters to the north. This will shed light on the precise origin of the water masses present along the Greenland shelfbreak and slope.

Our scientific objectives are 1) to determine the mechanisms by which Arctic-origin waters and their intrinsic zooplankton are exchanged across the boundary; 2) to quantify the magnitude of the fluxes; and 3) to identify the origin of the different water masses involved. The main hypothesis is that the shelf-basin exchange occurs by two processes: instability of the current that leads to eddy formation during periods of light winds, and downwelling during the frequent passage of storms along the North Atlantic storm track. The information obtained from the moored timeseries and hydrographic/velocity shipboard survey, together with a collaborative numerical modeling study, will put us in a better position to understand how the predicted increase in freshwater the sub-polar North Atlantic.

2. Configuration of the Moored Array and Proposed Hydrographic Survey

Figure 1 shows the moorings deployed in September 2007. A lateral view of the mooring sites is shown in Figure 1a, and a cross-section view of the main 7-mooring array situated across the East Greenland shelfbreak/slope is shown in Figure 1b. All of the moorings will be recovered in October 2008. After the recovery is complete, a hydrographic survey will be conducted. The precise station locations of the hydrographic survey are not yet determined, but the nominal plan is to conduct transects across the major currents within the boxed region of Figure 2.

2.2 Relevant previous or future research cruises:

There were four previous cruises related to this project:

- 1) *Oceanus* 369 (summer 2001)
- 2) *Oceanus* 380 (summer 2002)
- 3) *Oceanus* 395 (summer 2003)
- 4) *James Clark Ross* 105 (summer 2004)

2.3 Previously published research data relating to the project:

See R. Pickart's CV for previous publications related to this project.

3. Methods and Means to be Used

3.1 Particulars of vessel:	
Name:	Research Vessel Knorr
Nationality (Flag state):	USA
Owner:	United States
Operator:	Woods Hole Oceanographic Institution
Overall length (meters):	85 meters
Maximum draught (meters):	5.1 meters
Displacement/Gross tonnage:	2,518 T
Propulsion:	Diesel Electric
Cruising & Maximum speed:	12 knots/15 knots
Call sign:	KCEJ

Method and capability of communication (including emergency frequencies):	INMARSAT Satellite Telephone Iridium Satellite telephone VHF Channel 13 and 16 Single Side Band 2182 kHz
Name of master:	Captain Kent Sheasley
Number of crew:	23
Number of scientists on board:	34

3.2 Aircraft or other craft to be used in the project:
None

3.3 Particulars of methods and scientific instruments

Types of samples and data	Methods to be used	Instruments to be used
1. Hydrographic survey	Station casts; underway sampling	CTD; lowered ADCP; shipboard ADCP (75 kHz); microstructure probe
2. Biological sampling	Station casts	Video Plankton Recorder; Net tows
3. Meteorological survey	Vertical profiles; underway sampling	Radiosondes; sensors on ship's mast
4. Bottom survey	Bathymetry	12.5 kHz

3.4 Indicate whether harmful substances will be used:
None

3.5 Indicate whether drilling will be carried out:
None

3.6 Indicate whether explosives will be used:
None

4. Installations and Equipment

Details of installations and equipment (dates of laying, servicing, recovery; exact locations and depth):

An array of 8 moorings will be recovered. The array was deployed in September 2007 and will be recovered in October 2008. The positions of the moorings are:

	Latitude (N)	Longitude (W)	Bottom Depth (m)
1.	65 30.03	33 8.79	248
2.	65 26.58	33 4.54	268
3.	65 23.22	33 1.03	524
4.	65 20.01	32 57.25	894
5.	65 16.18	32 52.72	1163
6.	65 12.32	32 46.98	1378
7.	65 7.28	32 41.10	1585
8.	68 2.83	18 47.89	1026

5. Geographical Areas

5.1 Indicate geographical areas in which the project is to be conducted (with reference in latitude and longitude):

The project will be carried out in the waters of southeast Greenland and around Iceland. See the attached map in 5.2.

5.2 Attach chart(s) at an appropriate scale (1 page, high-resolution) showing the geographical areas of the intended work and, as far as practicable, the positions of intended stations, the tracks of survey lines, and the locations of installations and equipment.

See charts below.

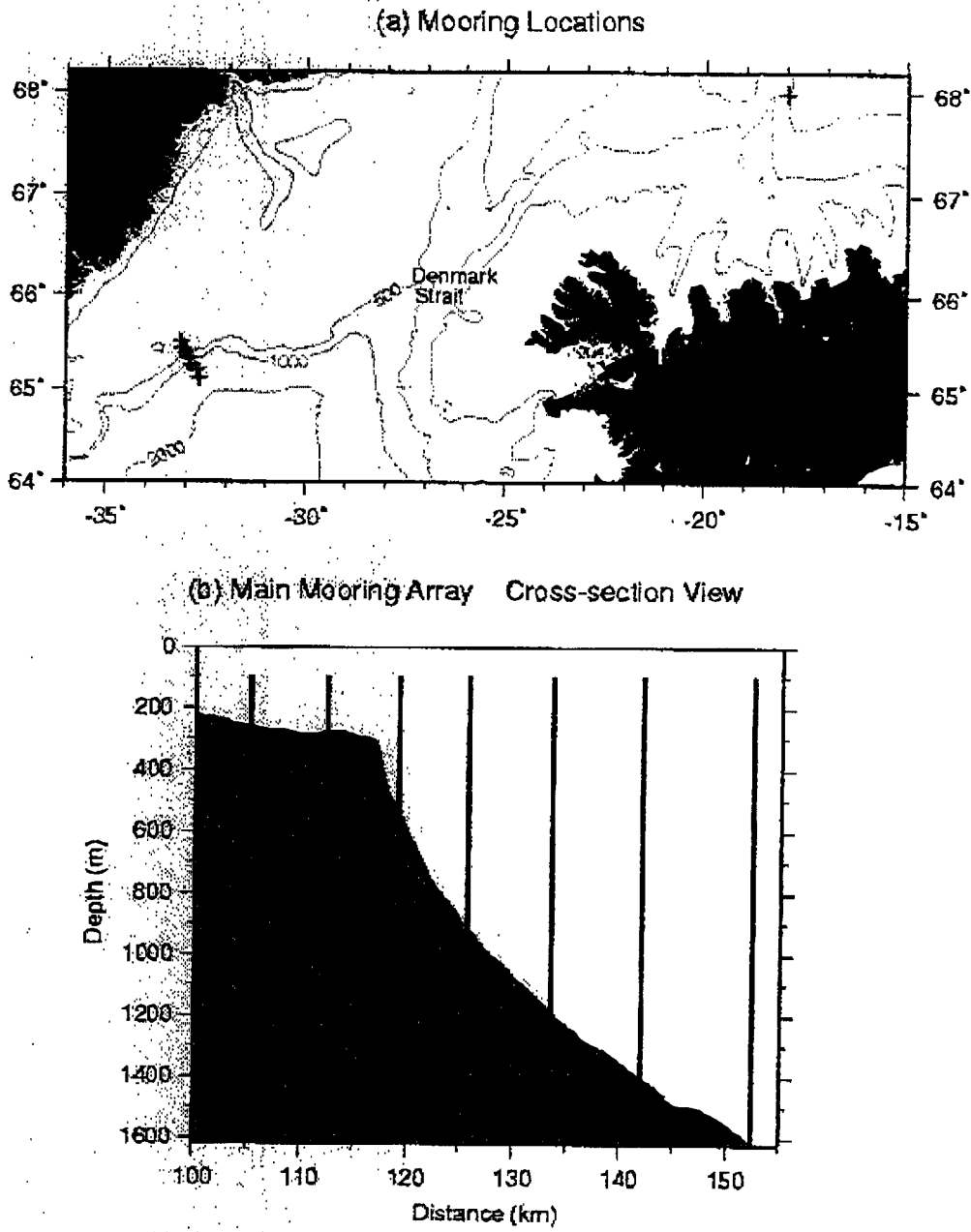


Figure 1: Moorings deployed in September 2007, to be recovered in October 2008.

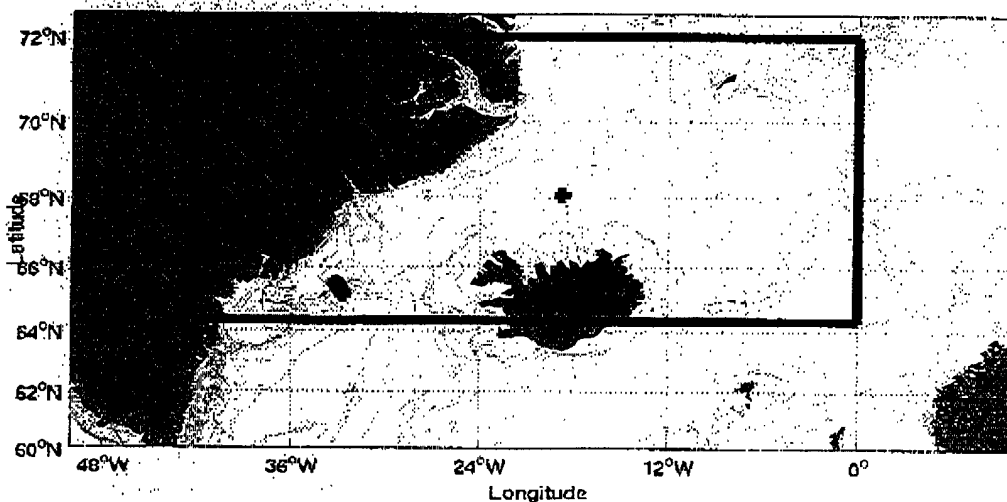


Figure 2: Area of intended operations in October 2008 (red box). The mooring locations are indicated by the + symbols.

6. Dates

6.1 Expected dates of first entry into and final departure from the research area of the research vessel:
 3 October 2008 to 30 October 2008

6.2 Indicate if multiple entry is expected:
 Yes

7. Port Calls

7.1 Dates and names of intended ports of call in
 Arrive Reykjavik, Iceland: 30 September 2008
 Depart Reykjavik, Iceland: 3 October 2008
 Arrive Reykjavik, Iceland: 30 October 2008
 Depart Reykjavik, Iceland: 2 November 2008

7.2 Any special logistical requirements at ports of call:

None

7.3 Name/Address/Telephone of shipping agent (if available):**Reykjavik, Iceland:**

EIMSKIP Port Agency Services
Kornagarour 2
104 Reykjavik
ICELAND

Contact: Berry Timmermans

Phone: 354 525 7273

Fax: 354 525 7279

Cell: 354 825 7273

Email: bvt@eimskip.is

8. Participation:**8.1 Extent to which coastal state will be enabled to participate or to be represented in the research project:**

Accommodations will be made for observers from the coastal state.

8.2 Proposed dates and ports for embarkation/disembarkation:

Disembark Reykjavik, Iceland: 30 September 2008

Embark Reykjavik, Iceland: 3 October 2008

Disembark Reykjavik, Iceland: 30 October 2008

Embark Reykjavik, Iceland: 2 November 2008

9. Access to data, samples and research results**9.1 Expected dates of submission to coastal state of preliminary reports, which should include the expected dates of submission of the final results:**

No more than 30 days from the end date of the cruise.

9.2 Proposed means for access by coastal state to data and samples:

Data will be made available at the Earth Observing Laboratory website (NCAR)
<http://www.eol.ucar.edu/>

9.3 Proposed means to provide coastal state with assessment of data, samples and research results or provide assistance in their assessment or interpretation:

Publications in scientific journals or upon request.

9.4 Proposed means of making results internationally available:

Publications in scientific journals.