Application for Port Call Clearance in Iceland and Norway and Consent to Conduct Marine Scientific Research in Areas Under National Jurisdiction of

Iceland, Norway, Denmark (Greenland, Faroe Islands), United Kingdom, Ireland

(name of coastal state)

Date: 11 October 2007

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. James Luyten, Acting Director

1.3 Scientist in charge of the project (CV and passport photo appended):	
Name:	Mary Jane Perry
Address:	193 Clark's Cove Road, Walpole ME 04573, USA
Telephone:	207-563-3147 ext. 245
Fax:	207-563-3119
Email:	perrymj@maine.edu

Mary Jane Perry

Professor, School of Marine Sciences and Ira C. Darling Center, University of Maine

Affiliate Professor, School of Oceanography, University of Washington

Email: perrymj@maine.edu, Voice: (207) 563-3146 ext. 245, FAX: (207) 563-31196

Mailing address: Ira C. Darling Marine Center, 193 Clark's Cove Road, Walpole ME 04573-3307 USA

A. Professional Preparation:

Ph.D. -1974	Scripps Institution of Oceanography, University of California, San Diego
1974 – 1976	Lecturer, Washington University Medical School, St. Louis, Missouri

B. Appointments:

1999 – present	Professor of Oceanography, University of Maine, Orono, Maine
1999 – present	Affiliate Professor, University of Washington, Seattle, Washington
1980 – 1982	Assistant and Associate Program Officer positions at NSF
1976 – 1999	Progression of professorial ranks at University of Washington, Seattle
1976	Assistant Professor, University of Georgia, Athens, Georgia

C. Recent Publications:

Sackmann, B. M. J. Perry, C. C. Eriksen, and C. M. Lee. Using Seaglider to quantify variability in mid-day fluorescence quenching off the Washington coast. Submitted to *Limnology and Oceanography*, Special Issue on Autonomous Platforms.

Perry, M. J., B. S. Sackmann, C. C. Eriksen, C. M. Lee. Seaglider observations of subsurface chlorophyll maxima off the Washington coast, USA. Submitted to *Limnology and Oceanography*.

Boss, E., D. Swift, L. Taylor, P. Brickley, R. Zaneveld, S. Riser, and M.J. Perry. Submitted. Robotic in-situ and satellite based observations of pigment and particle distributions in the Western North Atlantic. Submitted to *Limnology and Oceanography*, Special Issue on Autonomous Platforms.

Paul,J., C. Scholin, G. Van Den Engh, and M.J. Perry. 2007. A Sea of Microbes: *In situ* instrumentation. *Oceanography* 20(3): 70-78.

Sackmann, B., and M. J. Perry. 2006. Ocean color observations of a surface water transport event: Implications for Pseudo-nitzschia on the Washington coast. *Harmful Algae* 5:608-619.

Sackmann, B., L. Mack, M. Logsdon, and M. J. Perry. 2004. Seasonal and inter-annual variability of SeaWiFS-derived chlorophyll a concentrations in waters off the Washington and Vancouver Island coasts, 1998-2001. *Deep-Sea Res.* II 51: 945-965.

Daly, K.L, R.H. Byrne, A.G. Dickson, S.M. Gallager, M.J. Perry, and M.K. Tivey. 2004. Chemical and Biological Sensors for Time-Series Research; Current Status and New Directions. *J. Mar. Tech. Soc.* 38:121-141.

Rudnick, D.L., R.E. Davis, C.C. Eriksen, D.M. Fratantoni, and M.J. Perry. 2004. Underwater gliders for ocean research. *J. Mar. Tech. Soc.* 38:73-84.

Eisner, L.B., M.S. Twardowski, T.J. Cowles, and M.J. Perry. 2003. Resolving phytoplankton photoprotective: Photosynthetic carotenoid ratios on fine scales using in situ spectral absorption measurements. *Limnology and Oceanography* 48: 632-646.

McManus, M.A., {others}... M.J. Perry, et al. 2003. Changes in Characteristics, Distribution and Persistence of Thin Layers Over a 48-Hour Period. *Mar. Ecol. Prog. Ser.* 261: 1-19.

Perry, M. J., and D. L. Rudnick. 2003. Observing the ocean with autonomous and Lagrangian platforms and sensors (ALPS): role of ALPS in sustained ocean observing systems. *Oceanography* 16: 31-36.

D. Synergistic Activities

2007 Co-organizer, Special Issue of Limnology and Oceanography on ALPS

2007–present, UNOLS Council

2005–present, Ocean Observatory Steering Committee (formerly ORION Executive Steering Committee)

2005–present, The Oceanography Society, Councilor for Biological Oceanography

2005–present, ACT (Alliance for Coastal Technology), Advisory Committee on Fluorometry

2004 Co-Chair of NSF Committee of Visitors' review of "Biocomplexity in the Environment"

2004 Member of Office of Naval Research Board of Visitors' review of Ocean Sciences

2004 Alliance for Coastal Technologies workshop on AUVs and gliders, invited speaker

2003 Co-Chair of workshop on "Autonomous and Langrangian Platforms and Sensors"

2002 Member of NSF Committee of Visitors' to review ship operations and facilities

2000–2002, Member of NSF Advisory Committee / Geosciences

2000–2002, Member of NSF Advisory Committee / Environmental Research & Education

Innovative Teaching: In 1980, optical and biological oceanography were distinct communities with different languages and cultures. In 1985 I developed an interdisciplinary, team-taught, intensive summer course in bio-optical oceanography that has been taught many times since; this course has played a significant role in bridging the chasm between communities and in creating a new one.

Research: My long-term goal is to understand the mechanisms responsible for controlling the abundance, distribution, and productivity of marine phytoplankton in the ocean. My current research focuses on the interpretation of optical data in a physiological context and on the incorporation of optical sensors into under-water, autonomous platforms for long-term ocean observations.

E. Collaborators & Other Affiliations.

(i) *Graduate and Post Doctoral Advisors*

Doctoral advisor: R. W. Eppley (retired)

Postdoctoral advisor: O. H. Lowry, deceased.

(ii) Students and Post-Doctoral Scholars supervised

Postgraduate scholars: Emmanuel Boss (UMaine), Paula Coble (USF), Rick Reynolds (Scripps)

Ph.D. students: Bess Ward (Princeton), Joan Cleveland (ONR), Monica Orellana (UW), David Martin (UW), Collin Roesler (Bigelow Labs), Mary Culver (NOAA), Brandon Sackmann MBARI)

M.S. students: J. Bolger, N. Navaluna, Boh-Yen Bang, J. Coleman, B. Thompson, C. Carter

Present graduate students: Andrea Drzewianowski and Witold Bagniewski

1.4 Scientist(s) from coastal state involved in the planning of the project:	
Name(s):	Dr. Kristinn Gudmundsson <kristinn@hafro.is>
Address:	Marine Research Institute, P.O.Box 1390, Skulagata 4 , 121 Reykjavik, Iceland
Name(s):	Dr. Katherine Richardson <kr@adm.au.dk>
Address:	Det Naturvidenskabelige Fakultet, University of København, Øster Voldgade 3, 1350 København K, Denmark
Name(s):	Dr. Richard Lampitt <R.Lampitt@noc.soton.ac.uk>
Address:	National Oceanography Centre, Southampton Empress Dock, Southampton, SO14 3ZH, United Kingdom
Name(s):	Dr. Jan Kaiser <J.Kaiser@uea.ac.uk>
Address:	School of Environmental Sciences, University of East Anglia, Norwich, NR4 7TJ, United Kingdom
Name(s):	Ms. Nicole Bale <niba@pml.ac.uk>
Address:	Plymouth Marine Laboratory, Prospect Place, Plymouth, PL1 3DH, United Kingdom

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:

The overarching goal of this cruise is to study an important component of the oceanic carbon system – the North Atlantic Spring Bloom. Recent advances in autonomous platforms and novel sensors have enabled new approaches for studying oceanic carbon cycle research, with potentially broad impacts. This project addresses the North Atlantic Spring Bloom for its intrinsic merit but also as a testbed for developing strategies and knowledge needed to most effectively use these new autonomous methods in the future. Through the combination of autonomous platforms and ships, measurements will be made near 60°N, 20°W from late March 2008 (before the bloom) through early July (after the bloom). From late March through early July two Lagrangian floats will follow water parcels in the mixed layer, each with roving gliders to characterize its surroundings, and measure – in three dimensions over time – vertical and horizontal mixing rates and key carbon system components. Optical sensors will measure optical proxies for concentrations of phytoplankton, carbon and nitrate. Two-way communication via Iridium satellite will allow sampling strategies to evolve in response to observed conditions. The Lagrangian floats and underwater gliders will be deployed in March and retrieved in July from an Icelandic research vessel (Bjarni Saemundsson). In May R/V Knorr will sample in the vicinity of the floats and gliders and will deploy two additional types of autonomous profiling floats that will sample while the ship is in the vicinity of 60°N, 20°W.

The first key objective of the cruise is to collect water samples near the floats and gliders to verify the calibration of the autonomous sensors and to confirm the conversion factors to quantify phytoplankton carbon and nutrients. This objective may necessitate entry to coastal states waters, depending on the trajectory of the water masses the floats will follow. **The second key objective** is to determine the larger temporal and spatial scales surrounding the floats and gliders; this objective will be accomplished by CTD survey work and sampling underway with the ship's uncontaminated seawater system, and again may necessitate entry to coastal states waters. **The third key objective** is to bring together scientists from the United Sates, Iceland, Denmark, and the United Kingdom to study other phenomena associated with the bloom. Systematic comparison of these data with a bio-physical ecosystem model guided by adjoint analysis will be used to evaluate the appropriateness of such models for predicting both small-scale patchiness and net carbon uptake through the evolution of the bloom. These data sets will also be used by an educational program (COSEE–Ocean Systems) to develop a "story" on the role of the North Atlantic ocean ecosystem that will resonate with non scientists and be used in science curricula.

2.2 Relevant previous or future research cruises:
March and July 2008 cruises on Icelandic research vessel to same region, before and after the R/V Knorr cruise.

2.3 Previously published research data relating to the project:
This is a new 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:
Two profiling floats and three underwater gliders will already be in the water before the cruise; during the cruise, two other types of profiling floats will be deployed (Section 4, below).

3.3 Particulars of methods and scientific instruments

Types of samples and data	Methods to be used	Instruments to be used
Electronic samples	CTD package for profiles from ship	CTD (temperature, conductivity, depth); CDOM (chromphoric dissolved organic matter) and chlorophyll fluorometers; optical backscattering sensor; transmissometer
Electronic samples	Optical package for profiles from ship	Upwelling and downwelling spectral radiometers; absorption and attenuation meters
Electronic samples	Underway sampling of water from ship's uncontaminated seawater	Instruments same as above for CTD profiles; in addition, sensors for nitrate; variable fluorescence; pCO_2; argon and oxygen
Water samples	Collected from CTD/Rosette bottle profiles and from ship's uncontaminated seawater	Samples for chlorophyll a and HPLC pigments' nutrients; oxygen, argon and pCO_2; particulate and dissolved organic carbon, particulate organic nitrogen; particulate and dissolved spectral absorption coefficients; phytoplankton number and optical type by flow cytometry; phytoplankton isolates for culturing; phytoplankton samples for nitrogen metabolism genes; ^{14}C-rates of primary productivity; particulate-absorbed organic contaminates (also from air).
Settling particles	Floating sediment traps, to be deployed and retrieved during the May cruise.	APEX floats with sediment traps to collect particles

Aggregation of particles	Floating optical plankton counter, to be deployed and retrieved during the May cruise.	SOLO floats with an optical plankton counter to electronically measure aggregation of particles associate with phytoplankton bloom
Bathymetry	Bathymetric system	12.0 kHz and 3.5 kHz
Acoustic Doppler Current Profiles	ADCP	75 kHz and 150 kHz
Meteorological data	Meteorological Sensors	Meteorological Sensor Suite
Air samples for organic contaminants	Air filtration sample collection	Air Sampling Sensors

3.4 Indicate whether harmful substances will be used:
No harmful substances will be discharged from the ship. Solvents such as acetone and weak acid solutions will be used in small quantities on the ship. ^{14}C-bicarbonate will be used to measure phytoplankton primary productivity.

3.5 Indicate whether drilling will be carried out:
No.

3.6 Indicate whether explosives will be used:
No.

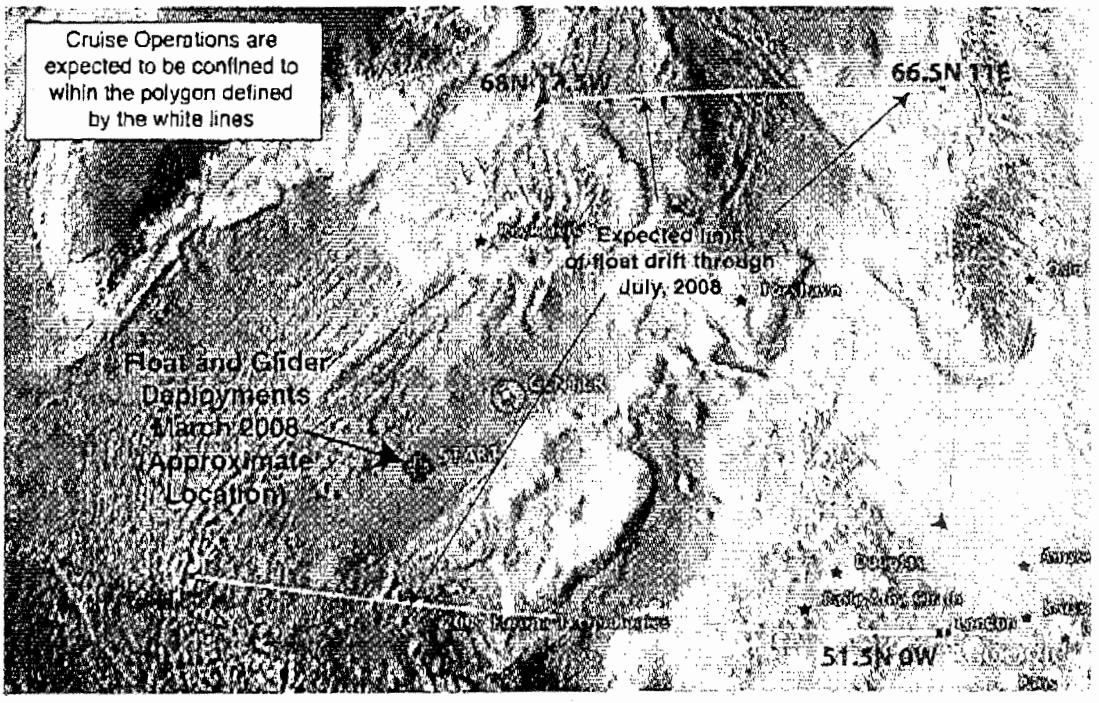
4. Installations and Equipment

Details of installations and equipment (dates of laying, servicing, recovery; exact locations and depth):
Two types of floats will be deployed from the R/V Knorr in May 2008 and retrieved before the end of the May cruise: 1) floating sediment traps: up to five floating sediments, each of which will be programmed to seek an independent depth between approximately 200 and 1,000 m. Each deployment will last 2-4 days, after which the traps will be retrieved. The intention is do to up to a maximum of four separate deployments. The exact location will depend on the existing oceanographic conditions, including where the highest concentrations of phytoplankton are located. 2) floating optical plankton counter that will be deployed once during the cruise to profile multiple times within the upper 200 m. The trap will be retrieved at the end of the cruise. The exact location will depend on the existing oceanographic conditions, including where the highest concentrations of phytoplankton are located.

5. Geographical Areas

5.1 Indicate geographical areas in which the project is to be conducted (with reference in latitude and longitude):
Within the following coordinates: 68°N 17.5°W, 54°N 35°W, 51.5°N 0°W, 66.5°N 11°E

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.



6. Dates

6.1 Expected dates of first entry into and final departure from the research area of the research vessel:
First entry on 26 April with final departure by 31May 2008.

6.2 Indicate if multiple entry is expected:
Multiple entry is not expected. However, if the floats and gliders being tracked drift in unintended trajectories, multiple entries may be necessary to sample near the floats and gliders, and to retrieve floats.

7. Port Calls

7.1 Dates and names of intended ports of call:
Reykjavik, Iceland: Estimated Arrival 3 May 2008 Reykjavik, Iceland: Estimated Departure 24 May 2008

7.2 Any special logistical requirements at ports of call:
No.

7.3 Name/Address/Telephone of shipping agent (if available):
Reykjavik, Iceland: EIMSKIP Port Agency Services Korngarour 2 104 Reykjavik ICELAND Contact: Berry Timmermans Phone: 354 525 7273 Fax: 354 525 7279 Cell: 354 825 7273 Email: byt@eimskip.is

8. Participation:

8.1 Extent to which coastal state will be enabled to participate or to be represented in the research project:
Scientists from Iceland, Denmark, and the U.K. will participate on the cruise.

8.2 Proposed dates and ports for embarkation/disembarkation:
Estimated embarkation on 3 May from Reykjavik, Iceland and estimated disembarkation in Reykjavik, Iceland on 24 May 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:
Participants from the coastal states will have access to the data collected on the cruise, results of analysis of water samples, and will participate in data analysis and reporting.

9.3 Proposed means to provide coastal state with assessment of data, samples and research results or provide assistance in their assessment or interpretation:
Participants from the coastal states will have access to the data and will participate in data analysis, reporting, and manuscript preparation for publication in scientific journals.

9.4 Proposed means of making results internationally available:
The results of this cruise will lead to collaborative scientific papers with scientists from coastal states; these papers will be published in internationally recognized scientific journals. Results from the cruise will be incorporated in educational learning modules that will available on the web.