

DRAFT STANDARD FORM A

APPLICATION FOR CONSENT TO CONDUCT MARINE SCIENTIFIC RESEARCH

Date: 1/29/2013

1. General Information

1.1 Cruise name and/or number:	A16N and WACS II - F2013-019
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1.2 Sponsoring institution(s):		
Name	Address	Name of Director
PMEL	Dan Simon	Chris Sabine

1.3 Scientist in charge of the project:	
Name:	Patricia Quinn
Country:	US
Affiliation:	NOAA, Pacific Marine Environmental Laboratory
Address:	7600 Sand Point Way NE
Telephone:	206-526-6862
Fax:	206-526-6744
Email:	Patricia.K.Quinn@noaa.gov
Website (for CV and photo):	

1.4 Entity(ies) /Participant(s) from coastal State involved in the planning of the project:	
Name:	
Country:	
Affiliation:	
Address:	
Telephone:	
Fax:	
Email:	
Website (for CV and photo):	

2. Description of Project

2.1 Nature and objectives of the project:
<p>The Western Atlantic Climate Study II (WACS II) project will involve measurements in the North Atlantic with the goal of encountering a wide range of oceanic and atmospheric conditions to assess the impact of aerosols on regional climate. The subsequent A16N project is a repeat hydrography cruise aimed at assessing changes in the distributions and fluxes of anthropogenic CO₂ in the North Atlantic.</p> <p>During the cruise an ancillary project will also be conducted to investigate oceanic lightning, which is poorly understood. An experimental low-frequency receiver will be used to detect and record lightning data in-situ. This will allow comparison of ship-borne measurements of oceanic lightning with measurements from land-based lightning networks and the space-based Lightning Imaging Sensor (LIS) on the National Aeronautical and Space Administration's (NASA's) Tropical Rainfall Measuring Mission. The LIS is a precursor to the satellite-borne Geostationary Lightning Mapper, planned to fly on NOAA's GOES-R geostationary satellite series.</p>

2.2 Relevant previous or future research projects:
<p>WACS - Western Atlantic Climate Study - August 2012 (WACS II) GOSHIP - www.go-ship.org (A16N)</p> <p>The lightning detection project is the first of its kind and will lead to performance assessment as well as additional research and development for the present-day land based lightning networks and the GOES-R Geostationary Lightning Mapper.</p>

2.3 Previous publications relating to the project:
<p>All previously published research data relevant to WACS II can be found at: http://saga.pmel.noaa.gov/data/</p> <p>Previously published data for A16N can be found in Wanninkhof, R., Doney, S., Bullister, J. L., Levine, N. M., Warner, M. J., and Gruber, N.: Detecting anthropogenic CO₂ changes in the interior Atlantic Ocean between 1989 and 2005, <i>J Geophys. Res.</i>, 115, C11028, C11028, doi:10.1029/2010JC006251, 2010.</p>

3. Geographical Areas

3.1 Indicate geographical areas in which the project is to be conducted (with reference in latitude and longitude, including coordinates of cruise track/ way points):

North Atlantic from Portsmouth, New Hampshire (43.1 N, 70.8 W) to Reykjavik, Iceland (65N, 22W). From Reykjavik via 63 18 N, 20 W to 63 12 N, 20 W.

3.2 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 location and depth of sampling stations, the tracks of survey lines, and the locations of installations and equipment.

4. Methods and Means to be Used

4.1 Particulars of vessel:	
Name:	RONALD H. BROWN
Type/Class:	Ship
Nationality (Flag state):	United States
Identification Number (IMO/Lloyds No.):	IMO 9105786
Website for diagram & specifications:	
Owner:	Department of Commerce, National Oceanic and Atmospheric Adminis
Operator:	Office of Marine and Aviation Operations
Overall length (meters):	83.50
Maximum draught (meters):	5.20
Displacement/Gross tonnage:	3250.00
Propulsion:	Two Fully Rotating Stern Z-Drives, 3000 HP each;
Cruising & maximum speed:	20.00 /28.00
Call sign:	WTEC
INMARSAT number and method and capability of communication (including emergency frequencies):	GMDSS Equipped; VHF Channel 16; MF/HF; Inmarsat-B, C, & M (156.525 MHz, 2187.5 kHz, 8414.5 kHz)
Name of master:	Captain Mark H. Pickett, NOAA
Number of crew:	28
Number of scientists on board:	30
Relevant documents required by international conventions and regulations:	
Other relevant information:	

4.5 Particulars of methods and scientific instruments:		
Types of samples and measurements	Methods to be used	Instruments to be used
Atmospheric particulate samples for chemical composition	Collection on impactor substrates	Ion Chromatographs, Thermal-Optical Combustion, Gravimetry, Xray Fluorescence
Real time analysis of chemical composition of atmospheric particulates	Mass Spectrometry	Aerosol mass spectrometer
Analysis of size distributions of atmospheric particulates	Differential mobility particle sizer and aerodynamic particle sizer	Short and medium column DMPSs with TSI particle counters
Aerosol light scattering absorption	Filter-based absorption; nephelometry	Radiance research particle soot absorption photometer (PSAP); TSI Nephelometer
Cloud condensation nuclei (CCN) concentrations	CCN counter	Droplet measurement technologies CCN counter
Discrete surface seawater samples for organic matter	Filtration of seawater	Sunset labs carbon analyzer
Continuous atmospheric meteorological observations	Meteorological sensors	Anemometer, Radiometers, Hygrometer
Lightning detection	Low frequency receiver	VLF receiver
Surface seawater partial pressure of CO2 (pCO2), oxygen, salinity, and temperature	automated instruments connected to the scientific seawater intake line on the ship	pCO2 - underway pCO2 system; oxygen - SeaBird optode; salinity and temperature - thermosalinograph
Conductivity-Temperature-Depth and O2 profiles to a water depth of maximum 6000 m. Profiles will be measured between June 24 and June 26 2013 in Icelandic waters at the following locations: 63 17.58 N 20 0.20 W, 63 12.84 N 19 59.63 W, 63 7.49 N 19 59.95 W, 62 44.91 N 20 0.02 W, 62 20.00 N 19 59.99	Water samples will be collected in rosette bottles for chemical measurements. Water samples from rosette bottle will be analyzed on board by spectrophotometry (nutrients), coulometry (inorganic carbon), infrared analysis and gas chromatography (dissolved gases and tracers), and titration (alkalinity and	CTD (conductivity, temperature, depth) profiler and chemical analyzers on board.

W, 61 49.97 N 19 59.95 W, 61 36.78 N 20 0.00 W, 61 20.01 N 19 59.93 W, 61 0.04 N 20 0.11 W.	oxygen)	
Water transport	Acoustic doppler current profiling	RDI Acoustic Doppler Current Profiler (ADCP)

4.6 Indicate nature and quantity of substances to be released into the marine environment:
No

4.7 Indicate whether drilling will be carried out. If yes, please specify:
No

4.8 Indicate whether explosives will be used. If yes, please specify type and trade name, chemical content, depth of trade class and stowage, size, depth of detonation, frequency of detonation, and position in latitude and longitude:
No

4.9 Indicate whether protected species be studied. If yes, please specify:
No

5. Installations and Equipment

Details of installations and equipment (including dates of laying, servicing, method and anticipated timeframe for recovery, locations and depth, and measurements):
No

6. Dates

6.1 Expected dates of first entry into and final departure from the research area by the research vessel and/or other platforms:
Project Start Date: Jun 06, 2013
Project End Date: Jun 30, 2013

6.2 Indicate if multiple entries are expected:

Coastal Area	Estimated Entry Date	Estimated Departure Date	Multiple Entries Expected?
Canada	Jun 06, 2013	Jun 20, 2013	No

Explanation of multiple entries:
N/A

Research will be performed: between 12-200 nm

Extent to which Canada will be enabled to participate or to be represented in the research project:

Participation by scientists/observer(s) is welcome. The participant(s) should be nominated to the Chief Scientist no later than 25 April 2013 so that travel/accommodations can be arranged and medical/security clearances can be obtained. Participant(s) must provide full name and contact information and stay in touch with the Chief Scientist in the event of schedule changes. Participant(s) may board in Portsmouth, New Hampshire, on or about 6 June 2013 and disembark in Reykjavik, Iceland, on or about 20 June 2013.

Current participants from coastal state: NO

Coastal Area	Estimated Entry Date	Estimated Departure Date	Multiple Entries Expected?
Iceland	Jun 06, 2013	Jun 30, 2013	No

Explanation of multiple entries:
N/A

Research will be performed: between 12-200 nm

Extent to which Iceland will be enabled to participate or to be represented in the research project:

Participation by scientists/observer(s) is welcome. The participant(s) should be nominated to the Chief Scientist no later than 25 April 2013 so that travel/accommodations can be arranged and medical/security clearances can be obtained. Participant(s) must provide full name and contact information and stay in touch with the Chief Scientist in the event of schedule changes. Participant(s) may board in Portsmouth, New Hampshire, on or about 6 June 2013 and disembark in Reykjavik, Iceland, on or about 20 June 2013.

Current participants from coastal state: YES

Provided name, affiliation and contact information for all participants from coastal state:

Dr. Jon Olafsson,
Marine Environment Section,
Marine Research Institute Iceland,
Skulagata 4, 121 Reykjavik, Iceland.
Phone 354 575 2000,
Fax 354 575 2001,
Email jon@hafro.is

7. Port Calls

Port	Arrival Date	End Date	Special Logistical Requirements	Shipping Agent
Reykjavik	6/20/2013	6/25/2013	Not applicable	Not available

8. Participation of the representative of the coastal State

8.1 Modalities of the participation of the representative of the coastal State in the research project:
See Section 6 (Dates)

8.2 Proposed dates and ports for embarkation/disembarkation:
See Section 7 (Port Call(s))

9. Access to Data, Samples and Research Results

9.1 Expected dates of submission to coastal State of preliminary report, which should include the expected dates of submission of the data and research results:
No more than 30 days from the end date of the research.

9.2 Anticipated dates of submission to the coastal State of the final report:
No more than 2 years from the end date of the research.

9.3 Proposed means for access by coastal State to data (including format) and samples:
Data will be provided through official channels at no cost to the coastal State(s). Samples will be provided upon request.

9.4 Proposed means to provide coastal State with assessment of data, samples and research results:
Assessment of data, samples, and research results will be provided at no cost to the coastal State(s). Assistance in further assessment or interpretation will be provided upon request.

9.5 Proposed means to provide assistance in assessment or interpretation of data, samples and research results:

9.6 Proposed means of making results internationally available:
All data will be accessible at:
<http://saga.pmel.noaa.gov/data/>
Results of the lightning detection project will likely be presented at the fall 2013 conference of the American Geophysical Union.

10. Other Permits Submitted

10.1 Indicate other types of coastal state permits anticipated for this research (received or pending):

11. List of Supporting Documentation

11.1 List of attachments, such as additional forms required by the coastal State, etc.:

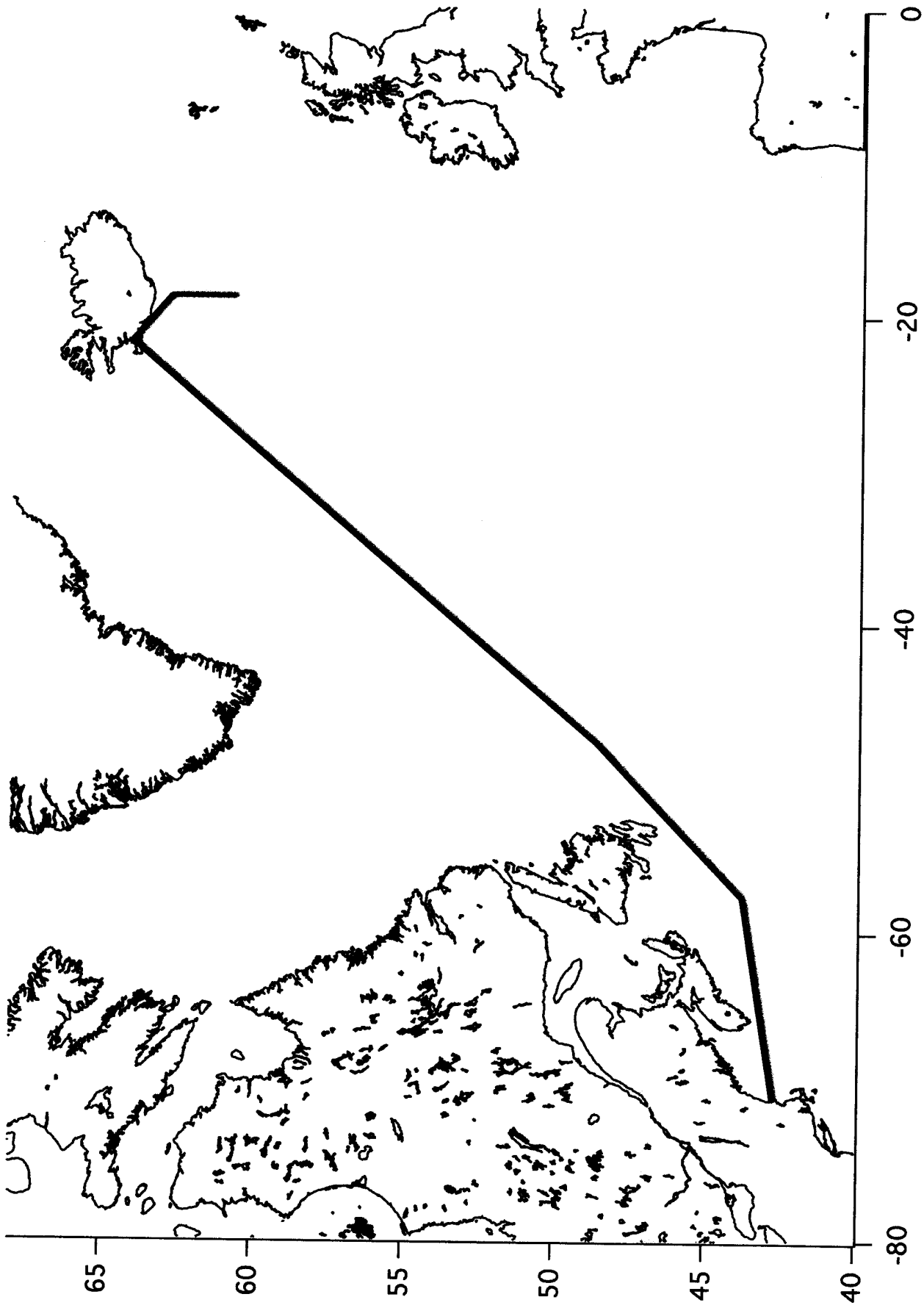
Attachment Type	Description	Attachment	Submission Date
Proposed Cruise Track	Cruise Track	1539375000_Cruise Track.pdf	Jan 10, 2013
Supplemental Material	CV of Chief Scientist Dr. Patricia Quinn	6532031250_Quinn cv for RATS.doc	Jan 25, 2013
Supplemental Material	Photo of Chief Scientist	6878281250_Quinn photo.jpg	Jan 25, 2013

12. Point of Contact for Additional Information on this Application

Name and address:	
Country:	
Affiliation:	

Address:	
Telephone:	
Fax:	
Email:	

WACS II Cruise Track



CURRICULUM VITA

Patricia K. Quinn

EDUCATION

1982 B.A. in Chemistry, Reed College, Portland, OR
1988 Ph.D. in Chemistry, University of Washington, Seattle, WA

EMPLOYMENT HISTORY

1993 - present, NOAA Pacific Marine Environmental Laboratory, Research Chemist
1990 - 1993, JISAO, University of Washington, Oceanographer III.
1989 - 1990, Cooperative Institute for Research in Environmental Studies (CIRES),
University of Colorado, Research Associate.

AWARDS AND HONORS

Editor's Citation for Excellence in Reviewing, Journal of Geophysical Research
Atmospheres, 1993, 1998, and 2008
PMEL Outstanding Scientific Paper, 2003
NOAA Administrator Award, 2008
AGU Fellow, 2010
U.S. Department of Commerce, Bronze Medal Award 2010

RESEARCH INTERESTS AND EXPERIENCE

Impact of atmospheric aerosols on climate and air quality.
Short lived climate forcers and Arctic climate.
Cloud nucleating and optical properties of ocean-derived aerosol.

Author and co-author of over 130 papers.
Participant in 13 research cruises.
Chief Scientist/co-chief scientist for 3 research cruises.

PUBLICATIONS Last 10 Years – First Author

- Quinn, P.K. and T.S. Bates, The case against climate regulation via oceanic phytoplankton sulfur emissions, *Nature*, 480, 51 – 56, 2011.
- Quinn, P.K., T.S. Bates, K. Schulz, and G.E. Shaw, Decadal trends in aerosol chemical composition at Barrow, Alaska: 1976 – 2008, *Atmos. Chem. Physics*, 9, 8883 – 8888, 2009.
- Quinn, P.K., T.S. Bates, D.J. Coffman, and D.S. Covert, Influence of particle size and chemistry on the cloud nucleating properties of aerosols, *Atmos. Chem. Physics*, 8, 1029-1042, 2008.
- Quinn, P.K., T.S. Bates, E. Baum, N. Doubleday, A. Fiore, M. Flanner, A. Fridlind, T. Garrett, D. Koch, S. Menon, D. Shindell, A. Stohl, and S.G. Warren, Short-lived pollutants in the Arctic: Their climate impact and possible mitigation strategies, *ACP*, 8, 1723 – 1735, 2008.
- Quinn, P.K., G. Shaw, E. Andrews, E.G. Dutton, T. Ruoho-Airola, S.L. Gong, Arctic Haze: Current trends and knowledge gaps, *Tellus*, 59B, 99 – 114, 2007.

- Quinn, P.K., T.S. Bates, D. Coffman, T.B. Onasch, D. Worsnop, T. Baynard, J.A. de Gouw, P.D. Goldan, W.C. Kuster, E. Williams, J. M. Roberts, B. Lerner, A. Stohl, A. Pettersson, and E.R. Lovejoy, Impacts of sources and aging on submicrometer aerosol properties in the marine boundary layer across the Gulf of Maine, *J. Geophys. Res.*, 111, D23S36, doi:10.1029/2006JD007582, 2006.
- Quinn, P. K., et al., Impact of particulate organic matter on the relative humidity dependence of light scattering: A simplified parameterization, *Geophys. Res. Lett.*, 32, L22809, doi:10.1029/2005GL024322, 2005.
- Quinn, P.K. and T.S. Bates, Regional Aerosol Properties: Comparisons from ACE 1, ACE 2, Aerosols99, INDOEX, ACE Asia, TARFOX, and NEAQS, *J. Geophys. Res.*, 110, D14202, doi:10.1029/2004JD004755, 2005.
- Quinn, P.K., D.J. Coffman, T.S. Bates, E.J. Welton, D.S. Covert, T.L. Miller, J.E. Johnson, S. Maria, L. Russell, R. Arimoto, C.M. Carrico, M.J. Rood, and J. Anderson, Aerosol optical properties measured onboard the *Ronald H. Brown* during ACE Asia as a function of aerosol chemical composition and source region, *J. Geophys. Res.*, 109, D19S01, doi:10.1029/2003JD004010, 2004.
- Quinn, P.K. and T.S. Bates, North American, Asian, and Indian haze: Similar regional impacts on climate?, *Geophys. Res. Lett.*, 30 (11), 1555, doi:10.1029/2003GL016934, 2003.
- Quinn, P.K., D.J. Coffman, T.S. Bates, T.L. Miller, J.E. Johnson, E.J. Welton, C. Neusüss, M. Miller, and P. Sheridan, Aerosol optical properties during INDOEX 1999: Means, variabilities, and controlling factors, *J. Geophys. Res.*, 107(D19), 8020, doi:10.1029/2000JD000037, 2002.
- Quinn, P.K., T.L. Miller, T.S. Bates, J.A. Ogren, E. Andrews, and G.E. Shaw, A three-year record of simultaneously measured aerosol chemical and optical properties at Barrow, Alaska, *J. Geophys. Res.*, 107(D11), 10.1029/2001JD001248, 2002.

PUBLICATIONS – Last 5 Years – Co-authored

- Smirnov, A., A.M. Sayer, B.N. Holben, N.C. Hsu, S.M. Sakerin, A. Macke, N.B. Nelson, Y. Courcoux, T.J. Smith, P. Croot, **P.K. Quinn**, J. Sciare, S.D. Gulev, S. Piketh, R. Losno, S. Kinne, and V.F. Radionov, Effect of wind speed on aerosol optical depth over remote oceans based on data from the Maritime Aerosol Network, *Atmos. Meas. Tech.*, 5, 377 – 388, 2012.
- Gaston, C.J., H. Furutani, S.A. Guazzotti, K.R. Coffee, T.S. Bates, **P.K. Quinn**, L.I. Aluwihare, B.G. Mitchell, and K.A. Prather, Unique ocean-derived particles serve as a proxy for changes in ocean chemistry, *J. Geophys. Res.*, 116, D18310, doi:10.1029/2010JD015289, 2011.
- Fisher, J.A., D.J. Jacob, Q. Wang, R. Bahreini, C.C. Carouge, M.J. Cubison, J.E. Dibb, T. Diehl, J.L. Jimenez, E.M. Leibensperger, M.B.J. Meinders, H. O.T. Pye, **P.K. Quinn**, S. Sharma, A. von Donkelaar, and R.M. Yantosca, Sources, distribution, and acidity of sulfate-ammonium aerosol in the Arctic in winter-spring, *Atm. Environ.*, 45, 7301 – 7318, 2011.
- Smirnov, A. B. N. Holben, D. M. Giles, I. Slutsker, N. T. O'Neill, T. F. Eck, A. Macke, P. Croot, Y. Courcoux, S. M. Sakerin, T. J. Smyth, T. Zielinski, G. Zibordi,

- J. I. Goes, M. J. Harvey, **P. K. Quinn**, N. B. Nelson, V. F. Radionov, C. M. Duarte, R. Losno, J. Sciare, K. J. Voss, S. Kinne, N. R. Nalli, E. Joseph, K. Krishna Moorthy, D. S. Covert, S. K. Gulev, G. Milinevsky, P. Larouche, S. Belanger, E. Horne, M. Chin, L. A. Remer, R. A. Kahn, J. S. Reid, M. Schulz, C. L. Heald, J. Zhang, K. Lapina, R. G. Kleidman, J. Griesfeller, B. J. Gaitley, Q. Tan, and T. L. Diehl, Maritime aerosol network as a component of AERONET – first results and comparison with global aerosol models and satellite retrievals, *Atmos. Meas. Tech.*, *4*, 583-597, 2011.
- Brock, C.A., J. Cozic, R. Bahreini, K.D. Froyd, A.M. Middlebrook, A. McComiskey, J. Brioude, O. Coper, K. Aikin, J.A. de Gouw, D.W. Fahey, R. Ferrare, R.S. Gao, W. Gore, J.S. Holloway, G. Hubler, A. Jefferson, D. Lack, S. Lance, R.H. Moore, D.M. Murphy, A. Nenes, J.A. Neuman, P.C. Novelli, J. Nowak, J.A. Ogren, J. Peischl, B. Pierce, P. Pilewskie, **P.K. Quinn**, J.M. Roberts, T.B. Ryerson, S. Schmidt, J.P. Schwarz, H. Sodemann, R. Spackman, H. Stark, A. Stohl, D. Thomson, T. Thornberry, P. Veres, L. Watts, and C. Warneke, Characteristics, sources, and transport of aerosols measured in spring during the Aerosol, Radiation, and Cloud Processes Affecting Arctic Climate (ARCPAC) Project, *Atm. Chem., Phys.*, *11*, 2423 – 2453, 2011.
- Frossard, A.A., P.M. Shaw, L.M. Russell, J.H. Kroll, M. Canagartna, D. Worsnop, **P.K. Quinn**, and T.S. Bates, Springtime Arctic haze contributions of submicron organic particles from European and Asian combustion sources, *J. Geophys. Res.*, *116*, D05205, doi:10.1029/2010JD015178, 2011.
- Jaegle, L., **P.K. Quinn**, T. Bates, B. Alexander, and J.T. Lin, Global distribution of sea salt aerosols: new constraints from in situ and remote sensing observations, *Atm. Chem. Phys.*, *11*, 3137 – 3157, 2011.
- Molders, N., J.N.Q. Tran, **P. K. Quinn**, K. Sassen, G.E. Shaw, and G. Kramm, Assessment of WRF/Chem to simulate sub-Arctic boundary layer characteristics during low solar irradiation using radiosonde, SODAR, and surface data, *Atmos. Poll. Research*, *2*, 283 – 299, 2011.
- Lack, D.A., C.D. Cappa, J. Langridge, R. Bahreini, G. Buffaloe, C. Brock, K. Cerully, D. Coffman, D.W. Fahey, K. Hayden, J. Holloway, B. Lerner, P. Massoli, S.M. Li, R. McLaren, A. Middlebrook, R. Moore, A. Nenes, I. Nuaanan, T. Onasch, J. Peischl, A. Perring, **P.K. Quinn**, T. Ryerson, J.P. Schwartz, R. Spackman, S.C. Wofsy, D. Worsnop, B. Xiang, and E. Williams, Impact of fuel quality regulation and speed reductions on shipping emissions: Implications for climate and air quality, *Environ. Sci. Tech.*, doi:10.1021/es2013424, 2011.
- Yang, M., B.J. Huebert, B.W. Blomquist, S.G. Howell, L.M. Shank, C.S. McNaughton, A.D. Clarke, L. Hawkins, L.M. Russell, D.S. Covert, D.J. Coffman, T.S. Bates, **P.K. Quinn**, N. Zaborac, A.R. Bandy, S.P. de Szoeki, P.D. Zuidema, S.C. Tucker, W.A. Brewer, K.B. Benedict, and J.L. Collett, Atmospheric sulfur cycling in the southeastern Pacific – longitudinal distribution, vertical profile, and diel variability observed during VOCALS-REx, *Atmos. Chem. Phys.*, *11*, 5079-5097, doi:10.5194/acp-11-5079-2011, 2011.
- Hirdman, D., J.F. Burkhardt, H. Sodemann, S. Eckhardt, A. Jefferson, **P.K. Quinn**, S. Sharma, J. Strom, and A. Stohl, Long-term trends of black carbon and sulfate aerosol in the Arctic: changes in atmospheric transport and source region emissions, *Atmos. Chem. Phys.*, *10*, 9351 - 9368, 2010.
- Hawkins, L.N., Russell, L.M., D.S. Covert, **P.K. Quinn**, and T.S. Bates, Carboxylic acids, sulfates, and organosulfates in processed continental organic aerosol over

- the southeast Pacific during VOCALS-Rex 2008, *J. Geophys. Res.*, *115*, D13, D14201, 2010.
- Shaw, P.M., L.M. Russell, **P.K. Quinn**, and A. Jefferson, Arctic organic aerosol measurements show particles from mixed combustion in spring haze and from frost flowers in winter, *Geophys. Res. Lett.*, *37*, L10803, doi:10.1029/2010GL042831, 2010.
- Ervens, B., M.J. Cubison, E. Andrews, G. Feingold, J.A. Ogren, J.L. Jimenez, **P.K. Quinn**, T.S. Bates, J. Wang, Q. Zhang, H. Coe, M. Flynn, and J.D. Allan, CCN predictions using simplified assumptions of organic aerosol composition and mixing state: A synthesis from six different locations, *ACP*, *10*, 4795 – 4807, 2010.
- Thornton, J.A., James P. Kercher, Theran P. Riedel, Nicholas L. Wagner, Julie Cozic, John S. Holloway, William P. Dube, Glenn M. Wolfe, **Patricia K. Quinn**, Ann M. Middlebrook, Becky Alexander, and Steven S. Brown, A large atomic chlorine source inferred from mid-continental reactive nitrogen chemistry, *Nature*, *464*, 271 – 274, 2010.
- Lack, D.A., **P.K. Quinn**, P. Massoli, T.S. Bates, D. Coffman, D. Covert, B. Sierau, S. Tucker, T. Baynard, E. Lovejoy, D.M. Murphy, and A.R. Ravishankara, Relative humidity dependence of light absorption by mineral dust after long-range atmospheric transport from the Sahara, *Geophys. Res. Lett.*, *36*, No. 24, L24805, doi:10.1029/2009GL040827, 2009.
- Hirdman, D., H. Sodemann, S. Eckhardt, J.F. Burkhardt, **P.K. Quinn**, S. Sharma, J. Strom, and A. Stohl, Source identification of short-lived air pollutants in the Arctic using statistical analysis of measurement data and particle dispersion model output, *Atmos. Chem. Phys.*, *10*, 669 – 693, 2010.
- Atkinson, D.B., P. Massoli, N. T. O'Neill, **P.K. Quinn**, S.D. Brooks, and B. Lefer, Comparison of in situ and columnar aerosol spectral measurements during TexAQS-GoMACCS 2006: testing parameterizations for estimating aerosol fine mode properties, *Atmos. Chem. Phys.*, *10*, 51 - 61, 2010.
- Russell, L.M., R. Bahadur, L.N. Hawkins, J. Allan, D. Baumgardner, **P.K. Quinn**, and T.S. Bates, Organic aerosol characterization by complementary measurements of chemical bonds and molecular fragments, *Atmos. Env.*, *43*, 6100 – 6105, 2009
- Russell, L.M., L.N. Hawkins, A.A. Frossard, **P.K. Quinn**, and T.S. Bates, Carbohydrate-like composition of submicron atmospheric particles and their production from ocean bubble bursting, *Proc. Natl. Acad. Sci.*, *107* (15) 6652 – 6657, doi:10.1073/pnas.0908905107, 2010.
- Roberts, J.M., H.D. Osthoff, S.S. Brown, A.R. Ravishankara, D. Coffman, **P.K. Quinn**, and T.S. Bates, Laboratory studies of products of N₂O₅ uptake on Cl containing substrates, *Geophys. Res., Lett.*, *36*, L20808, doi:10.1029/2009GL040448, 2009.
- Bertram, T.H., J.A. Thornton, T.P. Riedel, A.M. Middlebrook, R. Bahreini, T.S. Bates, **P.K. Quinn**, and D.J. Coffman, Direct observations of N₂O₅ reactivity on ambient aerosol particles, *Geophys. Res. Lett.*, *36*, L19803, doi:10.1029/2009GL040248, 2009.
- Cappa, C.D., T.S. Bates, **P.K. Quinn**, and D.A. Lack, Source characterization from ambient measurements of aerosol optical properties, *Geophys. Res. Lett.*, *36*, L14813, doi:10.1029/2009GL038979, 2009.
- CCSP 2009: Atmospheric Aerosol Properties and Climate Impacts, A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research (M. Chin, R.A. Kahn, and S.E. Schwartz, eds.). National Aeronautics and Space Administration, Washington, D.C., USA, 128 pp.
- Russell, L.M., S. Takahama, S. Liu, L.N. Hawkins, D.S. Covert, **P.K. Quinn**, and T.S. Bates, Oxygenated fraction and mass of organic aerosol from direct emission and atmospheric processing measured on the R/V Ronald H. Brown during

- TexAQS/GoMACCS 2006, *J. Geophys. Res.*, 114, D00F05, doi:10.1029/2008JD011275, 2009.
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DRAFT STANDARD FORM A

APPLICATION FOR CONSENT TO CONDUCT MARINE SCIENTIFIC RESEARCH

Date: 2/4/2013

1. General Information

1.1 Cruise name and/or number:	A16N Repeat Hydrography/CO2 - F2013-024
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1.2 Sponsoring institution(s):		
Name	Address	Name of Director
NOAA/Atlantic Oceanographic and Meteorological Laboratory	Richard Wanninkhof, NOAA/Atlantic Oceanographic and Meteorological Laboratory, 4301 Rickenbacker Causeway, Miami FL 33149 USA. Telephone 305-361-4379, Fax 305-361-4392, Email rik.wanninkhof@noaa.gov	Dr. Robert Atlas

1.3 Scientist in charge of the project:	
Name:	Molly Baringer
Country:	US
Affiliation:	NOAA/AOML
Address:	
Telephone:	305-361-4345
Fax:	305-361-4412
Email:	Molly.Baringer@noaa.gov
Website (for CV and photo):	

1.4 Entity(ies) /Participant(s) from coastal State involved in the planning of the project:	
Name:	
Country:	
Affiliation:	
Address:	
Telephone:	
Fax:	
Email:	
Website (for CV and photo):	

2. Description of Project

2.1 Nature and objectives of the project:
<p>This cruise is part of the decadal re-occupation of select NOAA hydrographic transects to determine natural and man-made changes in chemical and physical properties in the ocean under auspices of the international program GOSHIP (www.go-ship.org). The focus of this particular cruise is to determine the changes in anthropogenic CO₂, distributions and fluxes in the North Atlantic since the last occupation in 2003 as part of the CLIVAR/CO₂ program. Decadal variations of CO₂ tracer, oxygen, and temperature distributions are strongly influenced by climate change and natural processes. The repeat hydrography cruises are the only means to obtain climate quality data to study changes and impacts in the ocean. This research is co-sponsored by the USA agencies NOAA and NSF.</p> <p>During the cruise an ancillary project will also be conducted to investigate oceanic lightning, which is poorly understood. An experimental low-frequency receiver will be used to detect and record lightning data in-situ. This will allow comparison of ship-borne measurements of oceanic lightning with measurements from land-based lightning networks and the space-based Lightning Imaging Sensor (LIS) on the National Aeronautical and Space Administration's (NASA's) Tropical Rainfall Measuring Mission. The LIS is a precursor to the satellite-borne Geostationary Lightning Mapper, planned to fly on NOAA's GOES-R geostationary satellite series.</p>

2.2 Relevant previous or future research projects:
<p>Clearance was obtained from the maritime nations, including Portugal, for the 2003 A16N cruise as part of the CLIVAR/CO₂ program. The lightning detection project is the first of its kind and will lead to performance assessment as well as additional research and development for the present-day land based lightning networks and the GOES-R Geostationary Lightning Mapper.</p>

2.3 Previous publications relating to the project:
<p>Wanninkhof, R., Doney, S., Bullister, J. L., Levine, N. M., Warner, M. J., and Gruber, N.: Detecting anthropogenic CO₂ changes in</p>

the interior Atlantic Ocean between 1989 and 2005, J Geophys. Res., 115, C11028, C11028, doi:10.1029/2010JC006251, 2010

3. Geographical Areas

3.1 Indicate geographical areas in which the project is to be conducted (with reference in latitude and longitude, including coordinates of cruise track/ way points):

Atlantic Ocean from approximately 63N to 06S and from 20W to 30W.

3.2 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 location and depth of sampling stations, the tracks of survey lines, and the locations of installations and equipment.

4. Methods and Means to be Used

4.1 Particulars of vessel:

Name:	RONALD H. BROWN
Type/Class:	Ship
Nationality (Flag state):	United States
Identification Number (IMO/Lloyds No.):	IMO 9105786
Website for diagram & specifications:	
Owner:	Department of Commerce, National Oceanic and Atmospheric Adminis
Operator:	Office of Marine and Aviation Operations
Overall length (meters):	83.50
Maximum draught (meters):	5.20
Displacement/Gross tonnage:	3250.00
Propulsion:	Two Fully Rotating Stern Z-Drives, 3000 HP each;
Cruising & maximum speed:	20.00 /28.00
Call sign:	WTEC
INMARSAT number and method and capability of communication (including emergency frequencies):	GMDSS Equipped; VHF Channel 16; MF/HF; Inmarsat-B, C, & M (156.525 MHz, 2187.5 kHz, 8414.5 kHz)
Name of master:	Captain Mark H. Pickett, NOAA
Number of crew:	28
Number of scientists on board:	30
Relevant documents required by international conventions and regulations:	
Other relevant information:	

4.5 Particulars of methods and scientific instruments:

Types of samples and measurements	Methods to be used	Instruments to be used
CTD/O2 profiles. Stations will be completed to full water depth of maximum 6000 m. Water samples will be collected in rosette bottles for chemical measurements.	Temperature, conductivity, and oxygen will be collected with a CTD. Water samples from rosette bottle will be analyzed on board by spectrophotometry (nutrients), coulometry (inorganic carbon), infrared analysis and gas chromatography (dissolved gases and tracers), and titration (alkalinity and oxygen)	CTD (conductivity, temperature, depth) profiler, chemical analyzers on board
Water transport	Acoustic doppler current profiling	RDI Acoustic Doppler Current Profiler (ADCP)
Lightning detection	Low frequency receiver	VLF receiver
Surface seawater partial pressure of CO2 (pCO2), oxygen, salinity, and temperature	automated instruments connected to the scientific seawater intake line on the ship	pCO2 - underway pCO2 system; oxygen - SeaBird optode; salinity and temperature - thermosalinograph

4.6 Indicate nature and quantity of substances to be released into the marine environment:

No

4.7 Indicate whether drilling will be carried out. If yes, please specify:

No

4.8 Indicate whether explosives will be used. If yes, please specify type and trade name, chemical content, depth of trade class and stowage, size, depth of detonation, frequency of detonation, and position in latitude and longitude:

No

4.9 Indicate whether protected species be studied. If yes, please specify:
No

5. Installations and Equipment

Details of installations and equipment (including dates of laying, servicing, method and anticipated timeframe for recovery, locations and depth, and measurements):
No

6. Dates

6.1 Expected dates of first entry into and final departure from the research area by the research vessel and/or other platforms:
Project Start Date: Jun 25, 2013
Project End Date: Sep 04, 2013

6.2 Indicate if multiple entries are expected:

Coastal Area	Estimated Entry Date	Estimated Departure Date	Multiple Entries Expected?
Portugal	Jul 12, 2013	Jul 24, 2013	No
Explanation of multiple entries: N/A			
Research will be performed: between 12-200 nm			
Extent to which Portugal will be enabled to participate or to be represented in the research project: Coastal state will have full access to data			
Current participants from coastal state: NO			
Coastal Area			
Brazil			
Port Call Only			
Coastal Area	Estimated Entry Date	Estimated Departure Date	Multiple Entries Expected?
Iceland	Jun 25, 2013	Jun 30, 2013	No
Explanation of multiple entries: N/A			
Research will be performed: within 12 nm			
Extent to which Iceland will be enabled to participate or to be represented in the research project: Coastal state will have full access to data.			
Current participants from coastal state: YES			
Provided name, affiliation and contact information for all participants from coastal state: Dr. Jon Olafsson, Marine Environment Section, Marine Research Institute Iceland, Skulagata 4, 121 Reykjavik, Iceland. Phone 354 575 2000, Fax 354 575 2001, Email jon@hafro.is			

7. Port Calls

Port	Arrival Date	End Date	Special Logistical Requirements	Shipping Agent
Natal	8/27/2013	9/4/2013	Not available at this time.	Not available at this time.
Funchal, Madeira	7/17/2013	7/22/2013	Not available at this time	Not available at this time

8. Participation of the representative of the coastal State

8.1 Modalities of the participation of the representative of the coastal State in the research project:
See Section 6 (Dates)

8.2 Proposed dates and ports for embarkation/disembarkation:
See Section 7 (Port Call(s))

9. Access to Data, Samples and Research Results

9.1 Expected dates of submission to coastal State of preliminary report, which should include the expected dates of submission of the data and research results:
 No more than 30 days from the end date of the research.

9.2 Anticipated dates of submission to the coastal State of the final report:
 No more than 2 years from the end date of the research.

9.3 Proposed means for access by coastal State to data (including format) and samples:
 Data will be provided through official channels at no cost to the coastal State(s). Samples will be provided upon request.

9.4 Proposed means to provide coastal State with assessment of data, samples and research results:
 Assessment of data, samples, and research results will be provided at no cost to the coastal State(s). Assistance in further assessment or interpretation will be provided upon request.

9.5 Proposed means to provide assistance in assessment or interpretation of data, samples and research results:

9.6 Proposed means of making results internationally available:
 Results will be made available through a open website: <http://www.aoml.noaa.gov/ocd/gcc/A16N/>
 Results of the lightning detection project will likely be presented at the fall 2013 conference of the American Geophysical Union.

10. Other Permits Submitted

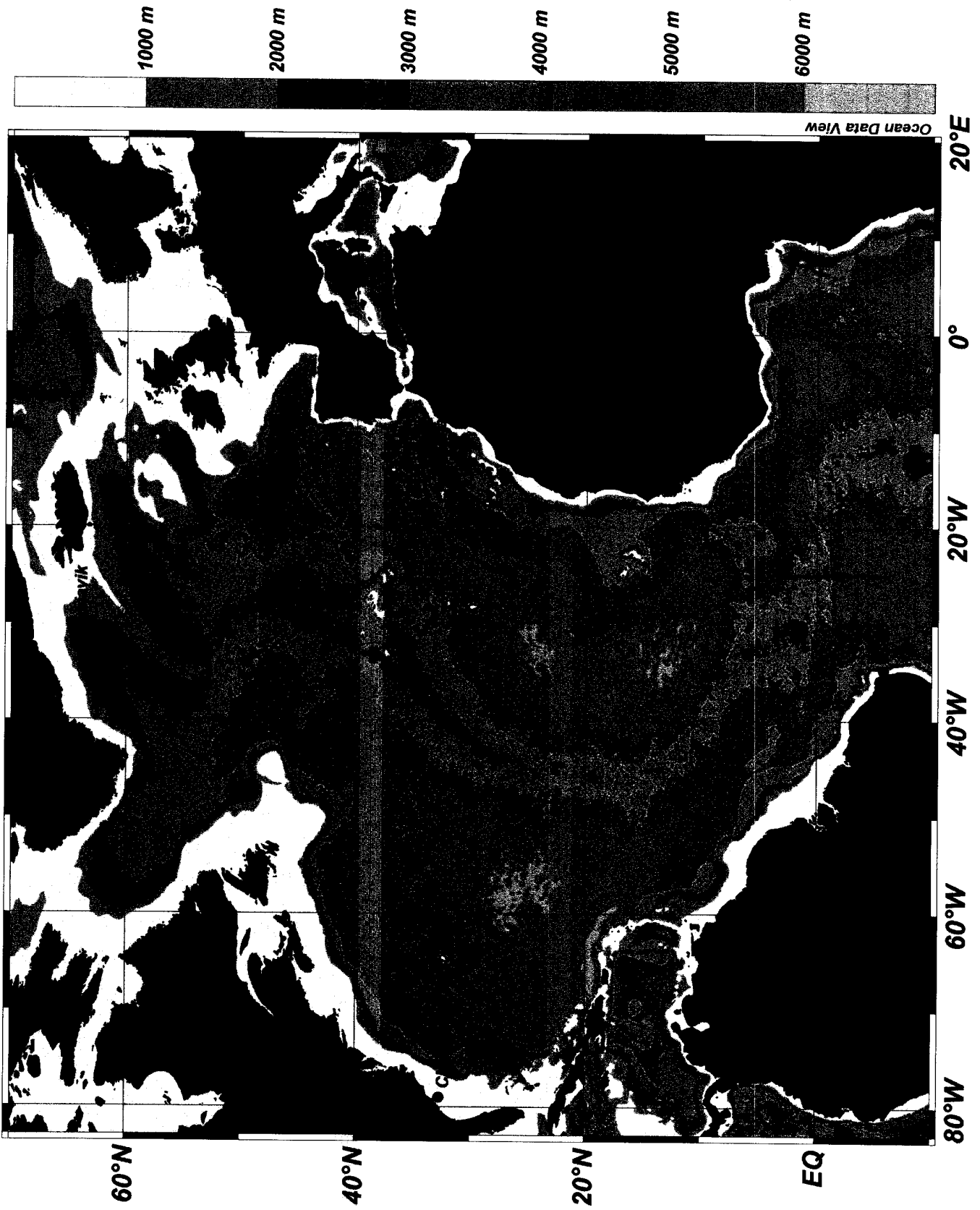
10.1 Indicate other types of coastal state permits anticipated for this research (received or pending):

11. List of Supporting Documentation

11.1 List of attachments, such as additional forms required by the coastal State, etc.:			
Attachment Type	Description	Attachment	Submission Date
Proposed Cruise Track	A16N cruise track	2212500000_A16N_cruisetrack.jpg	Jan 20, 2013
Supplemental Material	Description of leaders of the repeat hydrography program; the coordinator for this application, A16N; and the chief scientists for A16N	0029687500_Overview leaders chief sci repeathydro A16N.docx	Jan 23, 2013
Supplemental Material	CV and photo, Dr. Molly Baringer, Chief Scientist for Leg 1 (Reykjavik to Funchal)	1651093750_Baringer resume short clearances.pdf	Jan 24, 2013
Supplemental Material	CV and photo, Dr. John Bullister, Chief Scientist for Leg 2 (Funchal to Natal)	2348750000_cv_bullister.pdf	Jan 24, 2013

12. Point of Contact for Additional Information on this Application

Name and address:	
Country:	
Affiliation:	
Address:	
Telephone:	
Fax:	
Email:	





Curriculum Vitae

Dr. Molly O'Neil Baringer

Atlantic Oceanographic and Meteorological Laboratories, NOAA
Molly.Baringer@noaa.gov

Education

PhD in Physical Oceanography, October 1, 1993.

Massachusetts Institute of Technology, Joint Program with the Woods Hole Oceanographic Institution, Cambridge, Mass.

Bachelor of Science in Mathematics, May 1985.

Tulane University, New Orleans, La.

Experience

National Oceanic and Atmospheric Administration, Atlantic Oceanographic and Meteorological Laboratory, Physical Oceanography Division

Miami, FL

Oceanographer, 1994 – present.

Woods Hole Oceanographic Institution, Department of Physical Oceanography

Woods Hole, Mass.

Graduate Research Assistant, 1987 - 1993.

Current Funded Proposals

- NSF - An Observing System for Meridional Heat Transport Variability in the Subtropical North Atlantic, with W. E. Johns, \$2143K Total FY2008-2014.
- NOAA/OGP - CLIVAR Repeat Hydrography, with G. Johnson, C. Langdon, R. Wanninkhof and others, renewable, \$715K FY2005-to present.
- NOAA/OGP - Western Boundary Time Series in the Atlantic Ocean, with C. Meinen, and S. Garzoli, renewable, \$350K FY2012, renewable.
- NOAA/OGP - Atlantic Ocean High Density XBT Lines, with G. Goni, and S. Garzoli, renewable, \$1289K FY2012, renewable.
- NOAA/OGP - Meridional Heat Transport from Atlantic Ocean High Density XBT Lines, with S. Garzoli, renewable, \$88K FY2012., renewable

Recent Refereed Publications

Meinen, C. S., William E. Johns, Silvia L. Garzoli, Erik van Sebille, Darren Rayner, Torsten Kanzow, and Molly O. Baringer, 2011. Variability of the Deep Western Boundary Current at 26.5°N during 2004-2009. *Deep-Sea Res. II*, *accepted*.

van Sebille, Erik, Molly O. Baringer, William E. Johns, Christopher S. Meinen, Lisa M. Beal, M. Femke de Jong, and Hendrik M. van Aken, 2011. Propagation pathways of

classical Labrador Sea Water from its source region to 26deg N, *Journal of Geophysical Research Oceans*, 116, C12027, doi:10.1029/2011JC007171.

FY2011

- Lee S.-K., W. Park, E. van Sebille, M. O. Baringer, C. Wang, D. B. Enfield, S. Yeager, and B. P. Kirtman, 2011. What Caused the Significant Increase in Atlantic Ocean Heat Content Since the mid-20th Century? *Geophysical Research Letters*, doi:10.1029/2011GL048856.
- Dong, S., M. Baringer, G. Goni and S. Garzoli, 2011. Importance of the assimilation of Argo Float Measurements on the Meridional Overturning Circulation in the South Atlantic. *Geophysical Research Letters*, 38, L18603, doi:10.1029/2011GL048982.
- Dong, S. S. Garzoli and M. Baringer, 2011. The Role of inter-ocean exchanges on decadal variations of the northward heat transport in the South Atlantic, *J. Phys. Oceano.*, 41(8):1498-1511.
- Baringer, M. O., T. O. Kanzow, C. S. Meinen, S. A. Cunningham, D. Rayner, W. E. Johns, H. L. Bryden, Eleanor Faika-Williams, J. J-M. Hirschi, M. P. Chidichimo, L. M. Beal and J. Marotzke, 2011. Meridional Overturning Circulation Observations in the Subtropical North Atlantic, in *State of the Climate in 2010*, Blunden, J., D. S. Arndt, M. O. Baringer (eds.), *Bull. Am. Met. Soc.*, 92, S95–S98. doi: 10.1175/1520-0477-92.6.S1
- Blunden, J., D. S. Arndt, M. O. Baringer, 2011: *State of the Climate in 2010*. *Bull. Amer. Meteor. Soc.*, 92, S1–S236. doi: 10.1175/1520-0477-92.6.S1
- Johns, W. E., M. O. Baringer, L. M. Beal, S. A. Cunningham, T. Kanzow, H. L. Bryden, J. Hirschi, J. Marotzke, C. Meinen, B. Shaw, and R. Curry, 2010. Continuous, array-based estimates of Atlantic Ocean heat transport at 26.5 °N. *J. Clim.*, 24(10):2429-2449.
- Longworth, H. R., H. L. Bryden, M. O. Baringer, 2011. Historical Variability in Atlantic meridional baroclinic transport at 26.5°N from boundary dynamic height observations. *Deep-Sea Research Part II*, *Topical Studies in Oceanography*, Volume 58:1754-1767, ISSN 0967-0645, DOI: 10.1016/j.dsr2.2010.10.057.
- Rayner, D., Joel J.-M. Hirschi, Torsten Kanzow, William E. Johns, Stuart A. Cunningham, Paul G. Wright, Eleanor Frajka-Williams, Harry L. Bryden, Christopher S. Meinen, Molly O. Baringer, Jochem Marotzke and Lisa M. Beal, 2010. Monitoring the Atlantic Meridional Overturning Circulation, *Deep-Sea Res., Part II*, *Topical Studies in Oceanography*, Volume 58:1744-1753, ISSN 0967-0645, DOI: 10.1016/j.dsr2.2010.10.056.
- Kanzow, T., S.A. Cunningham, W.E. Johns, J. J-M. Hirschi, J. Marotzke, M. O. Baringer, C.S. Meinen, M. P. Chidichimo, C. Atkinson, L. M. Beal, H. L. Bryden, J. Collins, 2010. Seasonal variability of the Atlantic meridional overturning circulation at 26.5°N. *Journal of Climate*, 23, doi: 10.1175/2010JCLI3389.1171.

FY2010

- Arndt, D. S., M. O. Baringer, and M. R. Johnson, Eds., 2010: *State of the Climate in 2009*. *Bull. Amer. Meteor. Soc.*, 91 (7), S1-S224.
- Baringer, M. O., T. O. Kanzow, C. S. Meinen, S. A. Cunningham, D. Rayner, W. E. Johns, H. L. Bryden, J. J-M. Hirschi, L. M. Beal and J. Marotzke, 2010. The Meridional Overturning Circulation. in *State of the Climate in 2009*, D. S. Arndt, M. O. Baringer, and M. R. Johnson (eds.), *Bull. Am. Met. Soc.*, 91(6), 66-69.

The multi-agency repeat hydrography/CO2 effort is overseen in the USA by the repeat hydrography steering committee with as co-chairs:

Prof. Lynn Talley of Scripps Institute of Oceanography, La Jolla CA USA, (ltalley@ucsd.edu) and

Dr. Richard A. Feely, NOAA Pacific Marine Environmental Laboratory, Seattle WA USA (richard.a.feely@noaa.gov).

Details of the program can be found at: <http://ushydro.ucsd.edu/>

The A16N occupation in 2013 is coordinated by Dr. Rik Wanninkhof, NOAA Atlantic Oceanographic and Meteorological Laboratory, Miami FL USA(rik.wanninkhof@noaa.gov)

The chief scientist on the first leg (Reykjavik, Iceland to Funchal Madeira, Portugal) will be:

Dr. Molly Baringer NOAA Atlantic Oceanographic and Meteorological Laboratory, Miami FL USA (molly.baringer@noaa.gov)

The chief scientist on the second leg (Funchal Madeira, Portugal to Natal Brazil) will be

Dr. John Bullister NOAA Pacific Marine Environmental Laboratory Seattle WA USA (john.l.bullister@noaa.gov)