




UNITED STATES DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration
NOAA Marine and Aviation Operations
Marine Operations Center
439 W. York Street
Norfolk, VA 23510-1114

MEMORANDUM FOR: Captain Mark Pickett, NOAA
Commanding Officer, NOAA Ship *Ronald Brown*

FROM: 
Captain Anita L. Lopez, NOAA
Commanding Officer, NOAA Marine Operations Center-Atlantic

SUBJECT: Project Instruction for RB-13-04
GO-SHIP Repeat Hydrography A16N

Attached is the final Project Instruction for RB-13-04, GO-SHIP Repeat Hydrography A16N, which is scheduled aboard NOAA Ship *Ronald Brown* during the period of 16 July – 25 September, 2013. Of the 64 DAS scheduled for this project, 64 DAS are funded in support of OAR. This project is estimated to exhibit a Medium Operational Tempo. Acknowledge receipt of these instructions via e-mail to OpsMgr.MOA@noaa.gov at Marine Operations Center-Atlantic.

Attachment

cc:
MOA1



U.S. DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration Atlantic Oceanographic and Meteorological Laboratory
4301 Rickenbacker Causeway Miami FL 33149

Project Instructions


Date Submitted: June 26, 2013
Platform: NOAA Ship *Ronald H. Brown*
Project Number: RB-13-04
Project Title: GO-SHIP Repeat hydrography cruise A16N
Project Dates: July 16 – September 30, 2013

Prepared by:  Dated: June 26, 2013

Rik Wanninkhof
A16N Cruise coordinator
NOAA/OAR/AOML

Approved by:  Dated: July 3, 2013

Jodi Levy
Program Manager
Climate Observation Division of the Climate Program Office
NOAA/OAR

Approved by:  Dated: July 1, 2013

Robert M. Atlas
Director, AOML

Approved by:  Dated: 11 JUL 13

Captain Anita L. Lopez, NOAA
Commanding Officer
Marine Operations Center - Atlantic

I. Overview

A. Summary

This project will be a decadal reoccupation of repeat hydrography sections jointly funded by NOAA-COD/CPO (Climate Observation Division of the Climate Program Office) and NSF-OCE (National Science Foundation Division of Ocean Sciences) as part of the GO-SHIP (Global Ocean Ship-Based Hydrographic Investigation Program)/CO₂/hydrography/tracer program.


Academic institutions and NOAA research laboratories will participate. The program focuses on the need to monitor inventories of CO₂, heat and freshwater and their transports in the ocean. Earlier programs under CLIVAR, WOCE and JGOFS have provided a baseline observational field for these parameters.

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Approved by: _____ Dated: _____
Joel Levy
Program Manager
Climate Observation Division of the Climate Program Office
NOAA/OAR

Approved by: _____ Dated: _____
Robert M. Atlas
Director, AOML

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Academic institutions and NOAA research laboratories will participate. The program focuses on the need to monitor inventories of CO₂, heat and freshwater and their transports in the ocean. Earlier programs under CLIVAR, WOCE and JGOFS have provided a baseline observational field for these parameters.

The new measurements will reveal much about the changing patterns on decadal scales. The program will serve as a backbone to assess changes in the ocean's biogeochemical cycle in response to natural and/or man-induced activity. Global warming-induced changes in the ocean's transport of heat and freshwater, which could affect the circulation by decreasing or shutting down the thermohaline overturning, can be followed through long-term measurements. The Repeat Hydrography Program provides a robust observational framework to monitor these long-term trends. The goal of the effort is to occupy a set of hydrographic transects with full water column measurements over the global ocean to study physical and hydrographic changes over time. These measurements are in support of:

- * Model calibration and validation
- * Carbon system studies
- * Heat and freshwater storage and flux studies
- * Deep and shallow water mass and ventilation studies
- * Calibration of autonomous sensors

This program will follow the invasion of anthropogenic CO₂, CFCs and other tracers into intermediate and deep water on decadal timescales and determine the variability of the inorganic carbon system, and its relationship to biological and physical processes. More details on the program can be found at: <http://ushydro.ucsd.edu/>

In addition to the CTD/rosette casts, separate trace metal casts will be made at some stations along the section, nominally at 60 mile spacing. This will be the largest-scale study ever done of the distribution of iron in the ocean. Because of contamination problems in sampling for iron and aluminum, these samples will have to be collected on separate casts, utilize a special trace-metal-clean winch and 1500 meter Kevlar coated cable provided by the trace metal investigators.

Near surface seawater (temperature, salinity, pCO₂, ADCP, IOP, Fluorometry) and atmospheric measurements (CO₂, CFCs, aerosols) will be made along the cruise track. A few ALACE-type profiling floats will be deployed along the section.

B. Service Level Agreements

Originally 87 days on board NOAA Ship **Ronald H. Brown** were allocated for the **A16N** Project, between June 6 and September 15, 2013. These days, and the ship's budget, were based on the original Ship Time Request Form (NF-57-11-01) for the project and the financial projections of the Vessel Operations Portfolio (VOP). For this project, NOAA Ship **Ronald H. Brown's** (RHB's) budget was based on a **TRANSIT Fuel Tempo** and **MEDIUM Overtime** budget. The final FY13 FAP was signed by the Fleet Council with A16N at 64 OMAO base funded days in support of OAR. The days are allocated as follows:

DEP: 7/16/13 Charleston RB-13-04a Transit
ARR: 7/27/13 Reykjavik
DEP: 8/1/13 Reykjavik RB-13-04b Leg 1
ARR: 8/22/13 Madeira
DEP: 8/27/13 Madeira RB-13-04c Leg 2
ARR: 9/25/13 Natal

C. Operating Area (including map showing op area)

The RB-13-04 cruise will focus on completing a long meridional section through the middle of the North Atlantic, nominally along 20°W from 60°N to 5°S. (see Figure 1). This section repeats the A16N section occupied during the World Ocean Circulation Experiment (WOCE) and CLIVAR periods, hence this

cruise is designated A16N2013. This is a repeat of the NOAA lead cruise in 1993 and 2003, during which a full suite of inorganic carbon, hydrographic and CFC measurements were performed. Full water column CTD stations will be occupied at 30 nautical mile intervals and include a large variety of physical, chemical and biological parameters.

During RB-13-04a (transit from Charleston to Reykjavik) underway measurements will be performed taking samples from the scientific supply seawater line. One scientist will ride the ship from Charleston to Reykjavik.

The operating area is in the North Atlantic Ocean with a schematic of the cruise track shown in Figure 1.

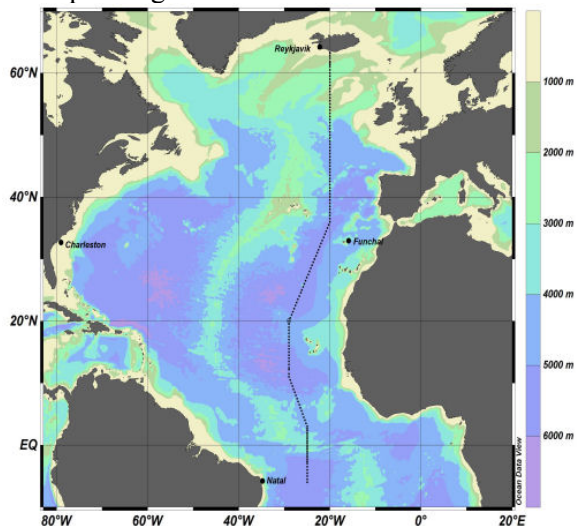


Figure 1: Cartoon of cruise track. The ship will depart Charleston and head to Reykjavik on a great circle route (in so far possible). A preliminary cruise schedule is listed in Appendix O, Table 1.

D. Summary of Objectives

(see Section A)

E. Participating Institutions

(for up to date list see <http://www.aoml.noaa.gov/ocd/gcc/A16N/participants.html>)

Primary:

United States Department of Commerce
 National Oceanic and Atmospheric Administration
 Atlantic Oceanographic and Meteorological Laboratory (NOAA/AOML)
 4301 Rickenbacker Causeway
 Miami, FL 33149 USA
 Telephone: 305 361 4380
 Facsimile: 305 361 4392

Additional:

RSMAS	Rosenstiel School of Marine and Atmospheric Science/University of Miami
PMEL	Pacific Marine Environmental Laboratory
FSU	Florida State University
SIO	Scripps Institution of Oceanography/University of California at San Diego
U Hawaii	University of Hawaii at Manoa

UCSB University of California, Santa Barbara
 U Washington University of Washington at Seattle
 TAMU Texas A&M University
 WHOI Woods Hole Oceanographic Institution
 Princeton Princeton University
 LDEO Lamont-Doherty Earth Observatory/Columbia University
 UCI University of California Irvine
 NASA National Aeronautics and Space Administration

F. *Personnel/Science Party: name, title, gender, affiliation, and nationality*
 (for up to date list see: <http://www.aoml.noaa.gov/ocd/gcc/A16N/participants.html>)

Personnel List as of May 10, 2013

Personnel on RB 13-04 - 2013 A16N Cruise – Transit leg :

	<i>Function</i>	<i>Name</i>	<i>Institution</i>	<i>Sex</i>	<i>Nationality</i>
1	CDOM	Stassinis, Erik	UCSB	M	US

Personnel on RB 13-04 - 2013 A16N Cruise - Leg 1:

	<i>Function</i>	<i>Name</i>	<i>Institution</i>	<i>Sex</i>	<i>Nationality</i>
1	Chief Scientist	Baringer, Molly	AOML	F	US
2	Co-Chief Scientist	Volkov, Denis	AOML/CIMAS	M	Russia
3	Data Manager	Schatzman, Courtney	SIO	F	US
4	CTD	McTaggart, Kristene	PMEL	F	US
5	CTD watch-stander	Mann, Christine	Cal State	F	US
6	CTD watch-stander	Wheeler, Ashley	Cal State	F	US
7	LADCP	Lundesgaard, Oyvind	U. Hawaii	M	Norway
8	LADCP/Salinity	Hooper, Jay	AOML	M	US
9	ET/LADCP/Salinity	Stefanick, Andrew	AOML	M	US
10	O2	Langdon, Chris	RSMAS	M	US
11	O2	Stoltenburg, Laura	RSMAS	F	Germany
12	Nutrients	Wisegarver, Eric	PMEL	M	US
13	Nutrients	Fischer, Charles	AOML	M	US
14	DIC	Castle, Robert	AOML	M	US

15	DIC	Featherstone, Charles	AOML	M	US
16	pCO2 discrete	Sullivan, Kevin	AOML/CIMAS	M	US
17	Alkalinity/pH	Woosley, Ryan	RSMAS	M	US
18	Alkalinity/pH	Levy, Josh	RSMAS	M	UK
19	Alkalinity/pH	Williamson, James	RSMAS	M	US
20	Alkalinity/pH	Byrne, Jennifer	RSMAS	F	US
21	Trace Metal	Barrett, Pamela	U Washing	F	US
22	Trace Metal	Resing, Joseph	PMEL	M	US
23	Trace Metal	Landing, William	FSU	M	US
24	Trace Metal	Shelley, Rachel	FSU	F	UK
25	CFCs/SF6	Wisegarver, David	PMEL	M	US
26	CFCs/SF6	Hertzberg, Jennifer	TAMU	F	US
27	Helium/Tritium	Dachille, Anthony	LDEO	M	US
28	DOM/DOC	Medjia, Monica	RSMAS	F	US
29	CDOM	Stassinis, Erik	UCSB	M	US
30	DOC14	Walker, Brett	UCI	M	US

Personnel on RB 13-04 - 2013 A16N Cruise - Leg 2:

	<i>Function</i>	<i>Name</i>	<i>Institution</i>	<i>Sex</i>	<i>Nationality</i>
1	Chief Scientist	Bullister, John	PMEL	M	US
2	Co-Chief Scientist	Sonnerup, Rolf	U Washington	M	US
3	Data Manager	Schatzman, Courtney	SIO	F	US
4	CTD	McTaggart, Kristene	PMEL	F	US
5	Student Helper	Kirk, Katie	WHOI	F	US
6	Student Helper	Schoonover, Joseph	FSU	M	US
30	Student Helper	Gilroy, Angela	UCSD	F	US
7	LADCP	Lundesgaard, Oyvind	U. Hawaii	M	Norway
8	LADCP/Salinity	Hooper, Jay	AOML	M	US
9	ET/LADCP/Salinity	Stefanick, Andrew	AOML	M	US
10	O2	Langdon, Chris	RSMAS	M	US
11	O2	Stoltenburg, Laura	RSMAS	F	Germany
12	Nutrients	Wisegarver, Eric	PMEL	M	US
13	Nutrients	Fischer, Charles	AOML	M	US
14	DIC	Castle, Robert	AOML	M	US
15	DIC	Featherstone, Charles	AOML	M	US
16	pCO2 discrete	Barbero, Leticia	AOML/CIMAS	F	Spain
17	Alkalinity/pH	Rodriquez, Carmen	RSMAS	F	US
18	Alkalinity/pH	Levy, Josh	RSMAS	M	UK
19	Alkalinity/pH	Williamson, James	RSMAS	M	US
20	Alkalinity/pH	Mastropole, Kristen	RSMAS	F	US
21	Trace Metal	Barrett, Pamela	U Washing	F	US
22	Trace Metal	Morton, Randy	FSU	M	UK
23	Trace Metal	Buck, Nathan	PMEL	M	US
24	Trace Metal	Morton, Peter	FSU	M	US
25	CFCs/SF6	Wisegarver, David	PMEL	M	US
26	CFCs/SF6	Freeman, Kyra	UCSD	F	US

27	Helium/Tritium	Dachille, Anthony	LDEO	M	US
28	DOM/DOC	Mejia, Monica	RSMAS	F	US
29	CDOM	Aghassi, Eli	UCSB	M	US

G. Administrative

Chief Scientist, leg 1: Dr. Molly Baringer
Atlantic Oceanographic and Meteorological Laboratory
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Molly.Baringer@noaa.gov

Chief Scientist, leg 2: Dr. John L. Bullister
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Ocean Climate Research Division
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Seattle, Washington 98115
Telephone: 206-526-6741 Facsimile: 206-526-6744
John.L.Bullister@noaa.gov

Project Coordinator: Dr. Rik Wanninkhof
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Rik.wanninkhof@noaa.gov

Alternate Point of Contact: LCDR Stephen Meador
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Telephone: 305-361-4544 Facsimile: 305-361-4449
AOML.Associate.Director@noaa.gov

2. Diplomatic Clearances

This project involves Marine Scientific Research in waters under the jurisdiction of the Canada, Iceland, and Madeira (Portugal). Diplomatic clearance has been requested via the RATS system through Wendy Bradfield-Smith.

3. Licenses and Permits

None

II. Operations

<i>Data to be collected:</i>	<i>Lead PI :</i>
CTD:	Molly Baringer - AOML
Salinity:	Molly Baringer - AOML
Total CO2(DIC), pCO2:	Rik Wanninkhof - AOML
Nutrients:	Jia-Zhong Zhang - AOML/Calvin Mordy - PMEL
Dissolved Oxygen:	Chris Langdon - RSMAS
Total Alkalinity/pH:	Frank Millero - RSMAS
CFCs/SF6:	John Bullister - PMEL

Helium/Tritium:	Peter Schlosser - LDEO
DOC/DOM:	Dennis Hansell - RSMAS
CDOM:	Craig Carlson - UCSB
Lightning:	Steve Goodman - NASA
Transmissometry:	Wilf Gardner - TAMU
LADCP:	Eric Firing/Jules Hummond - U Hawaii
Trace Metals:	Joe Resing - FSU
14DOC:	Ellen Druffel – UCI
Nitrate isotopes	Daniel Sigman- Princeton
Nitrous oxide isotopes	Bonnie Chang- Princeton
Bathymetry:	Ship personnel
Underway Thermosalinograph:	Ship personnel

A. *Project Itinerary*

The A16N2013 expedition is scheduled for 3 legs (RB-13-04a (Transit) , RB-13-04b (Leg 1), RB-13-04c (Leg 2)) on RHB. Estimated transit times and station locations are provided in Table 1 of Appendix O.

Leg RB-13-04a: Charleston, SC to Reykjavik

The vessel will depart Charleston and steam toward Reykjavik. The transit should roughly follow a great circle route, following the cruise track of the ship of opportunity (SOOP) *Reykjafoss* such that the data can be used to validate the SOOP data. Underway measurements of sea surface temperature, salinity, pCO₂, DIC, organic matter, IOP, and ADCP will be performed. The lighting detector will be operated.

Leg RB-13-04b (leg 1): Reykjavik to Funchal;

After departing Reykjavik, the vessel will steam to the start of the A16N2013 section and begin a series of full water column stations. On most casts the CTD/rosette will be lowered to within 10 meters of the bottom. The first station will be at a depth of ~200m. The vessel will move southward, occupying a series of closely spaced stations along the slope into deep water. Once deep water is reached (~1800m) CTD stations will be occupied at a nominal spacing of 30 nautical miles. Station spacing will be closer along boundary crossings and areas of steep bathymetry. Water samples will be collected with a 24 position, twelve-liter CTD/rosette system. Two backup rosette systems: a 24 position, 10-liter rosette; and RHB's CTD/rosette package [12 position, 10 liter] will also be available. Special trace metal casts will be occupied at some stations and will usually follow the completion of the CTD/rosette cast. The trace metal package will be deployed immediately after the CTD/rosette is on deck. Careful coordination will be required to minimize the time between the return of the CTD and deployment of the trace metal rosette. The number of trace metal casts will depend on the time required for each cast. If the trace metal casts require 1 hour to complete, then approximately 75 casts may be completed on the cruise.

We anticipate ending Leg 1 at about 32.5 °N 21.9 °W to minimize the transit time from the line to Funchal. If the cruise is ahead of schedule we will continue taking CTDs and backtrack to Funchal. Some scientific personnel will be exchanged in Funchal (see personnel list) and some scientific gear and spares may be on- or off-loaded.

Leg RB-03-04c (leg 2): Funchal to Natal

At the completion of the port stop, the ship will steam back to the section and continue the line southward as on the previous leg. If the section to 6°S is completed ahead of schedule, we plan to extend the section southward. At the completion of the section work, the ship will steam to port in Natal. We anticipate that the vans and stowed scientific gear will remain on RHB until the ship arrives at a US port after A16S.

B. *Staging and Destaging*

Staging of most equipment and laboratory vans for the cruise will be conducted in Charleston. We request access to the ship starting on July 12 for loading and equipment set-up. We plan to send to the ship five 20-foot lab containers: a 20-foot container for CO₂ analyses, a 20-foot container for CFC analyses, a 20-foot container for trace metal analyses, a 20-foot container from WHOI containing Helium/Tritium and ¹⁴C/¹³C of DIC sampling gear and a 20-foot container containing the CTD/rosette package. They will be loaded with the shipboard crane. Scientific personnel will be present for the purposes of scoping and securing the craned equipment. A list of equipment to be brought aboard is shown in the FACILITIES section of the Project Instructions and in Appendix B.

We will require the assistance of the shipboard ET and Survey Technician for 8 hours four-days prior to sailing and 8 hours the day before sailing to help install computer systems, terminations for the CTD and other science equipment. Laboratory vans should be connected to power as soon as practical once loaded on the ship and remained powered for the duration of the cruise.

Limited destaging will occur in Natal. Because of difficulties in shipping and storing scientific equipment from Brazil, we anticipate shipping the CFC, CO₂, trace metal and loose scientific gear from Valparaiso following the A16S cruise, along with miscellaneous scientific gear. The scientific party will prepare all documentation and shipping arrangements. Arrangements will be made for a scientist on the RB-13-05 and RB-13-06 legs to supervise any chemicals left on the ship.

C. *Operations to be conducted*

The preliminary personnel task assignments are indicated with each operation. The Chief Scientist and the Commanding Officer will determine final responsibilities.

- Full water column CTD/rosette casts (Ship's and scientific personnel)
- Sampling the rosette bottles for salinity, oxygen, nutrients, CFCs, helium, tritium, carbon dioxide, alkalinity, DIC, carbon isotopes, chlorophyll (Ship and scientific personnel)
- Release of ALACE floats (Ship and scientific personnel)
- Trace Metal Casts (Ship's and scientific personnel)
- Autonomous sampling from the underway sampling line

a. Full water column CTD/Rosette Casts (Ship's and scientific personnel)

It is of utmost importance to the success of the expedition that the ship be able to hold position at all times during the CTD casts, and that the CTD winch, meter wheel, hydraulic frame, conducting cable and backups function flawlessly during this expedition. Both primary and secondary winches must contain full lengths (10,000 m) of CTD conducting cable in good condition. Skilled ship personnel and adequate spare parts must be available on all legs to assure that this equipment is maintained in good working order. The ship's personnel must be skilled in CTD wire re-terminations, and adequate supplies of materials for CTD wire re-terminations must be available. Since typical steaming time between stations is less than 3 hours, re-terminations of the conducting cable (when required) must be completed within 2-3 hours.

The CTD/rosette system will be deployed off the starboard side. During recovery, the CTD/rosette package will be lowered onto a cart and rail system that will be tugged into the staging bay. A 24-position rosette system with 12 liter bottles will be used for CTD/rosette casts. In addition to this primary system, a 24-position rosette with 10 liter water bottles will be available. The second package must be secured in a readily accessible area, and will be switched when required. The rail system supplied by

PMEL will safely and quickly move the rosette into position for deployments and sampling during bad weather. A pinger and altimeter will be mounted on the rosette systems and used during casts to monitor distance from the bottom. We anticipate that during most casts, the CTD/rosette will be lowered within about 10 meters of the bottom. The ship's PDR must be working properly for this purpose.

The winch, wire and meter wheel must be capable of routinely making 6000 meter casts with these rosette systems. AOML and PMEL are sending CTD watch leaders on Legs 1 & 2 to perform CTD data collection, processing and quality control. CTD watch leaders will assign science party members to monitor CTD casts. During the casts, if needed and available, ship's personnel will assist the CTD operators monitoring of the bathymetric recorder and pinger signal and to properly assess the distance of the rosette package off the bottom. The ship's electronics technician will share responsibility with the scientific party for maintaining good electrical and mechanical connections between the CTD/rosette system, the conducting cable and winch slip-rings, and to the deck unit for the CTD/rosette system.

The ship's personnel will be responsible for the deployment and recovery of the CTD/rosette and trace metal rosettes with assistance of scientific personnel during deployment and recovery. A number of members of the scientific party have experience with CTD deployments and will be available to assist with these operations. Members of the scientific party will be responsible for collecting the water samples from the rosette. Members of the scientific party will also be responsible to collect oxygen, nutrient and salinity samples and recording sample ID's. Particular care must be taken in the collection and analysis of water samples to assure that all properties are measured with the greatest accuracy possible. Many of the chemical measurements are sensitive to contamination from smoke, soot, oils, solvents, spray cleaners, lubricants, paints, hydraulic fluid, and other substances. The Chief Scientist must be notified prior to the use of these substances. Care must be taken to avoid contamination of the rosette system with these substances. Smoking is prohibited in the area around the rosettes during sampling and at all times in the laboratories and in and near the staging bay.

Discharges from holding tanks must be secured 20 minutes before arriving on station. The tanks may be pumped when the cast is at depth (>200 meters). Discharges must again be secured 20 minutes before the CTD/rosette returns to the surface layer. The bridge must inform the ship's engineers in advance when discharges are to be secured.

b. Sampling the rosette bottles (Ship's and scientific personnel)

The usual order for drawing seawater samples on deck will be: CFCs, SF₆, helium/tritium, oxygen, pH, pCO₂, DIC, pH, alkalinity, DOM, nutrients, salinity. Samples will be collected for salinity, oxygen and nutrient analysis from each sample bottle.

Scientific personnel will analyze salinity samples. Two salinity samples will be drawn from the deepest bottle at each station to monitor the precision of the sampling/analysis procedures. Salinity samples will be run using RHB's Guild line 8600B Autosol instrument that is calibrated in coordination with AOML, complete with computer interface and laptop computer. A backup salinometer must be provided by the ship. The salinometers must be checked for accuracy and precision during the import before the start of the expedition and the tests will determine which unit will be the primary one. Salinity samples will be analyzed in the salinity lab off the main oceanographic laboratory, and variations in laboratory temperature must not exceed 1°C during a 24 hour period. The salinity samples will also be stored in this temperature controlled area for at least 8 hours to allow them to come to ambient temperature. The Autosol will be standardized at least once each run with new vials of standard seawater. Standard seawater will be provided by the scientific personnel for use on this cruise, and one vial will be analyzed per day. To maintain the required accuracy, it is advisable to have one person run all salinity samples. We anticipate ~140-160 samples/day. An accuracy of 0.003 PSS-78 or better is required, and will be monitored by scientific personnel by comparison with CTD and historical data. To assure timely

detection of any problems with the CTD system or Autosol, salinity analyses should be completed within 36 hours of sampling and submitted to the CTD operators. Any problems with the Autosol should be reported immediately to the Chief Scientist.

c. Oxygen and nutrient sampling and analysis (Scientific personnel)

Samples will be collected for oxygen and nutrient analysis from each sample bottle at all stations. Nutrients will be run on board ship by members of the scientific party. Refrigerator space will be required near the bio-analytical lab for nutrient sample storage prior to analysis. Nutrient measurements will be made using a AlpKem RFA system. Dissolved oxygen samples will be run in the bioanalytical lab by members of the scientific party.

d. CFC ('Freon'), SF₆ and helium samples (Scientific personnel)

Water samples will be drawn for CFC and SF₆ analyses at most stations. CFC/SF₆ samples must be drawn first, ahead of the helium and oxygen samples. The chief scientist should be notified prior to any service or maintenance of the air-conditioning system and of any discharge or leakage of CFCs or solvents on the ship.

e. Helium samples will be drawn at selected stations and will be stored. (Scientific Personnel)

Due to the risk of contamination, no luminous dial watches (that is, watches dials that glow in the dark and generally contain tritiated compounds) may be used on board the ship during this expedition. Bob Newton (LDEO) or his representative must be notified of any proposed use of helium gas on board ship during this expedition.

f. Dissolved inorganic carbon (DIC), Total Alkalinity (TALK), pH, pCO₂ (Scientific personnel)

The chemistry groups from AOML, and RSMAS will make the DIC, pH, pCO₂, and TALK measurements at the hydrocast stations. DIC and TALK samples will be collected from the 12-L Niskin bottles into 250 ml and 500 ml glass-stoppered bottles, respectively, containing 0.025 mL of a saturated solution of HgCl₂ to retard bacterial oxidation of organic matter prior to analysis. DIC samples will be measured by the coulometric titration method and will be done in a laboratory van. Discrete pCO₂ samples will be collected from the Niskins into 500 ml flasks for analyses at constant temperature by IR. TALK samples will be measured by the potentiometric methods. pH will be analyzed at constant temperature with a spectrophotometer.

g. Profiling ADCP (Scientific personnel)

The lowered ADCP (LADCP) will be used on the casts. The instrument is a broadband, self-contained, 150 kHz ADCP, which is to be mounted to the 24-position rosette system. The instrument is mounted in the inner part of the rosette. The instrument can be used to a depth of 6000 m. The instrument is turned on about 15 minutes prior to the launch of the CTD/rosette package using a removable cable connection to a deck box and PC computer. The deck box should be in a dry area within 10 m of the rosette. After the CTD station, about 30 minutes are required to transfer the data from the instrument and to turn it off. The LADCP may have to be removed from the rosette for repair and possible battery changes.

h. ALACE and Surface Float deployment (Ship and scientific personnel):

ALACE and surface floats will be released during this expedition. The Chief Scientist will co-ordinate this program. These floats require about an hour of preparation prior to deployment. Preparations will be completed while the CTD is in the water. Floats will be deployed at stations immediately following

recovery of the CTD and trace metal casts and before the ship gets underway. Deployment involves lowering the ~30 kg float by hand into the water from the stern of the ship. One or two persons from the ship and scientific party will be required for preparation and deployment.

i. Navigation (Ship's personnel)

Navigation shall be based on the best available information including GPS, radar and visual. When GPS control is available, it is the preferred navigation method. It is important that accurate speed and course information be used in satellite position computation. At least one GPS P-code receiver and one Seapath 3DF GPS unit must be functional and integrated with the ship's SCS system for ADCP and LADCP measurements.

The station locations listed in Appendix O are nominal positions and some drift during CTD/rosette casts is acceptable to maintain wire angle. In most cases, starting station positions along the section should be within 1-2 nautical miles of the listed position. Navigation information will be recorded on the MOA form. In addition to satellite fixes and other events as they occur, MOA entries shall be made at least once every four hours, and at the time of each course and speed change when the ship is en route between stations (including slowdowns on arrival at the station and speedups on departure).

The numerical MOA entries will suffice for scientific purposes; a cruise plot is not required in the cruise data package. Since copies of the MOA forms will be made and used by various cruise participants, it is important that the entries be checked and made clearly and dark enough for reproduction.

j. Trace Metal sampling (Scientific personnel):

Salinity and nutrient samples will be drawn from each Go-FLO bottle of the trace metal casts.

Information to be provided here by Chris Measures/ William Landing/Joe Resing.

k. CDOM sampling (Scientific personnel):

CDOM will be sampled one cast per day, near noon, all depths. Sample volume is 120 ml including rinses

While the cast is coming aboard samples from the underway system will be taken for particulate absorption (AP) and phytoplankton pigment analysis (HPLC). These will be 2-L each with occasional duplicates.

Backup CDOM samples will be shipped back to shore. Approximately 300, 40 ml EPA vials, need to be stored in the dark and at 4 °C, in the ship's scientific walk-in refrigerator. A 35L liquid nitrogen dewar for storing our AP and HPLC samples (particles on GF/F filters) will be stored in ship's freezer.

Equipment includes a Barnstead ultra pure water system, our CDOM spectrophotometer, and an along track IOP monitoring system. The alongtrack optics system (ca. 6 feet of bench space), a filter rig, and a pure water system (ca. 6 feet of bench space for these two) need to be adjacent to a sink. A nearby bench is required for spectrophotometer system and computers (another 6 feet is fine) - we'll need some underbench space to store consumables etc.

F. Underway Operations:

Underway measurements will be made along the entire cruise track, including the transit (Leg RB-13-04a) from Charleston to Reykjavik. The ship's seawater line including all branches of the lines to

laboratories should be flushed with fresh water and cleaned with bleach prior to departure from Charleston.

- Automated underway measurement of sea surface temperature and salinity. (Ship's personnel)
- Automated Underway sea surface measurements of carbon dioxide, chlorophyll, and atmospheric measurements of CFCs, aerosols, IOP, CDOM (Scientific personnel).
- Underway air measurements of carbon dioxide (Scientific and ship's personnel)
- ADCP (Scientific and ship's personnel)
- Routine weather observations (Ship's personnel).
- Center-beam Sea Beam data logging (Ship's personnel).
- During the transit from Charleston to Reykjavik water samples will be taken from the underway line by ship's and scientific personnel.

Sea surface temperature and salinity (Ship's personnel):

Sea surface temperature and salinity will be recorded continuously with a system accurate to within 0.02°C and 0.1 PSS-78. A copy of the calibration data will be provided to the Chief Scientist. The thermosalinograph should be calibrated no more than 3 months before the start of the cruise.

Underway sea surface measurements and sampling (Ship's and scientific personnel):

Continuous water sampling will be made from the ship's bow scientific seawater supply intake system. It is of utmost importance that the line is cleaned with bleach and flushed prior to departure from Charleston and during the cruise if contamination/biofouling is suspected. Ship's personnel will maintain this pump and provide adequate spare parts. This system must be capable of delivering 60 liters/minute of seawater at deck level. Seawater will be drawn off this line to three sea/air equilibrators. Care must be taken to prevent contamination from smoke, solvent fumes, cleaning solutions, etc. Continuous underway measurements of pCO₂ will be made from one of the headspace equilibrators utilizing a LICOR NDIR Analyzer. Continuous measurements of chlorophyll will also be made.

The Underway system for IOP requires 5-8 lpm from the underway uncontaminated seawater line to fill the system. The system is on boards that can mount to Unistrut with a lot of tubing and wiring. It will be mounted by the sink in the hydro lab.

On the Charleston - Reykjavik run Erik Stassinis will run the alongtrack IOP system. He will take CDOM, HPLC, and AP samples from the underway system once daily. He will collect samples for TCO₂ and TA as well.

Underway air measurements (Scientific personnel):

Aerosol and rainfall samples will be taken on the CLIVAR A16N2013 cruise. Installation of equipment will be done in consultation with officers/crew of RHB.

On the 2003 A16N cruise on RHB, an aluminum fold-down mast (20-ft tall, about 1.5-ft diameter) deployed on the forward starboard corner of the 03 deck was used. This mast interfered somewhat with the view forward from the bridge, although it turned out not to be a problem for steering and navigation. It requires stringing guy wires (in 3 directions) from the mast, and those guy wires can get in the way of people moving around on that deck.

To avoid these issues, different equipment might be deployed this time, on the forward safety rail of the 05 deck (above the bridge). The equipment includes one aerosol sampler and one automated rain collector. Mounting brackets will secure them to the safety rails. The aerosol sampler makes noise, and

sounds like a high-pitched vacuum cleaner and it should be deployed as high as possible on the ship where the noise won't bother anyone.

To avoid stack exhaust, the aerosol sampling is "sector controlled" using its own anemometer/wind vane sensor that mounts on a 10-ft pole (also attached to the forward safety rail). Since the ship is usually oriented into the wind while on station, the sector control is set to 60 degrees on either side of the bow. When the wind falls outside that sector, the control electronics turn the power off immediately. The anemometer sensor wires run down into a ship's lab (or other room on a upper deck) to the control electronics box, and power cords run through AC relays in the control box and back up to the samplers to turn them on/off depending on what the wind is doing. The electronics and relay boxes take up about 4-5 square feet of table-top space, or can be wall-mounted using the uni-strut channels on the wall. This could go in the Radio/Chart room or anywhere around the aft control station.

ADCP underway operations (Ship's and scientific personnel):

Data from the ADCP system will be logged continuously while underway.

Weather observations (Ship's personnel):

Observations must be done at each station, and at regular intervals while underway.

Seabeam and PDR (Ship's personnel):

While underway, in place of annotation of the bathymetric (PDR) chart record, Sea Beam (center beam) will be operated to obtain a continuous record of time, position and bottom depth. During CTD stations, the PDR will be required for bottom detection.

III. Equipment

Equipment and Capabilities provided by the ship (itemized)

The following communications devices are currently on board RHB and are expected to be in working order. The chief scientist should be apprised at earliest possibility of malfunction of equipment.

1. High Frequency SSB (SEA 330): SEA Inc. 300-watt high frequency transceiver. The transceiver covers a frequency range from 1.6 to 29.9 MHz
2. Furuno Global Maritime Distress and Safety System (GMDSS)
3. Satellite communication system (INMARSAT -A, -B, -M)
4. Five fixed VHF radios with eight channels pre programmed with a selection of marine band and NOAA frequencies.
5. Cell phones

The electronic instrumentation used for navigation includes:

6. Furuno Navigator GP-150 GPS
7. Applanix POSMV GPS
8. Furuno GP-90 GPS
9. Meridian Commercial Gyro Compass SG Brown
10. Two Furuno FAR 2xx7 Series Marine RADAR(S-band (10 cm) 30 kW radar and an X-band (3 cm) 25 kW radar)
11. Konsberg K-POS Dynamic Positioning System
12. Raytheon model DSN-450 Doppler Speed/distance log
13. NAVTEX receiving and printing the international automated medium frequency (518 KHz) weather warnings

14. Weather maps: Medium frequency/high frequency

Scientific Equipment requested from the Ship:

1. Echo Sounder (Ocean Data Equipment Corporation (ODEC) Bathy 2000 or the Knudsen system) used in 12 kHz mode (to track CTD package to within 10 meters of the bottom) to be used while on CTD station. This will be resolved with CST and ETs prior to cruise
2. Continuous EM122 multibeam swath bathymetric sonar system sampling while underway between stations.
3. Barometer
4. WOCE IMET sensors
5. Hydrographic Winch system and readouts (using 10 km of 0.322 conducting cable for CTD operations).
6. One backup hydrographic winch system for CTD operations with 10 km of 0.322 conducting cable.
7. Hull mounted acoustic Doppler current profiler (RD Instruments (RDI), 75 kHz Ocean Surveyor acoustic Doppler current profiler) with gyro input.
8. MAHRS gyro system for acquisition of heading data used by acoustic Doppler current profiler.
9. Seapath GPS system for acquisition of heading data for testing the new MAHRS system.

Equipment and Capabilities provided by the scientists (itemized)

In addition to the suite of oceanographic and meteorological instruments on board RHB, the science party will bring the following instruments and materials on board (in addition see Appendix B for full specifications):

Four container vans will be loaded aboard RHB for this cruise. Three of these containers will act as laboratory vans, and must be accessible at all times throughout the expedition. Compressed gas (non-flammable) cylinders will be used in ship's laboratories and laboratory vans.

- (a) Two 24 position rosette sampling with 12 (or 10) liter water sampling bottles and spare parts.
- (b) Complete CTD recording and processing system including 2 Sea-Bird CTDs, 2 deck units, connectors, spare parts and consumables.
- (c) Chemical analysis instrumentation including gas chromatographs, equilibrators, oxygen titration system, autoanalyzer, coulometer, alkalinity titrator, and spectrophotometers.
- (d) Chemical reagents, compressed gases (approximately 30 cylinders). A listing of chemicals is given in Appendix A and spreadsheet and will be updated prior to departure for Leg 1.
- (e) Two Benthos pingers with spare batteries, and altimeter.
- (f) Winch, Kevlar cable, meter wheel for trace metal casts rosette, CTD and data acquisition system for trace metal casts
- (g) Strain gage
- (h) Milli-Q system, and replacement parts

Equipment weight and location:

Extensive instrumentation to measure a variety of biogeochemical parameters in ocean water and atmosphere will be deployed during the cruise as detailed in Appendix B.

IV. Hazardous Materials

A. Policy and Compliance

The Chief Scientist is responsible for complying with FEC 07 Hazardous Materials and Hazardous Waste Management Requirements for Visiting Scientific Parties (or the OMAO procedure that supersedes it). By Federal regulations and NOAA Marine and Aviation Operations policy, the ship may not sail without a complete inventory of all hazardous materials by name and the anticipated quantity brought aboard, MSDS and appropriate neutralizing agents, buffers, or absorbents in amounts adequate to address spills of a size equal to the amount of chemical brought aboard, and a chemical hygiene plan. Documentation regarding those requirements will be provided by the Chief of Operations, Marine Operations Center, upon request.

Per FEC 07, the scientific party will include with their project instructions and provide to the CO of the respective ship 60 to 90 days before departure:

- A list of hazardous materials by name and anticipated quantity (See Appendix A)
- A list of neutralizing agents, buffers, and/or absorbents required for these hazardous materials, if they are spilled
- A chemical hygiene plan.

Upon embarkation and prior to loading hazardous materials aboard the vessel, the scientific party will provide to the CO or their designee:

- An inventory list showing actual amount of hazardous material brought aboard
- A link to the MSDS for each material (see spreadsheet *A16_2013_Hazmat.xlsx*)
- Confirmation that neutralizing agents and spill equipment were brought aboard

Upon departure from the ship, scientific parties will provide the CO or their designee an inventory of hazardous material indicating all materials have been used or removed from the vessel. The CO's designee will maintain a log to track scientific party hazardous materials. MSDS will be made available to the ship's complement on request, in compliance with Hazard Communication Laws.

The scientific party will manage and respond to spills of scientific hazardous materials. Overboard discharge of scientific chemicals is not permitted during projects aboard NOAA ships.

Radioactive Isotopes

Only sealed source radioisotopes will be used on the A16N (RB-13-04) cruise. They are solid Nickel-63, present in the Electron Capture detectors used in four gas chromatographs for CFC and SF6 analyses situated in the CFC laboratory van. The detectors contain low-activity (≈ 10 mCi) sealed sources used routinely in the laboratory and on research vessels. The Nickel-63 foils are in a sealed detector and operated according to the manufacturer's specification. These items are under NOAA-PMEL licensing and will undergo standard wipe-testing before shipment to RHB. They present no hazards to personnel and no contamination risk to scientific programs. These extremely low level sealed sources are classified as 'excepted materials'- no external labeling is required for commercial transport and use.

The Chief Scientist will comply with OMAO 0701-10 Radioactive Material aboard NOAA Ships.

At least three months in advance of a domestic project and eight months in advance of a foreign project start date the chief scientist shall submit required documentation to MOC-CO, including:

1. NOAA Form 57-07-02, Request to Use Radioactive Material aboard a NOAA Ship
2. Draft Project Instructions
3. Nuclear Regulatory Commission (NRC) Materials License (NRC Form 374) or a state license for each state the ship will operate in with RAM on board the ship.

4. Report of Proposed Activities in Non-Agreement States, Areas of Exclusive Federal Jurisdiction, or Offshore Waters (NRC Form 241), if only state license(s) are submitted).
5. MSDS
6. Experiment or usage protocols, including spill cleanup procedures.

Scientific parties will follow responsibilities as outlined in the procedure, including requirements for storage and use, routine wipe tests, signage, and material disposal as outline in OMAO 0701-10. All radioisotope work will be conducted by NRC or State licensed investigators only, and copies of these licenses shall be provided per OMAO 0701-10 at least three months prior to the start date of domestic projects and eight months in advance of foreign project start dates.

C. Chemical Inventory (itemized)

Appendix A provides the inventory according to scientific analysis

V. Additional Projects

A. *Supplementary (“Piggyback”) Projects*

Underway Measurements in support of Global Carbon Cycle Research

The underway sensors on RHB will be used in support of the objectives of the Global Carbon Cycle Research to quantify the uptake of carbon by the world's ocean and to understand the bio-geochemical mechanisms responsible for variations of partial pressure of CO₂ in surface water (pCO₂). This work is a collaborative effort between the CO₂ group at AOML.

Principal investigators:

Dr. Rik Wanninkhof, AOML 305-361-4379 rik.wanninkhof@noaa.gov
Contact person: Mr. Robert Castle, AOML 305-361-4418 robert.castle@noaa.gov

The semi-automated instruments are installed on a permanent basis in the hydro lab of RHB. All work is performed on a not-to-interfere basis and does not introduce any added ship logistic requirements other than the continuous operation of the bow water pump and thermosalinograph. The chief scientist assumes responsibility of the hazardous materials aboard RHB for this project. A list of the HAZMAT associated with this project is provided in Appendix A.

A. *NOAA Fleet Ancillary Projects*

Any additional work will be subordinate to the primary project and will be accomplished only with the concurrence of the Commanding Officer and the Chief Scientist(s).

The following projects will be conducted by ship's personnel in accordance with the general instructions contained in the MOC Directives, and conducted on a not-to-interfere basis with the primary project:

- a. SEAS Data Collection and Transmission
- b. Marine Mammal Reporting
- c. Bathymetric Track line
- d. Weather Forecast Monitoring
- e. Sea Turtle Observations
- f. Automated Sounding Aerological Program

VI. Disposition of Data and Reports

A. Data Responsibilities

The Chief Scientist will be responsible for the disposition, feedback on data quality, and archiving of data and specimens collected on board the ship for the primary project. As representative of the program manager (Director, AOML), the Chief Scientist will also be responsible for the dissemination of copies of these data to participants in the cruise, to any other requesters, and to NESDIS in accordance with NDM 16-11 (ROSCOP within 3 months of cruise completion). The ship may assist in copying data and reports insofar as facilities allow.

The Chief Scientist will receive all original data gathered by the ship for the primary project, and this data transfer will be documented on NOAA Form 61-29 "Letter Transmitting Data". The Chief Scientist in turn will furnish the ship with a complete inventory listing all data gathered by the scientific party detailing types and quantities of data.

Individuals in charge of piggyback projects conducted during the cruise have the same responsibilities for their project's data as the Chief Scientist has for primary project data. All requests for data should be made through the Chief Scientist.

B. Pre and Post Project Meeting

Prior to departure, the Chief Scientist will conduct a meeting of the scientific party to train them in sample collection and inform them of project objectives. Some vessel protocols, e.g., meals, watches, etiquette, etc. will be presented by the ship's Operations Officer.

Post-Project Meeting: Upon completion of the project, a meeting will be held at 0830 and attended by the ship's officers, the Chief Scientist and select members of the scientific party to review the project. Concerns regarding safety, efficiency, and suggestions for improvements for future projects should be discussed. Minutes of the post-project meeting will be distributed to all participants by email, and to the Commanding Officer and Chief of Operations, Marine Operations Center.

C. Ship Operation Evaluation Report

Within seven days of the completion of the project, a Ship Operation Evaluation form is to be completed by the Chief Scientist. The preferred method of transmittal of this form is via email to omao.customer.satisfaction@noaa.gov. If email is not an option, a hard copy may be forwarded to:

Director, NOAA Marine and Aviation Operations
NOAA Office of Marine and Aviation Operations
8403 Colesville Road, Suite 500
Silver Spring, MD 20910

VII. Miscellaneous

A. Meals and Berthing

The ship will provide meals for the scientists listed above. Meals will be served 3 times daily beginning one hour before scheduled departure, extending throughout the project, and ending two hours after the termination of the project. Since the watch schedule is split between day and night, the night watch may often miss daytime meals and will require adequate food and beverages (for example a variety of sandwich items, cheeses, fruit, milk, juices) during what are not typically meal hours. Special dietary

requirements for scientific participants will be made available to the ship's command at least seven days prior to the cruise.

Berthing requirements, including number and gender of the scientific party, will be provided to the ship by the Chief Scientist. The Chief Scientist and Commanding Officer will work together on a berthing plan to accommodate the gender mix of the scientific party taking into consideration the current make-up of the ship's complement. The Chief Scientist is responsible for ensuring the scientific berthing spaces are left in the condition in which they were received; for stripping bedding and linen return; and for the return of any room keys which were issued. The Chief Scientist is also responsible for the cleanliness of the laboratory spaces and the storage areas utilized by the scientific party, both during the project and at its conclusion prior to departing the ship.

All federal NOAA scientists will have proper travel orders when assigned to any NOAA ship. The Chief Scientist will ensure that all non-NOAA or non-Federal scientists aboard also have proper documentation. It is the responsibility of the Chief Scientist to ensure that the entire scientific party has a mechanism in place to provide lodging and food and to be reimbursed for these costs in the event that the ship becomes uninhabitable and/or the galley is closed during any part of the scheduled project.

All persons boarding NOAA vessels give implied consent to comply with all safety and security policies and regulations which are administered by the Commanding Officer. All spaces and equipment on the vessel are subject to inspection or search at any time. All personnel must comply with OMAO's Drug and Alcohol Policy dated May 7, 1999 which forbids the possession and/or use of illegal drugs and alcohol aboard NOAA Vessels.

B. Medical Forms and Emergency Contacts

The NOAA Health Services Questionnaire (NHSQ, Revised: 02 JAN 2012) must be completed in advance by each participating scientist. The NHSQ can be obtained from the cruise website: <http://www.aoml.noaa.gov/ocd/gcc/A16N/> or the NOAA website <http://www.corporateservices.noaa.gov/~noaaforms/eforms/nf57-10-01.pdf>. The completed form should be sent to the Regional Director of Health Services at Marine Operations Center. The participant can mail, fax, or scan the form into an email using the contact information below. The NHSQ should reach the Health Services Office no later than 4 weeks prior to the project to allow time for the participant to obtain and submit additional information that health services might require before clearance to sail can be granted. Please contact MOC Health Services with any questions regarding eligibility or completion of the NHSQ. Be sure to include proof of tuberculosis (TB) testing, sign and date the form, and indicate the ship or ships the participant will be sailing on. The participant will receive an email notice when medically cleared to sail if a legible email address is provided on the NHSQ.

Contact information:

Regional Director of Health Services
Marine Operations Center – Atlantic
439 W. York Street
Norfolk, VA 23510
Telephone 757-441-6320
Fax 757-441-3760
E-mail MOA.Health.Services@noaa.gov

Prior to departure, the Chief Scientist must provide an electronic listing of emergency contacts to the Executive Officer for all members of the scientific party, with the following information: contact name, address, relationship to member, and telephone number.

C. *Shipboard Safety*

Wearing open-toed footwear or shoes that do not completely enclose the foot (such as sandals or clogs) outside of private berthing areas is not permitted. Steel-toed shoes are required to participate in any work dealing with suspended loads, including CTD deployments and recovery. The ship does not provide steel-toed boots. Hard hats are also required when working with suspended loads. Work vests are required when working near open railings and during small boat launch and recovery operations. Hard hats and work vests will be provided by the ship when required.

D. *Communications*

A progress report on operations prepared by the Chief Scientist may be relayed to the program office. Sometimes it is necessary for the Chief Scientist to communicate with another vessel, aircraft, or shore facility. Through various means of communications, the ship can usually accommodate the Chief Scientist. Special radio voice communications requirements should be listed in the project instructions. The ship's primary means of communication with the Marine Operations Center is via e-mail and the Very Small Aperture Terminal (VSAT) link. Standard VSAT bandwidth at 128kbs is shared by all vessels staff and the science team at no charge. Increased bandwidth in 30-day increments is available on the VSAT systems at increased cost to the scientific party. If increased bandwidth is being considered, program accounting is required it must be arranged at least 30 days in advance.

E. *IT Security*

Any computer that will be hooked into the ship's network must comply with the *NMAO Fleet IT Security Policy* 1.1 (November 4, 2005) prior to establishing a direct connection to the NOAA WAN. Requirements include, but are not limited to:

- (1) Installation of the latest virus definition (.DAT) file on all systems and performance of a virus scan on each system.
- (2) Installation of the latest critical operating system security patches.
- (3) No external public Internet Service Provider (ISP) connections.

Completion of these requirements prior to boarding the ship is required. All computers of scientific parties that are connected to the ship's network will be scanned.

Non-NOAA personnel using the ship's computers or connecting their own computers to the ship's network must complete NOAA's IT Security Awareness Course within 3 days of embarking.

F. *Foreign National Guests Access to OMAO Facilities and Platforms*

All foreign national access to the vessel shall be in accordance with NAO 207-12 and RADM De Bow's March 16, 2006 memo (<http://deemedexports.noaa.gov>). National Marine Fisheries Service personnel will use the Foreign National Registration System (FRNS) to submit requests for access to NOAA facilities and ships. The Departmental Sponsor/NOAA (DSN) is responsible for obtaining clearances and export licenses and for providing escorts required by the NAO. DSNs should consult with their designated NMFS Deemed Exports point of contact to assist with the process.

The following are basic requirements. Full compliance with NAO 207-12 is required.

Responsibilities of the Chief Scientist:

1. Provide the Commanding Officer with the e-mail generated by the FRNS granting approval for the foreign national guest's visit. This e-mail will identify the guest's DSN and will serve as evidence that the requirements of NAO 207-12 have been complied with.
2. Escorts – The Chief Scientist is responsible to provide escorts to comply with NAO 207-12 Section 5.10, or as required by the vessel's DOC/OSY Regional Security Officer.
3. Ensure all non-foreign national members of the scientific party receive the briefing on Espionage Indicators (NAO 207-12 Appendix A) at least annually or as required by the servicing Regional Security Officer.
4. Export Control - Ensure that approved controls are in place for any technologies that are subject to Export Administration Regulations (EAR).

The Commanding Officer and the Chief Scientist will work together to implement any access controls necessary to ensure no unlicensed export occurs of any controlled technology onboard regardless of ownership.

Responsibilities of the Commanding Officer:

1. Ensure only those foreign nationals with DOC/OSY clearance are granted access.
2. Deny access to OMAO platforms and facilities by foreign nationals from countries controlled for anti-terrorism (AT) reasons and individuals from Cuba or Iran without written NMAO approval and compliance with export and sanction regulations.
3. Ensure foreign national access is permitted only if unlicensed deemed export is not likely to occur.
4. Ensure receipt from the Chief Scientist or the DSN of the FRNS e-mail granting approval for the foreign national guest's visit.
5. Ensure Foreign Port Officials, e.g., Pilots, immigration officials, receive escorted access in accordance with maritime custom to facilitate the vessel's visit to foreign ports.
6. Export Control - 8 weeks in advance of the project, provide the Chief Scientist with a current inventory of OMAO controlled technology onboard the vessel and a copy of the vessel Technology Access Control Plan (TACP). Also notify the Chief Scientist of any OMAO-sponsored foreign nationals that will be onboard while program equipment is aboard so that the Chief Scientist can take steps to prevent unlicensed export of Program controlled technology. The Commanding Officer and the Chief Scientist will work together to implement any access controls necessary to ensure no unlicensed export occurs of any controlled technology onboard regardless of ownership.
7. Ensure all OMAO personnel onboard receive the briefing on Espionage Indicators (NAO 207-12 Appendix A) at least annually or as required by the servicing Regional Security Officer.

Responsibilities of the Foreign National Sponsor:

1. Export Control - The foreign national's sponsor is responsible for obtaining any required export licenses and complying with any conditions of those licenses prior to the foreign national being provided access to the controlled technology onboard regardless of the technology's ownership.
2. The DSN of the foreign national shall assign an on-board Program individual, who will be responsible for the foreign national while on board. The identified individual must be a U.S. citizen, NOAA (or DOC) employee. According to DOC/OSY, this requirement cannot be altered.
3. Ensure completion and submission of Appendix C (Certification of Conditions and Responsibilities for a Foreign National)

APPENDICES

Appendix O

Station Operations

CTD Operations: CTD casts will include the CTD/O2 unit, a LADCP, a fluorometer, a transmissometer and a Rosette sampler and 24, 12-L bottles on the Rosette frame. Approximately 150 casts will be conducted to full water column depth, maximum estimated at 6000 meters. We will require a package tracking system and display for the CTD operations (Knudsen/Bathy2000). We request that the ship carries a back-up CTD conducting cable for this cruise and a functioning spare winch. Approximate station locations are listed in Table 1.

Table 1. Station locations and estimated times of arrival and departure. Extra time is added to each station equivalent to about 1 weather day per leg. Legs 1 and 2 will be extended if no delays occur

Sta #	Lat (N) (deg) min	Lon (W) (deg) min	dist (nm)	depth (m)	Arrival Time (LT)	Depart Time (LT)
Charl	32 47	79 56	0	0		7/16/13 10:00
Reykj	64 9	21 50	2825	0	7/27/13 7:46	
Reykj	64 9	21 50	0	0		8/1/13 11:46
1	63 18	20 0	71	264	8/1/13 18:51	8/2/13 4:24
2*	63 13	19 60	5	554	8/2/13 4:52	8/2/13 9:07
3	63 7	19 60	5	1005	8/2/13 9:39	8/2/13 13:15
4*	62 45	20 0	23	1412	8/2/13 15:30	8/2/13 18:52
5	62 20	19 60	25	1799	8/2/13 21:22	8/2/13 23:57
6*	61 50	19 60	30	1711	8/3/13 2:57	8/3/13 6:29
7	61 37	20 0	13	2060	8/3/13 7:48	8/3/13 10:42
8*	61 20	19 60	17	2358	8/3/13 12:23	8/3/13 16:16
9	61 0	20 0	20	2411	8/3/13 18:16	8/3/13 21:11
10*	60 30	20 0	30	2528	8/4/13 0:11	8/4/13 4:10
11	59 60	20 0	30	2724	8/4/13 7:10	8/4/13 10:16
12*	59 30	19 60	30	2768	8/4/13 13:16	8/4/13 17:23
13	58 60	19 60	30	2842	8/4/13 20:23	8/4/13 23:33
14*	58 30	20 0	30	2570	8/5/13 2:32	8/5/13 6:33
15	58 0	19 60	30	1638	8/5/13 9:32	8/5/13 12:02
16*	57 30	20 0	30	1168	8/5/13 15:02	8/5/13 18:16
17	56 60	19 60	30	972	8/5/13 21:16	8/5/13 23:13
18*	56 30	20 0	30	1375	8/6/13 2:12	8/6/13 5:32
19	56 0	19 60	30	1464	8/6/13 8:33	8/6/13 10:56
20*	55 30	20 0	30	1090	8/6/13 13:57	8/6/13 17:08
21	55 0	19 60	30	1611	8/6/13 20:07	8/6/13 22:36
22*	54 30	19 60	30	1384	8/7/13 1:36	8/7/13 4:57
23	54 0	19 60	30	1417	8/7/13 7:57	8/7/13 10:19
24*	53 30	19 60	30	2288	8/7/13 13:19	8/7/13 17:10
25	52 60	19 60	30	2677	8/7/13 20:11	8/7/13 23:15
26*	52 30	20 0	30	2781	8/8/13 2:15	8/8/13 6:22
27	52 0	19 60	30	3772	8/8/13 9:21	8/8/13 13:02
28*	51 30	19 60	30	3627	8/8/13 16:03	8/8/13 20:38
29	51 0	20 0	30	3658	8/8/13 23:38	8/9/13 3:15
30*	50 30	19 60	30	3933	8/9/13 6:15	8/9/13 11:01

31	49	60	20	0	30	4402	8/9/13 14:01	8/9/13 18:03
32*	49	30	20	0	30	3869	8/9/13 21:02	8/10/13 1:46
33	49	0	20	0	30	4415	8/10/13 4:45	8/10/13 8:47
34*	48	30	19	60	30	4046	8/10/13 11:48	8/10/13 16:38
35	48	0	19	60	30	4362	8/10/13 19:37	8/10/13 23:38
36*	47	29	19	60	31	4552	8/11/13 2:46	8/11/13 7:52
37	47	0	19	60	29	4535	8/11/13 10:44	8/11/13 14:50
38*	46	30	19	60	30	4864	8/11/13 17:51	8/11/13 23:08
39	46	0	20	0	30	4842	8/12/13 2:07	8/12/13 6:23
40*	45	30	20	0	30	4546	8/12/13 9:23	8/12/13 14:30
41	44	60	19	60	30	4332	8/12/13 17:31	8/12/13 21:30
42*	44	30	20	0	30	4242	8/13/13 0:29	8/13/13 5:25
43	43	60	20	0	30	4001	8/13/13 8:26	8/13/13 11:44
44*	43	30	19	60	30	3975	8/13/13 14:43	8/13/13 19:00
45	42	60	20	0	30	5539	8/13/13 22:01	8/14/13 2:10
46*	42	30	19	60	30	4150	8/14/13 5:11	8/14/13 9:34
47	42	0	20	0	30	2349	8/14/13 12:33	8/14/13 14:56
48*	41	30	20	0	30	2559	8/14/13 17:58	8/14/13 21:28
49	41	0	20	0	30	4708	8/15/13 0:26	8/15/13 4:08
50*	40	30	20	0	30	4920	8/15/13 7:08	8/15/13 11:57
51	40	0	20	0	30	4759	8/15/13 14:57	8/15/13 18:40
52*	39	30	20	0	30	4657	8/15/13 21:41	8/16/13 2:21
53	39	0	19	60	30	4750	8/16/13 5:20	8/16/13 9:03
54*	38	30	20	0	30	4147	8/16/13 12:04	8/16/13 16:27
55	38	0	20	0	30	5134	8/16/13 19:27	8/16/13 23:22
56*	37	30	19	60	30	4845	8/17/13 2:22	8/17/13 7:09
57	36	60	20	0	30	3797	8/17/13 10:10	8/17/13 13:21
58*	36	30	20	0	30	5157	8/17/13 16:20	8/17/13 21:17
59	35	60	20	0	30	5348	8/18/13 0:17	8/18/13 4:20
60*	35	30	20	17	33	5280	8/18/13 7:38	8/18/13 12:39
61	34	60	20	34	33	5141	8/18/13 15:57	8/18/13 19:53
62*	34	30	20	51	33	5169	8/18/13 23:11	8/19/13 4:08
63	33	60	21	8	33	5236	8/19/13 7:27	8/19/13 11:26
64*	33	30	21	24	33	5336	8/19/13 14:45	8/19/13 19:48
65	33	0	21	41	33	5258	8/19/13 23:06	8/20/13 3:06
66*	32	30	21	58	33	5212	8/20/13 6:26	8/20/13 11:24
Madeira		32	38	16	54	256	0	8/22/13 14:02
Madeira		32	38	16	54	0	0	8/27/13 10:02
67	32	0	22	15	274	5170	8/28/13 10:57	8/28/13 16:18
68*	31	30	22	32	33	5224	8/28/13 19:19	8/29/13 1:42
69	30	60	22	49	33	5247	8/29/13 4:44	8/29/13 10:08
70*	30	30	23	6	33	5284	8/29/13 13:09	8/29/13 19:34
71	29	60	23	22	33	5242	8/29/13 22:36	8/30/13 3:00
72*	30	0	23	22	0	5243	8/30/13 3:00	8/30/13 9:53
73	29	30	23	39	33	5242	8/30/13 12:56	8/30/13 17:19
74*	28	60	23	56	33	5189	8/30/13 20:21	8/31/13 1:43
75	28	30	24	13	33	5201	8/31/13 4:45	8/31/13 9:08
76*	28	0	24	30	33	5217	8/31/13 12:10	8/31/13 17:33
77	27	30	24	47	34	5206	8/31/13 20:36	9/1/13 0:58
78*	27	0	25	4	34	5244	9/1/13 4:01	9/1/13 9:25
79	26	30	25	21	34	5243	9/1/13 12:28	9/1/13 16:52
80*	25	60	25	38	34	4277	9/1/13 19:55	9/2/13 0:46
81	25	30	25	54	34	5354	9/2/13 3:50	9/2/13 8:17

82*	25	0	26	11	34	5398	9/2/13 11:20	9/2/13 16:48
83	24	34	26	26	29	5424	9/2/13 19:28	9/2/13 23:57
84*	23	60	26	45	38	5460	9/3/13 3:27	9/3/13 8:57
85	23	30	27	2	34	5502	9/3/13 12:01	9/3/13 16:34
86*	22	60	27	19	34	5517	9/3/13 19:38	9/4/13 1:11
87	22	30	27	36	34	5488	9/4/13 4:14	9/4/13 8:46
88*	21	60	27	53	34	5434	9/4/13 11:51	9/4/13 17:21
89	21	30	28	9	34	5364	9/4/13 20:25	9/5/13 0:53
90*	20	60	28	26	34	5031	9/5/13 3:58	9/5/13 9:14
91	20	30	28	43	34	5149	9/5/13 12:19	9/5/13 16:40
92*	20	0	29	0	34	4800	9/5/13 19:44	9/6/13 0:53
93	19	30	29	0	30	4959	9/6/13 3:36	9/6/13 7:50
94*	19	0	29	0	30	4571	9/6/13 10:35	9/6/13 15:36
95	18	30	29	0	30	4693	9/6/13 18:20	9/6/13 22:25
96*	17	60	28	60	30	4554	9/7/13 1:09	9/7/13 6:09
97	17	30	29	0	30	4615	9/7/13 8:52	9/7/13 12:55
98*	16	60	29	0	30	4884	9/7/13 15:39	9/7/13 20:51
99	16	30	29	0	30	4873	9/7/13 23:34	9/8/13 3:45
100*	15	60	29	0	30	4468	9/8/13 6:29	9/8/13 11:27
101	15	30	28	60	30	5268	9/8/13 14:11	9/8/13 18:35
102*	14	60	29	0	30	5299	9/8/13 21:18	9/9/13 2:44
103	14	30	29	0	30	5382	9/9/13 5:27	9/9/13 9:56
104*	13	60	28	60	30	5446	9/9/13 12:39	9/9/13 18:10
105	13	30	28	60	30	5540	9/9/13 20:53	9/10/13 1:27
106*	13	0	29	0	30	5712	9/10/13 4:10	9/10/13 9:49
107	12	29	29	0	31	5627	9/10/13 12:36	9/10/13 17:13
108*	12	8	28	60	21	5680	9/10/13 19:08	9/11/13 0:46
109	11	30	28	60	38	5944	9/11/13 4:15	9/11/13 9:02
110*	11	0	29	0	30	5974	9/11/13 11:45	9/11/13 17:33
111	10	30	28	45	33	5393	9/11/13 20:36	9/12/13 1:04
112*	9	60	28	30	33	5334	9/12/13 4:07	9/12/13 9:34
113	9	30	28	15	33	5406	9/12/13 12:36	9/12/13 17:05
114*	8	60	28	0	33	5203	9/12/13 20:07	9/13/13 1:29
115	8	30	27	45	33	4934	9/13/13 4:32	9/13/13 8:45
116*	8	0	27	30	33	5086	9/13/13 11:48	9/13/13 17:06
117	7	30	27	15	33	4638	9/13/13 20:08	9/14/13 0:12
118*	7	0	26	60	34	4365	9/14/13 3:15	9/14/13 8:09
119	6	30	26	45	33	4647	9/14/13 11:12	9/14/13 15:15
120*	6	0	26	30	34	4298	9/14/13 18:18	9/14/13 23:10
121	5	30	26	15	34	4251	9/15/13 2:13	9/15/13 6:04
122*	4	60	26	0	33	4520	9/15/13 9:06	9/15/13 14:06
123	4	30	25	45	33	4094	9/15/13 17:08	9/15/13 20:54
124*	3	60	25	30	34	4040	9/15/13 23:58	9/16/13 4:41
125	3	30	25	15	33	4059	9/16/13 7:43	9/16/13 11:27
126*	3	0	24	60	33	4403	9/16/13 14:29	9/16/13 19:24
127	2	40	25	0	20	4105	9/16/13 21:15	9/17/13 1:01
128*	2	20	25	0	20	3769	9/17/13 2:50	9/17/13 7:25
129	2	0	25	0	20	3887	9/17/13 9:14	9/17/13 12:52
130*	1	40	25	0	20	3829	9/17/13 14:41	9/17/13 19:18
131	1	20	25	0	20	3642	9/17/13 21:07	9/18/13 0:37
132*	1	1	24	60	19	3356	9/18/13 2:23	9/18/13 6:44
133	0	40	24	60	20	4520	9/18/13 8:34	9/18/13 12:34
134*	0	20	25	0	20	3565	9/18/13 14:23	9/18/13 18:50

135	0	0	25	0	20	3163	9/18/13 20:41	9/18/13 23:55
136*	0	-20	25	0	20	3059	9/19/13 1:44	9/19/13 5:55
137	0	-40	25	0	20	3220	9/19/13 7:44	9/19/13 11:00
138*	0	-60	25	0	20	3218	9/19/13 12:49	9/19/13 17:05
139	-1	-20	25	0	20	4731	9/19/13 18:55	9/19/13 23:01
140*	-1	-40	24	60	20	4931	9/20/13 0:50	9/20/13 6:03
141	-2	0	25	0	20	4951	9/20/13 7:52	9/20/13 12:06
142*	-2	-20	25	0	20	5018	9/20/13 13:55	9/20/13 19:11
143	-2	-40	25	0	20	5377	9/20/13 21:00	9/21/13 1:28
144*	-2	-60	25	0	20	5322	9/21/13 3:17	9/21/13 8:43
145	-3	-30	25	0	30	5571	9/21/13 11:27	9/21/13 16:02
146*	-4	0	25	0	30	5398	9/21/13 18:46	9/22/13 0:14
147	-4	-30	25	0	30	5547	9/22/13 3:00	9/22/13 7:34
148*	-4	-60	25	1	30	5721	9/22/13 10:15	9/22/13 15:55
149	-5	-30	25	0	30	5666	9/22/13 18:40	9/22/13 23:17
150*	-6	0	24	60	30	5808	9/23/13 2:01	9/23/13 7:43
Natal	-5	-46	35	12	609	0	9/25/13 15:05	

* Trace metal coast. Note The number of trace metal casts will depend on the time required for each cast. If the trace metal casts require 1 hour to complete, then approximately 75 casts may be completed on the cruise.

Appendix A. List of Chemicals

(For full detail and links to the relevant MSDS see spreadsheet A16_2013_Hazmat.xlsx)

I. CHEMICAL REAGENTS USED FOR THE DETERMINATION OF **DISSOLVED OXYGEN** IN SEA WATER

<u>NAME OF CHEMICAL</u>	<u>AMOUNT OF CHEMICAL</u>	<u>COMMENTS</u>
Manganese Chloride	12 Liters, (600gr/Liter)	Solution
Alkaline Sodium Iodide	6 Liters, (320gr. Sodium Hydroxide + 600gr. Sodium Iodide, in each liter).	Solution
Sulfuric Acid	12 Liters, 280ml/liter	Dilute Solution
Sodium Thiosulfate	7 Liters, 10gr/Liter	Very Dilute Solution
	7 vials of 10gr. Thiosulfate	Granular Salt
Potassium Iodate	12 Liter, (0.3567gr/Liter) Std.	Very Dilute Solution
		Primary Standard
Triton(R) X-100	1 Liter (Polyethylene Glycol Octylphenyl Ether)	Cleaning Solution

II. CHEMICAL REAGENTS USED FOR THE DETERMINATION OF **NITRATE, NITRITE, AMMONIA PHOSPHATE, AND SILICATE** IN SEAWATER

<u>NAME OF CHEMICAL</u>	<u>bottles</u>	<u>AMOUNT OF CHEMICAL</u>		<u>COMMENTS</u>
		wt. Ea. (g)	total (g)	
Oxalic Ac.	6	500	3000	Granular
NaOH	1	400	400	Granular
Cd	2	25	50	Granular
NEDA	1	30	30	Granular
Imidazole	8	50	400	Granular
Ascorbic Ac.	14	35	500	Granular
NH4.Molybdate	10	50	500	Granular
Hydrazine	15	20	300	Granular
Sulfanilamide	12	25	300	Granular
Antimony Potassium Tartrate	3	3	9	Granular
o-phthaldialdehyde	1	4.0	4	Granular
Sodium sulfite	1	2.5	2.5	Granular
Ammonium chloride	1	5.4	5.4	Granular
Tartaric acid	1	600	600	Granular
Stannous Chloride	1	300	300	Granular
<u>Chemical</u>	<u>bottles</u>	<u>Quantity (ml)</u>	<u>total (ml)</u>	
Brij-35	3	400	1200	Liquid
Dowfax	5	300	1500	Liquid
Methanol	1	400	400	Liquid
Formaldehyde	1	2	400	Liquid
<u>Chemical</u>	<u>bottles</u>	<u>Quantity (L)</u>	<u>total (L)</u>	
HCl	8	2.5	20	Liquid
H ₂ SO ₄	6	1	6	Liquid

Acetone	2	0.5	1	Liquid
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III. CHEMICAL REAGENTS USED FOR THE DETERMINATION OF TOTAL **DISSOLVED INORGANIC CARBON (DIC)**

<u>NAME OF CHEMICAL</u>	<u>AMOUNT OF CHEMICAL</u>	<u>COMMENTS</u>
Magnesium Perchlorate	4 bottles, 500 g each	Granular Salt
Soda lime	4 bottle, 500 g	Granular Salt
Isopropanol	8 Liters (4 x 2 L bottle)	Solvent
Acetone	12 Liters (6 x 2L bottle)	Solvent
Coulometer solution (cathode)	52 liters (13 x 4L bottle)	Liquid
Coulometer solution (anode)	10 liters (20 x 0.5L bottle)	Liquid
Nitrogen, compressed	24 steel cylinders Carrier Grade	Compressed Gas
Air, compressed	6 aluminum cylinders (size a)	Compressed Gas
Pure CO ₂	12 0.5 Liter canisters	Compressed Gas
HgCl ₂	200 gr	granular for sample preservation
Phosphoric acid	6 0.5 L bottles	Liquid
Certified Reference	240 bottles (12 cases of 20, 500 mL)	Seawater standard

IV. CHEMICAL REAGENTS USED FOR TALK AND THE *SPECTROPHOTOMETRIC* DETERMINATION OF **pH** IN SEAWATER

<u>NAME OF CHEMICAL</u>	<u>AMOUNT OF CHEMICAL</u>	<u>COMMENTS</u>
m-Cresol Purple	1000 mL (0.36 g/100mL)	Solution
Cresol Red	25 mL (.09 g/25 mL)	Solution
	2mM sodium bicarbonate	Dilute Solution
Hydrochloric acid	30 L (.2 Normal)	Dilute Solution
Tris buffer	7 L	
Certified reference	20 L (2 cases of 20 bottles)	Seawater Standard

V. CHEMICAL REAGENTS USED FOR THE DETERMINATION OF **CFCs** IN SEAWATER

<u>Qty</u>	<u>Units</u>	<u>Item</u>
14	cylinders	Nitrogen - compressed gas
2	cylinders	Air - compressed gas
2	cylinders	5% Methane in Argon - compressed gas
2	cylinders	Helium - compressed gas
1	kg	Magnesium perchlorate
1	kg	Ascarite - corrosive solid
20	pints	Ethanol

VI. CHEMICAL REAGENTS USED FOR THE DETERMINATION OF **HELIUM** IN SEAWATER

<u>Qty</u>	<u>Units</u>	<u>Item</u>
4	cylinders	Nitrogen - compressed gas
4	cylinders	Oxygen - compressed gas
4	cylinders	Air - compressed gas

8	liters	Acetone
8	liters	Methanol
80	liters	Isopropanol

VII. CHEMICAL REAGENTS USED FOR THE DETERMINATION OF **CDOM** IN SEAWATER

<u>Qty</u>	<u>Units</u>	<u>Item</u>
2.5	liters	Hydrochloric Acid
1	liters	Methanol
250	milliliters	Isopropanol

VIII. CHEMICAL REAGENTS USED FOR THE DETERMINATION OF **pCO₂** IN SEAWATER

<u>Qty</u>	<u>Units</u>	<u>Item</u>
6	cylinders	CO ₂ in air, compressed gas standard
1	cylinder	N ₂ , compressed gas

Appendix B. Equipment list including Haz mats for A16 Cruises

This section provides the list of equipment as shipped followed by a descriptive list of Haz Mats and location of setup, if applicable. The description includes the disposition of the equipment and vans between the A16N and A16S cruise. The location of setup is provided in the figure 2 below

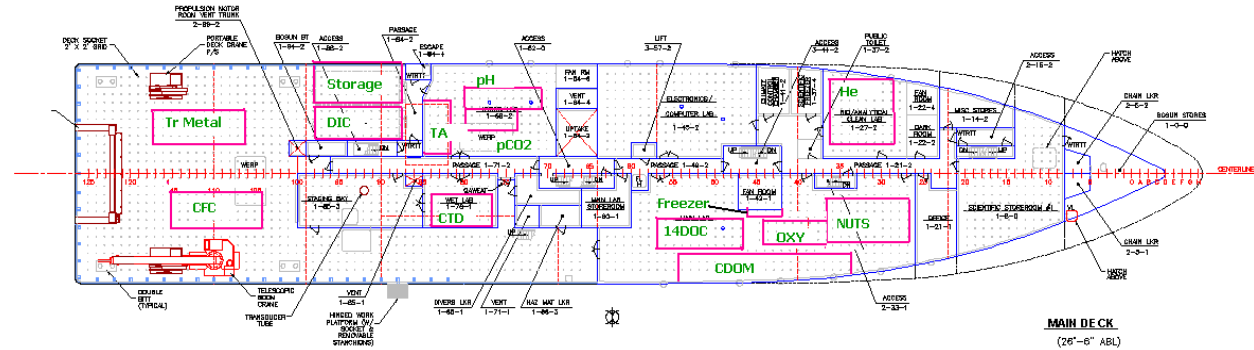


Figure 2: Layout of main deck of RHB and location of sampling and analysis groups

EQUIPMENT

AOML CTD/Oxy/Sal:

1 – 20’ Storage Van containing 8 D containers (sometimes called “totes” these are 48” x 46” x 42” high collapsible plastic containers) and 2 CTD 24-bottle frames. This van is normally stored on the fantail just aft of the Hydro Lab and can hopefully stay there between A16N and A16S.

6 – D containers of equipment

2 - Rosettes

PMEL CTD:

1 CTD 24 bottle frame

12 packages (foot-locker size) containing CTD equipment

1 pallet of sea water and salinity sampling bottles

3 D containers of nutrient equipment

PMEL CFC:

1 – 20’ laboratory van to be placed on the fantail, but can be moved between A16N and A16S.

6 – steel cylinders of N₂ gas. These can stay in the van between A16N and A16S. (I need to check with Dave if he will be bringing more than 6.)

AOML DIC/Discrete pCO₂:

1 – 20’ laboratory van normally placed next to the storage van on the fantail just aft of the Hydro Lab. Laboratory vans should remain under power connected between A16N and A16S to maintain temperature-controlled environment.

24 – steel cylinders of N₂ gas. These will probably be palletized and kept in the storage van during the GO-SHIP cruises. Between cruises they can be stored almost anywhere.

6 – aluminum cylinders of CO₂ in air. Storage is same as nitrogen cylinders above.

6 – aluminum cylinders of CO₂ standard gas for the discrete pCO₂ system. These can be kept in the Hydro Lab.

22 – cases of Certified Reference Materials (CRMs). These are in gray cases 24” x 19” x 12” and weigh 35 pounds when the bottles are full.

2 – D containers for the discrete pCO₂ equipment.

AOML Nutrients:

4 – D containers will be shipped in the AOML storage van. The equipment will be set up in the Main lab and if it can remain there during the NTAS and PNE cruises without causing problems it would be helpful. Otherwise it can be packed up and placed in the AOML storage container or scientific stores.

USF/UHawaii/PMEL, Measures/Landing/Resing Trace Metals:

1 – 20’ laboratory van to be placed on the fantail during the cruises but can be moved between A16N and A16S.

1 – FT winch, 59” x 50” x 56”, 2977 pounds. This will be mounted on the fantail just aft of the staging bay during the cruises. In between A16N and A16S cruises, the winch should be kept out of the weather.

1 – polymer block and signal cable to be mounted on the A-frame with a 12-position rosette for sampling. These can be stored in the Trace Metal van between A16N and A16S.

1 – aerosol sampler, 1 – automated rainfall collector, and 1 – 10’ pole. [These have been mounted on the forward safety rail of the 05 deck \(above the bridge\) in the past.](#)

1 – electronics/relay control box for aerosol sampler. This requires 4-5 square feet of space and can be either wall or bench mounted wherever is convenient ([possible the Radio/Chart room?](#)).

UH LADCP:

8 – Boxes of LADCP equipment. They are around 25” x 25” x 20” with weights ranging from 45-140 pounds. (Based on A10 cruise, 2011)

LDEO Helium/Tritium:

4 – cylinders N₂ gas

4 – cylinders O₂ gas

4 - cylinders compressed air

The cylinders and other equipment will be shipped in a 20’ container to Charleston where someone will be on hand to set it up in the Bio-Analytical Lab. The container will be kept on board for the duration. The container will be empty during the cruises and can be placed anywhere.

The Helium equipment will be set up in the Bio-Analytical lab. [If neither NTAS nor PNE is using this space, it would be appreciated if the equipment could remain set up or stored there between A16N and A16S.](#)

RSMAS Total Alkalinity/pH:

2 – D containers of equipment to be set up in the Hydro lab.

17 – gray cases of CRMs: 24” x 20” x 12”, 35 lbs.

SIO Data Management:

2 – Pelican cases 3’ x 2’ x 2’

1 – case 2.5’ x 2’ x 1’

[Their equipment will be set up in the Computer lab and will stay on board between A16N and A16S. It can be boxed up and stored in scientific stores/](#)

UCSB CDOM:

1 - Barnstead ultra pure water system

1 - CDOM spectrophotometer

1 - Along track IOP monitoring system

In total, their equipment requires about 18’ of bench space.

RSMAS DOC/DOM:

1 – case of sample bottles will remain on board between A16N and A16S.

UCI 14DOC:

1 – large chest freezer, 2.5' x 7' x 3', 120 lbs.

42 – 1 liter glass DOC14 bottles (packed inside freezer), 30 lbs.

10 – 1 gallon glass bottles (packed inside freezer), 20 lbs.

144 – glass ampoules, 2 lbs.

2 – boxes of miscellaneous supplies, 1.5' x 1.5' x 1.5', 20 lbs each.

The equipment will only be used on leg 1 and will be taken off the ship in Funchal or Natal

HAZMAT Shipping (for details on container size and phase see Appendix A)

AOML CTD/Oxy/Sal:

10 – liters Alkaline Iodide

10 – liters Manganese Chloride

10 – liters Dilute Sulfuric acid

60 – grams Sodium Thiosulfate

10 – liters Potassium Iodate

PMEL CTD:

None.

PMEL CFC:

6 – steel cylinders of N₂ gas. [These can stay in the van between A16N and A16S.](#)

6 – liters Ethanol

50 – grams Magnesium perchlorate

AOML DIC/Discrete pCO₂:

24 – steel cylinders of N₂ gas. [These will be palletized and kept in the storage van during the GO-SHIP cruises.](#)

6 – aluminum cylinders of CO₂ in air. Storage is same as nitrogen cylinders above.

6 – aluminum cylinders of CO₂ standard gas for the discrete pCO₂ system. [These can be kept in the Hydro Lab.](#)

11 – liters Acetone

3 – liters Phosphoric acid

2 – kg Magnesium perchlorate

200 – grams Mercuric chloride

AOML Nutrients:

500 - grams Cadmium metal granular

1.5 – liters Dowfax 2A1

300 – grams Hydrazine

500 – grams Imidazole

2 – liters Sodium Hydroxide

2.5 – liters HNO₃

3 – kg Oxalic acid

100 – grams SDS

20 – liters HCl

6 – liters H₂SO₄

3 – liters Acetone

30 – grams NEDA

500 – grams Ascorbic acid

500 – ml working standard
15 – grams NO₃ standard
5 – grams NO₂ standard
5 – grams PO₄ standard
10 – grams Silicate standard

FSU/U.Hawaii/PMEL, Measures/Landing Trace Metals:

8 – liters 6M HCl

UH LADCP:

None.

LDEO Helium/Tritium:

4 – cylinders N₂ gas
4 – cylinders O₂ gas
4 - cylinders compressed air
80 – liters Isopropanol
8 – liters Acetone
8 – liters Methanol

RSMAS Total Alkalinity/pH:

40 – liters 0.24N HCl
1 – liter 2.5mM mCp indicator
7 – liters TRIS buffer

SIO Data Management:

None.

UCSB CDOM:

2.5 – liters concentrated HCl
1 – liter methanol
0.25 – liters Isopropanol

RSMAS DOC/DOM:

None.

UCI 14DOC:

None.