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 Robert Kamphaus, NOAA
Commanding Officer, NOAA Ship *Ronald H. Brown*

FROM: Captain Scott M. Sirois, NOAA
Commanding Officer, NOAA Marine Operations Center-Atlantic

SUBJECT: Project Instruction for RB-16-06
P18 GO-SHIP/CO2 Repeat Hydro

Attached is the final Project Instruction for RB-16-06, P18 GO-SHIP/CO2 Repeat Hydro, which is scheduled aboard NOAA Ship *Ronald H. Brown.* Project RB-16-06 is delayed 5 days due to drydock repair extension. NOAA Ship *Ronald H. Brown* is now scheduled to sail during the period of November 7 – January 23, 2017. Amendments to this Project Instruction have been made. Of the 75 DAS scheduled for this project, 75 days are funded by a Line Office Allocation. This project is estimated to exhibit a High Operational Tempo. Acknowledge receipt of these instructions via e-mail to **ChiefOps.MOA@noaa.gov** at Marine Operations Center-Atlantic.

U.S. DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration
Pacific Marine Environmental Laboratory
7600 Sand Point Way NE, Seattle, WA 98115

Final Project Instructions

Date Submitted: September 29, 2016

Platform: NOAA Ship *Ronald H. Brown*

Project Number: RB-16-06

Project Title: P18 GO-SHIP/CO$_2$ Repeat Hydro

Project Dates: Nov 2, 2016 – Jan 19, 2017

Prepared by: Brendan Carter Dated: 10/4/2016
Dr. Brendan Carter
P18 Project co-coordinator
JISAO NOAA OAR PMEL

Dated: Oct 5 2016
Dr. Rolf Sonnerup
P18 Project co-coordinator
JISAO NOAA OAR PMEL

Approved by: Kathy Tedesco Dated: Oct 5 2016.
Dr. Kathy Tedesco
Program Manager
Climate Observation Division of the Climate Program Office
NOAA OAR

Christopher Sabine Dated: Oct. 6, 2016
Dr. Christopher Sabine
Director, NOAA PMEL

Dated: OCT. 25, 2016
CAPT Scott Sirois, NOAA
Commanding Officer
Marine Operations Center – Atlantic

I. Overview

A. Summary

This project will be a decadal reoccupation of repeat hydrography section P18 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 Global Ocean Ship-Based Hydrographic Investigation Program, or GO-SHIP/CO_2/hydrography/tracer program. Academic institutions and NOAA research laboratories will participate.

GO-SHIP focuses on the need to monitor inventories and transports of CO_2, heat, and freshwater in the ocean. The program serves to constrain long term changes and variability in marine biogeochemical and physical processes in response to natural and human-induced forcing. The program provides unique high-quality measurements of key oceanographic parameters at all ocean depths. These measurements are a cornerstone of numerous efforts to constrain long term changes and decadal variability in ocean properties, and are critical for calibrating and validating other observation and modeling programs. Earlier programs under the Joint Global Ocean Flux Study (JGOFS), World Ocean Circulation Experiment (WOCE), and Climate Variability (CLIVAR) banners have provided an approximately decadally-repeated set of observations that GO-SHIP builds upon. Examples of critical findings made possible by such decadally repeated measurements include ongoing ocean uptake and subsurface storage of anthropogenic CO_2 with consequent ocean acidification, ongoing warming and freshening of the deepest bottom waters, and accelerated overturning of water at intermediate depths in the Southern Ocean. The Repeat Hydrography Program provides a robust observational framework to monitor these long-term trends.

Continuation of these programs under GO-SHIP requires occupying the same set of hydrographic transects spanning the global ocean with full water column measurements. 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

In addition to its core missions, GO-SHIP secondarily provides a platform for collaborations with other ongoing and novel scientific programs. Examples include satellite algorithm calibration and validation, novel instrument and method testing and deployment, calibration and deployment of novel floats with biogeochemical sensors, and contributions to surface ocean pCO_2 measurement programs. Numerous discrete and underway sampling programs are supported by GO-SHIP projects on a project-by-project basis. More details on the repeat hydrography program can be found at: http://ushydro.ucsd.edu/

B. Days at Sea (DAS)

Of the 75 DAS scheduled for this project, 0 DAS are funded by an OMAO allocation, 75 DAS are funded by a Line Office Allocation (OAR), 0 DAS are Program Funded, and 0

DAS are Other Agency funded. The project is estimated to exhibit a High Operational Tempo.

The days are allocated as follows:

DEP: 11/2/2016 San Diego, CA, Leg 1
ARR: 12/8/2016 Easter Island, Chile

DEP: 12/13/2016 Easter Island, Chile, Leg 2
ARR: 1/19/2017 Punta Arenas, Chile

Amendment: 10/24/2016

DEP: 11/7/2016 San Diego, CA Leg 1

ARR: 12/13/2016 Easter Island, Chile

DEP: 12/17/2016 Easter Island, Chile Leg 2

ARR: 1/23/2017 Punta Arenas, Chile

C. Operating Area (including map)

The P18 project will focus on completing a long meridional section through the Eastern Pacific. The section proceeds along 110˚W from ~22.87˚N (offshore Cabo San Lucas) to 5˚S (Figure 1). From there, the section proceeds SE to 103˚W and 10˚S. The final portion of the section extends meridionally along 103˚W from this location to ~72˚S (offshore Antarctica). This section repeats the P18 section occupied during the World Ocean Circulation Experiment (WOCE) and CLIVAR periods, hence this project is designated P18 2016/2017. This is a repeat of the NOAA led projects in 1994 aboard the *Discoverer* and in 2007/2008 aboard the *Ronald H. Brown*. Following the completion of the P18 line, the portion of the P17E line connecting P18 at 103˚W to the final port stop of Punta Arenas between 53˚ and 55˚S will be occupied. This line was most recently occupied west of 88˚W in 1993 and east of 90˚W in 2005, both times by the R/V Knorr. A full suite of inorganic carbon, hydrographic, and CFC measurements were performed on each of these earlier projects. Full water column CTD stations will be occupied at 30 nautical mile intervals (with increased resolution in some areas) and include measurements of a large variety of physical, chemical and biological parameters. Underway sampling will proceed continuously for the project duration. Bongo net deployments will occur approximately once daily on leg 1. The operating area is in the Eastern Pacific Ocean. A portion of the operating area is in protected waters near Antarctica.

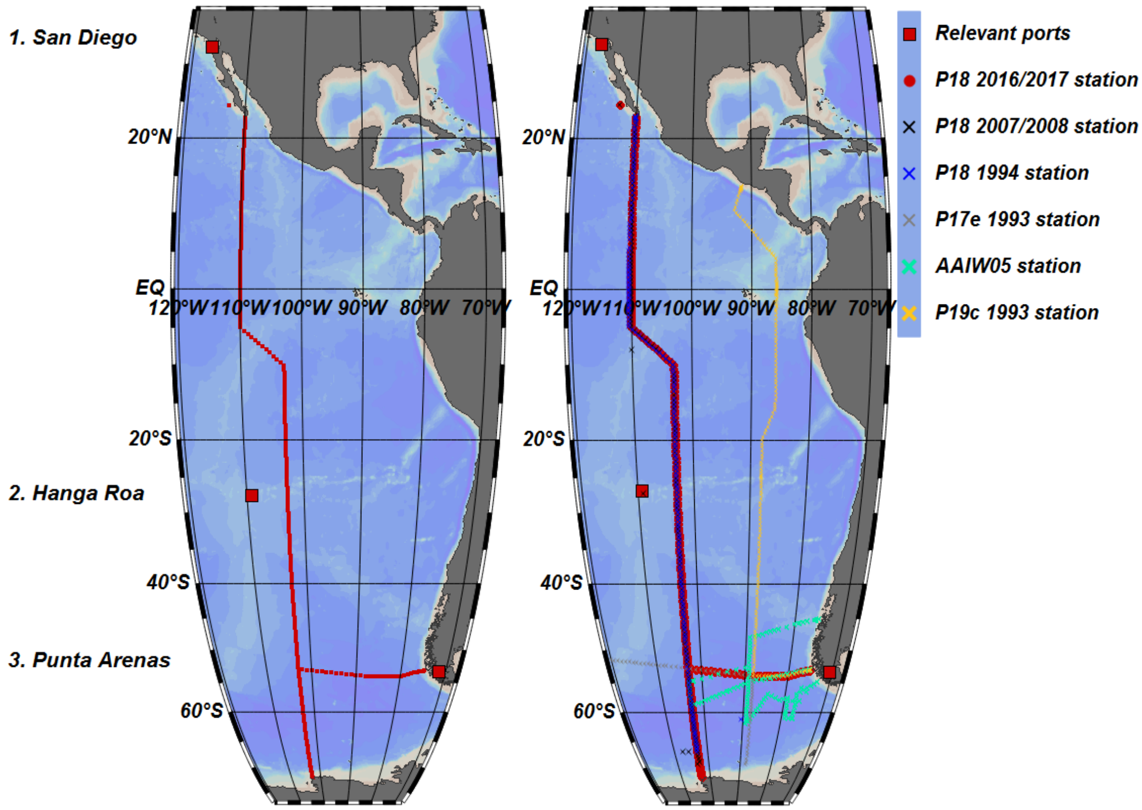

Figure 1: Locations of expected stations along the 2016/2017 P18 project track (red circles). In the version on the right, these stations are overlaid on previous occupations of the P18 and P17e lines that measured the full suite of GO-SHIP parameters including the 2007/2008 CLIVAR P18 (black xs) and 1994 WOCE P18 occupations (blue xs), the two 1993 projects occupying the Southwestern (grey xs) and northeastern (yellow xs) portions of P17e and P19, and the 2005 AAIW occupation in which the full range of physical and chemical parameters was measured. The project track will cross several hydrographic lines including P06 at 30°S, S4P at 67°S and P04 at 9.5°N.

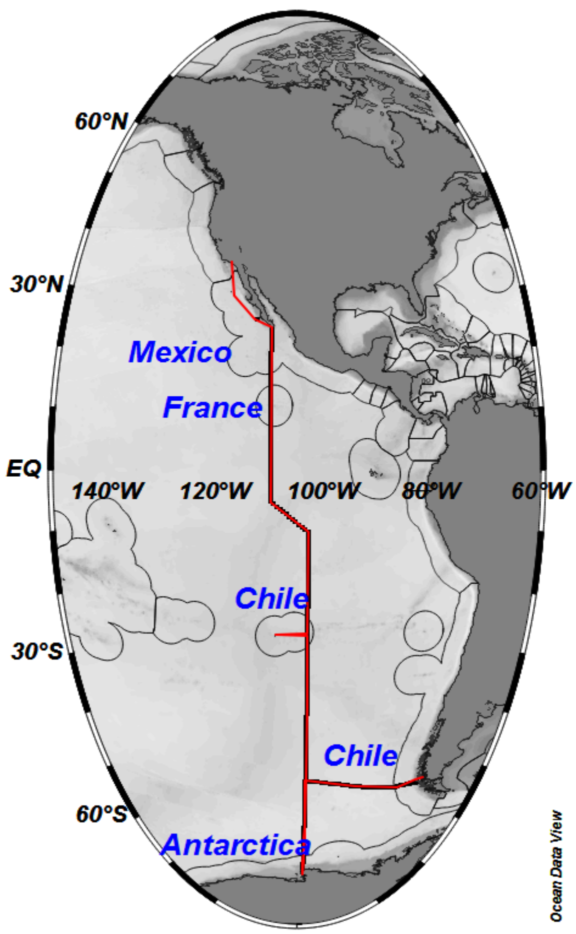

Figure 2: Schematic of the 2016/2017 P18 project track (red line with black station markers) with marine EEZ boundaries indicated with black lines. This project passes through U.S., Mexican, French (Clipperton Island), and Chilean territorial waters (Easter Island and the Chilean Mainland). The project will also go into waters protected by the United Nations Antarctic Treaty. A preliminary project schedule is listed in Appendix A, Table 1.

D. Summary of Objectives

(see Section A)

E. Participating Institutions

a. Primary:
United States Department of Commerce

National Oceanic and Atmospheric Administration
Pacific Marine Environmental Laboratory (NOAA/PMEL)
7600 Sand Point Way NE
Seattle, WA 98115 USA
Telephone: 206-526-4314
Facsimile: 206-526-6744

b. *Additional (alphabetical)*

APL	Applied Physics Laboratory
AOML	Atlantic Ocean and Meteorological Laboratory
CCU	Coastal Carolina University
CICIMAR	Centro Interdisciplinario de Ciencias Marinas, Mexico
INU	Incheon National University, Seoul, Korea
IPN	Instituto Politécnico Nacional, Mexico
JISAO	Joint Institute for the Study of Atmosphere and Ocean
MIT	Massachusetts Institute of Technology
MPIC	Max-Planck-Institut für Chemie, Germany
NESDIS	NOAA Satellite and Information Service
ODU	Old Dominion University
OSU	Oregon State University
Ox	Oxford University, England
PMEL	Pacific Marine Environmental Laboratory
PML	Plymouth Marine Laboratory, England
RSMAS	Rosenstiel School of Marine and Atmospheric Science/University of Miami
SIO	Scripps Institution of Oceanography/University of California at San Diego
UAF	University of Alaska, Fairbanks
UCI	University of California, Irvine
UCSD	University of California, San Diego
UM(1)	University of Maine
UM(2)	University of Miami
UM(3)	University of Michigan
URI	University of Rhode Island
USM	University of Southern Mississippi
UW(A)	University of Washington, Seattle
UW(I)	University of Wisconsin, Madison
WHOI	Woods Hole Oceanographic Institution
Yale	Yale University

F. Personnel/Science Party: duty, name (as appears on passport), affiliation, gender, and nationality (U.S. - United State, CA - Canada, MX - Mexico, CN - China, CH – Swiss, KN – South Korea, BR – Brazil, U.K. - United Kingdom, FR – France, USPR - United States Permanent Resident)

Table 1: LEG 1 Science Party Personnel

Duties	*Name*	*Affiliation*	*Gen.*	*Nationality*
Chief Scientist	*Brendan Carter*	*PMEL*	*M*	*U.S.*

Co-Chief Scientist	*Annie Bourbonnais*	*WHOI*	*F*	*CA, USPR*
CTD Processing	*Kristene McTaggart*	*PMEL*	*F*	*U.S.*
Data Manager	*Remy Okazaki*	*PMEL*	*M*	*U.S.*
CTD/Salinity/LADCP/ET	*James Hooper*	*AOML*	*M*	*U.S.*
CTD/Salinity/LADCP/ET	*Andrew Stefanick*	*AOML*	*M*	*U.S.*
CTD Watchstander	*Shineng Hu*	*Yale*	*M*	***CN***
CTD Watchstander	*Margot White*	*SIO*	*F*	*U.S.*
Dissolved O_2	*Samantha Ladewig*	*CCU*	*F*	*U.S.*
Dissolved O_2	*Alexander Sidelev*	*UM(2)*	*M*	*RU, USPR*
Nutrients	*Charles Fischer*	*AOML*	*M*	*U.S.*
Nutrients	*Eric Wisegarver*	*PMEL*	*M*	*U.S.*
DIC/underway pCO_2	*Robert Castle*	*AOML*	*M*	*U.S.*
DIC	*Dana Greeley*	*PMEL*	*M*	*U.S.*
CFCs/SF_6	*Bonnie Chang*	*PMEL*	*F*	*U.S.*
CFCs/SF_6	*Tae-Jun Choi*	*INU*	*M*	***KN***
CFCs/SF_6	*Laura Whitmore*	*USM*	*F*	*U.S.*
TALK/pH	*Ryan Woosley*	*RSMAS*	*M*	*U.S.*
TALK/pH	*Fen Huang*	*RSMAS*	*F*	*CN, USPR*
TALK/pH	*Andrew Babbin*	*MIT*	*M*	*U.S.*
TALK/pH	*Alexandra Fine*	*RSMAS*	*F*	*U.S.*
$DO^{14}C$*, black carbon*	*Brett Walker*	*UCI*	*M*	*U.S.*
$DO^{14}C$*, black carbon*	*Christian Lewis*	*UCI*	*M*	*U.S.*
Net Tows	*Javier Hernandez*	*CICIMAR*	*M*	***MX***
Genetics	*Alyse Larkin*	*UCI*	*F*	*U.S.*
DOM	*Mariana Bif*	*RSMAS*	*F*	***BR***
LADCP	*Pierre Dutrieux*	*LDEO*	*M*	***FR***
Satellite Cal/Val	*Charles Kovach*	*NESDIS*	*M*	*U.S.*

Table 2: LEG 2 Science Party Personnel

Duties	*Name*	*Affiliation*	*Gen.*	*Nationality*
Chief Scientist	*Rolf Sonnerup*	*JISAO*	*M*	*U.S.*
Co-Chief Scientist	*Sarah Purkey*	*LDEO*	*F*	*U.S.*
CTD Processing	*Kristene McTaggart*	*PMEL*	*F*	*U.S.*
CTD/Salinity/LADCP/ET	*James Hooper*	*AOML*	*M*	*U.S.*
CTD/Salinity/LADCP/ET	*Andrew Stefanick*	*AOML*	*M*	*U.S.*
CTD Watchstander	*Paige Logan*	*JISAO*	*F*	*U.S.*
CTD Watchstander	*Conrad Luecke*	*UM(3)*	*M*	*U.S.*
iTag Genetics	*Bethany Kolody*	*SIO*	*F*	*U.S.*
Dissolved O_2	*Christopher Langdon*	*UM*	*M*	*U.S.*
Dissolved O_2	*Emma Pontes*	*UM*	*F*	*U.S.*
Nutrients	*Charles Fischer*	*AOML*	*M*	*U.S.*
Nutrients	*Eric Wisegarver*	*PMEL*	*M*	*U.S.*
DIC/underway pCO_2	*Charles Featherstone*	*AOML*	*M*	*U.S.*
DIC	*Andrew Collins*	*PMEL*	*M*	*U.S.*
$CFCs/SF_6$	*Bonnie Chang*	*PMEL*	*F*	*U.S.*
$CFCs/SF_6$	*Tae-Jun Choi*	*INU*	*M*	***KN***
$CFCs/SF_6$	*Rachel McMahon*	*ODU*	*F*	*U.S.*
TALK/pH	*Ryan Woosley*	*RSMAS*	*M*	*U.S.*
TALK/pH	*Fen Huang*	*RSMAS*	*F*	*CN, USPR*
TALK/pH	*Andrew Babbin*	*MIT*	*M*	*U.S.*
TALK/pH	*Tammy LaBerge*	*RSMAS*	*F*	*U.S.*
$DO^{14}C$*, black carbon*	*Christian Lewis*	*UCI*	*M*	*U.S.*
Rare Earth Elements	*Yves Plancherel*	*Ox*	*M*	***CH***
Genetics	*Cathy Garcia*	*UCI*	*F*	*U.S.*
DOM	*Mariana Bif*	*RSMAS*	*F*	***BR***
Satellite Cal/Val	*Charles Kovach*	*NESDIS*	*M*	*U.S.*

G. Administrative

1. Points of Contact

Chief Scientist, Leg 1:	Dr. Brendan Carter Joint Institute for the Study of the Atmosphere and Ocean Pacific Marine Environmental Laboratory National Oceanic and Atmospheric Administration 7600 Sand Point Way NE, Seattle, WA 98115 USA Telephone: +1 206 526 6885 brendan.carter@noaa.gov
Chief Scientist, Leg 2:	Dr. Rolf Sonnerup Joint Institute for the Study of the Atmosphere and Ocean University of Washington 3737 Brooklyn Avenue, Seattle, WA, 98115 Telephone: +1 206 543 4024 rolf@uw.edu
Co-Chief Scientist, Leg 1:	Annie Bourbonnais Woods Hole Oceanographic Institution 266 Woods Hole Rd. MS# 25 Woods Hole, MA 02543-1050 Telephone: + 1 508 289 2346
Co-Chief Scientist, Leg 2:	Sarah Purkey Lamont-Doherty Earth Observatory 202C Oceanography 61 Route 9W - PO Box 1000 Palisades NY 10964-8000 Phone: (845) 365-8338 Fax: (845) 365-8157 purkeysg@ldeo.columbia.edu
Operations officer:	Brian Elliot ops.ronald.brown@noaa.gov (843) 297-1835 OOD Cell
Shipping agent San Diego:	Science Center: NOAAS RONALD H. BROWN Attn: NAME SWFSC 8901 LA JOLLA SHORES DRIVE LA JOLLA, CA 92037 --OR—

Direct ship to the pier, Pier 5 Berth 1 US Naval Base San Diego.

Shipping agent Hanga Roa: TBD

Shipping agent Punta Arenas: TBD

Project Operation Leads:

Data to be collected:	*Lead PI(s):*
CTD:	Greg Johnson - PMEL; Molly Baringer - AOML
Salinity:	Molly Baringer - AOML
LADCP:	Andreas Thurnherr -LDEO
Dissolved Oxygen:	Chris Langdon - RSMAS
Nutrients:	Calvin Mordy – PMEL Jia-Zhong Zhang – AOML
CFCs/SF_6:	John Bullister – PMEL
Total CO_2 (DIC):	Richard Feely - PMEL Rik Wanninkhof - AOML
Total Alkalinity/pH:	Frank Millero - RSMAS
Inorganic Carbon Isotopes:	Ann McNichol-WHOI; Robert Key- Princeton
Organic Carbon Isotopes:	Ellen Druffel – UCI
Dissolved Organics:	Brett Walker – UCI
DOM:	Dennis Hansell, RSMAS
Helium/Tritium:	Scott Doney - WHOI
Stable Gases (O, N, Ar):	Annie Bourbonnais - WHOI
Floats:	Greg Johnson – PMEL Steve Emerson – UW Lynne Talley – SIO Craig McNeil – UW Giorgio Dall'Olmo – PML
Drifters:	Shaun Dolk – AOML
HPLC:	Emmanuel Boss – UM(1)
Transmissometry:	Wilf Gardner – TAMU
Flour./backscatter:	Emmanuel Boss – UM(1)
Chipods:	Jonathan Nash – OSU
Net tows:	Laura Sanchez Velasco – CICIMAR
Bathymetry:	Ship personnel
Underway TSG:	Ship personnel
Underway pCO_2:	Rik Wanninkhof – AOML
Genetics:	Adam Martiny – UCI
iTag Genetics:	Eric Allen – SIO
Nitrate/nitrite isotopes:	Daniel Sigman – Princeton François Fripiat – MPIC Annie Bourbonnais – WHOI
N_2O isotopomers:	Annie Bourbonnais – WHOI
Radiometry/Chlorophyll:	Michael Ondrusek – NESDIS

2. Diplomatic Clearances

This project involves Marine Scientific Research in waters under the jurisdiction of France, Mexico, Chile, and the USA. The research area will include areas protected by the UN Antarctic Treaty. Diplomatic clearance has been requested via the RATS system through Wendy Bradfield-Smith.

3. Licenses and Permits

None

II. Operations

The Chief Scientist is responsible for ensuring the scientific staff are trained in planned operations and are knowledgeable of project objectives and priorities. The Commanding Officer is responsible for ensuring all operations conform to the ship's accepted practices and procedures.

A. Project Itinerary

The P18 2016/2017 expedition is scheduled for 2 legs: RB-16-06 (Leg 1), and RB-16-06 (Leg 2) on RHB. Estimated transit times and station locations are provided in Table 1 of Appendix A.

Leg RB-16-06 (Leg 1): San Diego, CA, USA – Hanga Roa, Easter Island, Chile

After departing San Diego, the vessel will steam to the start of the P18 2016/2017 section offshore Cabo San Lucas, Mexico along 110°W near 22.87°N. Along the way, a single test station will be occupied to verify all systems are in good working order. Nominally, this station will be located at 112.91°W and 24.46°N, though the exact location of this station is flexible provided the bottom depth is >2000 m. Upon reaching the P18 line, the ship will begin occupying 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 200-500m. The vessel will move southward, occupying a series of closely spaced stations. Initially these stations will be spaced to maintain a consistent bottom depth increase of ~750 to 1000 m on each subsequent station. After entering deep (>2000 m) water, stations will become spaced by approximately 30 nautical miles. Crossing the equator (5°N to 5°S), 15 nautical mile station spacing will be used. Then the nominal 30 nautical mile spacing will resume. The vessel will proceed due south to 5°S at which point it will angle SE toward 10°S at 103°W. It will resume heading due south after reaching this meridian.

We anticipate ending Leg 1 at or south of ~28°S 103°W to minimize the transit time from the line to Hanga Roa, Chile. If the project is ahead of schedule we will continue performing stations along the track proposed for P18 Leg 2 and then backtrack to Hanga Roa. Some scientific personnel will be exchanged in Hanga Roa (see personnel list). One group (net tows) will not send a participant for Leg 2, and one group (iTag genetics) will only perform work on leg 2. Small quantities of scientific gear and spares may be on- and off-loaded by small boat for various groups in Hanga Roa, Chile.

Water samples will be collected with a 24 position, eleven-liter CTD/rosette system from PMEL. Two backup rosette systems will also be available. These include a second 24 position, 10-liter rosette from PMEL and RHB's CTD/rosette package [12 position, 5 liter].

Leg RB-16-06 (Leg 2): Hanga Roa, Easter Island, Chile – Punta Arenas, Chile

At the completion of the port stop, the ship will steam back to the 103°W section and continue the line southward with nominal 30 nautical mile station spacing. We will reoccupy the last station of leg 1 as a test station for leg 2. The vessel will enter waters protected by the UN Antarctic Treaty on leg 2. On approach to the Antarctic Shelf, closer station spacing will be used over the rising bathymetry, with stations approximately every 750 m bathymetric change. The final station on the P18 line will occur at 200-500 m water depth or where ice conditions prevent further safe progress south (as determined by the vessel CO). The vessel will then proceed to the first station on the P17e line extension at 52.90°S and 102.24°W. The vessel will then follow the P17e line toward Punta Arenas. The P17e line proceeds ESE, then due E, and finally ENE before intersecting with the Chilean coast. Station spacing along this line will be less consistent than along P18. The vessel will aim for spacing that is over 30 nm west of 87°W and under 30 nm in eastern portions of the line (see table A1 (appendix)). Along the Chilean continental shelf station spacing will again decrease to provide a station at approximately every 750 m bathymetric change. The final station will occur in 200-500 m deep water. At the completion of the section work, the ship will steam to port in Punta Arenas, Chile. Some scientific gear will be offloaded in Punta Arenas.

As on Leg 1, water samples will be collected with a 24 position, eleven-liter CTD/rosette system from PMEL. Two backup rosette systems will also be available. These include a second 24 position, 10-liter rosette from PMEL and RHB's CTD/rosette package [12 position, 5 liter].

B. Staging and Destaging

Given past logistical and financial challenges with shipping to and from Chile and Brazil, we are arranging with the vessel CO and the Chief Scientist of the subsequent PIRATA NE project (RB 17-01) to store scientific materials for both projects for the duration of both projects. This will allow PIRATA materials to be loaded in San Diego and allow P18 materials to be offloaded in Charleston, SC. This will save significant taxpayer money from shipping costs and man hours.

Staging of laboratory vans and ARGO floats for the project will be conducted in San Diego. We request access to the ship starting on October 26, 2016 for loading and equipment set-up. We plan to send three 20-foot lab containers to the ship: a 20-foot container for DIC analyses, a 20-foot container for CFC analyses, also containing some equipment for nutrient analyses and the secondary CTD package, and a 20-foot container containing the primary CTD/rosette package. They will be loaded with a shore-based crane rented by the scientific party. The Argo programs will be loading 31 floats in San Diego, and these will be placed into a float-rack that was installed in the main lab prior to the 2016 dry dock repair period. All of these floats will be deployed on P18. These can be loaded with the onboard crane. Up to 30 drifters will also be loaded in two large pallets in San Diego for deployment along the P18 project track with an additional up-to 15 drifters stored for deployment along the subsequent PIRATA NE cruise. These will be stored in the forward scientific hold. Additionally, we will load some palletized equipment, deck boxes, and freezers. Scientific personnel will be present in San Diego for these operations.

The DIC, CFC, and CTD vans will contain some hazardous materials and compressed gases. These will be packaged according to DOT regulations, and can be safely stored in the containers between Punta Arenas, Chile and Charleston, SC.

The project will use 5 laboratory vans (designated as the DIC, CFC, AOML, WHOI, and AEROSE vans). The DIC and CFC vans are laboratory vans and will be staged on the main deck. The AOML and WHOI vans are storage vans that will need to be accessed routinely at sea. These will be staged on the main deck, ideally immediately aft of the Hydro Lab. The AEROSE van will be staged on the forward 02 deck. Several of the vans on the main deck will be relocated on the forward 02 deck with a shore based crane in Punta Arenas. It is preliminarily expected that the AOML, CFC, and DIC vans will be relocated forward, leaving the AOML van in place. However, the PIRATA NE project instructions will contain finalized details on this move.

In San Diego, we will require the assistance of the shipboard ET and Survey Technician for 8 hours on each of 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 (Sunday, 10/30/2016 excepted). Laboratory vans for use during P18 should be connected to power and remain powered for the duration of the project.

Limited on/off-loading of incidental scientific and personal equipment will occur via small boat in Hanga Roa, Chile. Because of difficulties in shipping and storing scientific equipment from/in Hanga Roa and from Punta Arenas, most staging will occur in San Diego, and most destaging will occur in Charleston, SC. All scientific equipment, vans, and hazardous materials used during Leg 2 or remaining from Leg 1 will be offloaded in Charleston, SC. The vans will require a shore-based crane. Palletized scientific equipment will be offloaded with the onboard crane. The scientific party will prepare all documentation and shipping arrangements.

A list of equipment to be brought aboard is shown in Appendix B.

C. Operations to be conducted

The preliminary personnel task assignments (ship's or scientific personnel) are indicated with each operation. The Chief Scientist and the Commanding Officer will determine final responsibilities. Note that in addition to these standard operations associated with CLIVAR, supplementary projects will also be conducted, including some operations not listed in this section (see Section V Additional Projects). This includes net tows for zooplankton along the first leg and genetics sampling along both legs. An abbreviated list of the core operations is given in Table 3 below, with extended descriptions following:

Table 3. Abbreviated list of core operations to be conducted.

a	Full water column CTD / Rosette Casts (Ship's and Scientific Personnel)		
	i	Profiling LADCP	Scientific personnel
	ii	Transmissometer	Scientific personnel
	iii	Altimeter	Ship's and scientific personnel
	iv	Chipods	see supp. projects section

	v	Flourescence and backscatter (FLBB)	see supp. projects section
b	Sampling of the rosette bottles		Scientific personnel
	i	Salinity sampling and analysis	Scientific personnel
	ii	Oxygen and nutrient sampling and analysis	Scientific personnel
	iii	CFC, SF_6, sampling and analysis	Scientific personnel
	iv	He / Tr sampling and analysis	Scientific personnel
	v	DIC sampling and analysis	Scientific personnel
	vi	TALK and pH sampling and analysis	Scientific personnel
	vii	Inorganic carbon isotopes (DIC^{14})	Scientific personnel
	viii	Organic carbon isotopes (DOC^{14}), biomarkers, dissolved organics molecular composition, and black carbon	Scientific personnel
	ix	DOC and TON	Scientific personnel
	x	HPLC, Chlorophyll, and POC	Scientific personnel
	xi	Stable dissolved gases (O, N, Ar)	Scientific personnel
	xii	Nitrate/nitrite isotopes and N_2O isotopomers	Scientific personnel
	xiii	Rare Earth Elements	Scientific personnel
c	Float and drifter deployment		Ship's and scientific personnel
d	Navigation		Ship's personnel
e	Underway sampling operations		Scientific personnel
	i	Automated sea surface temperature and salinity	Ship's personnel
	ii	ADCP underway operations	Ship's and scientific personnel
	iii	Weather observations	Ship's personnel
	iv	Seabeam and PDR	Ship's personnel

	v	Underway air measurements	Scientific personnel
	vi	Underway pCO_2 measurements	Scientific and ship's personnel
	vii	MAERI	Scientific personnel
f	Profiling Spectroradiometer		Ship's and scientific personnel

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. Both primary and secondary winches must contain full lengths (7,000 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, provided by the ship, allowing the CTD/rosette package to be safely tugged into the staging bay. The air winch used for tugging will be provided by PMEL. We request the ship's assistance to mount it up on a wall away from the rosette package to avoid water damage while sampling. A 24-position rosette system (AOML) with 10 liter bottles will be used for CTD/rosette casts. A secondary 24-position rosette with 10 liter water bottles will be available (PMEL system), with the RHB CTD system to be available as a tertiary system if necessary. The second package should be secured in a readily accessible area, to be deployed when required. 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 center beam of the SeaBeam system and/or the PDR must be working properly to aid this goal.

Two working winches with 7000+ meters 0.322" conducting cable in good shape (at least one new would be best) will be required for deployment of the CTD. The winch, wire and meter wheel for both winches must be capable of routinely making 6000 meter casts with these rosette systems. PMEL and AOML 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 (both for regular casts and for net tows and spectral casts) with assistance of scientific personnel (see Tables 1 & 2 above). 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 collect oxygen, nutrient, salinity and isotope samples and record 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. The Chief/Co-Chief scientists and CTD data processor in collaboration with the individual science teams will monitor the preliminary data measurements to ensure the highest possible quality. Many of the chemical measurements are sensitive to contamination from smoke, soot, oils, solvents, spray cleaners, lubricants, paints, hydraulic fluid, ospho (rust treatment) 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. Please use caution with spray cans especially near the sampling area as these could contain halogenated compounds capable of contaminating the CFC measurements.

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.

The collection of CTD data relies on using the ship's CTD workstation in the computer room, consisting of a desktop computer with a recent version of Sea-Bird acquisition and processing software installed, one (preferably two) monitors, and Sea-Bird V2 deck unit (and spare) with a NMEA data feed that allows position data to be merged with CTD data. The NMEA interface is designed to decode messages that are output from ship's navigation devices supporting NMEA protocol. The deck unit automatically decodes the messages and appends latitude and longitude to the CTD data stream that is passed to the computer for storage and real-time display with the CTD data. The NMEA interface is setup and maintained by the ship.

i. Profiling LADCP (Scientific personnel)

A lowered ADCP (LADCP) system will be used on the CTD casts. It consists of a downward-looking 150kHz ADCP and an upward-looking 300kHz ADCP, a battery pressure case, a pressure case containing an incidental measurement package (IMP) to obtain better pitch/roll/heading data, as well as cables connecting the components, which should be mounted in the inner part of the rosette. The instrument system can be used to a depth of 6000 m. While on deck, the LADCP system is connected to a battery charger and a data acquisition computer, installed on a dry workbench; if at all possible, cable runs should be kept shorter than 50 feet.

Both the ADCPs and the IMP should be turned on a few (not longer than 15) minutes prior to the launch of the CTD/rosette package. The ADCPs are turned on using the data acquisitions computer and the IMP is powered on by connecting it to the rosette-mounted battery cable. After each CTD station, about 30 minutes are required to transfer the ADCP data from the instruments and to re-charge the batteries, before the system can be turned off. Data downloading from the IMP is done wirelessly using a tablet computer and takes just a few minutes. If Alkaline batteries are used, the battery pressure case must be opened to swap batteries approximately every 90 hours of operations (18 deep casts). Any of the hardware may have to be removed for diagnostics and/or repairs between casts.

For processing LADCP profiles, 5Hz (0.2s interval) CTD files with the following information are required: scan number, pressure, temperature (in situ), salinity or conductivity, latitude and longitude. If it is not possible to co-record GPS with the CTD data (via a GPS feed to the CTD deck box), operators must ensure that the CTD and ADCP clocks are kept accurate to within 1s throughout the project. (Note: 5Hz, rather than the more usual 1Hz CTD time-series files are required for calculating vertical velocity from LADCP data.)

ii. Transmissometer (Scientific personnel)
iii. Altimeter (Ship's and scientific personnel)
iv. Chipods (see supplementary projects section)
v. Fluorometer and backscatter sensor (Scientific personnel)

b. Sampling of the rosette bottles (Scientific personnel)

The usual order for drawing seawater samples on deck will be: CFCs, Helium, oxygen, DIC, pH, TALK, stable gas isotopes, nitrous oxide isotopomers, $DI^{14}C$, $DO^{14}C$ (Druffel), DOC, TON, CDOM, POC, Chl, nutrients, salinity, nitrate/nitrite isotopes, REEs, tritium, black carbon, genetics, iTag, $DO^{14}C$ (White).

i. Salinity sampling and analysis (Scientific personnel):

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 Autosal 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 inport 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 (autosal room) off the hydrography laboratory, where 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 Autosal 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 project, 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 Autosal, salinity analyses should be completed within 36 hours of sampling and submitted to the CTD operators. Any problems with the Autosal should be reported immediately to the Chief Scientist.

ii. *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 Seal AA3 system. Dissolved oxygen samples will be run in the hydro lab or the main lab by members of the scientific party.

iii. *CFC ('Freon'), SF_6 and sampling and analysis (Scientific personnel)*

Water samples will be drawn for CFC and SF_6 analyses at most stations. CFC/SF_6 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. Atmospheric sampling for CFCs will be conducted while underway and on station only when the wind is forward of the beam. Air inlet cups will be mounted on the foredeck mast for collecting uncontaminated marine air. Air sampling lines (3/8" plastic tubing) will run from these inlets into the laboratory and laboratory vans.

iv. *Helium/Tritium sampling and analysis (Scientific Personnel)*

Helium samples will be drawn at selected stations into cold welded copper tubing and stored. Due to the risk of contamination, no luminous dial watches (that is, watches dials that glow in the dark and usually contain tritiated compounds) may be used on board the ship during this expedition. The chief scientist, the principle investigator Scott Doney (WHOI), and the representative for this group, Annie Bourbonnais (WHOI), must be notified of any proposed use of helium gas on board ship during this expedition.

Tritium samples will be drawn at selected stations and stored separately.

v. Dissolved inorganic carbon (DIC) sampling and analysis, (Scientific personnel)

The chemistry groups from PMEL and AOML will make the DIC measurements at the hydrocast stations. DIC samples will be collected from the 10-L Niskin bottles into 300 ml glass-stoppered bottles containing 0.12 mL of a 50% saturated solution of $HgCl_2$ 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.

vi. Total Alkalinity (TALK) and pH sampling and analysis (Scientific personnel)

The CO_2 chemistry group from U. Miami will make the pH and TALK measurements at the hydrocast stations. TALK samples will be measured by an acidimetric titration method; pH will be measured at constant temperature (25 °C) using a pH indicator dye (m-cresol purple) in a spectrophotometer. The expected water budget for these samples (including rinsing, etc.) is: TALK ~400 mL; pH ~ 600 mL, *i.e.* 1 L in all.

vii. Inorganic Carbon Isotopes (Scientific Personnel)

The radiocarbon content of seawater dissolved inorganic carbon ($DI^{14}C$) is measured by extracting the inorganic carbon as CO_2 gas, converting the gas to graphite, and counting the number of ^{14}C atoms in the sample directly using an accelerator mass spectrometer. Samples will be drawn from the CTD, processed, and stored in a climate controlled space. This project measures naturally present radiocarbon and does not require any radioactive reference materials.

viii. Organic carbon isotopes, biomarkers, organic molecular composition, and black carbon sampling and analysis (Scientific personnel)

Samples will be collected from up to 4 stations on each leg for two sample types ($DO^{14}C$ and BC). Samples are drawn directly from Niskin bottles and filtered through GF/F filters held inside a filter holder. Samples will be collected from up to 12 stations on each leg for 'Walker' biomarkers and also 12 stations on each leg for 'Walker' biomarkers + dissolved organic molecular composition. 'Walker' dissolved organic molecular composition stations will overlap with the 4 stations sampled for $DO^{14}C$ and BC on each leg.

For $DO^{14}C$, samples will be collected from 14 Niskin bottles at each station; 1.3 L per Niskin (including rinses). For BC, samples will be collected from 2 depths (~20 m and ~2000 m) at each station (or within 4 nearby stations and combine water); 13 L (including rinses) for ~20 m depth and 25 L (including rinses) for ~2000 m depth. Biomarkers samples require 100 mL including rinses, and 'Walker' dissolved organic molecular composition samples require 1 L, including rinses and will also be filtered through GF/F for samples above 400m.

Sampling will be conducted in conjunction with $DI^{14}C$ (McNichol/Key, as in (*vii*) above), DOC (Carlson/Hansell, as in (*ix*) below) and DIC and TA samples are collected (as in (*v*) and (*vi*) above, respectively).

Due to concern about sampling contamination with ^{14}C and tritium, several precautions will be taken. In order to detect potential pre-existing contamination problems, laboratory spaces will need to be tested prior to the project dates, likely in San Diego. During the project, the work areas designated for this sampling (~5 linear ft of bench space) will be thoroughly cleaned and covered with ^{14}C free plastic. After processing, samples will be stored in clean -20 °C chest freezers provided by the scientists.

"White" $DO^{14}C$ via pyrolysis are described as a supplementary project in section V.

ix. *Dissolved organic matter (DOM), including dissolved organic carbon (DOC) and Total Dissolved Nitrogen (TON) (Scientific personnel)*

DOC and TON will be sampled from each Niskin at approximately every other station, in conjunction with full profiles of DIC as in (*v*) above. Samples are drawn directly from Niskin bottle through an inline filter holding a GF/F filter and the filtrate is collected into 60 ml sample bottles. The water budget for these samples is ~100 ml including rinses. DOC sampling occurs directly after gas sampling to avoid organic contamination from spigot handling.

Samples will be stored in a -20 °C Freezer provided by scientists. Leg 1 and leg 2 Samples will be offloaded in Punta Arenas, Chile.

x. *HPLC, Chl,, and POC sampling and analysis (Scientific personnel):*

HPLC samples will be collected only at stations at which we will deploy one of our 10 Argo-SOCCOM floats. There will be up to 3 samples collected from up to 2 depths.

POC (particulate organic carbon): One limited profile (4 depths, 2L each depth) on non-Carbon casts for POC analysis to calibrate Wilf Gardner transmissometer. These samples are stored in liquid N_2, and will be analyzed on land.

Chl (fluorometric chlorophyll concentration): 1 profile per day, 8 – 10 depths in upper 200m, 300 ml per sample. A fume hood will be needed for extractions and -20 °C freezer for extracted samples (must be separate from DOM storage for Hansell as in (*ix*) above.)

xi. *Stable gas (O, N, Ar) isotope ratios*

Stable gas (O, N, Ar) isotope ratio samples will be collected throughout the cruise. 240 mL) samples will be collected at every 4 stations (every 2 degrees) in the ETNP and every 3-4 degrees south of 50°S, with higher resolution at the equator (every degree or so). Half of the stations sampled will be sampled at all depths and half of the station sampled will only be sampled from the top 1000 m.

xii. *Nitrate/nitrite (NO_3^-) isotopes*

Nitrate/nitrite (NO_3^-) isotope samples will be collected at alternating stations by the Bourbonnais group on leg 1 and for the Sigman group on leg 2. These samples require 300 mL (or less – 60 mL for the Bourbonnais group) seawater apiece. Samples collected by the Bourbonnais group will be preserved with pre-loaded 0.5 mL 2.5 mM sulfamic acid in 25% hydrochloric acid (nitrate isotope samples) and 1 mL 6M NaOH (nitrite isotope samples) and stored at room temperature. On leg 2, these samples will be frozen in a -20°C or colder freezer after collection. Nitrous oxide (N_2O) samples will be collected by the Bourbonnais group on leg 1 and by TBD personnel on leg 2.

xiii. *Rare Earth Elements (REEs)*

Samples for REEs will be collected in 60ml LDPE bottles that have been acid-cleaned using the sampling kits and gloves provided. Samples will be taken from the same stations/depths as helium/tritium samples and other selected stations as possible. A 20ml volume is first be drawn from the Niskin via provided tubing into a 50ml acid-cleaned syringe. That volume is then flushed through an acid-cleaned Puradisc 0.45um syringe filter into the sampling bottle, used to rinse the bottle and discarded. A larger 50ml sample is then drawn in the same way. The LDPE bottle is finally capped and the cap is sealed with parafilm to ensure the cap doesn’t come loose during transport. Each syringe/filter kit should be used for 3 sequential samples/station (more if absolutely necessary). All samples are stored at room temperature in leak-proof zip-lock bags and put in the opaque plastic crates for storage and shipping from Charleston, SC. Samples will be collected by Laura Whitmore (USM) on leg 1 and by Yves Plancherel (Ox) on leg 2. Contingency: if for some reason filtering cannot be achieved, fill the LDPE bottles with unfiltered sample and make a note for each bottle.

c. Float and drifter deployment (Ship and scientific personnel):

Twenty Argo/Argo-O_2 profiling floats, thirteen Argo-like (10 Argo-SOCCOM, 1 Argo-GasFloat, 2 Argo-PROVOR) profiling floats, and thirty drifters will be deployed during this expedition. The Chief Scientist will coordinate these programs.

Floats may need to be unpacked prior to deployment, preferably while the CTD is in the water. Floats will be deployed at designated stations immediately following completion of the final cast at each designated station, just before the ship gets well underway. Except for one Argo-like GasFloat (APL/UW), deployment involves lowering the ~20 kg float by hand into the water from the stern of the ship, with the ship slowly steaming ahead at about 1 to 2 kts. One or two persons from the ship and scientific party will be required for preparation and deployment. Shortly after deployments the following information should be e-mailed to PMEL_Floats@noaa.gov by the scientific party:

Float serial number
Deployment date and time (GMT)
Deployment latitude and longitude
Ship name
Deployer name(s)
Station number for the closest CTD
Any comments (problems with deployment, etc)

The Argo-like GasFloat (APL/UW) is modestly heavier than a standard Argo float and has fins attached to the side of the float, making it harder to deploy than a regular Argo float. It is recommended that the float be lowered into the water using a crane. A release system is provided with the float. Annie Bourbonnais will receive training before the cruise on how to setup and deploy the GasFloat. This float will be deployed in a region of strong eddy activity near 16.5 ^{o}N and 110 ^{o}W, and ideally inside an eddy. This float will be deployed at a scheduled CTD station (#14 to #22) informed by satellite imagery of the region during the cruise. The 2 Argo-like PROVOR floats will similarly be deployed in this region. These floats are also modestly longer (~2.25 m total) and heavier (35-40 kg total) than standard Argo floats. The use of a crane during deployment of these floats will at the discretion of the ship personnel involved in deployment.

Drifter deployment is simpler. After removing protective plastic wrap, the scientist or ship’s personnel will record the deployment coordinates and toss the buoy into the water from the lowest aft deck. The deployment information is then E-mailed to shaun.dolk@noaa.gov by scientific personnel.

d. 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. Navigation systems must be functional and integrated with the ship's SCS system for ADCP and LADCP measurements.

The station locations listed in Appendix A 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 frequently by the ship’s SCS system.

e. *Underway Sampling operations*

Underway measurements will be made along the entire project track. 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 San Diego for Leg 1 and from Hanga Roa for Leg 2.

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 San Diego 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.

i. *Automated 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 project.

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

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

iii. *Weather observations (Ship's personnel):*

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

iv. *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 12 kHz display will be required for bottom detection.

v. *Underway air measurements (*Scientific personnel):
Atmospheric sampling for CFCs will be conducted while underway and on station only when the wind is forward of the beam. Air inlet cups will be mounted on the foredeck mast for collecting uncontaminated marine air. Air sampling lines (3/8" plastic tubing) will run from these inlets into the laboratory and laboratory vans. If the inlet cups and 3/8” Decoran plastic tubing are not still mounted from previous projects, then ship personnel will be required to mount them with the inlet ~15’ high on the foredeck mast.

vi. *Underway p*CO_2 *measurements* (Scientific and ship's personnel):
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 CO_2 in surface water (pCO_2). This work is a collaborative effort between the CO_2 groups at AOML and PMEL. The system is maintained by the survey personnel on the RHB on all cruises. For P18 scientific personnel (Castle and Featherstone) will provide oversight

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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.

vii. *M-AERI sensor package*:
M-AERI is a sensor package that will be installed on the 03 and 02 deck. It measures or derives sea-surface skin temperature, sea surface and atmosphere emitted radiation (infrared), cloud type and cover, insolation, incident thermal radiation, columnar water vapor, air temperature, relative humidity, wind speed, wind direction, and barometric pressure. The sensor package should be integrated with the ship's network to allow shore-based software interaction.

The (120 kg) sensor package should be mounted at about 55° to vertical to deck railing on the 02 or 03 deck using a mounting structure provided by scientific personnel. The package is powered via provided cables to the vessel interior. The package should be moved by crane.

Mounting and network integration will be done by Miguel Angel Izaguirre working in conjunction with the ship ET and ST in port in San Diego. This sensor package will remain mounted until it is offloaded in Charleston, SC.

f. Profiling spectroradiometer (Ship's and scientific personnel)

Profiling spectroradiometer (Satlantic Hyperpro II): Deployment by hand at least once per day during high-sun hours (between 0900 and 1600 local works). Can perform when CTD arrives on deck while gas sampling is underway.

- < 30 minutes start to finish
- Multiple cast surface to ~20 m free fall, kited away from ship to avoid ship shadow
- Will need access to fantail from main lab
- Need communication means for computer/cable handlers and to bridge (handheld preferred)
- Need to place reference radiometer somewhere unobstructed by the ship's superstructure and preferably near the stern

D. Dive Plan

All dives are to be conducted in accordance with the requirements and regulations of the NOAA Diving Program (http://www.ndc.noaa.gov/dr.html) and require the approval of the ship's Commanding Officer.

Dives are not planned for this project.

E. Applicable Restrictions

See Appendix A for mitigation strategies to deal with delays.

III. Equipment

A. 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.

a. Furuno Global Maritime Distress and Safety System (GMDSS) suite
b. Satellite communication system (Sailor 500, INMARSAT, -M)
c. Five fixed VHF radios with eight channels preprogrammed with a selection of marine band and NOAA frequencies.
d. Cell phones

The electronic instrumentation used for navigation includes:

e. Furuno Navigator GP-150 GPS
f. Applanix POSMV GPS
g. Furuno GP-90 GPS
h. Meridian Commercial Gyro Compass SG Brown
i. Two Furuno FAR 2xx7 Series Marine RADAR(S-band (10 cm) 30 kW radar and an X-band (3 cm) 25 kW radar)
j. Kongsberg K-POS Dynamic Positioning System
k. Raytheon model DSN-450 Doppler Speed/distance log
l. NAVTEX receiving and printing the international automated medium frequency (518 KHz) weather warnings
m. E-mailed weather updates.

Ship's scientific equipment:

n. Echo Sounder (Ocean Data Equipment Corporation (ODEC) Bathy 2000 or the Knudsen system) used in 12 kHz mode to be used while on CTD station. This will be resolved with STs and ETs prior to project
o. Continuous EM122 multibeam swath bathymetric sonar system sampling while underway between stations.
p. Barometer
q. WOCE IMET sensors
r. Hydrographic Winch system and readouts (using 10 km of 0.322 conducting capable for CTD operations).
s. One backup hydrographic winch system for CTD operations with 10 km of 0.322 conducting cable.

t. Hull mounted acoustic Doppler current profiler (RD Instruments (RDI), 75 kHz Ocean Surveyor acoustic Doppler current profiler) with gyro input.

B. Equipment and Capabilities provided by the scientists (itemized)

Five container vans will be loaded aboard RHB for this project. Two containers (DIC and CFC) will act as laboratory vans, and must be accessible at all times throughout the expedition. Two additional container vans (WHOI and AOML) will be accessed routinely for laboratory storage. Compressed gas (non-flammable) cylinders will be used in ship's laboratories and laboratory vans. An additional container (AEROSE) will be loaded forward for use on the subsequent PIRATA NE project.

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

a. Two 24 position rosette sampling with 10 liter water sampling bottles and spare parts.
b. Complete CTD recording and processing system including 2 Sea-Bird CTDs, 2 deck units (to be used only as spares), 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 B (by research group) and Appendix C and will be updated prior to departure for Leg 1.
e. Altimeter and spares.
f. Strain gage
g. Milli-Q system, and replacement parts
h. 1-m Bongo nets with 505µm mesh.
i. Three chest freezers for storing $DO^{14}C$ and black carbon samples

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 quantity, MSDS, appropriate spill cleanup materials (neutralizing agents, buffers, or absorbents) in amounts adequate to address spills of a size equal to the amount of chemical brought aboard, and chemical safety and spill response procedures. Documentation regarding those requirements will be provided by the Chief of Operations, Marine Operations Center, upon request.

Per OMAO procedure, the scientific party will include with their project instructions and provide to the CO of the respective ship 30 days before departure:

- List of chemicals by name with anticipated quantity

- List of spill response materials, including neutralizing agents, buffers, and absorbents
- Chemical safety and spill response procedures, such as excerpts of the program's Chemical Hygiene Plan or SOPs relevant for shipboard laboratories
- For bulk quantities of chemicals in excess of 50 gallons total or in containers larger than 10 gallons each, notify ship's Operations Officer regarding quantity, packaging and chemical to verify safe stowage is available as soon as chemical quantities are known.

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
- An MSDS for each material
- Confirmation that neutralizing agents and spill equipment were brought aboard sufficient to contain and cleanup all of the hazardous material brought aboard by the program
- Confirmation that chemical safety and spill response procedures were brought aboard

Upon departure from the ship, scientific parties will provide the CO or their designee an inventory showing that all chemicals were 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, in compliance with Hazard Communication Laws.

Scientific parties are expected to manage and respond to spills of scientific hazardous materials. Overboard discharge of hazardous materials is not permitted aboard NOAA ships.

B. Inventory (itemized)

Appendix C provides the inventory according to scientific analysis

B. Chemical safety and spill response procedures

A: ACID

Wear appropriate protective equipment and clothing during clean-up. Keep upwind. Keep out of low areas. Ventilate closed spaces before entering them.

Stop the flow of material, if this is without risk. Dike the spilled material, where this is possible.

Large Spills: Dike far ahead of spill for later disposal. Use a non-combustible material like vermiculite, sand or earth to soak up the product and place into a container for later disposal.

Small Spills: Wipe up with absorbent material (e.g. cloth, fleece). Clean surface thoroughly to remove residual contamination.

Never return spills in original containers for re-use.

Neutralize spill area and washings with soda ash or lime. Collect in a non-combustible container for prompt disposal.

J. T. Baker NEUTRASORB® acid neutralizers are recommended for spills of this product.

C: Caustics:

Pick up and place in a suitable container for reclamation or disposal, using a method that does not generate dust. Residues from spills can be diluted with water, neutralized with dilute acid such as acetic, hydrochloric or sulfuric.

F:Formalin/Formaldehyde
Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust.

G:General Spill
Wear appropriate personal protective equipment recommended by MSDS. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Sweep up and containerize for reclamation or disposal. Vacuuming or wet sweeping may be used to avoid dust dispersal. Following product recovery, wipe or flush area with water.

M: Mercury
Spills: Pick up and place in a suitable container for reclamation or disposal in a method that does not generate dust. Sprinkle area with sulfur or calcium polysulfide to suppress mercury. Use PMEL Mercury Spill Kit if need be.

N: Liquid Nitrogen
Extremely cold liquid and under pressure. Asphyxiant, if needed, evacuate all personnel from danger area and use self-contained breathing apparatus. Avoid contact with liquid and allow to evaporate. Ventilate area of leak and test for sufficient oxygen especially if in confined area.

NA: Not applicable (Gases)
Gases cannot “spill,” but can displace breathable air (Asphyxiant). If large quantities are emitted, then thoroughly ventilate the area before entering without a breathing device.

P: Phenol
Small Spills: Wipe up with absorbent material (e.g. cloth, fleece). Collect in a non-combustible container for prompt disposal. Never return spills in original containers for re-use. Clean up in accordance with all applicable regulations. Neutralize spill area and washings with soda ash or lime. Collect in a non-combustible container for prompt disposal.

S: Solvents
ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area). Stop the flow of material, if this is without risk. Dike the spilled material, where this is possible. Use only non-sparking tools. All

equipment used when handling the product must be grounded. **Large Spills**: Use a non-combustible material like vermiculite, sand or earth to soak up the product and place into a container for later disposal. Dike far ahead of spill for later disposal. **Small Spills**: Wipe up with absorbent material (e.g. cloth, fleece). Collect in a non-combustible container for prompt disposal. Never return spills in original containers for re-use. Clean surface thoroughly to remove residual contamination.
1-5 gallon bucket of Spill X-S adsorbent is recommended and will handle up to 3.2 gallons of Acetone.

X: Virtually Harmless
Small Quantities of less than 5 gallons/pounds should be collected in a ziplock or bucket and marked as "used".

D. Radioactive Materials (R)

No radioactive isotopes are planned for this project.

V. Additional Projects

A. Supplementary ("Piggyback") Projects

a. Micro-structure Measurements using a CTD-Chipod

Chipods are self-contained instruments that use fast response thermistors and precision accelerometers to measure microscale temperature gradients, from which we compute the dissipation rate of temperature variance (chi) and the eddy diffusivity of heat and other tracers. Unlike traditional microstructure measurements based on shear probes, chi is not sensitive to platform vibration but does require that our sensors see undisturbed, "clean" fluid on both down and upcasts. We will install 3 small pressure cases and 3 cabled sensors that will be attached to rods that either protrude above the rosette or position the sensor in a void near the LADCP head. Instruments record data autonomously, are rated to 6000-m and data will be monitored and downloaded periodically via USB cable, and monitored by a student or research tech during the project.

The instrument is installed on the rosette and all work is performed on a not-to-interfere basis and does not introduce any added logistical requirements. 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 C.

Data will be retrieved on leg 1 by scientific personnel selected by the chief scientist.

b. Measurement of Pteropod Distribution and Calcification Adaption: Net Tows

Net tows will be used to collect organisms from 100 m to the surface once per evening. Tows should be conducted several hours after nightfall, preferably between 12 AM - 3AM (note the preferred time frame will change as the ship proceeds southward). The following is provided as an example towing procedure, though the specific procedure will change depending on the target organism. We will use 0.5 m diameter zooplankton nets (Bongo; 30 lbs) with 60-80 lbs weight attached, which will be obliquely towed at 1-2 knots on the starboard side of the ship from the forward (backup) winch. The net will remain at 100 m for 10 minutes, then will be brought to the surface at ~10 m per minute. The net will be in the water for a total of about 20 minutes after which a member of the science party will rinse the net with seawater, and collect and store the net contents for later identification of different species.

The assistance of ship's personnel is requested for the deployment and recovery of nets. The scientific party will collect samples and wash the nets with salt water for the next use.

All net tows will be performed after the regular CTD casts, and a detailed operating procedure will be provided to the Brown. All work is to be performed on a not-to-interfere basis and does not introduce any additional ship logistical requirements other than those stated above. 30 hours of ship time have been allotted for net deployments on the northern leg 1. 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.

c. *Genetics, Particulate Organic Carbon (POC) and Phosphorous (POP) and Chemical Oxygen Demand (COD).*

Genetics: From the clean underway sampling seawater system, 10L of seawater will be collected into plastic containers and filtered through 0.2µm Sterivex filters. Sterivex filters will be frozen and analyzed at UC Irvine.

If ~4L water is available from on-station CTD bottle in mixed layer, we wish to collect leftover water for genetics. Collection could be every few stations if the water budget allows, and is preferable to the underway system. The process would be same as above.

POC, POP, and COD: Samples for particulate organic matter and chemical oxygen demand will be collected from the clean underway circulating seawater system, multiple times per day. It is best if the underway system is left on at a constant flow rate for the duration of the cruise, when sampling is allowed. For each sample, ~8L of seawater will be filtered through a 30µm mesh into a plastic container. In total twelve containers will be filled (3x POP, 3x POC/PON, 6x COD). The 8L of seawater will be filtered onto a 25mm GF/F filter and stored frozen until analysis at UC Irvine.

d. *DO14C via pyrolysis*

Ramped PyrOx Analysis of DOM Dissolved organic matter samples will be collected for radiocarbon analysis. Up to 15 samples will be collected in total, with 3 to 5 liters of water from a niskin required for each sample. Stations are yet to be determined but should include 3 samples from North Pacific Deep Water, companion samples from the base of the euphotic zone and in addition a 3-4 sample profile through the OMZ. Water will be collected from the CTD, passed through a filter and then a PPL cartridge after which DOM is collected following elution with methanol. Samples will be subjected to ramped oxidation according to previously established methods and analyzed for radiocarbon content. This technique allows us to fractionate the radiocarbon pool based on thermal lability. This program is collecting samples to measure natural abundance of radioactive materials and will bring no radioactive materials on board.

B. *NOAA Fleet Ancillary Projects*

No ancillary projects are planned.

VI. Disposition of Data and Reports

Disposition of data gathered aboard NOAA ships will conform to NAO 216-101 *Ocean Data Acquisitions* and NAO 212-15 *Management of Environmental Data and Information.* To guide the implementation of these NAOs, NOAA's Environmental Data Management Committee (EDMC) provides the *NOAA Data Documentation Procedural Directive* (data documentation) and *NOAA Data Management Planning Procedural Directive* (preparation of Data Management Plans). OMAO is developing procedures and allocating resources to manage OMAO data and Programs are encouraged to do the same for their Project data.

A. Data Classifications: *Under Development*

a. OMAO Data

b. Program Data
We will be using the automated underway sea surface temperature and salinity data in conjunction with several projects, and request this data to be provided to the chief scientist within 3 months of the project completion.

B. 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 project, to any other requesters, and to NESDIS in accordance with NDM 16-11 (ROSCOP within 3 months of project 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 and ancillary projects conducted during the project 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.

VII. Meetings, Vessel Familiarization, and Project Evaluations

A. Pre-Project Meeting:

The Chief Scientist and Commanding Officer will conduct a meeting of pertinent members of the scientific party and ship's crew to discuss required equipment, planned operations, concerns, and establish mitigation strategies for all concerns. This meeting shall be conducted before the beginning of the project with sufficient time to allow for preparation of the ship and project personnel. The ship's Operations Officer usually is delegated to assist the Chief Scientist in arranging this meeting.

B. Vessel Familiarization Meeting:

The Commanding Officer is responsible for ensuring scientific personnel are familiarized with applicable sections of the standing orders and vessel protocols, e.g., meals, watches, etiquette, drills, etc. A vessel familiarization meeting shall be conducted in the first 24 hours of the project's start and is normally presented by the ship's Operations Officer.

C. Post-Project Meeting:

The Commanding Officer is responsible for conducted a meeting no earlier than 24 hrs before or 7 days after the completion of a project to discuss the overall success and shortcomings of the project. Concerns regarding safety, efficiency, and suggestions for future improvements shall be discussed and mitigations for future projects will be documented for future use. This meeting shall be attended by the ship's officers, applicable crew, the Chief Scientist, and members of the scientific party and is normally arranged by the Operations Officer and Chief Scientist.

D. Project Evaluation Report

Within seven days of the completion of the project, a Customer Satisfaction Survey is to be completed by the Chief Scientist. The form is available at http://www.omao.noaa.gov/fleeteval.html and provides a "Submit" button at the end of the form. Submitted form data is deposited into a spreadsheet used by OMAO management to analyze the information. Though the complete form is not shared with the ships', specific concerns and praises are followed up on while not divulging the identity of the evaluator.

VIII. 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 project.

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 detailed 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 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 orders. 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 17, 2000 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, NF 57-10-01 (3-14)) must be completed in advance by each participating scientist. The NHSQ can be obtained from the Chief Scientist or the NOAA website:
http://www.corporateservices.noaa.gov/noaaforms/eforms/nf57-10-01.pdf.
All NHSQs submitted after March 1, 2014 must be accompanied by NOAA Form (NF) 57-10-02 - Tuberculosis Screening Document in compliance with OMAO Policy 1008 (Tuberculosis Protection Program).

The completed forms should be sent to the Regional Director of Health Services at the applicable Marine Operations Center. The NHSQ and Tuberculosis Screening Document should reach the Health Services Office no later than 4 weeks prior to the start of the project to allow time for the participant to obtain and submit additional information should health services require it, before clearance to sail can be granted. Please contact MOC Health Services with any questions regarding eligibility or completion of either form. Ensure to fully complete each 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.

The participant can mail, fax, or email the forms to the contact information below. Participants should take precautions to protect their Personally Identifiable Information (PII) and medical information and ensure all correspondence adheres to DOC guidance (http://ocio.os.doc.gov/ITPolicyandPrograms/IT_Privacy/PROD01_008240).

The only secure email process approved by NOAA is Accellion Secure File Transfer which requires the sender to setup an account. Accellion's Web Users Guide is a valuable aid in using this service, however to reduce cost the DOC contract doesn't provide for automatically issuing full functioning accounts. To receive access to a "Send Tab", after your Accellion account has been established send an email from the associated email account to accellionAlerts@doc.gov requesting access to the "Send Tab" function. They will notify you via email usually within 1 business day of your approval. The 'Send Tab" function will be accessible for 30 days.

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
Email 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*

Hard hats are 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.

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. At the discretion of the ship CO, safety shoes (i.e. steel or composite toe protection) may be required to participate in any work dealing with suspended loads, including CTD deployment and recovery. The ship does not provide safety-toed shoes/boots. The ship's Operations Officer should be consulted by the Chief Scientist to ensure members of the scientific party report aboard with the proper attire.

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.

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 (FNRS) 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 Line Office Deemed Export point of contact to assist with the process.

Foreign National access must be sought not only for access to the ship involved in the project but also for any Federal Facility access (NOAA Marine Operations Centers, NOAA port offices, USCG Bases) that foreign nationals might have to traverse to gain access to and from the ship. 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 for providing 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 D) 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 E (Certification of Conditions and Responsibilities for a Foreign National

APPENDICES

Appendix A

Station Operations

CTD Operations: CTD casts will include the CTD/O2 unit, a LADCP with battery pack, a fluorometer, a transmissometer, Chi-pod, an altimeter and a Rosette sampler with 24, 10-L bottles on the Rosette frame.

Approximately 225 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 project and a functioning spare winch. Approximate station locations are listed in Table 1.

The primary goal for this project to complete sampling along the 110°W/103°W line from 22.87°N to 67°S. Secondary priorities, in order of decreasing importance are:
1. higher resolution sampling near coasts
2. extending the line to the edge of safe operation near the Antarctic ice edge
3. double resolution sampling near the equator
4. occupation of the P17e extension line at the specified spacing
5. occupation of 2-4 stations near recent SOCCOM float profiles between the southernmost station and Chile. Updated SOCCOM float locations: http://www3.mbari.org/soccom/images/SOOCNMAP.jpg.

Extra time available along P17e due, for example, to the Antarctic ice edge being encountered further north than anticipated will be used to augment station resolution along the P17e line. Priority 5 will only be pursued if the P17e extension is cut, but enough ship time remains to permit 2-4 additional stations along the path to Punta Arenas.

Strategies for dealing with delays:

The base plan assumes no weather or mechanical delays and includes ~6 days worth of opportunistic sampling along the P17e extension on the transit to Punta Arenas after the completion of the primary project objective (occupation of the P18 section). However, weather days are very likely for the P18 section, especially the portion crossing the Southern Ocean. Therefore the following guidelines will be used to trim or eliminate the opportunistic sampling along the P17e extension in the likely event of delays:

Leg 1: Minor additional early delays will be offset by ending the leg 1 section further north, increasing the station burden for leg 2.
Significant early delays will be offset by decreased station resolution near the equator.
Widening of nominal (30 nm) spacing is the last resort.

Leg 2: Minor early delays or an incomplete occupation of the stations slated for occupation on leg 1 will be offset by decreased station spacing along the P17e line.
Significant delays will result in cancellation of all stations along the P17e line.
Extreme delays will result in further cancellation of the section of P18 from 67°S to the Antarctic ice edge.
Decreased resolution along P18 north of 67°S will be a last resort.

Table 1. **(**a) Leg 1. (b) Leg 2. (c) supplemental. Planned station locations (positive degrees N & E); distances between stations; estimated station depths; and times of arrivals on stations, spent on stations, and departures from stations. Extra time is not included. Time is included for net tows and spectroradiometer casts once per day along the P18 line. This is considered a best possible scenario. Stations are budgeted without weather delays. Plans for delays due to weather or technical difficulties are described above. Should Leg 1 finish ahead of schedule it will continue with first Leg 2 stations. Leg 2 will begin with a repeat of the last Leg 1 station.

Table 1a

Leg 1 Start Date and Time: 11/2/2016 at 12:00 (all times are Pacific Daylight Time, GMT -7). Calculations presume an av
velocity of 10.5 knots between stations and 11.5 knots on transits. First and final transits were estimated from transits t
occupations to account for navigational constraints.

Station	Latitude °N	Longitude °E	Depth [m]	Arrival Date PST	Departure Date PST
Station	Latitude °N	Longitude °E	Depth [m]	Arrival Time Pacific	Departure Time Pacific
San Diego	32.72	-117.16	0	N/A	11/2/16 12:00
Test	24.46	-112.91	3005	11/4/16 11:16	11/4/16 13:53
1	22.87	-110	178	11/5/16 6:05	11/5/16 8:42
2	22.78	-110	1000	11/5/16 9:15	11/5/16 10:48
3	22.68	-110	1750	11/5/16 11:24	11/5/16 13:22
4	22.59	-110	2500	11/5/16 13:54	11/5/16 17:46
5	22.5	-110	3060	11/5/16 18:18	11/5/16 20:57
6	22	-110	3141	11/5/16 23:57	11/6/16 2:39
7	21.5	-110	3214	11/6/16 5:39	11/6/16 8:23
8	21	-110	3238	11/6/16 11:23	11/6/16 14:08
9	20.5	-110	2932	11/6/16 17:08	11/6/16 21:13
10	20	-110	2668	11/7/16 0:13	11/7/16 2:39
11	19.5	-110	3354	11/7/16 5:39	11/7/16 8:28
12	19	-110	3240	11/7/16 11:28	11/7/16 14:12
13	18.5	-110	3384	11/7/16 17:12	11/7/16 21:32
14	18	-110	3332	11/8/16 0:32	11/8/16 3:20
15	17.5	-110	3423	11/8/16 6:20	11/8/16 9:10
16	17	-110	3595	11/8/16 12:10	11/8/16 16:36
17	16.5	-110	3452	11/8/16 19:36	11/8/16 22:28
18	16	-110	3166	11/9/16 1:28	11/9/16 4:10
19	15.5	-110	3769	11/9/16 7:10	11/9/16 10:12
20	15	-110	3757	11/9/16 13:12	11/9/16 17:43
21	14.5	-110	3129	11/9/16 20:43	11/9/16 23:25
22	14	-110	3733	11/10/16 2:25	11/10/16 5:25
23	13.5	-110	3822	11/10/16 8:25	11/10/16 11:29
24	13	-110	3218	11/10/16 14:29	11/10/16 18:43
25	12.5	-110	3662	11/10/16 21:43	11/11/16 0:41
26	12	-110	3645	11/11/16 3:41	11/11/16 6:39
27	11.5	-110	3844	11/11/16 9:39	11/11/16 12:43
28	11	-110	3823	11/11/16 15:43	11/11/16 20:16

Dates Shifted
10/24/2016

29	10.5	-110	3379	11/11/16 23:16	11/12/16 2:05
30	10	-110	3441	11/12/16 5:05	11/12/16 7:57
31	9.5	-110	3589	11/12/16 10:57	11/12/16 13:52
32	9	-110	3966	11/12/16 16:52	11/12/16 21:30
33	8.5	-110	3937	11/13/16 0:30	11/13/16 3:37
34	8	-110	3559	11/13/16 6:37	11/13/16 9:32
35	7.5	-110	3806	11/13/16 12:32	11/13/16 17:05
36	7	-110	3766	11/13/16 20:05	11/13/16 23:07
37	6.5	-110	3643	11/14/16 2:07	11/14/16 5:04
38	6	-110	3706	11/14/16 8:04	11/14/16 11:04
39	5.5	-110	3998	11/14/16 14:04	11/14/16 18:43
40	5	-110	3903	11/14/16 21:43	11/15/16 0:49
41	4.5	-110	3891	11/15/16 3:49	11/15/16 6:54
42	4	-110	3850	11/15/16 9:54	11/15/16 12:59
43	3.5	-110	3818	11/15/16 15:59	11/15/16 20:32
44	3	-110	3876	11/15/16 23:32	11/16/16 2:37
45	2.5	-110	3767	11/16/16 5:37	11/16/16 8:39
46	2	-110	3755	11/16/16 11:39	11/16/16 14:40
47	1.5	-110	3792	11/16/16 17:40	11/16/16 22:12
48	1	-110	3798	11/17/16 1:12	11/17/16 4:15
49	0.5	-110	3770	11/17/16 7:15	11/17/16 10:16
50	0	-110	3943	11/17/16 13:16	11/17/16 17:54
51	-0.5	-110	3829	11/17/16 20:54	11/17/16 23:57
52	-1	-110	4006	11/18/16 2:57	11/18/16 6:06
53	-1.5	-110	3860	11/18/16 9:06	11/18/16 12:11
54	-2	-110	3922	11/18/16 15:11	11/18/16 19:47
55	-2.5	-110	3913	11/18/16 22:47	11/19/16 1:54
56	-3	-110	3765	11/19/16 4:54	11/19/16 7:55
57	-3.5	-110	3929	11/19/16 10:55	11/19/16 14:02
58	-4	-110	3755	11/19/16 17:02	11/19/16 21:33
59	-4.5	-110	3606	11/20/16 0:33	11/20/16 3:30
60	-5	-110	3510	11/20/16 6:30	11/20/16 9:23
61	-5.29	-109.59	3477	11/20/16 12:23	11/20/16 16:46
62	-5.59	-109.18	3528	11/20/16 19:48	11/20/16 22:42
63	-5.88	-108.76	3331	11/21/16 1:45	11/21/16 4:33
64	-6.18	-108.35	3374	11/21/16 7:35	11/21/16 10:24
65	-6.47	-107.94	3157	11/21/16 13:24	11/21/16 17:36
66	-6.76	-107.53	2942	11/21/16 20:36	11/21/16 23:12
67	-7.06	-107.12	3076	11/22/16 2:14	11/22/16 4:53
68	-7.35	-106.71	3466	11/22/16 7:53	11/22/16 10:45
69	-7.65	-106.29	3275	11/22/16 13:50	11/22/16 18:06
70	-7.94	-105.88	3492	11/22/16 21:06	11/22/16 23:58
71	-8.24	-105.47	3421	11/23/16 3:00	11/23/16 5:51
72	-8.53	-105.06	3130	11/23/16 8:50	11/23/16 11:32

73	-8.82	-104.65	3738	11/23/16 14:31	11/23/16 19:02
74	-9.12	-104.24	3732	11/23/16 22:03	11/24/16 1:04
75	-9.41	-103.82	4141	11/24/16 4:06	11/24/16 7:19
76	-9.71	-103.41	3871	11/24/16 10:20	11/24/16 13:25
77	-10	-103	4611	11/24/16 16:24	11/24/16 21:23
78	-10.5	-103	4533	11/25/16 0:23	11/25/16 3:49
79	-11	-103	4250	11/25/16 6:49	11/25/16 10:06
80	-11.5	-103	4131	11/25/16 13:06	11/25/16 17:49
81	-12	-103	4306	11/25/16 20:49	11/26/16 0:08
82	-12.5	-103	4144	11/26/16 3:08	11/26/16 6:21
83	-13	-103	4276	11/26/16 9:21	11/26/16 12:39
84	-13.5	-103	4015	11/26/16 15:39	11/26/16 20:18
85	-14	-103	4167	11/26/16 23:18	11/27/16 2:33
86	-14.5	-103	4377	11/27/16 5:33	11/27/16 8:54
87	-15	-103	4074	11/27/16 11:54	11/27/16 15:05
88	-15.5	-103	4031	11/27/16 18:05	11/27/16 22:45
89	-16	-103	3857	11/28/16 1:45	11/28/16 4:50
90	-16.5	-103	3106	11/28/16 7:50	11/28/16 10:30
91	-17	-103	3922	11/28/16 13:30	11/28/16 18:07
92	-17.5	-103	4045	11/28/16 21:07	11/29/16 0:17
93	-18	-103	4146	11/29/16 3:17	11/29/16 6:31
94	-18.5	-103	3945	11/29/16 9:31	11/29/16 12:38
95	-19	-103	4072	11/29/16 15:38	11/29/16 20:19
96	-19.5	-103	4146	11/29/16 23:19	11/30/16 2:33
97	-20	-103	4143	11/30/16 5:33	11/30/16 8:46
98	-20.5	-103	4036	11/30/16 11:46	11/30/16 14:57
99	-21	-103	4119	11/30/16 17:57	11/30/16 22:39
100	-21.5	-103	3973	12/1/16 1:39	12/1/16 4:48
101	-22	-103	3953	12/1/16 7:48	12/1/16 10:55
102	-22.5	-103	4014	12/1/16 13:55	12/1/16 18:34
103	-23	-103	3986	12/1/16 21:34	12/2/16 0:43
104	-23.5	-103	3995	12/2/16 3:43	12/2/16 6:52
105	-24	-103	3838	12/2/16 9:52	12/2/16 12:56
106	-24.5	-103	3740	12/2/16 15:56	12/2/16 20:26
107	-25	-103	3528	12/2/16 23:26	12/3/16 2:20
108	-25.5	-103	3514	12/3/16 5:20	12/3/16 8:14
109	-26	-103	3434	12/3/16 11:14	12/3/16 14:05
110	-26.5	-103	3508	12/3/16 17:05	12/3/16 21:28
111	-27	-103	559	12/4/16 0:28	12/4/16 1:48
112	-27.5	-103	3287	12/4/16 4:48	12/4/16 7:34
113	-28	-103	3429	12/4/16 10:34	12/4/16 13:25
114	-28.5	-103	3367	12/4/16 16:25	12/4/16 20:44
115	-29	-103	3334	12/4/16 23:44	12/5/16 2:32
116	-29.5	-103	3232	12/5/16 5:32	12/5/16 8:16

117	-30	-103	3054	12/5/16 11:16	12/5/16 13:55
118	-30.5	-103	3404	12/5/16 16:55	12/5/16 21:15
119	-31	-103	3338	12/6/16 0:15	12/6/16 3:03
120	-31.5	-103	3504	12/6/16 6:03	12/6/16 8:56
121	-32	-103	3638	12/6/16 11:56	12/6/16 14:54
Hanga Roa	-27.15	-109.42	0	12/8/16 5:28	12/13/16 12:00
Test leg 2	-32	-103	3638	12/15/16 2:34	12/15/16 6:01
122	-32.5	-103	3653	12/15/16 9:01	12/15/16 11:59
123	-33	-103	3166	12/15/16 14:59	12/15/16 18:12
124	-33.5	-103	3125	12/15/16 21:12	12/15/16 23:53
125	-34	-103	3664	12/16/16 2:53	12/16/16 5:51
126	-34.5	-103	3472	12/16/16 8:51	12/16/16 11:43
127	-35	-103	3586	12/16/16 14:43	12/16/16 18:09
128	-35.5	-103	3114	12/16/16 21:09	12/16/16 23:50
129	-36	-103	3367	12/17/16 2:50	12/17/16 5:39
130	-36.5	-103	3478	12/17/16 8:39	12/17/16 11:31
131	-37	-103	3740	12/17/16 14:31	12/17/16 18:02
132	-37.5	-103	3256	12/17/16 21:02	12/17/16 23:47
133	-38	-103	3882	12/18/16 2:47	12/18/16 5:53
134	-38.5	-103	3871	12/18/16 8:53	12/18/16 11:58
135	-39	-103	3705	12/18/16 14:58	12/18/16 18:27
136	-39.5	-103	3926	12/18/16 21:27	12/19/16 0:34
137	-40	-103	3981	12/19/16 3:34	12/19/16 6:42
138	-40.5	-103	4000	12/19/16 9:42	12/19/16 12:51
139	-41	-103	3954	12/19/16 15:51	12/19/16 19:29
140	-41.5	-103	3969	12/19/16 22:29	12/20/16 1:37
141	-42	-103	4489	12/20/16 4:37	12/20/16 8:01
142	-42.5	-103	3854	12/20/16 11:01	12/20/16 14:06
143	-43	-103	3835	12/20/16 17:06	12/20/16 20:39
144	-43.5	-103	3996	12/20/16 23:39	12/21/16 2:48
145	-44	-103	3875	12/21/16 5:48	12/21/16 8:53
146	-44.5	-103	3853	12/21/16 11:53	12/21/16 14:58
147	-45	-103	3824	12/21/16 17:58	12/21/16 21:31
148	-45.5	-103	3730	12/22/16 0:31	12/22/16 3:31
149	-46	-103	3833	12/22/16 6:31	12/22/16 9:35
150	-46.5	-103	3824	12/22/16 12:35	12/22/16 16:09
151	-47	-103	4039	12/22/16 19:09	12/22/16 22:19
152	-47.5	-103	4360	12/23/16 1:19	12/23/16 4:39
153	-48	-103	4230	12/23/16 7:39	12/23/16 10:56
154	-48.5	-103	4113	12/23/16 13:56	12/23/16 17:38
155	-49	-103	4184	12/23/16 20:38	12/23/16 23:53
156	-49.5	-103	4235	12/24/16 2:53	12/24/16 6:09
157	-50	-103	4270	12/24/16 9:09	12/24/16 12:27
158	-50.5	-103	4252	12/24/16 15:27	12/24/16 19:14

159	-51	-103	4039	12/24/16 22:14	12/25/16 1:24
160	-51.5	-103	3556	12/25/16 4:24	12/25/16 7:19
161	-52	-103	4223	12/25/16 10:19	12/25/16 13:35
162	-52.5	-103	4479	12/25/16 16:35	12/25/16 20:30
163	-53	-103	4199	12/25/16 23:30	12/26/16 2:45
164	-53.5	-103	4059	12/26/16 5:45	12/26/16 8:56
165	-54	-103	4333	12/26/16 11:56	12/26/16 15:15
166	-54.5	-103	3939	12/26/16 18:15	12/26/16 21:52
167	-55	-103	4424	12/27/16 0:52	12/27/16 4:15
168	-55.5	-103	4556	12/27/16 7:15	12/27/16 10:42
169	-56	-103	4394	12/27/16 13:42	12/27/16 17:33
170	-56.5	-103	4324	12/27/16 20:33	12/27/16 23:52
171	-57	-103	4190	12/28/16 2:52	12/28/16 6:07
172	-57.5	-103	4548	12/28/16 9:07	12/28/16 12:34
173	-58	-103	4491	12/28/16 15:34	12/28/16 19:28
174	-58.5	-103	4906	12/28/16 22:28	12/29/16 2:06
175	-59	-103	5077	12/29/16 5:06	12/29/16 8:50
176	-59.5	-103	4582	12/29/16 11:50	12/29/16 15:17
177	-60	-103	5196	12/29/16 18:17	12/29/16 22:34
178	-60.5	-103	5216	12/30/16 1:34	12/30/16 5:22
179	-61	-103	5132	12/30/16 8:22	12/30/16 12:07
180	-61.5	-103	5195	12/30/16 15:07	12/30/16 19:24
181	-62	-103	5043	12/30/16 22:24	12/31/16 2:06
182	-62.5	-103	5120	12/31/16 5:06	12/31/16 8:51
183	-63	-103	5085	12/31/16 11:51	12/31/16 15:34
184	-63.5	-103	5075	12/31/16 18:34	12/31/16 22:47
185	-64	-103	5006	1/1/17 1:47	1/1/17 5:28
186	-64.5	-103	4998	1/1/17 8:28	1/1/17 12:09
187	-65	-103	4954	1/1/17 15:09	1/1/17 19:18
188	-65.5	-103	4838	1/1/17 22:18	1/2/17 1:54
189	-66	-103	4851	1/2/17 4:54	1/2/17 8:30
190	-66.5	-103	4786	1/2/17 11:30	1/2/17 15:04
191	-67	-103	4709	1/2/17 18:04	1/2/17 22:06
192	-67.5	-103	4636	1/3/17 1:06	1/3/17 4:35
193	-68	-103	4490	1/3/17 7:35	1/3/17 10:59
194	-68.5	-103	4279	1/3/17 13:59	1/3/17 17:47
195	-69	-103	4013	1/3/17 20:47	1/3/17 23:57
196	-69.5	-103	4002	1/4/17 2:57	1/4/17 6:06
197	-70	-103	3966	1/4/17 9:06	1/4/17 12:14
198	-70.5	-103	3038	1/4/17 15:14	1/4/17 18:22
199	-71	-103	1323	1/4/17 21:22	1/4/17 23:06
200	-71.5	-103	930	1/5/17 2:06	1/5/17 3:37
201	-72	-103	409	1/5/17 6:37	1/5/17 7:52
202	-72.5	-103	381	1/5/17 10:52	1/5/17 12:06

203	-73	-103	<200	1/5/17 15:06	1/5/17 16:38
204	-73.5	-103	588	1/5/17 19:38	1/5/17 20:58
205	-74	-103	202	1/5/17 23:58	1/6/17 1:06
206	-74.5	-103	401	1/6/17 4:06	1/6/17 5:21
207	-75	-103	398	1/6/17 8:21	1/6/17 9:36
208	-75.5	-103	664	1/6/17 12:36	1/6/17 14:28
209	-52.97	-101.26	4559	1/11/17 12:04	1/11/17 16:01
210	-53.15	-99.18	4476	1/11/17 23:35	1/12/17 2:59
211	-53.29	-97.12	4321	1/12/17 10:26	1/12/17 13:45
212	-53.45	-95.04	4498	1/12/17 21:15	1/13/17 1:10
213	-53.62	-92.96	4924	1/13/17 8:39	1/13/17 12:18
214	-53.78	-90.89	4653	1/13/17 19:43	1/13/17 23:43
215	-53.94	-88.83	4925	1/14/17 7:04	1/14/17 10:42
216	-53.99	-87.04	4985	1/14/17 17:01	1/14/17 21:12
217	-54.00	-85.50	5041	1/15/17 2:38	1/15/17 6:20
218	-54.00	-84.02	4991	1/15/17 11:33	1/15/17 15:13
219	-54.01	-82.51	4744	1/15/17 20:34	1/16/17 0:36
220	-54.00	-81.00	4540	1/16/17 5:55	1/16/17 9:22
221	-53.91	-79.52	4287	1/16/17 14:36	1/16/17 18:24
222	-53.65	-78.19	4093	1/16/17 23:23	1/17/17 2:35
223	-53.40	-76.93	4031	1/17/17 7:19	1/17/17 10:29
224	-53.27	-76.05	3754	1/17/17 13:43	1/17/17 17:14
225	-53.19	-75.43	1877	1/17/17 19:32	1/17/17 21:34
226	-53.11	-75.01	1144	1/17/17 23:07	1/18/17 0:46
227	-53.04	-74.91	174	1/18/17 1:18	1/18/17 2:26
Punta Arenas	-53.16	-70.92	0	1/19/17 6:26	N/A

Leg 2 Final Date and Time: 01-19-16 11:26 local, (2:26 GMT)

Appendix B. Equipment list including Hazmat for P18 projects

1. AOML VAN:

- Estimated total weight ~8,500 lbs.
- CTD: Greg Johnson - PMEL / Molly Baringer – AOML
    - CTD rosette and instruments will be packed in container
        - Transmissometer: Wilf Gardner - TAMU
        - FLBB: Emmanuel Boss UM(1)
        - Chipods: Jonathan Nash
    - Extra LADCP battery packs (but not the instrument)
- Salinity: Molly Baringer - AOML
    - Salinometer will be packed in container

2. CFC VAN:

- Estimated total weight ~13,000 lbs.
- CFC van contains its own laboratory space and instrumentation.
- Equipment for nutrient and oxygen analysis is also packaged in this van.
- The hazmat listed below will be packed according to DOT regulations and can be stored in the van during the transit from Punta Arenas.

Group	Common Name	Quantity	Notes	Trained Individual		Spill Control	Where stored during PIRATA NE?
				Leg 1	Leg 2		
AOML-Nutrients	Ammonium molybdate	45x 7.1g	Granular Solid	Charles Fischer	Charles Fischer	G	PMEL CFC Van
AOML-Nutrients	Ammonium molybdate	45x 10.8g	Granular Solid	Charles Fischer	Charles Fischer	G	PMEL CFC Van
AOML-Nutrients	Ascorbic Acid	45x 17.6g	Granular Solid	Charles Fischer	Charles Fischer	A	PMEL CFC Van
AOML-Nutrients	Brij-35, 21%	2x 125 mL	Liquid	Charles Fischer	Charles Fischer	G	PMEL CFC Van
AOML-Nutrients	Cadmium metal granular	2x 25g	Granular Solid	Charles Fischer	Charles Fischer	G	PMEL CFC Van
AOML-Nutrients	Culpric Sufate (Copper Sulfate)	5x 20g	Granular Solid	Charles Fischer	Charles Fischer	G	PMEL CFC Van
AOML-Nutrients	Dodecyl sodium salt, 15%	2x 500 mL	Liquid	Charles Fischer	Charles Fischer	G	PMEL CFC Van
AOML-Nutrients	Hydrazine Sulfate	30x 10g	Granular Solid	Charles Fischer	Charles Fischer	G	PMEL CFC Van
AOML-Nutrients	Hydrochloric Acid 32-38%	24x 500 mL	Liquid	Charles Fischer	Charles Fischer	A	PMEL CFC Van
AOML-Nutrients	Imidazole	30 x 13.6g	Granular Solid	Charles Fischer	Charles Fischer	G	PMEL CFC Van
AOML-Nutrients	NEDA	30x 1g	Granular Solid	Charles Fischer	Charles Fischer	G	PMEL CFC Van
AOML-	Oxalic	45x 50g	Granular	Charles	Charles	A	PMEL

Nutrients	Acid		Solid	Fischer	Fischer		CFC Van
AOML-Nutrients	Potassium Nitrate	8x 4g	Granular solid	Charles Fischer	Charles Fischer	G	PMEL CFC Van
AOML-Nutrients	Potassium phosphate monobasic	8x 0.5g	Granular solid	Charles Fischer	Charles Fischer	G	PMEL CFC Van
AOML-Nutrients	Sodium hexafluoro silicate	16x 0.9 g	Granular solid	Charles Fischer	Charles Fischer	G	PMEL CFC Van
AOML-Nutrients	Sodium Hydroxide	20g	Granular Solid	Charles Fischer	Charles Fischer	C	PMEL CFC Van
AOML-Nutrients	Sodium Hydroxide 10N	15x 30mL	Liquid	Charles Fischer	Charles Fischer	C	PMEL CFC Van
AOML-Nutrients	Sodium nitrate	20x 0.3g	Granular solid	Charles Fischer	Charles Fischer	G	PMEL CFC Van
AOML-Nutrients	Sulfanilam ide	3 x 10g	Granular Solid	Charles Fischer	Charles Fischer	G	PMEL CFC Van
AOML-Nutrients	Sulfuric Acid 90-98%	18x 500 mL	Acid	Charles Fischer	Charles Fischer	A	PMEL CFC Van
AOML-Oxygen	Manganes e Chloride (1M)	9x 1L	Liquid	Brian Locher	Chris Langdon	G	PMEL CFC Van
AOML-Oxygen	Potassium Hydroxide	9x 1L	Liquid	Brian Locher	Chris Langdon	C	PMEL CFC Van
AOML-Oxygen	Potassium Iodate	9x 0.5L	Liquid	Brian Locher	Chris Langdon	G,X	PMEL CFC Van
AOML-Oxygen	Sodium thiosulfate	20x 1g	Granular Solid	Brian Locher	Chris Langdon	G	PMEL CFC Van
AOML-Oxygen	Sulfuric Acid	9x 1L	Acid	Brian Locher	Chris Langdon	A	PMEL CFC Van
PMEL-CFC	5% Methane in Argon	1 cylinder (60” tall type T)	Compress ed Gas	Bonnie Chang	Rolf Sonnerup	NA	PMEL CFC Van
PMEL-CFC	Ascarite	1 kg	Granular solid	Bonnie Chang	Rolf Sonnerup	G,X	PMEL CFC Van
PMEL-	Ethanol	20 pints	Solvent	Bonnie	Rolf	S	PMEL

CFC				Chang	Sonnerup		CFC Van
PMEL-CFC	Magnesium perchlorate	2 kg	Granular solid	Bonnie Chang	Rolf Sonnerup	G	PMEL CFC Van
PMEL-CFC	N2 (60" tall type T)	8 cylinders	Compressed gas	Bonnie Chang	Rolf Sonnerup	NA	PMEL CFC Van
PMEL-CFC	N2 (60" tall type T)	5 cylinders	Compressed gas	Bonnie Chang	Rolf Sonnerup	NA	PMEL CFC Van

3. DIC VAN:

- Estimated total weight 12,500 lbs.
- Total CO_2 (DIC): Richard Feely – PMEL / Rik Wanninkhof - AOML
- DIC Van contains its own laboratory space and instruments.
- The hazmat listed below will be packed according to DOT regulations and can be stored in the van during the transit from Punta Arenas to Rio de Janeiro and during the PIRATA NE project.
- The non-hazardous reference materials listed below are temperature sensitive. In conjunction with PIRATA NE, we will load the small number of unused reference materials into the wet lab for storage for the PIRATA NE project.

Group	**Common Name**	**Quantity**	**Notes**	**Trained Individual**		**Spill Control**	**Where stored during PIRATA NE?**
				Leg 1	**Leg 2**		
RSMAS-Alkalinity	Certified reference	200 x 0.5 L in 10 cases	Liquid	R. Woosley	R. Woosley	G	Bio A. Lab or Fwd. Sci Hold
PMEL-DIC	Certified reference	240x 500 mL bottles in 12 cases	Seawater standard	D. Greeley	C. Featherstone	G	Bio A. Lab or Fwd. Sci Hold
PMEL-DIC	Acetone	6x 1L	Solvent	D. Greeley	C. Featherstone	S	PMEL DIC Van
PMEL-DIC	CO2 + N2	1 cylinder (60" tall type T)	Compressed Gas	D. Greeley	C. Featherstone	NA	PMEL DIC Van

PMEL-DIC	Coulometer solution (anode)	12x 0.5L	Liquid	D. Greeley	C. Featherstone	G	PMEL DIC Van
PMEL-DIC	Coulometer solution (cathode)	9 gallons	Liquid	D. Greeley	C. Featherstone	G	PMEL DIC Van
PMEL-DIC	Magnesium perchlorate	2x 500 g	Granular Salt	D. Greeley	C. Featherstone	G,X	PMEL DIC Van
PMEL-DIC	Mercuric Chloride	6 x 5g	Granular salt	D. Greeley	C. Featherstone	M	PMEL DIC Van
PMEL-DIC	Nitrogen	1 cylinder (60" tall type T)	Compressed gas	D. Greeley	C. Featherstone	NA	PMEL DIC Van
PMEL-DIC	Phosphoric Acid	3x 0.5L bottles	Acid	D. Greeley	C. Featherstone	A	PMEL DIC Van
PMEL-DIC	Potassium Iodide	20x 50 g	Granular Salt	D. Greeley	C. Featherstone	G,X	PMEL DIC Van
PMEL-DIC	Pure CO2	6 cylinders (0.5L each)	Compressed Gas	D. Greeley	C. Featherstone	NA	PMEL DIC Van
PMEL-DIC	Soda Lime	2x 500g	Granular Salt	D. Greeley	C. Featherstone	C	PMEL DIC Van
UW-Chipods	Lithium-Ion batteries	16x 4.5g Li /cell, 72g Li total	Battery	M. Jimenez Urias	Bryan Kaiser	G	PMEL DIC Van

4. **<u>Helium/Tritium/14 DIC (WHOI) Van: Scott Doney – WHOI</u>**

- 11,000 lbs estimated total weight at loading, 15,500 lbs estimated total weight from Punta Arenas to offloading
- Cold welding (air compression) sealer
- 580 tritium samples, 1.25L each
- 17x14x11 1 liter empty Bottles - wooden box with 12 bottles per box
- 580 copper tube samples, 1L each:6 27x28x16 Pelican Caseswith 9 rolls copper tubing each
- 25x19x14 CHA POD-751 Cold Welder S/N 035414 - pelican case
- CHA POD-751 Cold Welder S/N 027780
- 27x21x15 Dymo LabelWriter 330, HP 5650 printer, Dell Latitude E6510 (WHOI ID 114173)

- 25x19x14 office supplies, cordless drill, sampling gear, crimpers
- 27x21x15pana press vises, 2x air regulators, tools, air-lines, sampling gear
- 24x15x7 empty green plastic boxes
- 15x16x24 office supply box
- 13x16x22 office supply box
- 82 17x14x11 boxes with DI14C bottles

5. Net Tows: Nina Bednarsek – UW and Laura Sanchez Velasco - CICIMAR

- 1x 4x4x4 pallet of scientific equipment, including a bongo net
- The hazmat listed below will be packaged according to DOT regulations and is being sent to San Diego.

Group	Common Name	Quantity	Notes	Trained Individual		Spill Control	Where stored during PIRATA NE?
				Leg 1	Leg 2		
Net tows	90% Ethanol	8 x 1L bottles	Solvent	Brendan Carter	Rolf Sonnerup	F	shipped back

6. Spectroradiometry: Michael Ondrusek– NESDIS

- Satlantic Hyperpro II Profiler system. Includes profiler measuring upwelled radiance, downwelled irradiance, and a on-deck reference measuring down welling surface irradiance.
- Hyperpro: 11”x59”x18”, 45 lbs
- Cooler: 18”x34”x16”, 50 lbs
- Cables: 20”x23”x23”, 64 lbs

7. DO^{14}C / carbon isotopes: Ellen Druffel and Brett Walker – UCI

- 2x 2Lx30Wx32H crates, ~14 cu ft. each
- 4x 26Lx19Wx16H totes, ~7 cu ft. each
- No Hazmat
- 3 chest freezers, ~22 cubic feet

8. Alkalinity/pH: Frank Millero – RSMAS

- ~3 pallets containing lab equipment
- The hazmat listed below will be packaged according to DOT regulations and is being sent to San Diego.

RSMAS-Alkalinity	Mercuric Chloride	2x 25g	Granular salt	R. Woosley	R. Woosley	M	PMEL DIC Van
RSMAS-Alkalinity	Meta-cresol purple	1g	Solid	R. Woosley	R. Woosley	G,X	PMEL DIC Van
RSMAS-Alkalinity	sodium chloride	54 g	Solid	R. Woosley	R. Woosley	G,X	PMEL DIC Van

RSMAS-Alkalinity	Sodium hydroxide	1.5 g	Solid	R. Woosley	R. Woosley	B	PMEL DIC Van
RSMAS-Alkalinity	Tris buffer reference	15 x 0.25 L	Liquid	R. Woosley	R. Woosley	G	PMEL DIC Van

9. Nitrate/nitrite isotopomers and Stable Gas (O, N, Ar) Isotopes: Danny Sigman – Princeton; François Fripiat – MPIC; Annie Bourbonnais – WHOI;

- (75cm by 55 cm by 38cm) boxes filled with 60ml HDPE sample bottles, Sigman
- 6 grey boxes (55cm by 40cm by 25cm), 5 kg (25 kg post project) each, Bourbonnais
- 14 (92 cm by 44 cm by 42 cm) coolers, 25 kg (50 kg post project) each, Bourbonnais
    - Will remain inside for PNE.
- 1 (65 cm by 34cm by 37 cm) cooler, 6 kg (25 kg post project), Bourbonnais
- The hazmat listed below will be packaged according to DOT regulations and is being sent to San Diego.

WHOI-Nitrate isotopes	2.5 mM Sulfamic Acid in Hydrochloric Acid (25%)	0.6 L	Liquid (0.5 mL pre-loaded in each 60 mL sampling bottle)	A. Bourbonnais	R. Sonnerup	A	Hazmat locker
WHOI-Nitrite isotopes	6 M NaOH	0.3 L	Liquid (1 mL pre-loaded in each 60 mL sampling bottle)	A. Bourbonnais	R. Sonnerup	B	Hazmat locker
WHOI-Nitrous oxide isotopomers	Saturated mercuric chloride	200 mL	Liquid	A. Bourbonnais	R. Sonnerup	M	Hazmat locker
WHOI-Stable gases (O, N, Ar) concentrations and isotopes	Hydrochloric acid (25%)	1 L	Liquid	A. Bourbonnais	R. Sonnerup	A	Hazmat locker

10. LADCP: Andreas Thurnherr – LDEO

- Battery / gyro

11. Floats: Greg Johnson – PMEL; Lynne Talley – SIO; Steve Riser – UW; Steve Emerson – UW; Craig McNeil – UW; Giorgio Dall'Olmo – PML

- 33 Floats will be loaded in San Diego to be deployed on P18. 31 of floats will be stored on an expanded rack in the main lab (both legs). The remaining 2 will be stored in the main lab or forward scientific hold.
- 2 Dall'Olmo BGC floats will arrive by separate shipment
- One Argo-style GasFloat to be loaded in San Diego and deployed early on Leg 1 of P18 near 16.5° N by Annie Bourbonnais. The float will need to be accessed several days prior to deployment, deck tested, and should therefore be stored in the main lab with easy access. The float and custom deployment harness for the crane is shipped in a plywood crate (82"L x 18" W x 18"H and 160 lb). HazMat (lithium batteries, UN code 3091, class 9, packing instructions 970).

UW/APL GasFloat	Lithium-Ion batteries	2.76 kg combined mass	Battery	A. Bourbonnais	Deployed (Rolf Sonnerup if not deployed)	G	Deployed or shipped back

12. Drifters: Shaun Dolk – AOML

- Up to 30 drifters to be deployed during P18. These drifters will be stored in the forward science hold except for ~5 at a time that will be stored prior to deployment in the main lab.

13. iTag Genetics and DO14C via pyrolysis -- SIO

- Basic laboratory equipment (2 35 gallon storage totes) and sample bottles to be brought on board by scientists from SIO.

iTag genetics	Parformaldehyde (10%)	100 mL	Liquid	Brendan Carter	Bethany Kolody	G	Hazmat Locker
iTag genetics	Hydrochloric acid 33.5-38%	5 L	Liquid	Brendan Carter	Bethany Kolody	A	Hazmat Locker
iTag genetics	Ethanol (70%)	4 L	Liquid	Brendan Carter	Bethany Kolody	S	Hazmat Locker

14. Genetics: Martiny -- UCI

- All packages will be loaded onto ship by cruise participants in San Diego and be offloaded by cruise participants (or shipping company on pallet, not determined yet) in Charleston, SC, USA.
- 1 white YETI cooler (26x16x18 inches), weight TBD
- 2-3 brown cardboard boxes (20x19x16) with plastic carboys
- 2-3 red totes (24x20x12) with filtration equipment and supplies
- 2 brown cardboard boxes (17x13x22) with aspirator filtration pump, each
- Hazmat listed below was packaged according to DOT regulations and was loaded into RHB's hazmat locker in San Diego:

Genetics & POM	Liquid Bleach	1x1 gallon bottle	Liquid	Alyse Larkin	Catherine Garcia	B	TBD
Genetics & POM	Sodium Sulfate	250g Na_2SO_4	Granular solid	Alyse Larkin	Catherine Garcia	G	TBD

15. DOM (i.e. DOC and TON): Hansell – RSMAS

- 1 plastic shipping case with assorted laboratory gear (e.g. sampling trays, gloves, silicon tubes, adhesive belts, filter holders, GF/F filters).
- 8 coolers filled with a total of 2800 60 mL sample bottles.
- The hazmat listed below will be packaged according to DOT regulations and is being sent to San Diego.

RSMAS - DOM	WR solution:	2L	Liquid	Mariana Bif	Mariana Bif	G	Shipped back
RSMAS - DOM	Sodium Nitrate $NaNO_3$ (0.1 M)	100 mL	Liquid (1 mL pre-loaded in each 60 mL sampling bottle)	Mariana Bif	Mariana Bif	G	Shipped back
RSMAS - DOM	Ammonium chloride NH_4Cl (0.1 M)	100 mL	Liquid	Mariana Bif	Mariana Bif	G	Shipped back
RSMAS - DOM	Monosodium phosphate (0.01 M)	100 mL	Liquid	Mariana Bif	Mariana Bif	G	Shipped back
RSMAS - DOM	FeEDTA	0.001 M	Liquid	Mariana Bif	Mariana Bif	G	Shipped back
RSMAS - DOM	Trace metals solution	10^{-6} M	Liquid	Mariana Bif	Mariana Bif	G	Shipped back
RSMAS - DOM	Ammonium standard	2 mg L^{-1}	Liquid	Mariana Bif	Mariana Bif	G	Shipped back

16. $DO^{14}C$ via Pyrolysis: Margot White – SIO

- 1 box of assorted lab equipment, with 1 peristaltic pump
- The hazmat listed below will be packaged according to DOT regulations and is being sent to San Diego.

SIO-Pyrolysis	Methanol	200 mL	Liquid	Margot White	Rolf Sonnerup	S	Shipped back
SIO-Pyrolysis	Hydrochloric Acid (concentrated)	300 mL	Liquid (1 mL pre-loaded in each 60	Margot White	Rolf Sonnerup	A	Shipped back

			mL sampling bottle)				

17. Rare earth elements (REEs): Yves Plancherel – Oxford

- ~6x (600mm x 400m x 161mm) grey lidded stackable plasic boxes containing a total of 1200 60ml LDPE bottles, 400 syringes and 400 syringe filters (about 6kg each when bottles are empty, 15 kg when bottles are full)
- 1x (600 x 400 x 285mm) grey lidded stackable box containing miscelenous gears (boots, waterproofs, gloves, tape, labels, sharpies, bungees, etc.)
- no chemicals or hazmats

18. PIRATA NE equipment – AOML

- 20' 8.5 ton (AEROSE) atmospheric van that can sit forward during the P18 project. From Howard University. Contains 500 pounds worth of He cylinders (60" tall type T).
- 2 to 3 5'x5'x4'crates weighing ½ ton collectively.
- 10 additional ARGO floats in cardboard boxes to be stored during P18
- Up to 15 additional drifters
- M-AERI sensor package and associated equipment:
    - 700 lb plastic pallet with M-AERI sensor
    - 600 lb plastic crate
    - 300 lb plastic crate
- The following surface mooring hardware:

Item	Size (m)	Weight (kg)	Quantity	Total (kg)
Toroid	2.3m diameter x 1 m high	318	4	1272
Tower	Triangle 1.5m base, 2.3m high	61	4	244
Bridle	Triangle 1.5m base, 1m high	84	4	336
Wire rope reel (Nilspin)	0.71m diameter, .6m high	341	7	2387
Nylon rope reel	0.71m diameter, .6m high	120	15	1800
Cast Anchor (2 x 3000 lb per buoy)	.76m (l) x .76m (w) x .41m(h)	1361	10	13610

Appendix C. List of Chemicals

A listing of hazardous materials is given below, including the responsible group, trained individuals, storage spaces, and name, quantity, and description of materials, as well as the trained individual and spill control response. As in section IV-C listed above, spill control abbreviations indicate Acid (A), Base (B), Mercury (M), Formalin (F). O is used for 'other' for spills that have a non-codified response (see MSDS). Avoid inhalation of non-toxic, non-flammable gases and ventilate well (G).

Group	Common Name	Quantity	Notes	Trained Individual		Spill Control	Where stored during PIRATA NE?
				Leg 1	Leg 2		
RSMAS-Alkalinity	Certified reference	200 x 0.5 L in 10 cases	Liquid	R. Woosley	R. Woosley	G	Wet Lab
PMEL-DIC	Certified reference	240x 500 mL bottles in 12 cases	Seawater standard	D. Greeley	B. Carter	G	Wet Lab
RSMAS-Alkalinity	Mercuric Chloride	2x 25g	Granular salt	R. Woosley	R. Woosley	M	PMEL DIC Van
RSMAS-Alkalinity	Meta-cresol purple	1g	Solid	R. Woosley	R. Woosley	G,X	PMEL DIC Van
RSMAS-Alkalinity	sodium chloride	54 g	Solid	R. Woosley	R. Woosley	G,X	PMEL DIC Van
RSMAS-Alkalinity	Sodium hydroxide	1.5 g	Solid	R. Woosley	R. Woosley	B	PMEL DIC Van
PMEL-DIC	Acetone	6x 1L	Solvent	D. Greeley	C. Featherstone	S	PMEL DIC Van
PMEL-DIC	CO2 + N2	1 cyllinder	Compress ed Gas	D. Greeley	C. Featherstone	NA	PMEL DIC Van
PMEL-DIC	Coulomete r solution (anode)	12x 0.5L	Liquid	D. Greeley	C. Featherstone	G	PMEL DIC Van
PMEL-DIC	Coulomete r solution (cathode)	9 gallons	Liquid	D. Greeley	C. Featherstone	G	PMEL DIC Van
PMEL-DIC	Magnesiu m perchlorat e	2x 500 g	Granular Salt	D. Greeley	C. Featherstone	G,X	PMEL DIC Van
PMEL-DIC	Mercuric Chloride	6 x 5g	Granular salt	D. Greeley	C. Featherstone	M	PMEL DIC Van
PMEL-DIC	Nitrogen	1 cylinder (60” tall type T)	Compress ed gas	D. Greeley	C. Featherstone	NA	PMEL DIC Van

PMEL-DIC	Phosphoric Acid	3x 0.5L bottles	Acid	D. Greeley	C. Featherstone	A	PMEL DIC Van
PMEL-DIC	Potassium Iodide	20x 50 g	Granular Salt	D. Greeley	C. Featherstone	G	PMEL DIC Van
PMEL-DIC	Pure CO2	6 cylinders (0.5L each)	Compressed Gas	D. Greeley	C. Featherstone	NA	PMEL DIC Van
PMEL-DIC	Soda Lime	2x 500g	Granular Salt	D. Greeley	C. Featherstone	C	PMEL DIC Van
UW-Chipods	Lithium-Ion batteries	16x 4.5g Li /cell, 72g Li total	Battery	B. Carter	R. Sonnerup	G	PMEL DIC Van
AOML-Nutrients	Ammonium molybdate	45x 7.1g	Granular Solid	Charles Fischer	Charles Fischer	G	PMEL CFC Van
AOML-Nutrients	Ammonium molybdate	45x 10.8g	Granular Solid	Charles Fischer	Charles Fischer	G	PMEL CFC Van
AOML-Nutrients	Ascorbic Acid	45x 17.6g	Granular Solid	Charles Fischer	Charles Fischer	A	PMEL CFC Van
AOML-Nutrients	Brij-35, 21%	2x 125 mL	Liquid	Charles Fischer	Charles Fischer	G	PMEL CFC Van
AOML-Nutrients	Cadmium metal granular	2x 25g	Granular Solid	Charles Fischer	Charles Fischer	G	PMEL CFC Van
AOML-Nutrients	Culpric Sufate (Copper Sulfate)	5x 20g	Granular Solid	Charles Fischer	Charles Fischer	G	PMEL CFC Van
AOML-Nutrients	Dodecyl sodium salt, 15%	2x 500 mL	Liquid	Charles Fischer	Charles Fischer	G	PMEL CFC Van
AOML-Nutrients	Hydrazine Sulfate	30x 10g	Granular Solid	Charles Fischer	Charles Fischer	G	PMEL CFC Van
AOML-Nutrients	Hydrochloric Acid 32-38%	24x 500 mL	Liquid	Charles Fischer	Charles Fischer	A	PMEL CFC Van

AOML-Nutrients	Imidazole	30 x 13.6g	Granular Solid	Charles Fischer	Charles Fischer	G	PMEL CFC Van
AOML-Nutrients	NEDA	30x 1g	Granular Solid	Charles Fischer	Charles Fischer	G	PMEL CFC Van
AOML-Nutrients	Oxalic Acid	45x 50g	Granular Solid	Charles Fischer	Charles Fischer	A	PMEL CFC Van
AOML-Nutrients	Potassium Nitrate	8x 4g	Granular solid	Charles Fischer	Charles Fischer	G	PMEL CFC Van
AOML-Nutrients	Potassium phosphate monobasic	8x 0.5g	Granular solid	Charles Fischer	Charles Fischer	G	PMEL CFC Van
AOML-Nutrients	Sodium hexafluoro silicate	16x 0.9 g	Granular solid	Charles Fischer	Charles Fischer	G	PMEL CFC Van
AOML-Nutrients	Sodium Hydroxide	20g	Granular Solid	Charles Fischer	Charles Fischer	B	PMEL CFC Van
AOML-Nutrients	Sodium Hydroxide 10N	15x 30mL	Liquid	Charles Fischer	Charles Fischer	B	PMEL CFC Van
AOML-Nutrients	Sodium nitrate	20x 0.3g	Granular solid	Charles Fischer	Charles Fischer	G	PMEL CFC Van
AOML-Nutrients	Sulfanilam ide	3 x 10g	Granular Solid	Charles Fischer	Charles Fischer	G	PMEL CFC Van
AOML-Nutrients	Sulfuric Acid 90-98%	18x 500 mL	Acid	Charles Fischer	Charles Fischer	A	PMEL CFC Van
AOML-Oxygen	Manganes e Chloride (1M)	9x 1L	Liquid	Brian Locher	Chris Langdon	G	PMEL CFC Van
AOML-Oxygen	Potassium Hydroxide	9x 1L	Liquid	Brian Locher	Chris Langdon	C	PMEL CFC Van
AOML-Oxygen	Potassium Iodate	9x 0.5L	Liquid	Brian Locher	Chris Langdon	G	PMEL CFC Van
AOML-Oxygen	Sodium thiosulfate	20x 1g	Granular Solid	Brian Locher	Chris Langdon	G	PMEL CFC Van
AOML-Oxygen	Sulfuric Acid	9x 1L	Acid	Brian Locher	Chris Langdon	A	PMEL CFC Van
PMEL-	5%	2 cylinder	Compress	B. Chang	B. Chang	NA,	PMEL

CFC	Methane in Argon	(60" tall type T)	ed Gas			flammable gas	CFC Van
PMEL-CFC	Ascarite	1 kg	Granular solid	B. Chang	B. Chang	G,X	PMEL CFC Van
PMEL-CFC	Ethanol	20 pints	Solvent	B. Chang	B. Chang	S	PMEL CFC Van
PMEL-CFC	Magnesium perchlorate	2 kg	Granular solid	B. Chang	B. Chang	G,X	PMEL CFC Van
PMEL-CFC	N2	10 cylinders (60" tall type T)	Compressed gas	B. Chang	B. Chang	NA	PMEL CFC Van
PMEL-CFC	N2	4 cylinders (53" tall aluminum cylinder)	Compressed gas	B. Chang	B. Chang	NA	PMEL CFC Van
PMEL-DIC	90% Ethanol	8 x 1L bottles	Solvent	B. Carter	R. Sonnerup	S	n/a
WHOI-Nitrate isotopes	2.5 mM Sulfamic Acid in Hydrochloric Acid (25%)	0.6 L	Liquid (0.5 mL preloaded in each 60 mL sample bottle)	A. Bourbonnais	R. Sonnerup	A	Hazmat locker
WHOI-Nitrite isotopes	6 M NaOH	0.3 L	Liquid (1 mL pre-loaded in each 60 mL sampling bottle)	A. Bourbonnais	R. Sonnerup	B	Hazmat locker
WHOI-Dissolved gases concentrations and isotopes (O, N, Ar)	Saturated mercuric chloride	200 mL	Liquid	A. Bourbonnais	R. Sonnerup	M	PMEL DIC Van
WHOI-	Hydrochlo	1 L	Liquid	A.	R. Sonnerup	A	Hazmat

Nitrous oxide isotopomers	ric acid (25%)			Bourbonnais			locker
iTag genetics	Parformaldehyde (10%)	100 mL	Liquid	Brendan Carter	Bethany Kolody	G	Hazmat Locker
iTag genetics	Hydrochloric acid 33.5-38%	5 L	Liquid	Brendan Carter	Bethany Kolody	A	Hazmat Locker
iTag genetics	Ethanol (70%)	4 L	Liquid	Brendan Carter	Bethany Kolody	S	Hazmat Locker
RSMAS - DOM	WR solution:	2L	Liquid	Mariana Bif	Mariana Bif	G	Shipped back
RSMAS - DOM	Sodium Nitrate $NaNO_3$ (0.1 M)	100 mL	Liquid (1 mL pre-loaded in each 60 mL sampling bottle)	Mariana Bif	Mariana Bif	G	Shipped back
RSMAS - DOM	Ammonium chloride NH_4Cl (0.1 M)	100 mL	Liquid	Mariana Bif	Mariana Bif	G	Shipped back
RSMAS - DOM	Monosodium phosphate (0.01 M)	100 mL	Liquid	Mariana Bif	Mariana Bif	G	Shipped back
RSMAS - DOM	FeEDTA	0.001 M	Liquid	Mariana Bif	Mariana Bif	G	Shipped back
RSMAS - DOM	Trace metals solution	10^{-6} M	Liquid	Mariana Bif	Mariana Bif	G	Shipped back
UW/APL GasFloat	Lithium-Ion batteries	2.76 kg combined mass	Battery	A. Bourbonnais	Deployed (Rolf Sonnerup if not deployed)	G	Deployed or shipped back
Genetics & POM	Liquid Bleach	1x1 gallon bottle	Liquid	A. Larkin	C. Garcia	B	TBD

Genetics & POM	Sodium Sulfate	250g Na_2SO_4	Granular solid	A. Larkin	C. Garcia	G	TBD
SIO-Pyrolysis	Methanol	200 mL	Liquid	Margot White	Rolf Sonnerup	S	Shipped back
SIO-Pyrolysis	Hydrochloric Acid (concentrated)	300 mL	Liquid (1 mL pre-loaded in each 60 mL sampling bottle)	Margot White	Rolf Sonnerup	A	Shipped back