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-17-01
PIRATA Northeast Extension/ AEROSE

Attached is the final Project Instruction for RB-17-01, PIRATA Northeast Extension/ AEROSE, which is scheduled aboard NOAA Ship *Ronald H. Brown* during the period of February 11 – March 27, 2017. Of the 43 DAS scheduled for this project, 43 days are funded by a Line Office Allocation. This project is estimated to exhibit a Medium Operational Tempo. Acknowledge receipt of these instructions via e-mail to **Opsmgr.MOA@noaa.gov** at Marine Operations Center-Atlantic.

Cruise Instructions

Date Submitted:	27 January 2017
Platform:	NOAA Ship *Ronald H. Brown*
Cruise Number:	RB-17-01
Project Title:	PIRATA Northeast Extension / AEROSE
Cruise dates:	Leg 1: 11 February – 16 February 2017 Leg 2: 19 February – 27 March 2017

Prepared by: Renellys C. Perez Dated: 1/27/17
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University of Miami/CIMAS
NOAA/AOML/PhOD

Approved by: Rick Lumpkin Dated: 1/27/17
Dr. Rick Lumpkin
PNE Project Lead
NOAA/AOML/PhOD

Approved by: Robert Atlas Dated: 1/27/17
Dr. Robert Atlas
Director
NOAA/AOML

Approved by: ______ Dated: 2/3/17
Captain Scott Sirois, NOAA
Commanding Officer
Marine Operations Center - Atlantic

I. Overview

The primary goal of the cruise is to recover and redeploy the PIRATA Northeast Extension (PNE) moorings and to sample oceanic and atmospheric variables along the cruise track. The purpose of the PIRATA/PNE moorings is to provide time series of the upper ocean temperature, salinity, current structure and heat fluxes between the ocean and atmosphere. Shipboard and atmospheric observations collected along 23°W, from 5°S to 20.5°N, as well as data from surface drifters, XBTs, and Argo profiling floats deployed during this cruise, will provide an improved picture of seasonal-to-interannual oceanic and atmospheric variability in the tropical Atlantic.

A. Cruise Period

Leg 1: 11 February – 16 February 2017 (6 DAS)
Leg 2: 19 February – 27 March 2017 (37 DAS)

B. Days at Sea (DAS)

Of the 43 DAS scheduled for this project, 43 DAS are funded by a Line Office Allocation (OAR). This project is estimated to exhibit a Medium Operational Tempo.

C. Operating Area

Leg 1 of the cruise will depart from Punta Arenas, Chile, on or about 11 February 2017 and arrive in Montevideo, Uruguay, on or about 16 February 2017. During the transit, a subset of the scientific team (see Section G) will collect supporting meteorological and atmospheric observations and radiosonde launches as part of the Aerosols and Ocean Science Expedition (AEROSE) and Marine Atmospheric Emitted Radiance Interferometer (M-AERI) projects. The ship will spend about two days in Montevideo for crew rest and logistic support.

Leg 2 of the cruise will depart from Montevideo, Uruguay, on or about 19 February 2017. After exiting Uruguay and Brazilian Exclusive Economic Zones (EEZs), the scientific party will resume atmospheric measurements and begin collecting oceanographic data (water temperature, salinity, oxygen and currents) along the ship's track from a way point near 35°S, 48.5°W to PIRATA Northeast Extension (PNE) operating area. Along the way, an instrument repair (rain gauge replacement) and deep (down to 3500 m) hydrographic test cast will be performed at the Brazilian PIRATA mooring at 19°S, 35°W. Small boat operations may be required during the servicing of the rain gauge. An additional test cast (down to 1500 m) may be required en route to the PNE operating area.

The PNE operating area is the eastern tropical North Atlantic, primarily along 23°W. A hydrographic line will be conducted along 23°W, from 5°S to 20.5ºN, detouring slightly eastward or westward around the Cape Verde plateau. Approximately 62 hydrographic casts are planned. An instrument repair on the equatorial French PIRATA mooring at 23°W will be done if needed and if time permits. Along 23°W, PNE moorings will be recovered and redeployed at 4ºN, 11.5ºN and 20.5ºN. The ship will then proceed to the last PNE mooring station at 20°N, 38°W recover and redeploy the PNE mooring and conduct a final hydrographic cast. The ship will then proceed to Charleston, South Carolina.

Atmospheric measurements and radiosonde and ozonesonde launches will be performed throughout leg 2. Eight Argo floats will be deployed during the cruise in locations identified as having low Argo float coverage. Sixteen surface drifting buoys and about 55 XBTs will be deployed, primarily along 23°W. The drifters and XBTs can be deployed while the ship is underway.

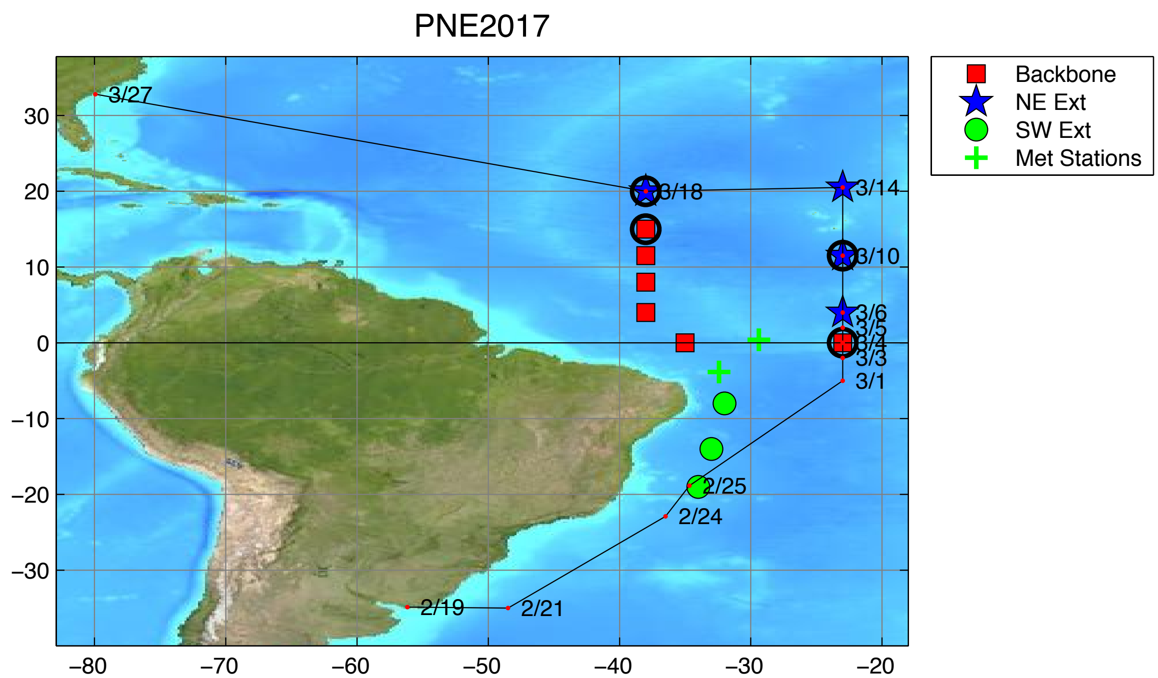

Figure 1. PNE leg 2 cruise track (black line) with origin in Montevideo, Uruguay, and ending port in Charleston, South Carolina. Blue stars indicate the PNE moorings that will be recovered and redeployed. Red squares indicate PIRATA backbone moorings, and green circles indication PIRATA Southwest Extension moorings. The Brazilian PIRATA mooring at 19°S, 35°W will be serviced. If needed, the French PIRATA mooring at 0ºN, 23ºW will be serviced.

D. Summary of Objectives

The PIRATA Northeast Extension

PIRATA stands for "Prediction Research Moored Array in the Tropical Atlantic" and is a three-party project between Brazil, France and the United States that seeks to monitor the upper ocean and near surface atmosphere of the Tropical Atlantic via the deployment and maintenance of an array of moored buoys and automatic meteorological stations (Bourles et al., 2008). This array is the Atlantic's analogue of the Pacific Ocean's Tropical Atmosphere Ocean (TAO) array. The PIRATA array consists of a backbone of ten moorings that runs along the equator and extends southward along 10ºW to 10ºS, and northward along 38ºW to 15ºN (Fig. 1).

The northeastern and north central Tropical Atlantic is a region of strong climate variations from intraseasonal to decadal scales, with impacts on rainfall rates and storm strikes for the surrounding regions of Africa and the Americas. The northeastern Tropical Atlantic includes the southern edge of the North Atlantic subtropical gyre, defined by the westward North Equatorial Current (NEC), and the northern edge of the clockwise tropical/equatorial gyre defined by the North Equatorial Countercurrent (NECC) (Fig. 2). The mean meridional currents in the northeastern Tropical Atlantic are typically weak (on the order of 5 to 10 cm/sec) compared with the robust mean zonal velocities of the South Equatorial Current (SEC), Equatorial Undercurrent (EUC), NEC, and NECC (Perez et al., 2014). However, both zonal and meridional velocity can exhibit large fluctuations between 5ºS and 5ºN along 23ºW associated with the passage of tropical instability waves (Perez et al., 2014 and references therein). This area is home to the North Atlantic's oxygen minimum zone (OMZ) at a depth of 400—600m. The size and intensity of this zone is a potential integrator of long-term North Atlantic circulation changes (Zheng et al., 2000), and the extremely low oxygen values have significant impacts on the biota of the region (Childress and Seibel, 1998). The cyclonic Guinea Dome (c.f., Siedler et al., 1992) is centered near 10ºN, 24ºW (Stramma et al., 2005), between the NECC and NEC in the eastern TA. It is driven by trade wind-driven upwelling, and may play an active role in modulating air-sea fluxes in this region (Yamagata and Lizuka, 1995).

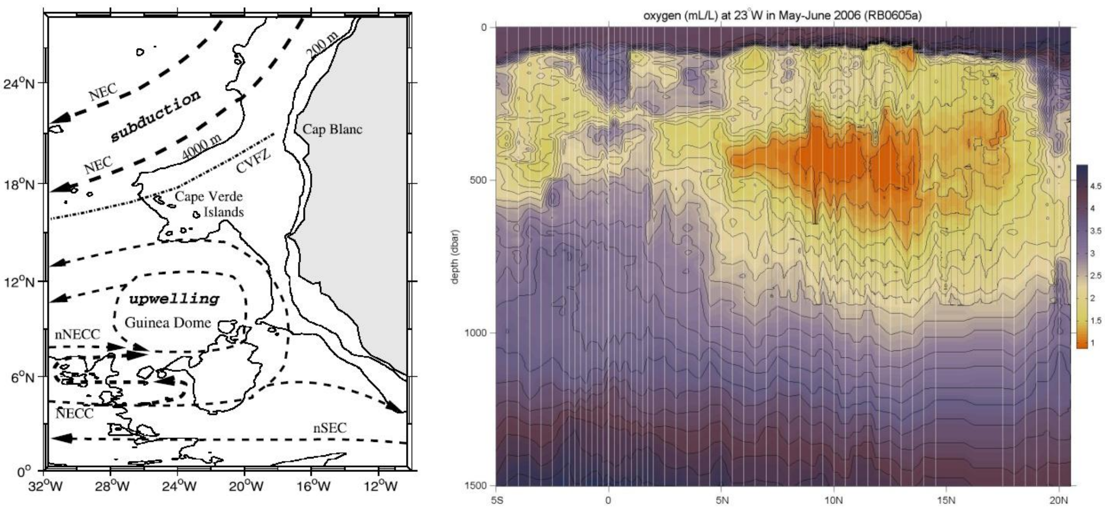

Fig. 2: *Left*: schematic of surface currents and features in the northeastern TA, from Stramma *et al.* (2005). Right: oxygen (ml/l) measured during the 2006 PNE cruise aboard *Ronald H. Brown*, showing the pronounced oxygen minimum.

The tropical North Atlantic is the Main Development Region (MDR) of tropical cyclones. Many major hurricanes that ultimately threaten the eastern United States begin as atmospheric easterly waves that propagate off the African continent. Once over the MDR in the latitude band of 10-20ºN, these waves are exposed to convective instability driven by the upper ocean's heat content. The resulting infusion of energy can result in closed cyclonic circulation and development from tropical depression to tropical storm and hurricane. These hurricanes are known as Cape Verde-type hurricanes, to distinguish them from storms forming further west, and they are often the most powerful storms to strike the US east coast. Prominent examples include Andrew (1992), Floyd (1999) and Ivan (2004). An average season has two Cape Verde hurricanes, but some years have up to five while others have none. There is uncertainty regarding the specific atmospheric/oceanic conditions that determine which atmospheric waves will develop into tropical cyclones and then hurricanes (on average, one of ten; J. Dunion, personal communication). Specifically, the quantitative effects of the Saharan Air Layer (SAL), anomalous sea surface temperatures (SST), upper layer oceanic heat content and atmospheric wind shear on the formation of tropical cyclones are poorly known.

Seasonal tropical storm and hurricane forecasts are generated annually and based primarily on statistical analyses of historical data and the formulation of empirical predictors (e.g., El Niño South Oscillation index, Atlantic SST, Sahel rainfall, etc.). Recent empirical studies have demonstrated that tropical storm and hurricane activity in the Atlantic Ocean varies on decadal and multi-decadal time-scales and that this variability is correlated with sea-surface temperature anomalies in the MDR (e.g., Shapiro and Goldenberg, 1998). The SST signal in the MDR has been correlated with the North Atlantic Oscillation (NAO) on decadal time-scales. The multi-decadal signal indicates that an extended period of increased hurricane activity is to be expected. Other historical studies have also demonstrated spatial variability in storm formation areas and landfall locations on longer timescales.

Despite the climate and weather significance of the tropical North Atlantic region, it was not sampled by the PIRATA backbone array except for the 38ºW line of moorings extending north to 15ºN (Fig. 1). In 2005, a formal Northeast Extension of PIRATA was proposed as a joint project between NOAA/AOML and NOAA/PMEL (Rick Lumpkin, Mike McPhaden and Bob Molinari, co-principal investigators). This PIRATA Northeast Extension (PNE) was proposed to consist of four moorings, three creating a northward arm up 23°W (building on the equatorial backbone mooring there), and a fourth extending the 38°W arm up to 20°N.

In June 2006, the first two moorings of this extension were deployed on *Ronald H. Brown* during RB-06-05a. The mooring at 11.5°N, 23°W was deployed on June 7, and the mooring at 4°N, 23°W was deployed on June 11. Both moorings were replaced in May 2007, during RB-07-03, and two moorings were added at 20.5°N, 23°W and 20°N, 38°W. The four buoys were planned for servicing during the April 2008 cruise RB-08-03. Due to the cancellation of this cruise, the buoys failed and a data gap was introduced in mid to late 2008. All four sites were subsequently serviced in November 2008 by NOAA charter of the French R/V *Antea*. In 2009-2011, the four moorings were serviced by *Ronald H. Brown* cruise during RB-09-04, RB-10-03, and RB-11-01. Cancellation of the cruise RB-12-05 led to another gap in the record. After the make-up cruise in January-February 2013, all four buoys, which need to be serviced annually, were once again reporting meteorological and oceanographic data onto the Global Telecommunications System for weather and climate forecasting. The optimal configuration to conduct a PNE cruise and service the moorings is once every 12 months. The three most recent cruises have occurred within 9-15 months of one another, and have on average met that mark: November-December

2013 on *Ronald H. Brown* during RB-13-06, January-February 2015 on the UNOLS R/V Endeavor, and November-December 2015 on the NATO R/V Alliance.

In the Memorandum of Understanding from the PIRATA-12 meeting (November 2006), the United States agreed that

> *[I]t is recognized that the Parties are dependent upon year-to-year funding allocations from their governments, and thus commitments for future funding and logistical support cannot be guaranteed. Given this proviso, the Parties affirm that PIRATA is a high priority for Brazil, France, and the United States, and that the institutions are making plans for continued support ... NOAA will provide ship time for maintenance of four moorings in the North East Extension.*

Ronald H. Brown's cruise RB-17-01 serves to honor this commitment for the fiscal year 2017.

Aerosols and Ocean Science Expeditions (AEROSE)

Large uncertainties remain in our understanding of the impact of mineral dust and biomass burning aerosols on the weather and climate of the tropical Atlantic. In order to advance knowledge and improve predictive models, it is important that we address gaps in our understanding of regional and trans-boundary aerosol issues. The African continent is one of the world's major source regions of mineral dust and biomass burning aerosols. This makes the need for understanding the mobilization, transport, and impacts of aerosols originating from natural and anthropogenic processes in Africa a high priority for improving predictive models. Saharan dust storms are estimated to inject over three billion metric tons of mineral aerosols into the troposphere annually, with large quantities advecting westward over the tropical North Atlantic within tropical easterly winds and waves. These aerosols impact phenomena ranging from cloud seeding and precipitation, ocean fertilization, and downstream air quality and ecosystem impacts in the Caribbean and U.S. eastern seaboard. Red tides, increasing rates of asthma, and precipitation variability in the eastern Atlantic and Caribbean have been linked to increases in the quantities of Saharan dust transported across the Atlantic. The contribution of the Saharan air layer (SAL) to the development of the West African Monsoon (WAM) and its role in tropical cyclogenesis are important topics of ongoing research. The interplay between thermodynamics, microphysics, and aerosol chemistry are currently unknown and field measurements are thus desirable for unraveling these complex interactions.

The NOAA Aerosols and Ocean Science Expeditions (AEROSE) constitute a comprehensive measurement-based approach for gaining understanding of the impacts of long-range transport of mineral dust and smoke aerosols over the tropical Atlantic (Morris et al., 2006; Nalli et al., 2011). The project, involving international coordination of monitoring in Puerto Rico, Mali, the Canary Islands, and Senegal, hinges on multi-year, trans-Atlantic field campaigns conducted in collaboration with PNE project over the tropical Atlantic. AEROSE is supported through collaborative efforts with NOAA's National Environmental Satellite Data and Information Service, Center for Satellite Applications and Research (NESDIS/STAR) and the National Weather Service (NWS), as well as NASA and several academic institutions linked through the NOAA Center for Atmospheric Sciences at Howard University.

The AEROSE campaigns (to date, comprised of eleven separate trans-Atlantic Project legs) have provided a set of *in situ* measurements to characterize the impacts and microphysical evolution of continental African aerosol outflows (including both Saharan dust and sub-Saharan and biomass burning) across the Atlantic Ocean (Nalli et al., 2011). AEROSE has sought to address three central scientific questions (Morris et al., 2006):

1) How do Saharan mineral dust aerosols, biomass burning aerosols, and/or the SAL affect atmospheric and oceanographic parameters during trans-Atlantic transport?
2) How do the aerosol distributions evolve physically and chemically during transport?
3) What is the capability of satellite remote sensing and numerical models for resolving and studying the above processes?

Specific objectives of RB-17-01

The objectives of this *Ronald H. Brown* project address NOAA's Climate Goal and Weather and Water Goal, and are an explicit NOAA contribution to the PIRATA and AEROSE programs. Specific goals are in the areas of oceanography, marine meteorology, atmospheric chemistry and satellite validation.

Oceanography: Numerical models that are used to simulate the coupled air-sea system and to forecast atmospheric climate are notoriously inaccurate in the eastern tropical Atlantic. For example, the majority of the models cannot simulate the sign of the SST gradient. They show cold water in the west and warm water in the east, exactly out of phase with observed conditions. The main objective of the oceanographic component of RB-17-01 is to collect the data needed to evaluate the terms in the heat budget of the upper ocean and to compare the observed results with model results. The comparison should identify areas/processes of model deficiencies.

Four PNE moorings will be recovered and redeployed. The purpose of these moorings is to provide time series of the upper ocean temperature, salinity, current structure and heat fluxes between the ocean and atmosphere. Shipboard observations will include upper-ocean and surface heat flux data along 23°W, from 5°S to 20.5°N. These observations will be supplemented by data from surface drifters, XBTs, and Argo profiling floats to be deployed during this and other cruises to the area. Combining the various data will allow estimation of the terms in the heat budget. Data to be collected provide an improved picture of seasonal-to-interannual tropical Atlantic variability.

Marine Meteorology: Atmospheric data will be collected to characterize the vertical structure of the Saharan air layer (SAL) (e.g., Nalli et al., 2005; 2011), including mineral dust aerosol over the Atlantic Ocean. The atmospheric data will also be used to investigate the effect of the SAL on the marine boundary layer, clouds, precipitation, and surface radiation balance.

Recent work by Min et al (2009) indicates that ice particles are abundant in the dusty sectors of deep tropical convective systems that have entrained Saharan mineral dust. This is particularly evident at altitudes at which heterogeneous ice nucleation is a dominant process. Other studies suggest that mineral dust may be of critical importance in precipitation processes but studies are inconclusive regarding whether it suppresses or enhances rainfall in tropical systems. The AEROSE team will take advantage of opportunistic measurements of Atlantic dust outflow events via radiosonde observations (RAOBs), ship-based lidar, optical and chemical determination of the dust load composition, as well as supporting Suomi NPP, A-Train and other relevant satellite observational overpasses.

Atmospheric Chemistry: Profile measurements of the atmosphere will be conducted to investigate the linkages between the vertical distributions of tropospheric ozone with dust and biomass burning outflows (e.g., Nalli et al., 2011). Historical data show a seasonal variation in tropospheric ozone that peaks during June-August. The origins of this peak remain uncertain and may be due to anthropogenic sources (e.g., transport from biomass burning in the Congo Basin) or natural sources (e.g., lightning over West Africa, stratospheric injections).

Current atmospheric chemistry models are challenged by the need to account for a variety of processes in dense aerosol outflows. Very few *in-situ* measurements have been reported for tropical air masses that are rich in mineral dust aerosols, biomass burning aerosols, West African mega city urban aerosols, and/or mixtures of these aerosol types that characterize the trade wind and SAL outflow regimes. AEROSE will extend its record of key measurements of trace gases that will allow for better constraints on the chemistry within these outflows. The measurements include ozone, carbon monoxide, sulfur dioxide, NOx (nitric oxide and nitrogen dioxide), methane, and aggregate non-methane volatile organic carbon species (VOC).

A comprehensive suite of aerosol measurements and *in situ* sampling will also be performed in order to quantify the microphysical and chemical evolution of the Saharan dust during trans-Atlantic transport, to characterize aerosol mixing, to identify microbial distributions and microbial load on the aerosols, to determine evidence for heterogeneous chemistry within dusty air mass outflows. Offline microbiological and chemical composition analysis will be performed as a function of size and source region. The filter samples collected during the cruise will be frozen following sample collection and processing. Number distributions will be measured continuously for Aitken, accumulation mode, and fine aerosols using mobility analyzers and optical particle counters. Mass density and gravimetric aerosol analysis will be performed using a suite of tandem quartz crystal cascade impactors, cyclone impactors, and high volume gravimetric sequential samplers.

Satellite validation: Infrared, microwave, visible, and *in situ* measurements will be collected to support the calibration/validation (cal/val) and improvement of advanced satellite retrievals and data products (Nalli et al., 2011), namely the Suomi National Polar-orbiting Partnership (SNPP) Cross-track Infrared Sounder (CrIS) and Advanced Technology Microwave Sounder (ATMS) (Nalli et al., 2013), Visible Infrared Imaging Radiometer Suite (VIIRS), as well as the NOAA R-Series Geostationary Operational Environmental Satellite (GOES-R).

E. Participating Institutions

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F. Personnel (Science Party)

Leg 1:

Name (Last, First)	Title	Date Aboard	Date Disembark	Gender	Affiliation	Nationality
Morris, Vernon	Chief Sci.	02/10	03/28	M	NCAS/Howard	USA
Roper, Ebony	Res. Sci.	02/10	02/17	F	Howard U.	USA
Sakai, Ricardo	Res. Sci.	02/10	02/17	M	Howard U.	USA
Sleinkofer, Amanda	Res. Sci.	02/10	02/17	F	Howard U.	USA
Arratia, Juan	Res. Sci.	02/10	02/17	M	Howard U.	USA
Wang, Alexander	Res. Sci.	02/10	02/17	M	Howard U.	USA
Medina Calderon, Richard	Res. Sci.	02/10	02/17	M	Howard U.	USA
Izaguirre, Miguel	Res. Sci.	02/10	02/17	M	UM/RSMAS	USA
Szczodrak, Malgorzata	Res. Sci.	02/10	03/28	F	UM/RSMAS	USA

Leg 2:

Name (Last, First)	Title	Date Aboard	Date Disembark	Gender	Affiliation	Nationality
Perez, Renellys	Chief Sci.	02/18	03/28	F	CIMAS/UM	USA
Dolk, Shaun	Res. Sci.	02/18	03/28	M	CIMAS/UM	USA
Hooper, James	Res. Sci.	02/18	03/28	M	CIMAS/UM	USA
Valdes, Erik	Res. Sci.	02/18	03/28	M	CIMAS/UM	USA
Valdes, Carlos	Volunteer	02/18	03/28	M	CIMAS/UM	USA
Kunze, Steven	Mooring Tech.	02/18	03/28	M	NOAA/PMEL	USA
Wells, Ryan	Mooring Tech.	02/18	03/28	M	NOAA/PMEL	USA
Hahn, Johannes	Res. Sci.	02/18	03/28	M	GEOMAR	Germany
Morris, Vernon	Senior Sci.	02/10	03/28	M	NCAS/Howard	USA
Nalli, Nicholas	Senior Sci.	02/18	03/28	M	NOAA/NESDIS	USA
Olayinka, Kafayat	Res. Sci.	02/18	03/28	F	Howard U.	USA
Yeager, Daniel	Res. Sci.	02/18	03/28	M	Howard U.	USA
Rosado, Keren	Res. Sci.	02/18	03/28	F	Howard U.	USA
Ndiaye, Aissatou	Res. Sci.	02/18	03/28	F	Howard U.	Senegal
Szczodrak, Malgorzata	Res. Sci.	02/10	03/28	F	UM/RSMAS	USA

G. Administrative

1. Points of Contact:

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Alternate Point of Contact: **LCDR Justin Kibbey**
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Agent in Punta Arenas, Chile: None
Agent in Montevideo, Uruguay: None

2. Diplomatic Clearances

Research clearance has been requested for Cape Verde. No Marine Scientific Research will be conducted in jurisdictional waters of Argentina, Brazil, Chile, United Kingdom, or Uruguay. The request was submitted to the State Department by Wendy Bradfield-Smith (Wendy.Bradfield-Smith@noaa.gov).

3. Licenses and Permits

Not Applicable

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. Cruise Plan/Itinerary

The primary goal of the cruise is to recover and redeploy the PNE moorings and to sample oceanic and atmospheric variables along the cruise track.

All PNE moorings will be recovered and redeployed at four sites: 4°N, 11.5°N, and 20.5°N along 23°W, as well as 20°N, 38°W. Note, during the November-December 2015 PNE cruise ATLAS (Autonomous Temperature Line Acquisition System) moorings were deployed at all the PNE mooring sites except at 11.5°N, 23°W where a next generation Tropical Flex (T-Flex) mooring was deployed. During this cruise, only T-Flex moorings will be deployed at the four PNE mooring sites.

To obtain additional information from PNE moorings: (1) A pilot deployment for the Tropical Atlantic Current Observations Study (TACOS) of eleven current meters between 5 m and 90 m depth at the 4°N, 23°W PNE mooring will also be conducted to study the vertical shear of the horizontal currents at that location (e.g., Perez et al., 2014), and (2) 2 to 3 oxygen loggers will be deployed at the three PNE mooring sites 4°N, 11.5°N, and 20.5°N along 23°W in collaboration with German colleagues at GEOMAR. Planned depths are 300m, 500m at 4°N; 80m, 300m, 500m at 11.5°N; and 80m, 150m, 300m at 20.5°N. The underwater sensors are physically mounted to the wire and inductively coupled to the system.

A CTD/LADCP/O2 section (ocean temperature, salinity, dissolved oxygen, and horizontal currents) will be taken along 23°W from 5°S to 20.5°N, sampling from the sea surface to 1500 m depth, with at least two deep CTD stations (down to 3500 m) at 19°S, 35°W and at 0°N, 23°W. The actual hydrographic stations sampling plan may deviate from this proposed plan (Appendix G) in both number of stations and their locations. Some CTD station locations are in Cape Verde's EEZ. Drifter, Argo float, and XBT deployments will be performed along the cruise track.

Atmospheric data will be collected throughout the cruise as part of the Aerosols and Ocean Science Expedition (AEROSE). At the Chief Scientist's discretion changes in speed may be requested for radiosonde launches, which will be done at positions determined by the AEROSE scientists and based on satellite overpass predictions determined on the ship while underway (i.e., pre-cruise positions cannot be provided). Changes in heading may also be requested by the Chief Scientist for large-balloon ozonesonde launches, depending on wind conditions. Satellite tracked surface drifters will be deployed along the track line at locations determined by the Chief Scientist. Pre-cruise deployment locations cannot be provided as final deployment sites will be determined by the locations of drifters previously deployed.

The M-AERI (Marine-Atmosphere Emitted Radiance Interferometer – see Minnett et al., 2001) project led by P. Minnett (RSMAS/UM, Miami, FL, USA) has long partnered with the PNE project and participated in the PNE cruises, and will participate in RB-17-01. The primary objective of M-AERI deployments is the accurate measurement of the skin sea-surface temperature (SST) for the validation of satellite-derived SST, and the improvement of algorithms applied to the satellite measurements to correct for the effects of the intervening atmosphere. M-AERI measures spectra of infrared emission from the ocean and atmosphere, and these support a number of research topics related to the structure of the troposphere and air-sea interactions. A suite of meteorological sensors is also deployed to provide ancillary data to aid the interpretation of the M-AERI spectra. Except for a small surface-following tethered float that is deployed when the ship is on station, the M-AERI and ancillary sensors operate continuously, and being meteorological sensors are not subject to the need for diplomatic clearance.

Leg 1 of the cruise: NOAA Ship Ronald H. Brown (RHB) will depart from Punta Arenas, Chile, on or about 11 February 2017 and transit to Montevideo, Uruguay, on or about 16 February 2017. During the transit, a subset of the scientific team (see Section G) will collect supporting meteorological and atmospheric observations as part of the AEROSE and M-AERI projects. RHB will spend about two days in Montevideo, Uruguay for crew rest and logistic support.

Leg 2 of the cruise: RHB will depart from Montevideo, Uruguay, on or about 19 February 2017. After exiting Uruguay and Brazil EEZs, the scientific party will resume atmospheric measurements and begin collecting oceanographic data (water temperature, salinity, oxygen and currents) along the ship's track from a way point near 35°S, 48.5°W to the PNE operating area. Along the way, an instrument repair (rain gauge replacement) and a deep (down to 3500 m) hydrographic test cast will be performed at the Brazilian PIRATA mooring at 19°S, 35°W. Small boat operations may be required during the servicing of the rain gauge. An additional test cast (down to 1500 m) may be required en route to the PNE operating area. The RHB will continue northeastward towards 5°S, 23°W.

A hydrographic line will be then conducted along 23°W, heading northward from 5°S to the equator. A CTD cast and instrument repair on the equatorial French PIRATA mooring at 23°W will be done if needed and if time permits. The RHB will continue the CTD section while heading northward along 23°W to the first ATLAS mooring recovery and T-Flex deployment site at 4°N, 23°W. The RHB will continue northward to the 11.5°N mooring and take CTD stations along the way. At 11.5°N, the T-Flex mooring will be recovered and redeployed, and the RHB will continue the CTD section while heading northward nominally along 23°W (detouring slightly eastward or westward around the Cape Verde plateau) to the next ATLAS recovery and T-Flex deployment at 20.5°N, 23°W. RHB will then steam westward to the last mooring site (20ºN, 38ºW). A final CTD cast will be conducted, and the ATLAS mooring will be recovered and a T-Flex mooring will be redeployed. After the last mooring operation, the RHB will head northwest to Charleston, South Carolina.

B. Staging and Destaging

Staging for the cruise was conducted in San Diego, California prior to the P18 cruise on October 31, 2016 in concert with staging for the GOSHIP P18 cruise. Equipment characteristics are given in Appendix B.

The AOML 20' van with equipment for the collection of hydrographic data was loaded in San Diego, California on October 31, 2016. All PNE equipment will remain on the ship during P18 and PNE. The van will be mounted at the main lab level just aft of the hydro lab for both the P18 and PNE cruises. A shoreside crane will be required to load/off-load the container.

Argo profiling floats for PNE: Eight Argo floats were shipped to San Diego by Pelle Robbins at Woods Hole Oceanographic Institute (WHOI). Argo floats will be in 1'x1'x6' boxes and must remain in the boxes for deployment. The Argo float boxes shouldn't be stacked more than 3 high. Argo floats can be stored on the ship wherever there is room during P18, preferably in science stores. They can be moved into the main lab after P18 once the P18 Science Party has deployed all of their Argo floats and dissembled the Argo float rack that they will be using.

Drifters for PNE: Sixteen drifters shipped in the AOML 20’ van for deployment during PNE. The drifters can be stored on the ship wherever there is room, preferably in wet lab, science stores, or in the AOML van. Just prior to PNE, they can be stored on the deck (just outside the main lab exit door, which is covered).

XBTs for PNE: Six boxes of XBTs were shipped in the AOML container. XBT cases can be stored on the ship wherever there is room, preferably in wet lab or in the science stores.

Equipment for recovery of three ATLAS moorings and one T-Flex mooring and deployment of the 4 T-Flex moorings were loaded in San Diego on November 1, 2016. A large part of this equipment needs to be stored near the Fantail (typically on the port side). The ship’s crane will be required to load/off-load equipment on the ship.

NCAS van: 20’ van with standard fitting, was loaded in San Diego, California prior to the P18 cruise. The van was loaded on the forward 02 Level with a shoreside crane, since it is too heavy for the ship’s crane (van weight is about 8 tons including equipment/gases stored therein). In addition, there would be one or two 5’x5’x4’ crates weighing about 500 pounds together. A shoreside crane will be required to off-load the NCAS van in Charleston.

NCAS requires engineering help on connecting the van to ship's power supply before departure from Punta Arenas, Chile. A NCAS team will work on sensor deployment during the port of call in Punta Arenas, Chile.

NCAS requires help unloading and securing gas cylinders (30, each about 4.5’ tall), secured on the 02 winch deck.

Loading of small items needs to be coordinated with the OPS if not included in the NCAS van. NCAS will take care of them.

The M-AERI and ancillary was installed on the ship in San Diego and are intended to operate continuously from San Diego to Charleston. Two people from RSMAS installed the equipment in San Diego and will remove it in Charleston. A small crane is needed to load the equipment onto the O2 forward deck, lifting weight ~500 lb. No crane operations are envisaged at other ports until the equipment is off-loaded in Charleston.

After P18, three of the P18 20’ vans will need to be moved forward to the 02 Level with a rented crane in Punta Arenas, Chile.

AOML will require the assistance of the shipboard ET to help install computer systems in Montevideo, Uruguay.

The Leg 1 science party will stay on board the ship the night prior to departure in Punta Arenas, Chile to allow for maximum time for setup of the scientific gear prior to sailing. We understand that the galley may not be available for meals on the day prior to departure. We request that scientists be allowed to stay on board RHB the night of arrival in Montevideo, Uruguay, and that the 2 scientists also participating in Leg 2 be allowed to stay on the ship for the duration of the port call in Montevideo.

The Leg 2 science party will stay on board the ship the night prior to departure in Montevideo, Uruguay to allow for maximum time for setup of the scientific gear prior to sailing. We understand that the galley may not be available for meals on the day prior to departure. We request that scientists be allowed to stay on board RHB the night of arrival in Charleston, South Carolina.

Destaging will occur in Charleston, South Carolina following the PNE cruise on or about March 28, 2017.

C. Operations to be Conducted

Leg 1 of the cruise: NOAA Ship *Ronald H. Brown* (RHB) will steam from Punta Arenas, Chile to Montevideo, Uruguay and collect supporting meteorological and atmospheric observations and radiosondes as part of the AEROSE and M-AERI projects. The M-AERI measurements will be of the infrared emission spectra from the ocean surface and atmosphere. The ancillary measurements will include standard meteorological variables (air temperature, relative humidity, wind speed and direction, incident solar and infrared radiation, and pictures of clouds from an all-sky camera. A microwave radiometer will measure the total moisture in the atmosphere and the liquid water in clouds. Standard ship's meteorological and navigation data (position, speed, heading and track over ground) will be required in the data analysis.

Leg 2 of the cruise: RHB will steam from Montevideo, Uruguay to perform an instrument repair (rain gauge replacement) and a deep (down to 3500 m) hydrographic test cast at the Brazilian PIRATA mooring at 19°S, 35°W. An additional test cast (down to 1500 m) may be required en route to the PNE operating area. RHB will proceed to 5°S, 23°W and begin CTD stations every ½ degree of latitude while heading northward to 0°N along 23°W. Between 2°S and 2°N, stations will be occupied every ¼ degree of latitude. If needed, repairs of the equatorial ATLAS mooring at 23°W will be conducted after the deep (down to 3500 m) equatorial CTD cast. RHB will continue the hydrographic line along 23°W to 20.5°N, and along the way the PNE moorings at 4°N, 11.5°N, and 23°W will be recovered and redeployed. RHB will then head west to 20ºN, 38ºW to conduct the final CTD cast and recover and redeploy the last PNE mooring. RHB will then head northwest to Charleston, South Carolina.

Approximate Station Locations for the mooring operations and CTD casts are listed in Appendix G. The locations of the CTD casts are subject to small changes. If time permits, deep (down to 3500 m) CTD casts will be performed at the near-equatorial locations (within two degrees of the equator), in addition to the planned deep casts at 19°S, 35°W and 0°N, 23°W.

PNE observations will be supplemented by data from 16 surface drifters and 8 Argo profiling floats which will be deployed while the ship is underway.

Approximately 55 XBTs will be deployed along the cruise track, primarily during the 23°W CTD section. The XBTs will be deployed while the ship is underway between CTD casts. The exact deployment locations and number may change at the Chief Scientist's discretion.

The AEROSE group will deploy approximately 20 ozonesondes, spaced approximately evenly in time throughout the cruise. Deployments may require the ship to stop and reposition, depending on the meteorological conditions. It is estimated that a maximum of approximately half an hour will be required for each ozonesonde deployment. It is anticipated that most ozonesonde deployments will require less than 15 minutes for deployment. Radiosonde deployments will be conducted usually without the need to decrease ship speed. For both ozonesonde and radiosonde deployments it is important that there is sufficient space and clearance for maneuvering a helium filled balloon and launching from either the starboard or port quarters.

M-AERI measurements will also be made during Leg 2, as described in Leg 1.

During Leg 2, the ship shall continuously collect ADCP, meteorological, thermosalinograph (TSG), and bathymetric (Kongsberg EM122) data while underway (where MSR clearance permits). The ship shall also collect heading information from both the gyro compass and GPS system for comparison and testing.

Small boat operations may be required during the servicing of the ATLAS/T-Flex moorings at 4°N, 23°W; 11.5°N, 23°W; 20.5°N, 23°W and 20°N, 38°W. Small boat operations may also be needed at the Brazilian ATLAS mooring at 19°S, 35°W, and at the French ATLAS mooring at 0°N, 23°W if it requires repairs. Small boat operations will be conducted at the discretion of the Commanding Officer.

Multibeam monitoring at the recovery/redeployment sites is requested for the T-Flex mooring sites. No systematic survey (typical full surveys cover 5 nm x 5 nm around the sites) is necessary since the previous year's surveys should be sufficient for mooring ops for most mooring sites. A single 5nm pass should be quite sufficient at these mooring sites.

Data to be collected and operations

1. Recovery of PNE moorings along 23°W at 4°N (ATLAS), 11.5°N (T-Flex) and 20.5°N (ATLAS), and 20°N, 38°W (ATLAS). Redeployment of T-Flex moorings at all four locations.
2. Replace rain gauge on ATLAS mooring at 19°S, 35°W.
3. Repair ATLAS mooring at 0°, 23°W if necessary and time allows.
4. CTD profiles at the test cast location, along 23°W, and at the PNE mooring locations. CTD casts will include the CTD unit and a Rosette sampler with 12-14 bottles. The casts at the 62 station locations will extend to 1500 m (one deep cast at the equator, and possibly shallower casts in the vicinity of Cape Verde) and are listed in Appendix G. The cast rate is about 60m/min. We request a package tracking system and display for the CTD operations (with Knudsen and 12kHz Echo Sounder).
5. Salinity of the water samples collected with the bottles on the CTD rosette.
6. Dissolved oxygen concentration in the water samples collected with the bottles.
7. Continuous recording of ship mounted ADCP data (where MSR clearance permits).

8. Heading data from both the gyro compass system and the GPS system for comparison of heading quality for the gyro compass system.
9. Continuous recording of Thermosalinograph (TSG).
10. Continuous recording of Kongsberg EM122 bathymetry requested (with help from ship science technician) (where MSR clearance permits).
11. Deployment of approximately 10 Argo profiling floats, 15 surface drifters, and 50 XBTs along the trackline specified by the Chief Scientist. No slow-down or stop is required.
12. Deployment of an additional 48 XBTs in batches of four XBTs (two deployments at a time) immediately prior to 12 of the CTD casts. Slow-down is required.
13. Lidar aerosol and wind observations (NCAS)
14. Total column aerosol optical depth (AOD) from handheld sun photometer measurements (NCAS)
15. Tropospheric profiles of pressure, temperature, humidity and wind from launching of approximately 60 Vaisala RS41 radiosondes during Suomi NPP CrIMSS and MetOp IASI overpasses. They will be launched with small (200 g) balloons at locations along the trackline specified by the Chief Scientist. (NESDIS)
16. Ozone profiles from launching of 20 ozonesondes during Suomi NPP and MetOp overpasses. They will be launched with large (1200 g) balloons at locations along the trackline specified by the Chief Scientist. (NESDIS)
17. Laser particle counters (NCAS)
18. Ceilometer (ESRL)
19. Broadband pyranometers and pyrgeometers to measure downwelling solar (visible) and terrestrial (infrared) radiation (NCAS)
20. Ambient trace gas (O_3, CO, SO_2, NO_x, VOC, CH_4) measurements (NCAS)
21. Aerobiological sampling (NCAS)
22. Partiosol 2025 Sequential high-volume aerosol sampler (NCAS)
23. Low-volume bulk sampler for fungi and chemical analysis (NCAS)
24. Scanning Mobility Particle Sizer (NCAS)
25. Aerosol Particle Sizer (NCAS)
26. Spectra of infrared radiation emitted by the ocean surface and atmosphere (RSMAS)
27. Subsurface thermometer in tethered surface-following float deployed at some stations (RSMAS)
28. Atmospheric water vapor and liquid water content by microwave radiometer (RSMAS)
29. All-sky camera images of clouds (RSMAS)
30. Standard meteorological variables (RSMAS)
31. Incident short-wave and long-wave radiation (RSMAS)
32. SST at a depth of ~5cm using a tethered float while the ship is on station.

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. Interior Space Requirements

All benches cleared in main lab, computer room, hydro lab, and wet lab. Approximately five feet of bench space and access to the fume hood in bioanalytics lab. Approximately 2-3 feet of space in the science freezer. Room for 6 boxes of XBTs, 16 drifters, and 8 Argo floats, preferably either in the wet lab, the forward science stores, the AOML 20 foot container, or a combination of these locations.

F. Applicable Restrictions

Conditions which preclude normal operations: Poor weather conditions may delay or cancel certain procedures, such as small boat operations, ozonesonde launches, and CTD and XBT casts. Decisions will be made on a case by case basis after consultation between the ship's crew and captain and the chief scientist and mooring technicians. The primary consideration is the safety of the ship's crew and scientists. Possible mitigation strategies include waiting until conditions improve, canceling ozonesonde launches, and recovering moorings without small boat operations. Unforeseen circumstances such as equipment failure may also cause a delay or cancellation of certain operations. Appropriate courses of action will be determined after discussion among the captain, crew, and chief scientist.

III. Equipment

A. Equipment and Capabilities Provided by the Ship

The following communications devices are currently on board *Ronald H. Brown*.

1. Hull-mounted transducer for release deckset use
2. VSAT for 24/7 Internet capabilities. All scientists can access their email via web browser. All NOAA IT rules apply when using the ship's VSAT connection.
3. Satellite communication systems (Sailor 500, INMARSAT-M, Iridium voice comms)

Scientific Equipment requested from the Ship

1. Echo Sounder (Ocean Data Equipment Corporation (ODEC) Bathy 2000 or the Knudsen system) used in 12 kHz mode (to track CTD package to within 10 meters of the bottom) to be used while on CTD station. CTD package will have altimeter as primary method of bottom detection.
2. Continuous Kongsberg EM122 Multibeam bathymetric sonar system sampling while underway between stations.
3. Barometer
4. WOCE IMET sensors
5. Hydrographic Winch system and readouts (using 322 conducting cable for CTD operations).
6. Hull mounted acoustic Doppler current profiler (RD Instruments (RDI), 75 kHz Ocean Surveyor acoustic Doppler current profiler) with gyro compass input.
7. gyro compass system for acquisition of heading data used by acoustic Doppler current profiler.
8. GPS and POS-MV system for acquisition of heading data.
9. Winch and A-frame for ATLAS and T-Flex recovery and T-Flex deployment.
10. Two Guildline 8400B Autosals for processing salinity bottle samples. Also need a temperature controlled room stable to within one degree C of 24 degree C.
11. CTD package as backup for the package provided by the science party

The above listed scientific equipment provided by the ship is all critical for meeting the objectives of this cruise. However, the hull-mounted transducer, Kongsberg EM122, IMET, sADCP and TSG are particularly important for satisfying the objectives of this cruise.

B. Equipment and Capabilities Provided by the Scientists

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

AOML equipment
see Appendix C

NCAS equipment
see Appendix B

NOAA/NESDIS equipment:
see Appendix B

NOAA/ESRL equipment:
see Appendix D

PMEL equipment
see Appendix E

RSMAS equipment
see Appendix F

IV. Hazardous Materials

A. Policy and Compliance

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

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

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

A chemical hygiene plan is a written document establishing procedures, equipment, personal protective equipment and work practices to protect employees from the health hazards from chemicals used in that particular workplace. This document is usually managed by the laboratory or science center personnel. On most projects, the program doesn't bring the entire hygiene plan, just the relevant portions about PPE; spills, etc for underway operations. For reference: http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10106

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

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

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

B. Radioactive Isotopes

No radioactive isotopes are planned for this project.

C. Inventory

See Appendix A.
The required MSDS for all chemicals loaded before to the start of PNE will be provided by the Chief Scientists of P18 and PNE.

V. Additional Projects

A. Supplementary ("Piggyback") Projects

Underway pCO2 Measurements:

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

Principal investigators:

Dr Rik Wanninkhof, AOML 305-361-4379 wanninkhof@aoml.noaa.gov
Dr Richard Feely, PMEL 206-526-6214 feely@pmel.noaa.gov

The semi-automated instruments are installed on a permanent basis in the hydrolab 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 for the hazardous materials aboard RHB for this project. A list of the HAZMAT associated with this project is provided in Appendix A.

B. NOAA Fleet Ancillary Projects

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

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

a. SEAS Data Collection and Transmission
b. Marine Mammal Reporting
c. Bathymetric Trackline
d. Weather Forecast Monitoring
e. Sea Turtle Observations

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

B. Data Responsibilities

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

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

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

The Commanding Officer is responsible for all data collected for ancillary projects until those data have been transferred to the project's principal investigators or their designees. Data transfers will be documented on NOAA Form 61-29. Copies of ancillary project data will be provided to the Chief Scientist when requested. Reporting and sending copies of ancillary project data to NESDIS (ROSCOP) is the responsibility of the program office sponsoring those projects.

DATA REQUIREMENTS
The ship's SCS system should log the following parameters:

- Gyro compass (Degrees)
- GPS positions from Northstar 941 and Furuno GP-90 systems
- TSG_Unit_Temp (Degrees_C)
- TSG_Conductivity (Mega_Mhos)
- TSG_Salinity (PPT)
- Barometer (MB)
- Precip9-trwlhs (mm/hr)
- Imet-Rain (mm)
- Imet-Rel_Hum (Percent)
- Imet-Temp (Degrees_C)
- Fluoro-Value (PPM)
- Imet-TWind1-Speed-MSEC (M/SEC)
- Imet-Twind1-Dir (Degrees)
- Imet-Rwind2-Spd-Knts (Knots)
- Imet-TWind2-Speed-KNTS (Knots)
- Imet-TWind2-Dir (Degrees)

Bottom Depth (meters)

The Senior Survey Technician (SST) will provide an event file logging of all the above variables as two-minute averages. The CST will also provide an additional event file with the parameters needed for LADCP and SADCP processing as will be requested at the time of sailing.

The ship shall record ADCP raw data continuously during the cruise (where MSR clearance permits).

The following data products will be produced by the ship and, if requested, will be given to the Chief Scientist at the end of each leg. The Chief Scientist will bring an external hard drive to receive this data:

a. Kongsberg EM122 and navigational data, including location and depths of acoustic profile locations;
b. SCS system data;
c. ADCP raw data on thumb drive
g. Two event files: summary data above, and SADCP event files

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

Meals and berthing are required for up to 9 scientists during Leg 1 from Punta Arenas to Montevideo, and up to 15 scientists during Leg 2 from Montevideo to Charleston. Meals will be served 3 times daily beginning one hour before scheduled departure, extending throughout the cruise, and ending two hours after the termination of the cruise. 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 survey.

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 cruise 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 7, 1999 which forbids the possession and/or use of illegal drugs and alcohol aboard NOAA Vessels.

B. Medical Forms and Emergency Contacts

The NOAA Health Services Questionnaire (NHSQ, Revised: March 2016) must be completed in advance by each participating scientist. The NHSQ can be obtained from the Chief Scientist or the NOAA website at 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

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

D. Communications

A progress report on operations prepared by the Chief Scientist may be relayed to the program office. Sometimes it is necessary for the Chief Scientist to communicate with another vessel, aircraft, or shore facility. Through various modes of communication, the ship is able to maintain contact with the Marine Operations Center on an as needed basis. These methods will be made available to the Chief Scientist upon request, in order to conduct official business. 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.

Program contacts

Claude (Rick) Lumpkin	Rick.Lumpkin@noaa.gov	305-361-4513
Renellys C. Perez	Renellys.C.Perez@noaa.gov	305-361-4518

E-mail addresses:

Commanding Officer, RHB	CO.Ronald.Brown@noaa.gov
Executive Officer, RHB	XO.Ronald.Brown@noaa.gov
Field Operations Officer, RHB	OPS.Ronald.Brown@noaa.gov
Medical Officer, RHB	Medical.Ronald.Brown@noaa.gov

E. IT Security

Any computer that will be hooked into the ship's network must comply with the *NMAO Fleet IT Security Policy* 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 (FRNS) to submit requests for access to NOAA facilities and ships. The Departmental Sponsor/NOAA (DSN) is responsible for obtaining clearances and export licenses and for providing escorts required by the NAO. DSNs should consult with their designated NMFS Deemed Exports point of contact to assist with the process.
The following are basic requirements. Full compliance with NAO 207-12 is required.
Responsibilities of the Chief Scientist:

1. Provide the Commanding Officer with the e-mail generated by the FRNS granting approval for the foreign national guest's visit. This e-mail will identify the guest's DSN and will serve as evidence that the requirements of NAO 207-12 have been complied with.
2. Escorts – The Chief Scientist is responsible to provide escorts to comply with NAO 207-12 Section 5.10, or as required by the vessel's DOC/OSY Regional Security Officer.
3. Ensure all non-foreign national members of the scientific party receive the briefing on Espionage Indicators (NAO 207-12 Appendix A) at least annually or as required by the servicing Regional Security Officer.
4. Export Control - The NEFSC currently neither possesses nor utilizes 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 on board 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 cruise, provide the Chief Scientist with a current inventory of OMAO controlled technology on board 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 on board 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 on board regardless of ownership.

7. Ensure all OMAO personnel on board 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:

A. 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 on board regardless of the technology's ownership.
B. 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.
C. Ensure completion and submission of Appendix C (Certification of Conditions and Responsibilities for a Foreign National Guest) as required by NAO 207-12 Section 5.03.h.

APPENDICES

Appendix A. List of Hazardous Materials

NCAS

Person Responsible	chemical/compressed gas	quantity	unit	neutralizer
Vernon Morris	Helium	30	cylinders	none
Vernon Morris	UHP Nitrogen	2	cylinders	none
Vernon Morris	Air	3	cylinders	none
Vernon Morris	Hydrogen	1	cylinder	none
Vernon Morris	ethanol	1	1-L	spill kit
Vernon Morris	toluene	1	1-L	spill kit
Vernon Morris	Sodium Phosphate	1	200-g	spill kit
Vernon Morris	Hydrogen peroxide	1	0.5-L	spill kit
Vernon Morris	Drierite	16	0.5-L	spill kit
Vernon Morris	hexane	1	1-L	spill kit

OXYGEN

Person Responsible	chemical/compressed gas	quantity	unit	neutralizer
Grant Rawson	sodium iodide & alkaline Iodide	10	1 liter	spill kit
Grant Rawson	Manganese Chloride	10	1 liter	spill kit
Grant Rawson	Dilute H_2SO_4 (Sulfuric Acid)	10	1 liter	spill kit
Grant Rawson	Sodium Thiosulfate	10	35g	spill kit
Grant Rawson	potassium iodate	10	1 liter	spill kit

RSMAS

Person Responsible	chemical/compressed gas	quantity	unit	neutralizer
Miguel Izaguirre	Industrial grade nitrogen	1	cylinder	none
Miguel Izaguirre	Ethanol	1	1-L	spill kit

Appendix B. Equipment/Van List

1) AOML

One 20’ van with about 10,480 lbs of equipment (total van weight approximately 15,000 lbs) mounted aft of the Hydro lab.

See Appendix C.

2) ATLAS/T-FLEX MOORINGS (NOAA/PMEL)

See Appendix E.

3) NCAS

1. Van on 01 deck, 16,000 lbs
2. 30 He cylinders including rack (behind winch 02 deck)
3. radiometers – mounted atop van on O2 deck
4. Partisol sequential sampler – 02 deck railing
5. bio-samplers 02 deck railing
6. Microwave radiometer 01 starboard railing
7. Microtops sun photometers
8. EN-SCI ECC ozone sondes
9. QCM Cascade Impactors and control units
10. Climet laser particle counter
11. Partisol sequential aerosol sampler
12. Staplex cyclone impactor
13. Respicon 3-stage impactors
14. Single-stage impactors
15. Ceilometer
16. MFRSR
17. Broadband pyranometer
18. Pyrgeometer
19. TSI SMPS
20. TSI APS
21. Thermo Ozone monitor
22. Thermo Carbon Monoxide monitor
23. Thermo Sulfur Dioxide monitor
24. Thermo VOC monitor
25. Thermo NOx monitor
26. Assorted pumps
27. Tethered sonde

5) NESDIS/NCAS equipment

1. Vaisala RS41 rawinsondes
2. 200 g balloons

6) NESDIS/NCAS general laboratory requirements

Site: Main Laboratory: 24-30 feet of contiguous lab space (tables), storage cabinets, and bench top – roughly 5-6 tables and seating for 9-10 persons
Bio-Lab: 6-ft of bench top space and storage, access to and space in the fume hood
Hydro-Lab bench space for sounding system setup
Hazmat locker: Modest chemical stores
Radiosonde and ozonesonde launches from fantail and hangar; clearance for balloon launches from the starboard and port quarters
Freezer: 2-3 feet of space requested in the freezer

7) NOAA/ESRL equipment

see Appendix D

8) RSMAS equipment

see Appendix F

8) P18 equipment

Three 20' vans to be moved forward to the 02 Level after P18
P18 equipment will primarily remain the bio-lab, freezers, forward science stores, and in the three 20' vans.

Appendix C: AOML equipment

CTD packages	2	about 2200 lb
CTD sensors	6 sets	about 60 lb
CTD comp/tool chests	2	about 150 lb
laptops	4	about 40 lb
Computer monitor	1	about 10 lb
UPS	1	about 20 lb
LADCP	3	about 150 lb
altimeter	2	about 20 lb
SB32 carousels	3	about x lb
SBE parts box	1	about x lb
electric supply box	1	about 25 lb
deck unit SB11	1	about x lb
ADCP battery packs	1	about 180 lb
Niskin/salt supply box	1	about 20 lb

Oxygen equipment:

sample bottles	10 boxes	about 50 lb
analysis system	1	about 50 lb
reagents	see Appendix A	about 100 lb

Salinity equipment:

standard water	84	about 70 lb
autosals	2	about 300 lb
autosal interface	2	about 10 lb
autosal pumps	3	about 10 lb
backup AC unit	1	about 50 lb

Surface drifters	16	about 750 lb

(often staged in forward science stores; can be removed from boxes)

XBTs	6 boxes	about 240 lb
XBT backup system	1	about 35 lb

(usually stored in wet lab, but can be stored wherever there is room, such as forward science stores)

Science party luggage		about 200 lb

Argo floats	8	about 480 lb

(often staged in forward science stores, but must remain in boxes; can be moved to main lab after P18 cruise)

Appendix D: NOAA/ESRL Equipment (PNE/AEROSE 2017)

Earth Systems Research Laboratory

Physical Science Division

Weather and Climate Physics Branch

Daniel E. Wolfe, Chris Fairall, Sergio Pezoa, and Ludovic Bariteau

NOAA Earth System Research Laboratory

Boulder, CO USA

Background on Measurement Systems

The Physical Science Division (PSD) air-sea flux and cloud group conducts measurements of fluxes and near-surface bulk meteorology during field programs on *Ronald H. Brown* (RHB).

The air-sea flux system consists of six components:

(1) A fast turbulence system with ship motion corrections mounted on the jack staff. The jack staff sensors are: GILL Sonic anemometer, Fast Ozone Sensor's inlet, LiCor LI-7500 fast CO_2/hygrometer, and a Systron-Donner motion-pak.

(2) A mean T/RH sensor in an aspirator on the jack staff.

(3) Solar and IR radiometers (Eppley pyranometers and pyrgeometers) mounted on the railing on the 03 deck starboard side.

(4) A near surface sea surface temperature sensor consisting of a floating thermistor deployed off port side with outrigger (Sea Snake).

(5) A Riegl laser rangefinder wave gauge mounted on the jack staff.

(6) An optical rain gauge mounted on the jack staff. Slow mean data (T/RH, PIR/PSP, etc) are digitized on a Campbell 23x data logger and transmitted via a combination of RS-232 and wireless as 1-minute averages. A central data acquisition computer logs all sources of data via RS-232 digital transmission:

PSD/Flux operates the following remote system:

1. Vaisala CL31 cloud base ceilometer

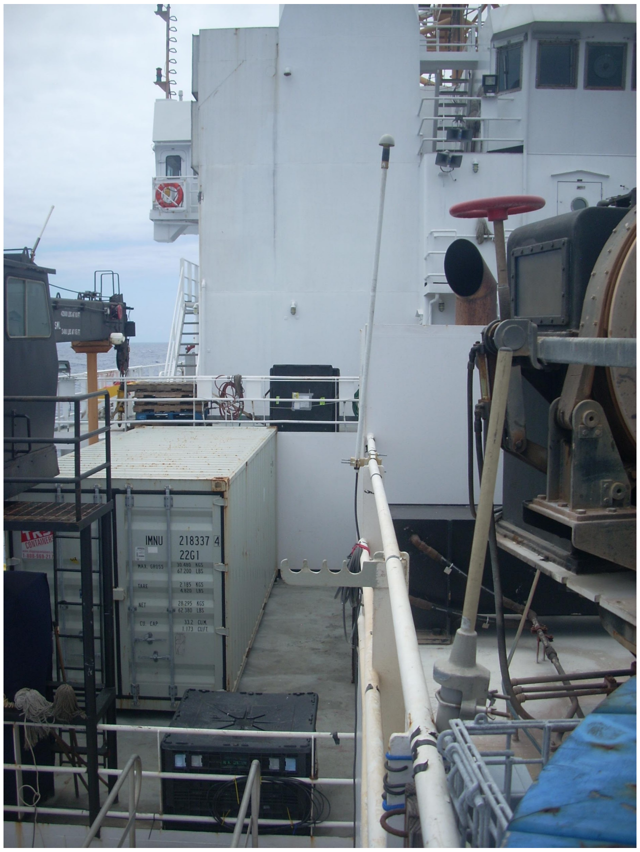
The ceilometer is a vertically pointing lidar that determines the height of cloud bottoms from time-of-flight of the backscatter return from the cloud. The time resolution is 30 seconds and the vertical resolution is 15 m.

ESRL is also the mentor for the weather balloon operations on board RHB. A Vaisala MW41 system is maintained by PSD and available to visiting scientists upon request. Expendables (balloons, radiosondes, helium, etc) are the responsibility of the person(s) requesting use of this system. This system can handle RS41 digital GPS radiosondes and ozonesondes.

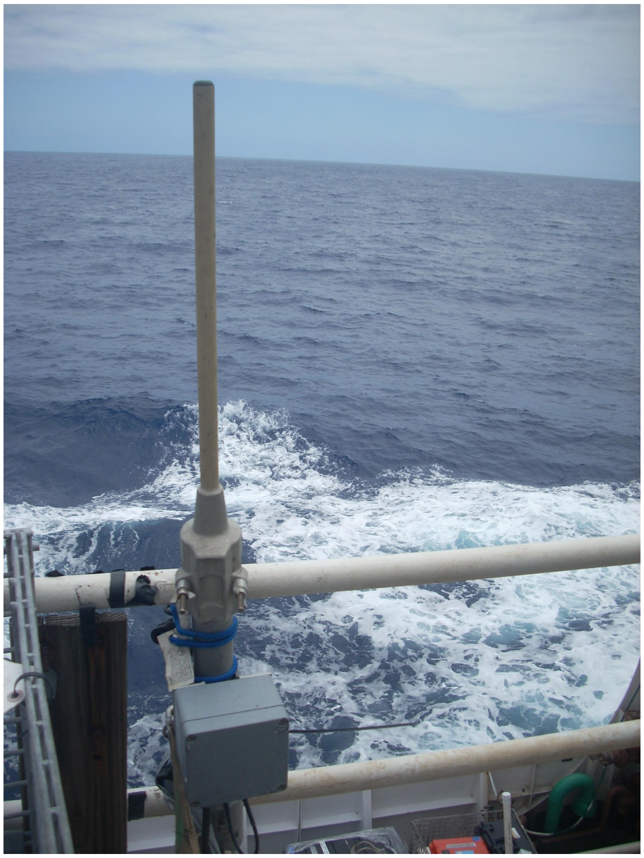
Instrumentation Set-up

The primary flux sensors are already mounted on the forward jack staff. Data cables run from the mast into the main lab. Three data loggers are mounted on the forward starboard side of the main lab. From these data-loggers cables are run into the Science Office forward of the main computer room. Two computers are setup in this lab and connected to the ship's internet. Power to the instruments is supplied by the AC connections at the bottom of the jack staff. A water hose is run from the O2 deck fresh water connection to the top of the jack staff for rinsing the LiCor sensor window. The sea surface temperature sensor (sea snake) is attached to a mounting arm located port-side O1 Deck.

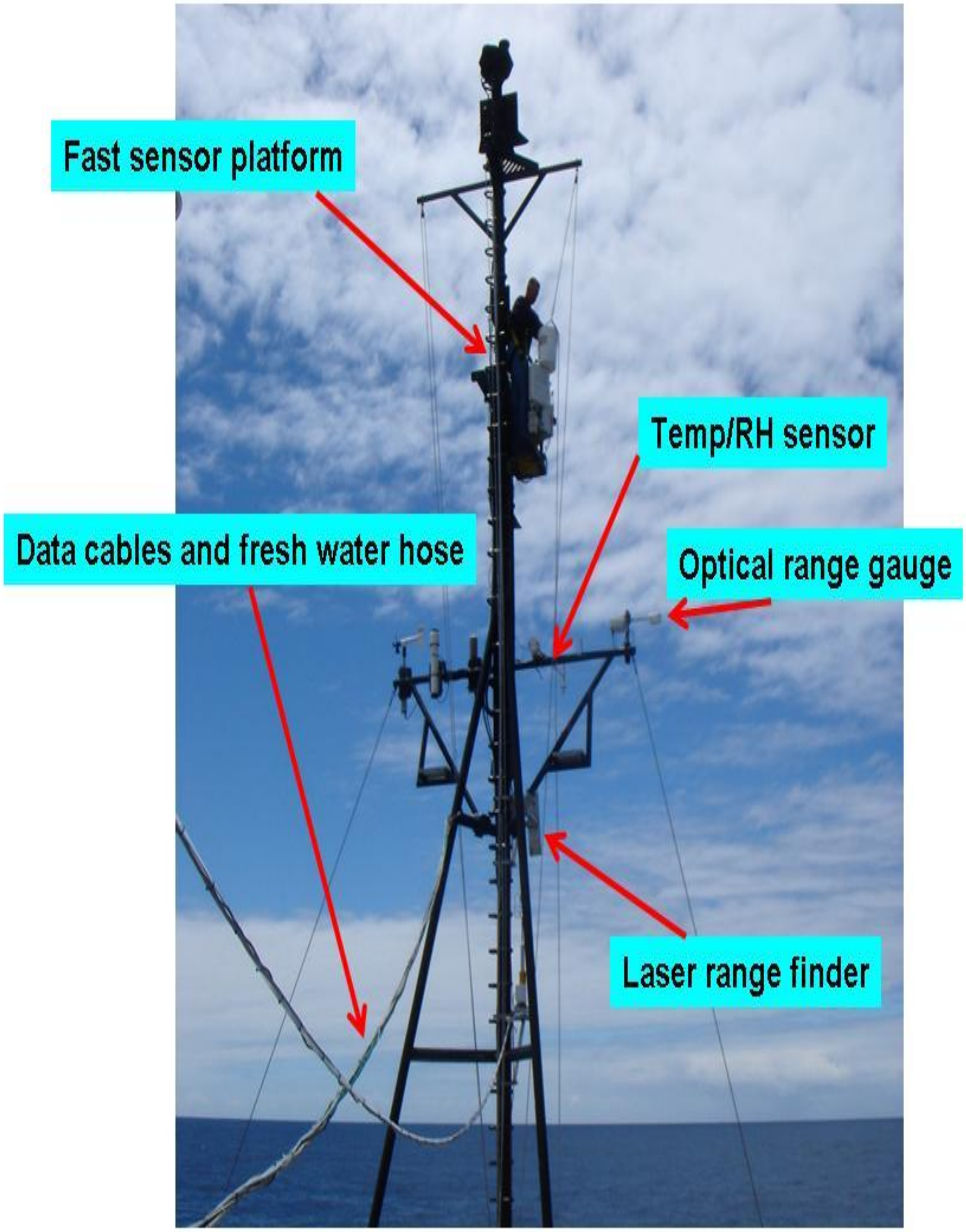
The new Vaisala balloon sounding system stored in Boulder will need to be deployed on the ship and will need to be tested.



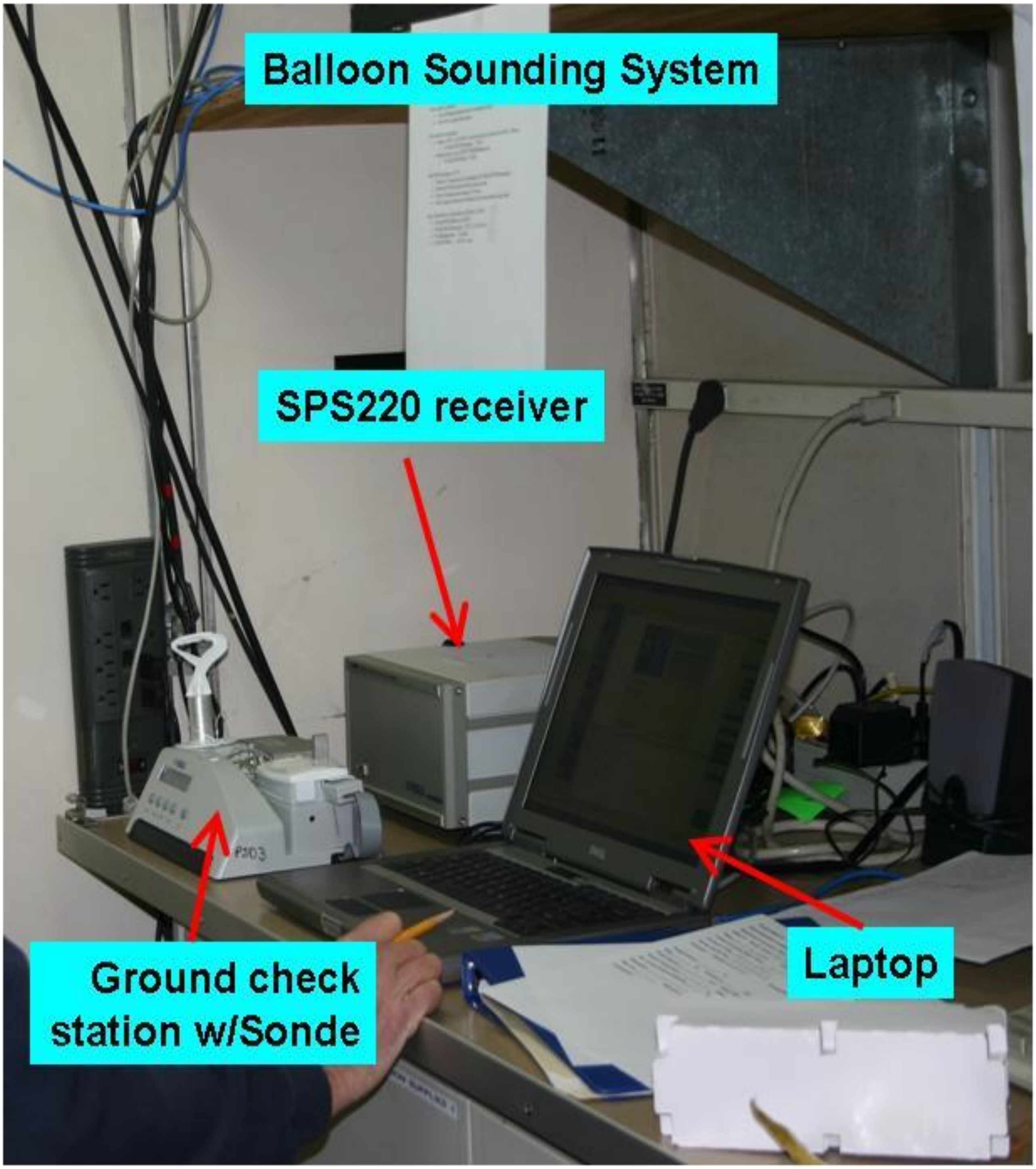
Sounding System GPS Antenna.


Sounding system 403 MHz Antenna.

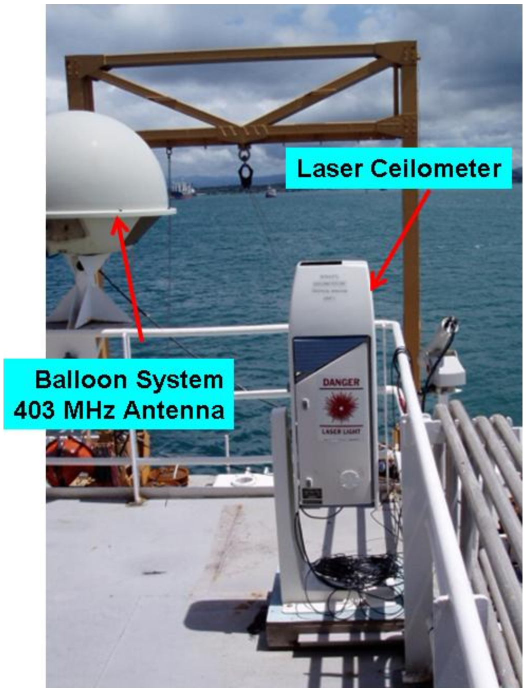
Data loggers in main computer room

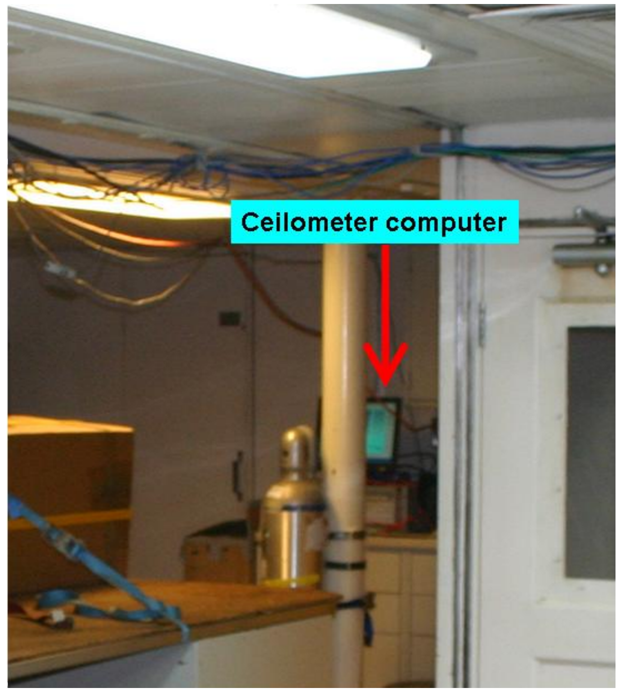


Forward Jack staff with PSD Flux sensors



ESRL older MW31 Vaisala sounding system in Hydrolab (receiving station). This system has been updgraded to the new Vaisala MW41 system.





Ceilometer on O2 Deck

Ceilometer PC in Hydro-Lab

Appendix E: NOAA/PMEL Equipment (PNE2017a)

Total weight:		**55,630 lb**
Anchors - 5980#	5	29900 lb
Buoy Toroids	4	6800 lb
Metal Buoy Towers	4	1200 lb
Buoy Bridles	4	1200 lb
Reels of Nylon Line – Unmarked	12	2400 lb
Reels of Nylon Line - Marked Every 50m	2	400 lb
Reels of Nylon Line - 50m Pieces	5	1000 lb
Nilspin wire rope	5	3500 lb
Nilspin wire rope, 3 x 300 meter lengths	2	800 lb
Empty Reels	0	00 lb
Reels of Nylon Line - Working Line	1	200 lb
Reel Stand (52"x48"x38")	2	40 lb
Anti- theft cages	2	40 lb
6 Lead weights	1	330 lb
Current meter stands	2	30 lb
Rolling Toolcart, tools	1	120 lb
Topsections cables	5	45 lb
Grey Hardware Tote (4'x4'x3')	1	1150 lb
Module Mounts	1	25 lb
Orange Electronics Toolbox (22"x18"x10")	1	65 lb
Nylon cutter	1	50 lb
White Plastic Box (36"x27"x17")	1	99 lb
4 current meters		
power supply		
comm. cable		
spiral wrap		
tool kit		
cables		
manual		
fins		
White Plastic Box (35"x27"x17")	1	133 lb
SBE37 Water Sensor		
SBE39 Water Sensor		
Aquadopp Water Current Meter		
Test loop cable and ground lug cable		
White Plastic Box (35"x27"x17")	1	101 lb
SBE37 Water Sensor		
SBE39 Water Sensor		
Aquadopp Water Current Meter		
Short Wave Radiation Sensor		
Long Wave Radiation Sensor		

Wind Sensor		
Air Temperature Sensor		
Baromater		
IM Test cable and ground lug cable		
Wooden Box (31"x14"x15")	1	80 lb
Paint (white, orange, black, antifouling)		
Acoustic Release Model 8242N	5	575 lb
Acoustic Release Deck Set Model 8011M	2	110 lb
Black plastic box (52"x22"14")	1	108 lb
Rain Sensors		
5 wind sensor aluminum masts		
6 Bird Spike covers		
ATLAS Temp, Conductivity Modules	6	330 lb
Grey Plastic Box (White Box) (32"x18"x16")	1	115 lb
Panasonic Laptop CF-29		
Dell laptop		
Alegro hand held		
HP Printer		
Telonics uplink receiver		
Fluke Multimeterc		
Fluke Mega ohm meter		
Cables, antennas, cables		
manuals, office supplies		
Cardboard Tube Box (64"x3.5"x3.5")	1	6 lb
TFLEX RF modem antennae		
Black plastic box (53"x22"x14")	1	100 lb
2 Gill Wind Sensor masts, 2 Rad masts		
2 Rain gauges SN		
2 Bird wire tops, SW Rad		
2 Micarta mast bases		
Black plastic box (44"x16"14")	5	435 lb
TFLEX Electronics Tube		
Sensor Cables		
Black plastic box (44"x16"14")	5	495 lb
TFLEX Battery #1		
Battery Cables		
Orange plastic box (32"x21"16")	2	142 lb
2 Seabird Inductive Modem boxes with test loops		
1 Seabird Inductive modem (not in box)		
2 SBE37SMP Com cables		
2 SBE37IM Internal Com cables		
2 SBE39 Internal Com cables		
2 TFLEX Com cables		
1 Spare Long IM test loop with clips		
9-pin Serial cable		

SBE Manuals & Sofware CD
3 Digi RF modems (2 Serial & 1 USB)
2 RF modemserial com cables & 1 USB cable
2 power supplies
2 small antennas
Digi Software CD
50' & 30' RF modem antenna cable
Base antenna
Bag of TFLEX dummy plugs
Organizer box of spare TFLEX hardware
USB to Serial Converter
Canvas bag of TFLEX tools
    2 of each: 3/8", 3/16", 7/16" nut drivers
    1-13/16" SBE39 wrench
    Nortek tool box & spares

Box of Kimwipes
Spare AA batteries (28) packed separately
9volt batteries (3)
Nortek com cable & DC power supply
ScotchKote, Silicone grease, Maglite flashlight.

Appendix F: RSMAS Equipment

Total weight: 1500 lb

Box 1 (48"x32"x28") Weight: 400 lb

MAERI UNIT A. UM DECAL# 0288732
MAERI BLACK BODIES
MAERI POWER SUPPLY
MEARI COMPUTER /ELECTRONICS BOX
MAERI MIRROR FRONT END (HEX)
MAERI SIGNAL CABLE
MAERI RAIN SENSORS
MAERI EXTERNAL MONITOR & KEYBOARD
MAERI PDU
MAERI SHOCKS
ETHERNET CABLES
NETWORK SWITCHES (4 AND 8 PORT)
POWER STRIPS
LAPTOP COMPUTERS (2)
WEATHER MODULE: VAISALA WEATHER TRANSMITTER SN: G3850008
POWER EXTENSION BOXM-AERI (optics, calibration units, and electronics).

Box 2 (31"x24"x24") Weight: 200 lb.

RADIOMETER EPPLEY PSP SN 31190F3
RADIOMETER EPPLEY PSP SN 34400F3
RADIOMETER EPPLEY PIR SN 31238F3
RADIOMETER EPPLEY PIR SN 34363F3
CORDLESS DRILL. DE Walt DCD780 SN 573751
SKY CAMERA
EMPTY NITROGEN TANKS
REGULATOR AND VALVE FOR NITROGEN TANKS
MAERI POWER CONDITIONER
MAERI MIRROR RINSE SYSTEM

Box 3 (48"x40"x41") Weight: 600 lb.

TOOLS BOXES
WEATHER PACK DATA LOGGER ZENO
RADIOMETERS GIMBALS AND WEIGHTS
MAERI TABLE BASE PLATE
MAERI BB ENCLOSURE
MAERI TABLE AND RAILING HARDWARE
WATER VAPOR RADIOMETER RAILING TABLE
MAERI A/C & A/C ENCLOSURE AND HOSES
HARD HAT SIGNAL CABLE AND SPARES
HARD HATS & ROPES

WEATHER PACK T FRAME
ELECTRIC EXTENSION CORDS
POWER EXTENSION BOX
ETHERNET CABLES
CABLE TIES
TIE DOWN STRAPS

Box 4 (42"x31"x28") Weight: 300 lb.

WATER VAPOR RADIOMETER (POWER AND SIGNAL CABLES)
WVR SPARE PARTS
WVR RAILING BRACKETS
MULTIMETER HP 34401A SN US36084133
UPS
LAPTOP COMPUTERS (2)
LEVEL

Locations of RSMAS equipment on the 02 deck.

Appendix G: Station Locations

Activity		Latitude			Longitude	
	Deg.	Minutes		Deg.	Minutes	
Montevideo, Uruguay	34	53.00	S	56	10.00	W
CTD 1 (test, deep cast)	18	51.60	S	34	40.80	W
CTD 2	5	0.00	S	23	0.00	W
CTD 3	4	30.00	S	23	0.00	W
CTD 4	4	0.00	S	23	0.00	W
CTD 5	3	30.00	S	23	0.00	W
CTD 6	3	0.00	S	23	0.00	W
CTD 7	2	30.00	S	23	0.00	W
CTD 8	2	0.00	S	23	0.00	W
CTD 9	1	45.00	S	23	0.00	W
CTD 10	1	30.00	S	23	0.00	W
CTD 11	1	15.00	S	23	0.00	W
CTD 12	1	0.00	S	23	0.00	W
CTD 13	0	45.00	S	23	0.00	W
CTD 14	0	30.00	S	23	0.00	W
CTD 15	0	15.00	S	23	0.00	W
CTD 16 (deep cast)	0	0.00	N	23	0.00	W
ATLAS repair	0	0.00	N	23	0.00	W
CTD 17	0	15.00	N	23	0.00	W
CTD 18	0	30.00	N	23	0.00	W
CTD 19	0	45.00	N	23	0.00	W
CTD 20	1	0.00	N	23	0.00	W
CTD 21	1	15.00	N	23	0.00	W
CTD 22	1	30.00	N	23	0.00	W
CTD 23	1	45.00	N	23	0.00	W
CTD 24	2	0.00	N	23	0.00	W
CTD 25	2	30.00	N	23	0.00	W
CTD 26	3	0.00	N	23	0.00	W
CTD 27	3	30.00	N	23	0.00	W
CTD 28	4	0.00	N	23	0.00	W
Buoy 1	4	0.00	N	23	0.00	W
CTD 29	4	30.00	N	23	0.00	W
CTD 30	5	0.00	N	23	0.00	W
CTD 31	5	30.00	N	23	0.00	W
CTD 32	6	0.00	N	23	0.00	W
CTD 33	6	30.00	N	23	0.00	W
CTD 34	7	0.00	N	23	0.00	W
CTD 35	7	30.00	N	23	0.00	W
CTD 36	8	0.00	N	23	0.00	W
CTD 37	8	30.00	N	23	0.00	W

CTD 38	9	0.00	N	23	0.00	W
CTD 39	9	30.00	N	23	0.00	W
CTD 40	10	0.00	N	23	0.00	W
CTD 41	10	30.00	N	23	0.00	W
CTD 42	11	0.00	N	23	0.00	W
CTD 43	11	30.00	N	23	0.00	W
Buoy 2	11	30.00	N	23	0.00	W
CTD 44	12	0.00	N	23	0.00	W
CTD 45	12	30.00	N	23	0.00	W
CTD 46	13	0.00	N	23	0.00	W
CTD 47	13	30.00	N	23	0.00	W
CTD 48	14	0.00	N	23	0.00	W
CTD 49	14	30.00	N	23	0.00	W
CTD 50	15	0.00	N	23	0.00	W
CTD 51	15	30.00	N	23	0.00	W
CTD 52	16	0.00	N	23	0.00	W
CTD 53	16	30.00	N	23	0.00	W
CTD 54	17	0.00	N	23	0.00	W
CTD 55	17	30.00	N	23	0.00	W
CTD 56	18	0.00	N	23	0.00	W
CTD 57	18	30.00	N	23	0.00	W
CTD 58	19	0.00	N	23	0.00	W
CTD 59	19	30.00	N	23	0.00	W
CTD 60	20	0.00	N	23	0.00	W
CTD 61	20	30.00	N	23	0.00	W
Buoy 3	20	30.00	N	23	0.00	W
CTD 62	20	0.00	N	38	0.00	W
Buoy 4	20	0.00	N	38	0.00	W
Charleston	32	43.00	N	79	49.00	W