GO-SHIP A13.5 2020 CRUISE INSTRUCTIONS

Projec U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
anographic and Meteorological Laboratory
acker Causeway Miami FL 33149

Y 31, 2020

Platform: NOAA Ship *Ronald H. Brown*

Project Number: RB-20-02 (OMAO)

Project Title: GO-SHIP A13.5 2020

Project Dates: February 21, 2020 to May 2, 2020

Prepared by: ____________________ Dated: 01/30/2020
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Approved by: CORTINAS.JOHN.VICTOR.JR.1369422690 Digitally signed by CORTINAS.JOHN.VICTOR.JR.1369422690 Date: 2020.02.05 08:59:43 -05'00' Dated: ____________
Dr. John Cortinas
Director, AOML
NOAA/OAR/AOML

Approved by: ____________________ Dated: ____________
Captain David J. Zezula, NOAA
Commanding Officer
Marine Operations Center – Atlantic

I. Overview

A. Brief Summary and Project Period

This cruise will be part of a decadal series of repeat hydrography sections jointly funded by NOAA-CPO/OOMD and NSF-OCE as part of the GO-SHIP program (https://usgoship.ucsd.edu/). Academic institutions and NOAA research laboratories will participate. The program focuses on the need to monitor inventories of CO2, tracers, heat and freshwater and their transports in the ocean. Earlier programs under CLIVAR, WOCE and JGOFS have provided a baseline observational field for these parameters. The new measurements reveal much about the changing patterns on decadal scales. The program serves as a backbone to assess changes in the ocean's biogeochemical cycle in response to natural and/or man-induced activity. Global changes in the ocean's transport of heat and freshwater, which can have significant impact on climate, can be followed through these long-term measurements. The GO-SHIP Program provides a robust observational framework to monitor these long-term trends. The goal of the effort is to occupy a set of hydrographic transects with full water column measurements over the global ocean to study physical and hydrographic changes over time. These measurements are in support of:

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

This program follows the invasion of anthropogenic CO2, CFCs and other tracers into intermediate and deep water on decadal timescales and determines the variability of the inorganic carbon system, and its relationship to biological and physical processes. More details on the program can be found at the website referenced above.

Full water column CTD/rosette casts will be made along the cruise track (nominally along the prime meridian from 54˚S to 5˚N) with stations at approximately 30-mile spacing. In the equatorial region from 3˚S to 3˚N spacing will decrease to 20 miles to capture the smaller spatial scales of variability in the region. Ten Argo profiling CTD floats, seven SOCCOM BGC-Argo, and 23 drifters will be deployed along the section. Near surface seawater (temperature, salinity, pCO2, ADCP) and atmospheric measurements (CO2, and CFCs) will be made. Surface seawater from the seawater line will be collected throughout the cruise to conduct phytoplankton studies.

The operations on this cruise will be similar to those on previous GO-SHIP cruises completed on NOAA Ship Ronald H. Brown, including cruises RB-13-04, RB-13-07, RB-15-03, RB-16-06 and RB-18-03. On this cruise we will use a 24 position rosette as our primary sampling package.

On the transit leg from Barbados - Cape Town, CO_2 near surface seawater (temperature, salinity, pCO_2) measurements will be taken from the scientific seawater line and the hull mounted ACDP will provide measurement of currents. Discrete seawater samples will be collected from the ship's seawater line for CO_2, nutrients and oxygen analysis. Atmospheric balloons, and Argo profiling CTD floats will be deployed on the transit as well.

The transit leg will take place from February 21 2020 to March 11 2020, and the main scientific leg executing GO-SHIP line A13.5 will take place from March 19 2020 to May 2 2020 (see also, https://www.aoml.noaa.gov/ocd/gcc/A13.5_2020/)

B. Days at Sea (DAS)

Of the 65 DAS scheduled for this project, 65 DAS are funded by an OMAO allocation to the Ocean Observations and Monitoring Division of the Climate Program Office of OAR. This project is estimated to exhibit a high Operational Tempo. The transit leg will involve 20 DAS and the A13.5 occupation is slated for 45 DAS.

C. Operating Area (include optional map/figure showing op area)

The operating area is in the South Atlantic Ocean, with a schematic of the cruise track shown in Figure 1. The cruise is comprised of two legs, a transit leg and a scientific leg. The transit from Barbados en route to Cape Town will occur from February 21, 2020 to March 11, 2020. The most direct route will be taken that accommodates the deployment of Argo floats in under-sampled areas. The A13.5 leg (19 March-2 May 2020) will focus on completing a long meridional section through the Eastern part of the South Atlantic, nominally along the prime meridian from 54˚S to 5˚N (See Figure 1).

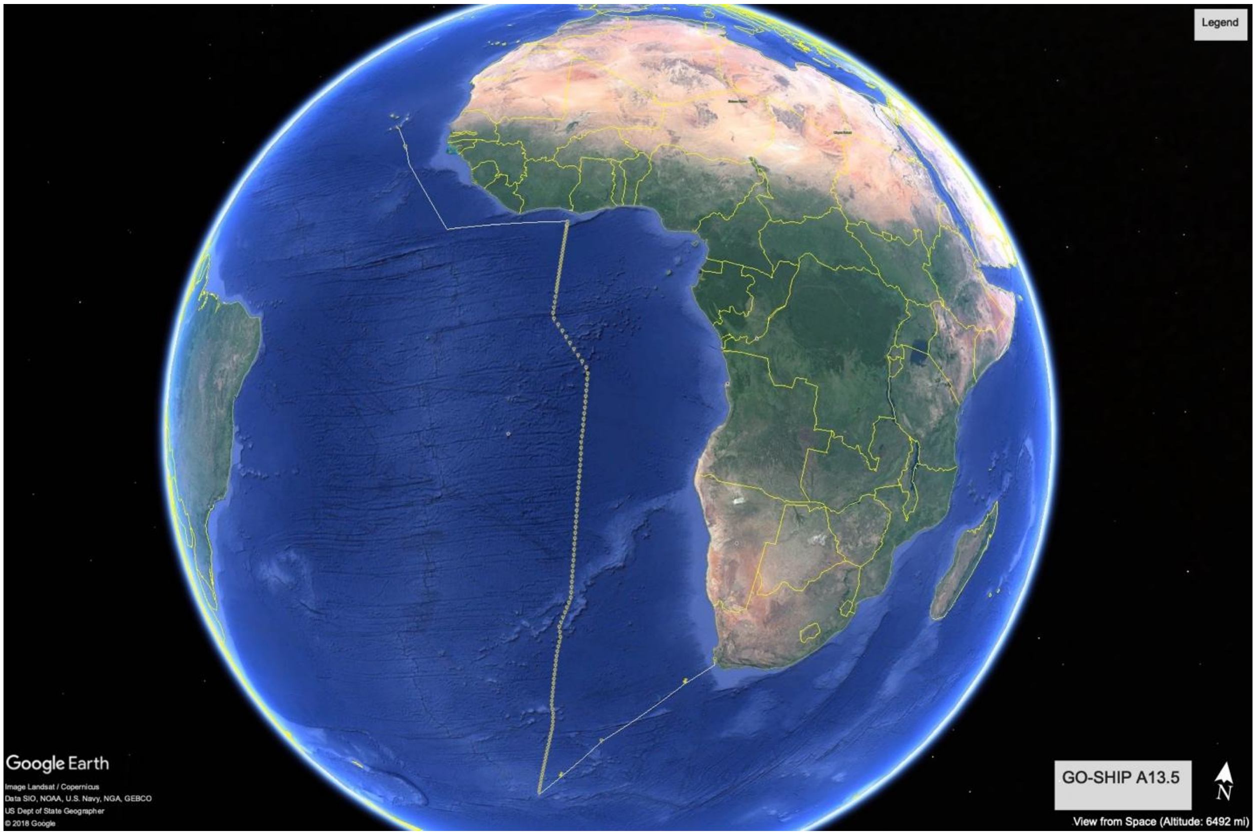

Figure 1: Cartoon of cruise track. The ship will depart Cape Town, South Africa and end in Praia, Cabo Verde. The cruise will take 45 days.

The GO-SHIP A13.5 leg will be executed under challenging conditions. It will run under MARSEC level 2 requirements which decreases the scientific berthing from 30 to 28, a decrease of 2 scientists such that an extra 2 able bodied seamen in deck department can sail to perform the additional underway sea watches under MARSEC 2. The decrease of scientific berthing has meant that berthing request for two scheduled projects had to be curtailed. The cruise to the Southern Ocean will occur at the edge of the weather window for scientific over the side operations due to time critical nature of the preceding ATOMIC cruise. The end port, Takoradi, Ghana that was used in 2010 was changed to Praia Cape Verde by OMAO. The area of operation, anticipated weather and seas, and duration of the cruise will require utmost dedication of all to complete the ambitious effort.

D. Summary of Objectives

Two main scientific activities are proposed for the 22-day transit of the National Oceanic and Atmospheric Administration (NOAA) ship, the *Ronald H. Brown,* from Bridgetown, Barbados to Cape Town, South Africa. This transect extends through the tropical North Atlantic Ocean across the equator and into the South Atlantic Ocean. We propose (1) to collect spatially and size-resolved aerobiological filter samples in the marine boundary layer and (2) to launch dedicated radiosondes (and a limited number of ozonesondes - if resources are available) along this transit. These capabilities are a subset of the comprehensive suite of observations that the AEROSE cruises collects during the joint PNE/AEROSE missions which are designed to characterize dust and biomass burning air masses originating from West Africa and traveling across the tropical Atlantic Ocean. The PNE/AEROSE cruises have been conducted nearly annually since 2006. In addition to this, underway seawater samples will be collected regularly to measure inorganic carbon, pH, alkalinity, nutrients and oxygen.

The transit region is severely under-sampled with respect to *in situ* and profiling measurements that correspond to space-borne sensor retrievals. Thus, the transit offers a prime opportunity to collect profiling observations in the remote tropics and southern hemisphere Atlantic Ocean that can be used to validate satellite observations and verify numerical models. The AEROSE team proposes to launch radiosondes on a 2-per-day schedule to coincide with specific low-earth orbit satellite overpasses and atmospheric phenomena targets of opportunity (e.g. heavy biomass burning outflows, volcanic eruptions, dust outbreaks). Previous AEROSE observations have been employed for improvement of the retrievals for several space-based sensors and to provide correlative data necessary for validation of environmental data records (EDRs) derived from the Joint Polar Satellite System (JPSS) SNPP and NOAA-20 NOAA Unique Combined Atmospheric Processing System (NUCAPS) satellites (), as well as the Geostationary Operational Environmental Satellite R series (GOES-R). The payload will require the Vaisala RS41 radiosondes, ozonesondes, balloons, a ground station and antenna for the radiosonde launches, parachutes for the larger payloads, helium gas cylinders, accessories for the launches, and chemical reagents (e.g., salt solution, peroxide) for ozonesonde preparation.

Both of these endeavors will add value to the public investment in space-based earth observation systems, more fully subscribe the *Ronald H. Brown*, and act to maximize benefits from this platform's time at sea. A team of six individuals will be deployed to execute this mission. We anticipate that we will be fully operational for 80% of the days at sea (17 days) which would require a minimum of 34-200-g balloons and 34-RS41 radiosondes; note that doubling this number would enable 4/day launches that could also coincide with overpasses of the EUMETSAT Metop-C, but 2/day would suffice for the NOAA-20 overpasses. Gas requirements for launching 34 radiosondes is approximately 7 Helium cylinders. If 4-5 ozonesondes are also launched over this time period, the cylinder requirement would increase by two.

The GO-SHIP A13.5 2020 cruise is the third comprehensive survey of inorganic carbon, nutrients and other biogeochemical parameters along the WOCE A13.5 transect in the South Atlantic. The section repeats part of the Ajax cruise occupied by the R/V KNORR in 1983/1984 and the CLIVAR A13.5 cruise occupied by the NOAA ship *Ronald H. Brown* in 2010. The upcoming cruise will yield a comprehensive snapshot of changes in anthropogenic CO_2 and tracer inventories and hydrographic changes in the region over the past 35 years. Full water column CTD stations will be occupied at 30 nautical mile intervals or closer and include collecting water samples from Niskin bottles for a variety of physical, chemical and biological parameters.

During the transit from Cape Town to the start of the A13.5 line, a few brief (~1-2 hour each) or full depth test casts may be performed to check the CTD/rosette package and collect water samples for instrument testing. These tests will involve stopping the ship and lowering the package into the water. The locations of these tests will be chosen once the analytical gear is running, and in consultation with the ship's captain. A number of drifters and floats will be deployed during the main transect. Deployment will be coordinated so it happens at a location where a CTD cast is being conducted usually when the ship is leaving station. Drifters will also be deployed while in transit between stations without need to stop the ship.

E. Participating Institutions

AOML	NOAA - Atlantic Oceanographic and Meteorological Laboratory
CIMAS	Cooperative Institute for Marine and Atmospheric Studies, University of Miami
Howard	Howard University
JISAO	Joint Institute for the Study of Atmosphere and Ocean/University of Washington
LDEO	Lamont-Doherty Earth Observatory, Columbia University
MPIC	Max Planck Institute of Chemistry
NESDIS/STAR	NOAA - National Environmental Satellite, Data, and Information Service/ Center for Satellite Applications and Research
Oregon	Oregon State University
PMEL	NOAA - Pacific Marine Environmental Laboratory
Princeton	Princeton University
RSMAS	Rosentstiel School of Marine and Atmospheric Science/University of Miami
SIO	Scripps Institution of Oceanography, University of San Diego
TAMU	Texas A&M University
U Alaska	University of Alaska
U Del	University of Delaware
U Hawaii	University of Hawaii
U Maine	University of Maine
UC Irvin	University of California Irvine
UCSB	University of California Santa Barbara
WHOI	Woods Hole Oceanographic Institution

F. Personnel/Science Party: name, title, gender, affiliation, and nationality

Personnel on Transit Leg: (Barbados to Cape Town, South Africa)

Name (Last, First)	Title	Date Aboard	Date Disembark	Gender	Affiliation	Nationality
Dillard, Julian	Scientist	Feb 20	March 12	M	Howard University	US
Mears, Patrick	Acting Chief	Feb 20	Stays for	M	CIMAS/UM -	US

	Scientist		A13.5		AOML/NOAA	
Nalli, Nicholas	Scientist	Feb 20	March 12	M	NESDIS STAR	US
Sakai, Ricardo	Scientist	Feb 20	March 12	M	Howard University	US

Personnel on A13.5: (Cape Town, South Africa to Praia, Cabo Verde)

Name (Last, First)	Title/Function	Date Aboard	Date Disembark	Gender	Affiliation	Nationality
Barbero, Leticia	Chief Scientist, data manager, discrete pCO2	March 18	May 3	F	CIMAS/UM - AOML/NOAA	Spain
Becker, Susan	Nutrients	March 18	May 3	F	UCSD/SIO	USA
Chang, Bonnie	CFC/SF6	March 18	May 3	F	JISAO/UW - PMEL/NOAA	USA
Chomiak, Leah	ADCP/LADCP	March 18	May 3	F	CIMAS/UM - AOML/NOAA	USA
Collins, Andrew	DIC	March 18	May 3	M	JISAO/UW - PMEL/NOAA	USA
English, Chance	DOC	March 18	May 3	M	UCSB	USA
Featherstone, Charles	DIC	March 18	May 3	M	AOML/NOAA	USA
Garcia, Nathan	Genomics	March 18	May 3	M	UC Irvine	USA
Hooper, James	Salinity	March 18	May 3	M	CIMAS/UM - AOML/NOAA	USA
Huang, Fen	Alkalinity/pH	March 18	May 3	F	RSMAS/UM	China (Green card)
Huse, Megan	Dissolved O2	March 18	May 3	F	RSMAS/UM	USA
Hussein, Najid	13C/DIC	March 18	May 3	M	UDel	USA
Lanpher, Kaycie	Alkalinity/pH	March 18	May 3	F	RSMAS/UM	USA
Martin, Molly	CTD watch-stander	March 18	May 3	F	UCSD	USA
McTaggart, Kristy	CTD Processing	March 18	May 3	F	PMEL/NOAA	USA
Mears, Patrick	Discrete pCO2, UW pCO2	March 18	May 3	M	CIMAS/UM - AOML/NOAA	USA
Mejias, Carla	CFC/SF6	March 18	May 3	F	UPR	USA
Norton, Emily	CFC/SF6	March 18	May 3	F	UW	USA
O'Daly, Stephanie	UVP	March 18	May 3	F	U. Alaska	USA
Pontes, Emma	Dissolved O2	March 18	May 3	F	RSMAS/UM	USA
Prend, Channing	CTD watch-stander/SOCCOM	March 18	May 3	M	UCSD/SIO	USA
Rodriguez, Carmen	Alkalinity/pH	March 18	May 3	F	RSMAS/UM	USA
Schatzman, Courtney	Co-Chief Scientist, data manager	March 18	May 3	F	UCSD/SIO	USA
Siddiqui, Ali Hasan	CTD watch-stander	March 18	May 3	M	JHU	India
Smith, Ian	Nutrients	March 18	May 3	M	CIMAS/UM - AOML/NOAA	USA
Stefanick, Andrew	Salinity	March 18	May 3	M	AOML/NOAA	USA

Su, Jianzhong	13D/DIC	March 18	May 3	M	UDel	China
Ortiz, Albert	Alkalinity/pH	March 18	May 3	M	RSMAS/UM	USA

G. Administrative

1. Points of Contact:

Chief Scientist: Dr. Leticia Barbero

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2. Diplomatic Clearances (MSR-EEZ clearances)

This project involves Marine Scientific Research in waters under the jurisdiction of Barbados, South Africa, Norway, Ghana, Liberia, Cote d'Ivoire and Cabo

Verde. Diplomatic clearance has been requested using the RATS submission procedures with Wendy Bradfield Smith as NOAA OMAO liaison. As of Feb. 2, 2020 consent has been received from Cabo Verde. Consent from Barbados, South Africa, Norway, Ghana, Liberia, and Cote d'Ivoire is pending.

3. Licenses and Permits

None Required.

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:

NOAA Ship *Ronald H. Brown* (RHB) will depart Bridgetown, Barbados on February 21, 2020 for a transit to Cape Town, South Africa with a scheduled arrival of March 11, 2020. During the transit 8 Argo floats will be released while the ship is underway. Please see table 1 below for approximate deployment locations. One Deep Argo Float will be deployed approximately between the equator and 1S on 35W that requires special attention (see below). A number of atmospheric weather balloons will be released. The systems to measure physical (TSG) and chemical parameters (pCO_2) from the underway sampling line, and the ship's ADCP and SCS system will be operational. Periodic water samples will be taken from the underway sampling line during the voyage. We request partial support from the survey tech department to assist with underwater sampling while the acting chief scientist is sleeping. Training will be provided. No slowdown for scientific operations is anticipated during the transit with the exception of the Deep Argo Float deployment which will require slowing the ship to under 2 knots. Deployment of the Deep Float will require use of the crane or A-frame to ensure float is deployed away from the ship. A technician will fly to Bridgetown to provide the necessary training to the crew. The float weighs 70 lbs in air and is made of glass so it is extremely fragile. Two ship personnel are required to maneuver the float on deck.

NOAA Ship *Ronald H. Brown* (RHB) will depart Cape Town, South Africa on March 19, 2020, to begin scientific operations. The primary goals of the cruise are to sample along a previously occupied hydrographic section according to specifications of GO-SHIP http://www.go-ship.org/ All attempts will be made to reoccupy the CTD stations as closely as possible (see station listing below and appendix). The actual hydrographic stations sampling plan may deviate from this proposed plan in both number of stations and their locations.

The cruise will proceed from Cape Town to the start of the line at 54 ˚S, 0 ˚E/˚W, performing one or more test CTD casts en route. The exact location of the test station(s) will be determined in consultation with the Commanding Officer. We will then begin the CTD section along the prime meridian working from south to north. Upon completion of the CTD section at nominally 5 degrees N, or as close to that as possible, we will start our transit into port in Praia, Cabo Verde. All underway systems (TSG, pCO2, ADCP, SCS) will remain operational until arrival in port. Discrete underway water samples will be collected during a portion of the transit. Seven SOCCOM floats (BGC-Argo) will be deployed in the southern portion of the hydrographic line. The deployments will take place at CTD stations, so no additional ship time will be required. Ten Argo floats will also be deployed in coordination with CTD stations. See Appendix D for preliminary locations of float deployment. 23 drifters will also be deployed along the route (preliminary locations still to be determined by drifter program lead scientist). Figure 2 shows the draft location of Argo and SOCCOM float deployments during the transit leg and A13.5 cruise.

We require that the ship suspend pumping and dumping for the duration of each CTD cast while the ship is on station. In extenuating circumstance it should be suspended at minimum, the last 500m of the CTD upcasts. The ship should also suspend any operations (eg incineration, paint chipping, deck washing, etc.) while on station if these activities lead to release quantities of material into the surface water in the area where the rosette is recovered. Smoking is prohibited in and near the CTD hanger at all times.

A map of the A13.5 cruise track is shown in Figure 1.

Float type	Latitude	Longitude
Core Argo	11° 0'N	56° 0'W
Core Argo	10° 0'N	54° 0'W
Core Argo	9° 0'N	52° 0'W
Core Argo	7° 20'N	49° 0'W
Core Argo	5° 40'N	46° 0'W
Core Argo	0° 0'S	36° 0'W
Core Argo	16° 8'S	11° 0'W
Core Argo	19° 50'S	5° 0'W

Table 1. Approximate location for Argo float deployments during the transit leg (no need to slow down ship).

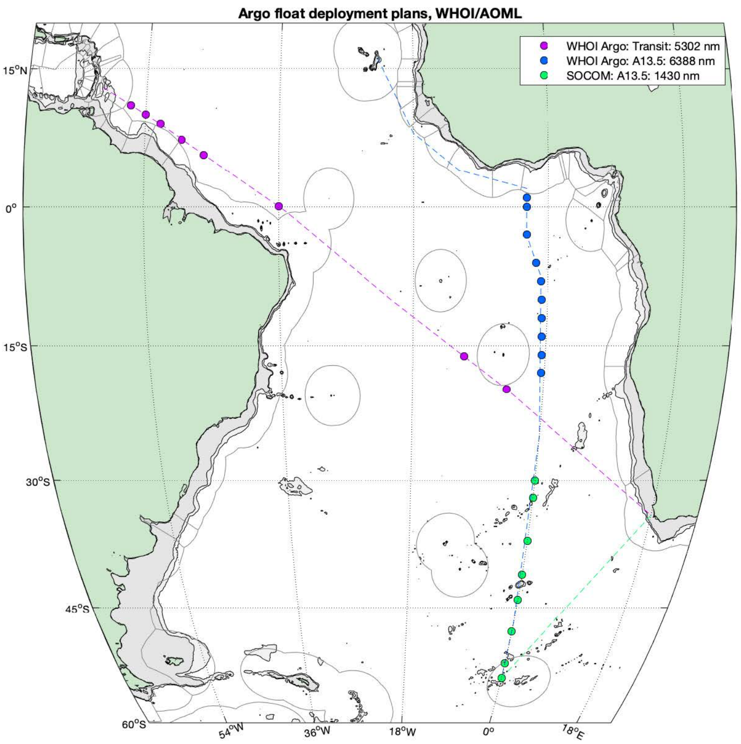

Figure 2. Location of Argo (blue circles) and SOCCOM float (green circles) deployments.

B. Staging and Destaging:

Staging of part of the equipment for the cruise was conducted in Charleston, SC in December, 2019 in consultation with ship and with the chief scientists of preceding and following cruises. One twenty-foot shipping container with equipment and an additional CTD frame was loaded on the ship. All chemicals were accompanied by MSDS. All chemicals, except compressed gases and those packaged according to DOT regulations in the shipping/laboratory containers, were stored in the HazMat locker. A list of equipment and chemicals brought aboard was provided to the ship's Field Operations Officer. Two additional twenty-foot laboratory containers will be loaded in Barbados prior to the transit to Cape Town. See Appendix B for container details. Several Argo floats and drifters will also be loaded in Barbados. Some of the drifters will remain on board after GO-SHIP A13.5, to be deployed during the following cruise, PNE.

The remaining equipment will be loaded in Cape Town prior to departure.

Copies of equipment lists, including country of origin will be supplied to the CO and Chief Scientist prior to the departure of the ship from Cape Town. It is the responsibility of each group of investigators to arrange for shipping their equipment to and from *Ronald H. Brown*, including setting up contract with agent, preparing all necessary customs or export/import documentation, and transfers to the ship.

The science party that will participate on the transit will meet the ship in Bridgetown, Barbados and will move aboard the night before departure, on February 20, 2020. Patrick Mears, who will be acting chief scientist for the transit, will remain for GO-SIP A13.5. The rest of the science party for A13.5 will meet the ship in Cape Town and will plan to move aboard on the night before sailing on March 18, 2020. We understand the galley may not be available for science party meals before sailing. Loading by science party and setup will occur throughout the in-port. We will require the assistance of the shipboard ET and Survey Technician(s) and other shipboard personnel for 8 hours on three-days prior to sailing and connect ship power to the laboratory vans, to install computer systems, and to make terminations for the CTD as well as to aid in the setup of other science equipment.

Destaging of several empty gas cylinders from the transit to Cape Town will require several hours in Cape Town. The ship's crane might be necessary. After A13.5, minor destaging of scientific equipment will be necessary in Praia, Cabo Verde, requiring the ship's crane. If the containers need to be repositioned, a shoreside crane will be required in Cabo Verde. The bulk of the scientific gear will be packed up on board. Some scientific gear from the A13.5 cruise, including the CTD/rosette system, will be used on the following PNE cruise.

Full de-staging will occur when the ship returns to the US (anticipated de-staging port is San Diego, CA). All scientific equipment and remaining chemicals will be offloaded at that time except for two 20 foot laboratory containers (the "DICE van", and the "CFCs van"), which will remain on board to be used during the WCOA cruise, and will be offloaded in Seattle, WA. Storage of equipment and vans on *Ronald H. Brown* during PNE and WCOA will occur in consultation and permission with chief scientists of PNE and WCOA and the Commanding Officer.

C. Operations to be Conducted:

a) During the transit:

Atmospheric Profiling (Radiosonde and Ozonesonde Deployments)

The AEROSE team proposes to launch a minimum of two (2) radiosondes per day. Each radiosonde launch will be scheduled to coincide with a specific low-earth orbit satellite overpass for (NOAA) GOES-R or for (EUMETSAT) Met-Op depending on the location of the ship. The overpass times will be calculated based on the average speed of the ship, the sea state and any other relevant phenomena (e.g. ship performance, synoptic conditions). The launch times vary with latitude but are roughly 12 hours apart and we anticipate they will usually fall between the hours of 1100 – 1500 and 2300 – 0200 GMT daily based on the anticipated cruise track.

Additional "gap" sondes may be launched between the scheduled soundings depending on observations of opportunity; e.g. stratospheric intrusion events, extreme biomass burning events, continental outflows of aerosols. Our estimate of the total number of launches (44) is based on an estimate of two soundings per day for the seventeen days at sea outside of any EEZs and up to ten "gap" sondes. In addition to the regular radiosondes, up to ten ozonesondes may be launched. The ozonesondes are devices that enable the measurement of ozone concentrations as a function of altitude along with the standard (temperature, relative humidity, pressure, wind speed/direction) meteorological measurements derived from the radiosondes.

Each normal radiosonde launch will take about 10 minutes to deploy from preparation of the sounding to release of the balloon. The balloons are typically released from the fantail center deck or off of the aft starboard rail. A team of two scientists is normally sufficient for these operations. In the event of high relative winds on the fantail, a request for reduction in ship speed or a change in heading to null the winds will be made. This reduction in speed or change in heading should not exceed five minutes total under normal conditions. In the event that the fantail is fully occupied with equipment, it is possible to both fill the balloons and launch the sondes from the winch deck. Similar precautions based on wind will be followed to ensure successful deployment in this location.

In the event of an ozonesonde deployment, both preparation times (~30 minutes) and deployment times (~20 minutes) are longer due to the requirements for stabilizing the response of the electrochemical cell and the filling of a much larger balloon (1200 to 1400-g balloons versus a 200-g balloon). As the larger balloon can be more unwieldy under high wind conditions a team of 4-5 scientists is usually required for successful deployment. The ozonesondes can be launched from either position (as described above) but it is strongly preferred to launch them from the fantail. It is estimated that a maximum of approximately half an hour will be required for each ozonesonde deployment. \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 of the fantail.

Air Filter Sampling – Aerobiological Sampling

The aerobiological sampling will complement an ongoing study investigating the atmospheric microbiome over the remote tropical oceans. Two samplers will be employed. The first will be a Staplex two-stage microbial sampler that will collect three filters per day at size cuts of 2.1 microns, 1.1 microns, and 0.62 microns on pre-sterilized 47-mm, quartz fiber filters. The second instrument will be an aqueous microbial sampler that collects total suspended particulate by drawing an ambient air stream into a milliQ water reservoir. All samples will be placed in cold storage until arrival in Cape Town and then transferred under vacuum to a lab for DNA extraction, genomic analysis and/or molecular analysis. The associated payload will require a small autoclave, a small refrigerator, the two samplers, sampling accessories, and chemical reagents (MilliQ water, dilute cleaning solutions of hydrogen peroxide and ethyl alcohol).

Sampling inlets will be deployed daily from an intake line affixed to the forward mast and a shorter intake affixed on the forward 03 deck. It is critical that smoking of cigarettes and cigars be conducted downwind of the sample intakes and in no events adjacent to these sensitive devices for the sake of sample integrity. Samplers will be cleaned and prepared in the biolab under the fume hood.

In addition to this, we request: Continuous recording of ship mounted ADCP data, Thermosalinograph (TSG), underway pCO2.

b) On A13.5:

1. CTD profiles of depth along hydrographic transects. Approximately 129 stations will be completed to full water depth, with an estimated maximum of 5714 meters.
2. Water samples collected in rosette bottles for comparison with the CTD profiles.
3. Profiles of northward and eastward velocity from the LADCP.
4. Salinity of the water samples collected with the bottles.
5. Dissolved oxygen, nutrients, in the water samples collected with the bottles.

6. Trace gases (chlorofluorocarbons, sulfur hexafluoride) in the water samples collected with the bottles.
7. Continuous recording of ship mounted ADCP data.
8. Heading data from both the MAHRS gyro system and the Seapath GPS system for correction and processing of shipboard ADCP data.
8. Continuous recording of Thermosalinograph (TSG).
9. Continuous recording of Seabeam bathymetry requested (lead by ship Survey Dept.)
10. Nutrient concentrations of the water samples collected with the bottles.
11. Full carbon characterization (inorganic and organic carbon system parameters and isotopes) of the water samples collected with the bottles.
12. Deployment of 7 BGC-Argo floats (SOCCOM)
13. Deployment of Argo floats during the transit leg and on A13.5
14. Deployment of 23 drifters

These activities will be performed by the science party, with assistance of ships survey for items 1, 7, 8,9, 12, 13 and 14

D. Dive Plan

Dives are not planned for this project

E. Applicable Restrictions

Conditions which preclude normal operations:

For the transit: Extreme high seas and wind – in the event that the sea state precludes deck operations, balloon deployments will be suspended. Otherwise, unless there is an instrument malfunction, we expect to be able to deploy the soundings. We note that this team has experience deploying soundings under fairly rough conditions.

Aerobiological sampling will not be conducted under rainy conditions or conditions of high sea spray.

For A13.5: CTD/Rosette deployments will be curtailed if weather conditions are such to create unsafe operating conditions. Decisions will be made by the command on a case by case basis after consultation between the ship's crew and captain and the chief scientist. The primary consideration is the safety of the ship's crew and scientists. Possible mitigation strategies include waiting until conditions improve. 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.

There shall be no smoking, no painting, and no use of solvents in the area near the equilibrators and other underway analysis equipment, or near the Niskin bottles (in the staging bay) at any time during the cruise.

III. Equipment

A. Equipment and Capabilities provided by the ship (itemized)

The following communications devices are currently on board the *Ronald H. Brown* and are expected to be in working order. The chief scientist should be apprised at earliest possibility of malfunction or poor function of equipment.

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

The electronic instrumentation used for navigation includes:

5. Trimble Centurion P-code GPS
6. Magnavox MX-200 GPS
7. Northstar 941x differential GPS
8. Sperry Mark 37 Gyro Compass
9. Furuno navigational radar
10. KongsbergDynamic Positioning System
11. Raytheon model DSN-450 Doppler Speed/distance log
    13. NAVTEX receiving and printing the international automated medium frequency (518 KHz) weather warnings
    14. Weather maps: Medium frequency/high frequency

Scientific Equipment requested from the Ship to be in full operational condition with calibration data on file and supplied with the data at the end of the cruise:

1. Echo Sounder (Ocean Data Equipment Corporation (ODEC) Bathy 2010 or the Knudesen system) used in12 kHz mode (to track CTD package to within 10 meters of the bottom) to be used while on CTD station.
2. Continuous Kongsberg EM-122 Multibeam (12 kHz) swath bathymetric sonar system sampling while underway between stations.
3. Barometer
4. WOCE IMET sensors
5. Hydrographic Winch system and readouts (using 0.322 conducting cable (at least 8000-m length for CTD operations).
6. One backup hydrographic winch system for CTD operations with at least 8000 m of 0.322 " cable.
7. Hull mounted acoustic Doppler current profiler (RD Instruments (RDI), 75 kHz Ocean Surveyor acoustic Doppler current profiler) with gyro input.
8. MAHRS gyro system for acquisition of heading data used by acoustic Doppler current profiler.
9. Science walk-in fridge set at ~ +4 degrees Celsius
10. Science walk-in freezer set at ~ -20 degrees Celsius
11. Ice-maker
12. Access to approximately 20L/day of pre-brominated water either from the evaporators or the RO water system, when the ship is producing fresh water.
13. Source of seawater to flow into /out of incubation tank on fantail. Seawater is for thermal purposes and does not need to be "uncontaminated". Deck or seawater hose is adequate
14. Fume Hood

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

Three 20’ container vans will be loaded aboard Ronald H. Brown for this cruise. Two of these containers will act as laboratory vans, and must be accessible at all times throughout the expedition. Compressed gas (non-flammable) cylinders will be used in ship's laboratories and laboratory vans. See Appendix B for container details.

1. Two 24 position rosette sampling with water sampling bottles of 11 (or 12)-liter volume, spare bottle and spare parts.
2. Complete CTD recording and processing system including 2 Sea-Bird CTDs, 2 deck units, connectors, spare parts and consumables.
3. Chemical analysis instrumentation including gas chromatographs, equilibrators, oxygen titration system, nutrient auto analyzer, coulometer, alkalinity titrator, salinity bottles.
4. Chemical reagents, compressed gases (approximately 30 cylinders). A listing of chemicals is given in Appendix A and will be updated prior to departure from Charleston.
5. Two Benthos pingers with spare batteries, and altimeter.
6. Strain gage.
7. Milli-Q system, filters and replacement parts
8. One 300 KHz (lowered) LADCP.
9. Aerobiological Samplers
10. Autoclave
11. Ozone ground station
12. Radiosonde receiving station
13. Vaisala RS41 rawinsondes
14. 200 g balloons
15. 1200-g or 1400-g balloons
16. Ozonesondes
17. Portable hood
18. Dessicated chamber

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, SDS, 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
- A SDS 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. SDS 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

See attached Appendix A

C. Chemical safety and spill response procedures

See attached Appendix A

D. Radioactive Materials

The Chief Scientist is responsible for complying with OMAO 0701-10 Radioactive Material aboard NOAA Ships. Documentation regarding those requirements will be provided by the Chief of Operations, Marine Operations Center, upon request.

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

1. NOAA Form 57-07-02, Request to Use Radioactive Material aboard a NOAA Ship
2. Draft Project Instructions
3. Nuclear Regulatory Commission (NRC) Materials License (NRC Form 374) or a state license for each state the ship will operate in with RAM on board the ship.
4. Report of Proposed Activities in Non-Agreement States, Areas of Exclusive Federal Jurisdiction, or Offshore Waters (NRC Form 241), if only state license(s) are submitted).
5. SDS
6. Experiment or usage protocols, including spill cleanup procedures.

Scientific parties will follow responsibilities as outlined in the procedure, including requirements for storage and use, routine wipe tests, signage, and material disposal as outline in OMAO 0701-10.

All radioisotope work will be conducted by NRC or State licensed investigators only, and copies of these licenses shall be provided per OMAO 0701-10 at least three months prior to the start date of domestic projects and eight months in advance of foreign project start dates.

E. Inventory (itemized) of Radioactive Materials

Common Name Radioactive Material	**Concentration**	**Amount**	**Notes**
Sealed source Nickel 63 electron capture detector	0.37 GBq each	3	See Appendix C
Sealed source Nickel 63 electron capture detector	0.33 GBq	1	See Appendix C

V. Additional Projects

A. Supplementary ("Piggyback") Projects

Description:

1) Underway Measurements in support of Global Carbon Cycle Research

The underway sensors on RHB will be used in support of the objectives of the Global Carbon Cycle Research (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 CO_2 in surface water (pCO_2). This work is a collaborative effort between the CO_2 groups at AOML and PMEL.

Principal investigators:

Dr. Rik Wanninkhof, AOML 305-361-4379 rik.wanninkhof@noaa.gov

Contact person:

Dr. Denis Pierrot, AOML 305-361-4441 denis.pierrot@noaa.gov

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

2) Float and drifter deployment

A number of drifters, SOCCOM and ARGO floats will be deployed along the route. All work is performed on a not-to-interfere basis and does not introduce any added ship logistic requirements.

3) Microbial metabolic energy potential

Samples will be collected to investigate the variation in microbial metabolic energy potential across the diverse biogeochemical regimes traversed in the transect, and how metabolic energy relates to microbial biomass and dissolved nutrient availability. Microbial metabolic energy potential will be measured as particulate adenosine triphosphate (p-ATP) normalized to particulate phosphorus (PP); in addition to the nutrients measured as core GO-SHIPS data (phosphate, nitrate, and nitrite), we will analyze samples for total dissolved phosphorus (TDP), which combined with the GO-SHIPS measurement of dissolved inorganic phosphorus (DIP, phosphate) will provide data on dissolved organic phosphorus (DOP). To quantify the microbial community, we will collect samples for cell counts of phytoplankton and bacteria using flow cytometry. In summary the proposed research will collect samples to quantify particulate ATP, particulate phosphorus, total dissolved phosphorus, and phytoplankton and bacteria.

To test hypotheses about the influence of nutrient availability on shifts in microbial metabolic energy we propose conducting nutrient amendment incubations (each lasting -3-4 days) using surface seawater from the ship's flow-through seawater system, comparing the response of different microbial communities at 3 or 4 contrasting locations across the transect. Each incubation would be conducted in incubators supplied by the Poppendorf group and sampling would be the same as described above for depth profile samples.

4) Microbial respiration

Microbial respiration measurements where water budget allows would be conducted at 15 stations along the transect. Sampling will be conducted in the upper 200 m. These estimates are conducted using a short incubation with a Iodonitrotetrazolium salt reduction approach.

B. NOAA Fleet Ancillary Projects

No NOAA Fleet Ancillary Projects are planned. OR

Description: (Provide a description of each NOAA Fleet Ancillary project)

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. For this the main leg of the cruise that will be run as GO-SHIP line A13.5, scientific data collected will be submitted to national repositories following the timeline and guideline as in https://usgoship.ucsd.edu/cruise-data-submit-download/

A. Data Classifications: *Under Development*

a. OMAO Data

b. Program Data

B. Responsibilities: *Under Development*

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 or Principal Investigator, as appropriate. The form is available at https://sites.google.com/a/noaa.gov/omao-intranet-dev/operations/marine/customer-satisfaction-survey and provides a "Submit" button at the end of the form. It is also located at https://docs.google.com/a/noaa.gov/forms/d/1a5hCCkgIwaSII4DmrHPudAehQ9HqhRqY3J_FXqbJp9g/viewform. 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 makeup 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. Unless prior arrangements are made, the science party may move aboard the night before scheduled departure and must move off the ship the day after scheduled arrival (at the end of project). The Chief Scientist/Principal Investigator 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 or Principal Investigator 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.

NHSQs must be submitted every 2 years for individuals under the age of 50 and every 1 year for ages 50 and above. NHSQs must be accompanied by NOAA Form (NF) 57-10-02 - Tuberculosis

Screening Document in compliance with OMAO Policy 1008 (Tuberculosis Protection Program, which requires a yearly PPD or TB exam).

The completed forms should be sent to the Marine 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 submission process approved by NOAA is kiteworks by Accellion Secure File Transfer, which requires the sender to set up an account using a valid NOAA email address and password. User accounts may expire after 30 days of inactivity. Simply re-register to send and receive files.

Persons without a NOAA email account must fax or mail their forms.

Contact information:

Marine 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 email and the Very Small Aperture Terminal (VSAT) link. Standard VSAT bandwidth has increased, on average per ship, to 768 kbs and is shared by all vessel's staff and the science team at no charge to sailing personnel. Increased bandwidth in 7 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 and it must be arranged through the ship's Commanding Officer at least 30 days in advance.

E. IT Security

Any computer that will be hooked into the ship's network must comply with the *OMAO 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 the above requirements prior to boarding the ship is required.

Computer Operating Systems that the support vendor has identified as reaching "End of Life" for support will not be allowed on the shipboard network. Examples include Microsoft Windows XP and Vista as well as Windows Server 2003.

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.

Full compliance with NAO 207-12 is required.

Responsibilities of the Chief Scientist:

1. Provide the Commanding Officer with the email generated by the Servicing Security Office granting approval for the foreign national guest's visit. (For NMFS-sponsored guests, this email will be transmitted by FNRS.) This email will identify the guest's DSN and Designated Escorts (if any) 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 Security Office.
4. Export Control - Ensure that approved controls are in place for any technologies subject to Export Administration Regulations (EAR) that will be brought aboard the ship. .

The Commanding Officer and the Chief Scientist will keep each other informed of controlled technologies belonging to the ship and to the scientific party and will work together to implement any access controls necessary to ensure no unlicensed export occurs.

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 approval from the Director of the Office of Marine and Aviation Operations 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 FNRS or Servicing Security Office email 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. 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 Security Office.

Responsibilities of the Foreign National Sponsor:

1. Export Control - The DSN 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, if not sailing for the project, 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 and a NOAA or DOC employee. According to DOC/OSY, this requirement cannot be altered.
3. Ensure completion and submission of 207-12 Appendix C (Certification of Conditions and Responsibilities for a Foreign National) within three days of the FN's arrival onboard the ship.

IX. Appendices

APPENDIX A: HAZMAT

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

Common Name of Material	Qty	Notes	Trained Individual	Spill control
Sodium Iodide	1	1 liter	Emma Pontes	spill kit
Alkaline Iodide	1	1 liter	Emma Pontes	spill kit
Manganese Chloride	2	1 liter	Emma Pontes	spill kit
Dilute H_2SO_4 Sulfuric Acid)	2	1 liter	Emma Pontes	spill kit
Sodium Thiosulfate	1	1 liter	Emma Pontes	spill kit
potassium iodate	2	1 liter	Emma Pontes	spill kit
PenaTriton(R) X-100	1	1 liter	Emma Pontes	spill kit

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

Common Name of Material	Qty	Notes	Trained Individual	Spill control
Oxalic Ac.	7	Granular	Susan Becker	spill kit
NaOH	1	Granular	Susan Becker	spill kit
Cd	12	Granular	Susan Becker	spill kit
NEDA	10	Granular	Susan Becker	spill kit
Imidazole	6	Granular	Susan Becker	spill kit
Ascorbic Ac.	14	Granular	Susan Becker	spill kit
NH4.Molybdate	14	Granular	Susan Becker	spill kit

NH4.Molybdate	14	Granular	Susan Becker	spill kit
Hydrazine	14	Granular	Susan Becker	spill kit
Sulfanilamide	12	Granular	Susan Becker	spill kit
Antimony Potassium Tartrate	3	Granular	Susan Becker	spill kit
Brij-35	2	Liquid	Susan Becker	spill kit
Dowfax	2	Liquid	Susan Becker	spill kit
HCl	4	Liquid	Susan Becker	spill kit
H2SO4	4	Liquid	Susan Becker	spill kit
Acetone	2	Liquid	Susan Becker	spill kit

III. CHEMICAL REAGENTS USED FOR THE DETERMINATION OF TOTAL **DISSOLVED INORGANIC CARBO**N **(DIC), pCO_2, AND UNDERWAY pCO_2**

Common Name of Material	**Qty**	**Notes**	**Trained Individual**	**Spill control**
Magnesium Perchlorate	2 bottles, 500 g each	Granular Salt	Charles Featherstone	spill kit
Ascerite (hydroxide)	1 bottle, 500 g	Granular Salt	Charles Featherstone	spill kit
Isopropanol	4 Liters (1 x 4 L bottle)	Solvent	Charles Featherstone	spill kit
Acetone	4 Liters (1 x 4L bottle)	Solvent	Charles Featherstone	spill kit
Coulometer solution (cathode)	12 liters (3 x 4L bottle	Liquid	Charles Featherstone	spill kit
Coulometer solution (anode)	2 liters (4 x 0.5L bottle	Liquid	Charles Featherstone	spill kit
Nitrogen, compressed	5 steel cylinders Carrier Grade	Compressed Gas	Charles Featherstone	
Air, compressed	8 aluminum cylinders (size a)	Compressed Gas	Charles Featherstone	
HgCl2	3, 300 ml of saturated solution	Liquid	Charles Featherstone	spill kit

IV. CHEMICAL REAGENTS USED FOR THE DETERMINATION OF **TOTAL ALKALINITY** IN SEAWATER

Common Name of Material	Qty	Notes	Trained Individual	Spill control
Hydrochloric Acid, 0.1m in 0.45m NaCl	30 L	Liquid	Carmen Rodriguez	spill kit

V. CHEMICAL REAGENTS USED FOR THE DETERMINATION OF **MICROBIAL RESPIRATION AND METABOLIC ENERGY**

Common Name of Material	Qty	Notes	Trained Individual	Spill control
Formaldehyde	8L	Liquid	Kaycie Lanpher	spill kit
Liquid Nitrogen	1	Dry Shipper	Kaycie Lanpher	spill kit
HCl, 4N	1 bottle, 100 ml	Liquid	Chance English	spill kit
Formalin	4 Liters	Liquid	Chance English	spill kit

VI. CHEMICAL REAGENTS USED FOR THE DETERMINATION OF **CFCs**

Common Name of Material	Qty	Notes	Trained Individual	Spill control
Nitrogen, compressed	8 steel cylinders Carrier Grade	Compressed Gas	Bonnie Chang	
Compressed gas, N.O.S. (argon, methane)	2 steel cylinders Carrier Grade	Compressed Gas	Bonnie Chang	
Magnesium perchlorate	3x250g	Granular Salt	Bonnie Chang	spill kit
Sodium hydroxide, solid, mixture	2x250g	Granular Salt	Bonnie Chang	spill kit
Ethanol	10x500ml	Liquid	Bonnie Chang	spill kit

VII. CHEMICAL REAGENTS USED FOR ATMOSPHERIC SONDES (Transit leg only)

Person(s) Responsible	chemical/compressed gas	quantity	unit	neutralizer
Ricardo Sakai	Helium	30	cylinders	none
Ricardo Sakai	Potassium Iodide	1	2-L	Spill kit
Ricardo Sakai	Ethyl Alcohol	1	2-L	spill kit
Ricardo Sakai	Sodium Phosphate	1	200-g	spill kit
Ricardo Sakai	Hydrogen peroxide	1	0.5-L	spill kit
Ricardo Sakai	Drierite	16	0.5-L	spill kit

Ricardo Sakai	MIlliQ Water	1	2-L	None required

APPENDIX B: **VAN DIMENSIONS, LOCATIONS AND REQUIREMENTS**

1) CFC van

wt 13000 lbs

size 8' x 8' x 20'

power input 440V, 3 phase

location main deck, aft

Door: Left side of van near double doors

Needs phone (and Ethernet).

Contract Person: Bonnie Chang, PMEL (bxc@uw.edu)

2) DICE van

wt 19000 lbs

size 8' x 8' x 20'

power input 30 amps, 3 phase, and 440v.

location main deck aft

Door: center, right side of van

Needs compressed air, fresh water available, phone and Ethernet.

Contact Person: Charles Featherstone, AOML (Charles.Featherstone@noaa.gov)

3) Storage van

wt 10000 lbs

size 8' x 8' x 20'

power input none

location flexible

Door: aft

Contact Person: Andy Stefanick, AOML (Andrew.Stefanick@noaa.gov)

APPENDIX C: PACKAGE RADIATION SAFETY LETTER

Jan. 8, 2020 R/E/PM

Shipper: NOAA/PMEL
Bin C15700/Blg. 3
7600 Sand Point Way NE
Seattle, Wa. 98115-0070

Consignee: RV Ronald H. Brown
Barbados

Attention:

This package contains four electron capture detectors containing sealed radioactive sources (^{63}Ni, one is 0.33 GBq and the other three are 0.37 GBq each). These devices and the surface of the package have been tested and found to comply with all the requirements listed in IATA 10.3.11.1.3 and 10.3.11.1. Therefore:

> **This package conforms to the conditions and limitations specified in IATA 10.5.9.5 for radioactive material, excepted package, instruments, UN2911.**

Kevin Roe

Kevin Roe
Radiation Safety Officer

APPENDIX D: STATION/WAYPOINT LIST

Station Operations

CTD Operations: CTD casts will include the CTD/O2 unit, a Rosette sampler and 24, 12-L bottles on the Rosette frame. Approximately 125 casts will be conducted to full water column depth. We will require a package tracking system and display for the CTD operations (Knudsen/Bathy2000). The ship must carry a fully functional back-up CTD conducting cable for this cruise and a functioning spare winch. Approximate station locations are listed below. Science party will provide one person to assist in the launching and recovery of the CTD and a CTD computer operator.

Station	Lat N (Deg)	Lon E (Deg)	Float/drifter
CTD 1	-54.000	0.000	SOCCOM
CTD 2	-53.500	0.070	
CTD 3	-53.000	0.140	
CTD 4	-52.500	0.210	
CTD 5	-52.000	0.280	SOCCOM
CTD 6	-51.500	0.350	
CTD 7	-51.000	0.420	
CTD 8	-50.500	0.480	
CTD 9	-50.000	0.550	
CTD 10	-49.500	0.620	
CTD 11	-49.000	0.690	
CTD 12	-48.500	0.760	
CTD 13	-48.000	0.830	SOCCOM
CTD 14	-47.500	0.900	
CTD 15	-47.000	0.970	
CTD 16	-46.500	1.040	
CTD 17	-46.000	1.110	
CTD 18	-45.500	1.180	
CTD 19	-45.000	1.250	
CTD 20	-44.500	1.320	
CTD 21	-44.000	1.350	SOCCOM
CTD 22	-43.500	1.340	
CTD 23	-43.000	1.330	
CTD 24	-42.500	1.290	
CTD 25	-42.000	1.150	
CTD 26	-41.500	1.010	
CTD 27	-41.000	0.970	SOCCOM
CTD 28	-40.500	0.980	
CTD 29	-40.000	0.980	
CTD 30	-39.500	0.980	
CTD 31	-39.000	0.980	
CTD 32	-38.500	0.980	

CTD 33	-38.000	0.980	
CTD 34	-37.500	0.990	
CTD 35	-37.000	1.000	SOCCOM
CTD 36	-36.500	1.000	
CTD 37	-36.000	1.010	
CTD 38	-35.500	1.050	
CTD 39	-35.000	1.090	
CTD 40	-34.500	1.160	
CTD 41	-34.000	1.220	
CTD 42	-33.500	1.100	
CTD 43	-33.000	0.980	
CTD 44	-32.500	1.120	
CTD 45	-32.000	1.270	SOCCOM
CTD 46	-31.500	1.420	
CTD 47	-31.000	1.560	
CTD 48	-30.500	1.700	
CTD 49	-30.000	1.830	
CTD 50	-29.500	1.810	
CTD 51	-29.000	1.780	
CTD 52	-28.500	1.750	
CTD 53	-28.000	1.720	
CTD 54	-27.500	1.690	
CTD 55	-27.000	1.660	
CTD 56	-26.500	1.650	
CTD 57	-26.000	1.630	
CTD 58	-25.500	1.590	
CTD 59	-25.000	1.550	
CTD 60	-24.500	1.530	
CTD 61	-24.000	1.500	
CTD 62	-23.500	1.470	
CTD 63	-23.000	1.440	
CTD 64	-22.500	1.410	
CTD 65	-22.000	1.380	
CTD 66	-21.500	1.350	
CTD 67	-21.000	1.320	
CTD 68	-20.500	1.290	
CTD 69	-20.000	1.260	
CTD 70	-19.500	1.240	
CTD 71	-19.000	1.230	
CTD 72	-18.500	1.200	
CTD 73	-18.000	1.180	Core Argo
CTD 74	-17.500	1.140	

CTD 75	-17.000	1.110	
CTD 76	-16.500	1.060	
CTD 77	-16.000	1.000	Core Argo
CTD 78	-15.500	1.000	
CTD 79	-15.000	1.000	
CTD 80	-14.500	0.980	
CTD 81	-14.000	0.960	Core Argo
CTD 82	-13.500	0.940	
CTD 83	-13.000	0.930	
CTD 84	-12.500	0.900	
CTD 85	-12.000	0.870	Core Argo
CTD 86	-11.500	0.850	
CTD 87	-11.000	0.830	
CTD 88	-10.500	0.800	
CTD 89	-10.000	0.780	Core Argo
CTD 90	-9.500	0.560	
CTD 91	-9.000	0.140	
CTD 92	-8.500	-0.280	
CTD 93	-8.000	-0.720	Core Argo
CTD 94	-7.500	-1.150	
CTD 95	-7.000	-1.560	
CTD 96	-6.500	-1.970	
CTD 97	-6.000	-2.410	Core Argo
CTD 98	-5.500	-2.850	
CTD 99	-5.000	-3.000	
CTD 100	-4.500	-3.000	
CTD 101	-4.000	-3.000	
CTD 102	-3.500	-3.000	
CTD 103	-3.000	-3.000	Core Argo
CTD 104	-2.670	-3.000	
CTD 105	-2.330	-3.000	
CTD 106	-2.000	-3.000	
CTD 107	-1.670	-3.000	
CTD 108	-1.330	-3.000	
CTD 109	-1.000	-3.000	
CTD 110	-0.670	-3.000	
CTD 111	-0.330	-3.000	
CTD 112	0.000	-3.000	Core Argo
CTD 113	0.330	-3.000	
CTD 114	0.670	-3.000	
CTD 115	1.000	-3.000	Core Argo
CTD 116	1.330	-3.000	

CTD 117	1.670	-3.000	
CTD 118	2.000	-3.000	
CTD 119	2.330	-3.000	
CTD 120	2.670	-3.000	
CTD 121	3.000	-3.000	
CTD 122	3.310	-3.000	
CTD 123	3.400	-3.000	
CTD 124	3.470	-3.000	
CTD 125	3.820	-3.000	