Project Instructions

Date Submitted: January 10, 2023

Platform: NOAA Ship *Ronald H. Brown*

Project Number: RB-23-01 (OMAO) (As assigned in the current fleet allocation plan, Ex. SH-20-02*)* If the program wishes to assign a project ID of their format, do so after the OMAO PN with a comma, the program ID, & label it (*ORG*), Ex. 12-04-SH (SWFSC).

Project Title: GO-SHIP A16N 2023

Project Dates: March 6, 2023 to May 9, 2023

Prepared by: _____ Dated: 02/06/2023
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Chief Scientists
NOAA/OAR/AOML

Approved by: Kathy Tedesco _____ Dated: 1/30/2023
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NOAA/OAR/CPO/GOMO

Approved by: M. Molly Baringer Digitally signed by Dr. Molly Baringer DN: cn=Dr. Molly Baringer, o=AOML, ou=Deputy Director, email=Molly.Baringer@noaa.gov, c=US Date: 2023.02.09 10:48:40 -05'00' Adobe Acrobat version: 2020.013.20064 _____ Dated: 2/9/2023
Dr. John Cortinas
Director, AOML
NOAA/OAR/AOML

Approved by: GOELLER.AMANDA.LYNNE.1267671644 Digitally signed by GOELLER.AMANDA.LYNNE.1267671644 Date: 2023.02.10 09:18:56 -05'00' _____ Dated: _____
Captain Amanda Goeller, 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/GOMO and NSF-OCE as part of the GO-SHIP program, an international effort involving multiple countries (https://www.go-ship.org/). Academic institutions and NOAA research laboratories will participate on what will hopefully be the first successful NOAA GO-SHIP mission since 2018. The GO-SHIP program focuses on the need to monitor inventories of CO_2, 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 CO_2, 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.

The specific goals of this cruise are as follows:

1.- Re-occupation of the historic stations in this line, including up to the coast of Iceland. A total of 150 stations, from surface to bottom water sampling are required to fulfill the objectives for this cruise.

2.- A second cast dedicated to biological measurements at select stations throughout the line

3.- Deployment of up to 10 core Argo floats, up to 7 BGC-Argo floats and 1 deep Argo float

4.- Deployment of up to 40 drifters in support of NOAA's Global Drifter Program

Full water column CTD/rosette casts will be made along the cruise track (nominally along the 20-25th west meridian from 6˚S to 63˚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.

Additional CTD/rosette casts will be made at select stations along the line, once a day if time allows. The water collected during these casts will be used to do profiles of eDNA and other microbial diversity measurements.

About eighteen total floats will be deployed along the section: 6-10 MRV S2A core Argo, 4-7 SBE Navis BGC-Argo and 1 MRV Deep-Argo. 10 drifters will also be deployed.

Near surface seawater (temperature, salinity, pCO_2, ADCP) and atmospheric measurements (CO_2, and CFCs) will be made. Surface seawater from the seawater line will be collected throughout the cruise to conduct phytoplankton and eDNA studies. Sargassum will be collected on stations if present.

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 from Newport, RI to Brazil, discrete seawater samples for carbonate measurements will be collected at regular intervals by a scientist, Anna McCauliffe (NOAA affiliate) who will sail on the Brown during the transit.. These samples will be taken from the underway line in the hydrolab which does not require the ship to stop. They will be stored at room temperature in 500 ml borosilicate glass bottles until analyzed at a later time.

On the transit from Brazil (starting outside the Brazil EEZ) to the first station, on the way to/from Rota, and from the last station to Reykjavik, underway instruments will collect CO_2 near surface seawater measurements (temperature, salinity, pCO_2, Alkalinity) measurements will be taken from the scientific seawater line and the hull mounted ADCP will provide measurement of currents. Discrete seawater samples will be collected from the ship's seawater line for CO_2, nutrients and oxygen analysis, and biological measurements (phytoplankton, eDNA). Argo profiling floats might be deployed on the transits to and from the line as well.

The GO-SHIP line A16N will take place from March 6, 2023 to May 9, 2023 (see also AOML's website for the cruise at https://www.aoml.noaa.gov/ocd/gcc/A16N_2023/)

B. Days at Sea (DAS)

Of the _55_ DAS scheduled for this project, _55_ DAS are funded by an OMAO allocation This project will require 24/7 operations.

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

The operating area covers the Equatorial, Tropical and North Atlantic Ocean with a few stations in the South Atlantic Ocean, with a schematic of the cruise track shown in Figure 1.
It will occur from March 6 to May 9, 2023 and will focus on completing a long meridional section through the Eastern part of the North Atlantic, nominally along the 20th and 25th meridian from 6˚S to 63˚N (See Figure 1).

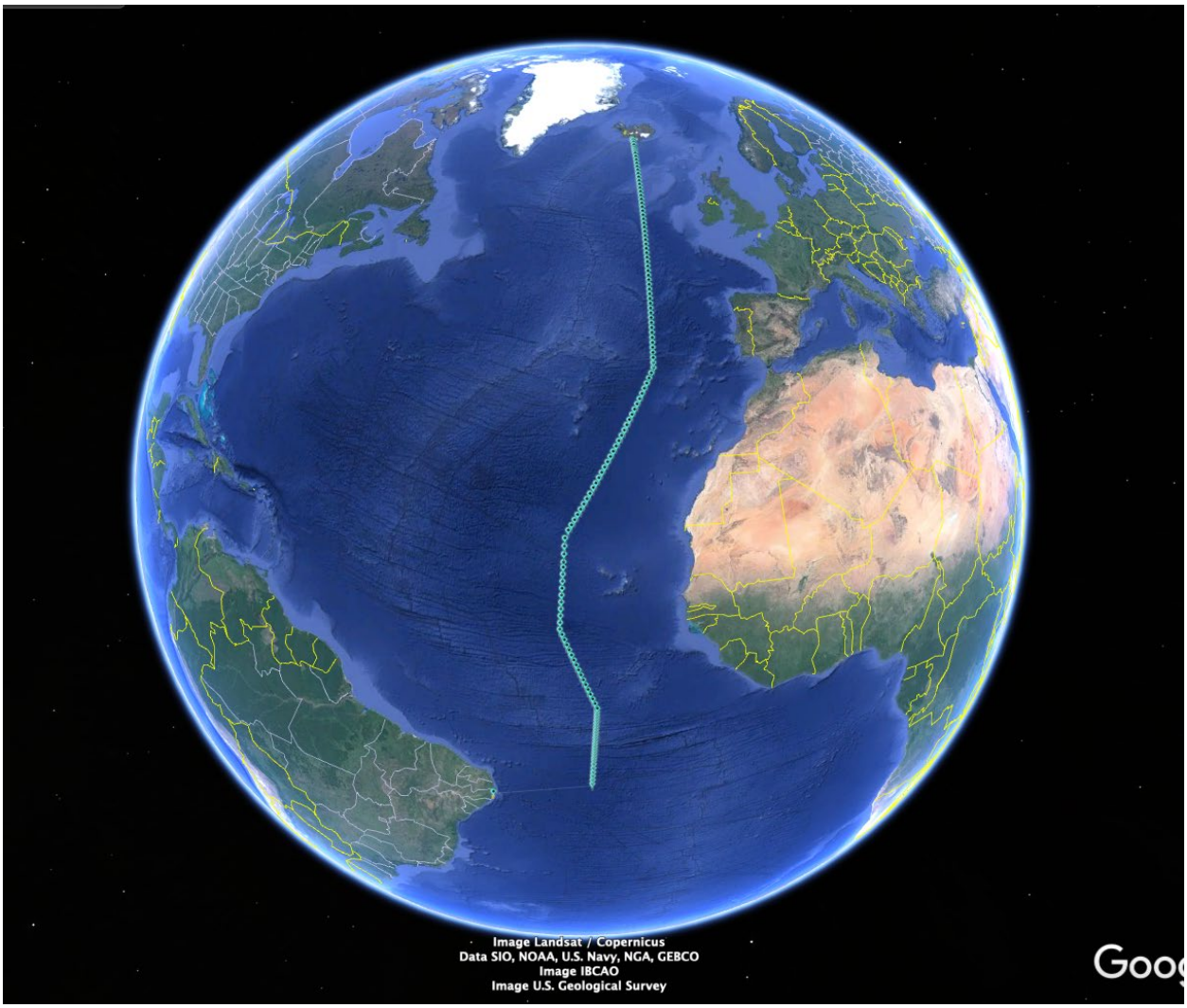

Figure 1: Plot of cruise track. The ship will depart the port of Suape, Brazil and end in Reykjavik, Iceland

D. Summary of Objectives

The GO-SHIP A16N 2023 cruise is the fourth comprehensive survey of inorganic carbon, nutrients and other biogeochemical parameters along the WOCE A16N transect in the Atlantic. The section repeats the WOCE line occupied by the NOAA ship *Malcom Baldrige* in 1993 and the CLIVAR and GO-SHIP A16N cruises of 2003 and 2013 (respectively) on the NOAA ship *Ronald H. Brown*. 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 30 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 Brazil to the start of the A16N 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 in international waters 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 cruise. Some float deployments (BGC Argos) will be coordinated so they happen at a location where a CTD cast is being conducted, usually when the ship is leaving the station. Drifters and regular Core Argo floats will also be deployed while in transit between stations without need to stop/slow down the ship. Sargassum will be collected with a net pole directly overboard if it is detected at stations.

While steaming to and from the main line, underway samples will be collected on a regular basis (~every hour) for discrete analyses of pCO_2, nutrients, oxygen and biological parameters (phytoplankton, eDNA). If Sargassum is observed on the route, we will ask the ship to stop to collect a sample by the same method described above.

At all times and where clearance will be granted, the ship's continuous underway measurements (pCO_2, SST, SSS, Oxygen, ADCP, …) will remain operational.

E. Participating Institutions

AOML	NOAA - Atlantic Oceanographic and Meteorological Laboratory
CICOES	Cooperative Institute for Climate, Ocean and Ecosystem Studies, University of Washington
CIMAS	Cooperative Institute for Marine and Atmospheric Studies, University of Miami
LDEO	Lamont-Doherty Earth Observatory, Columbia University
Oregon	Oregon State University
PMEL	NOAA - Pacific Marine Environmental Laboratory
Rosenstiel	Rosenstiel School of Marine and Atmospheric Earth Sciences, University of Miami
SIO	Scripps Institution of Oceanography, University of San Diego
TAMU	Texas A&M University
U Del	University of Delaware
U Hawaii	University of Hawaii
UCSB	University of California Santa Barbara
WHOI	Woods Hole Oceanographic Institution
UC Irvine	University of California - Irvine
NGI	Northern Gulf Institute
UW	University of Washington

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

Transit to Brazil							
	Name (First Last)	**Title**	**Date Aboard**	**Date Disembark**	**Gender**	**Affiliation**	**Nationality**
1	Anna McCauliffe	Chief Scientist	February 7	February 27	F	GML	USA

Leg 1

	Name (First Last)	Title	Date Aboard	Date Disembark	Gender	Affiliation	Nationality
1	Denis Pierrot	Chief Scientist	March 6	April 6	M	AOML	USA
2	Zachary Erickson	Co-Chief Scientist	March 6	April 6	M	PMEL	USA
3	Samuel Mogen	Scientist	March 6	April 6	M	U Colorado	USA
4	Taydra Low	Scientist	March 6	April 6	F	Scripps	USA
5	Andy Stefanick	Scientist	March 6	May 9	M	AOML	USA
6	Jay Hooper	Scientist	March 6	May 9	M	CIMAS	USA
7	Kristy McTaggart	Scientist	March 6	May 9	F	PMEL	USA
8	Alexandra Fine	Scientist	March 6	April 6	F	AOML	USA
9	Eric Wisegarver	Scientist	March 6	May 9	M	PMEL	USA
10	Riley Palmer	Scientist	March 6	May 9	F	UM	USA
11	Emma Pontes	Scientist	March 6	April 6	F	UM	USA
12	Chuck Featherstone	Scientist	March 6	May 9	M	AOML	USA
13	Alison McLeod	Scientist	March 6	April 6	F	CIMAS	USA
14	Bo Yang	Scientist	March 6	May 9	M	UM	USA
15	Jessica Leonard	Scientist	March 6	May 9	F	UM	USA
16	Mackenzie Blanusa	Scientist	March 6	April 6	F	UM	USA
17	Caroline Branan	Scientist	March 6	April 6	F	UM	USA
18	David Cooper	Scientist	March 6	May 9	M	CICOES	USA
19	Carol Gonzalez	Scientist	March 6	April 6	F	CICOES	USA
20	Rachel Bramblett	Scientist	March 6	April 6	F	Scripps	USA
21	Kieran Klaassen	Scientist	March 6	April 6	M	UM	USA
22	Patrick Mears	Scientist	March 6	May 9	M	AOML	USA
23	Katelyn Schockman	Scientist	March 6	April 6	F	CIMAS	USA
24	Victoria Dina	Scientist	March 6	May 9	F	UM	USA
25		Scientist	March 6	April 6	M	UW	0
26	Star Dressler	Scientist	March 6	May 9	F	U Guam	USA
27	Tyler Christian	Scientist	March 6	April 6	F	AOML	USA
28	Bo Dong	Scientist	March 6	May 9	M	U Del	China
29	Najid Hussain	Scientist	March 6	May 9	M	U Del	USA
30	Ellen Park	Scientist	March 6	April 6	F	WHOI	USA

LEG 2							
	Name (First Last)	Title	Date Aboard	Date Disembark	Gender	Affiliation	Nationality
1	Leticia Barbero	Chief Scientist	April 13	May 9	F	AOML	USA
2	Laura Cimoli	Co-Chief Scientist	April 13	May 9	F	UCSD	Italy
3	Audria Dennen	Scientist	April 13	May 9	F	Scripps	USA

4	Shannon McClish	Scientist	April 13	May 9	F	Scripps	USA
5	Andy Stefanick	Scientist	March 6	May 9	M	CIMAS	USA
6	Jay Hooper	Scientist	March 6	May 9	M	AOML	USA
7	Kristy McTaggart	Scientist	March 6	May 9	F	PMEL	USA
8	Ian Smith	Scientist	April 13	May 9	M	AOML	USA
9	Eric Wisegarver	Scientist	March 6	May 9	M	PMEL	USA
10	Riley Palmer	Scientist	March 6	May 9	F	UM	USA
11	Hannah Babbitz	Scientist	April 13	May 9	F	UM	USA
12	Chuck Featherstone	Scientist	March 6	May 9	M	AOML	USA
13	Dana Greeley	Scientist	April 13	May 9	M	PMEL	USA
14	Bo Yang	Scientist	March 6	May 9	M	UM	USA
15	Jessica Leonard	Scientist	March 6	May 9	F	UM	USA
16	Seamus Jameson	Scientist	April 13	May 9	M	SSJU	USA
17	Laura Stieghorst	Scientist	April 13	May 9	F	UM	USA
18	David Cooper	Scientist	March 6	May 9	M	CICOES	USA
19	Carol Gonzalez	Scientist	April 13	May 9	F	CICOESs	USA
20	Isabel Schaal	Scientist	April 13	May 9	F	WHOI	USA
21	Michael Cappola	Scientist	April 13	May 9	M	UDel	USA
22	Bo Dong	Scientist	March 6	May 9	M	U Del	China
23	Zhentao Sun	Scientist	March 6	May 9	M	U Del	China
24	Patrick Mears	Scientist	March 6	May 9	M	Oregon State	USA
25	Leah Chomiak	Scientist	April 13	May 9	F	CIMAS	USA
26	Victoria Dina	Scientist	March 6	May 9	F		USA
27		Scientist	April 13	May 9	M	UW	USA
28	Star Dressler	Scientist	March 6	May 9	F	Oregon State	USA
29	Rachel Cohn	Scientist	April 13	May 9	F	AOML	USA
30	Elliott Roberts	Scientist	April 13	May 9	M	UDel	USA

G. Administrative

1. Points of Contact:

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2. Diplomatic Clearances

This project involves Marine Scientific Research in waters under the jurisdiction of Spain and Iceland. Diplomatic clearance has been requested. Consent from these countries is pending. Approval documents will be shared with OPS/CO upon receipt.

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 the port of Suape, Brazil on March 6, 2023 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 in rare occasions

The cruise will proceed from Brazil to the start of the line at 6 ˚S, 25 ˚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. All underway systems (TSG, pCO_2, ADCP, SCS, …) will be started right after leaving the Brazilian EEZ at about 31.5 ˚W of longitude. We will then begin the CTD section along the 25th meridian working from south to north. We will do as many stations as possible in order to arrive in Rota, Spain at the scheduled time of April 6, 2023. This will complete leg 1. The second leg will start from Rota on April 13, 2013 and start the line with a repeat of the last station completed during leg 1.The cruise will then continue the CTD section until nominally 63 degrees N, after which we will start our transit to Reykjavik, Iceland. All underway systems (TSG, pCO_2, ADCP, SCS, …) will remain operational until arrival in port. Discrete underway water samples will be collected during a portion of the transit.

About 18 floats and 10 drifters will be deployed during the totality of the cruise. The exact location of the deployment is not yet known at the time of this draft and we will update this section when the information is known. Figure 2 in Appendix A will show the draft location of Argo and GO-BGC float deployments. The tentative positions of deployment will be given in Table 2 in Appendix A.

CTD Operations: CTD casts will include the CTD/O2 unit, a Rosette sampler and 24, 12-L bottles on the Rosette frame. 150 stations with CTD casts will be conducted to full water column depth. On up to 40% of those stations, a second CTD cast will be conducted to an approximate depth of 1000m to provide sufficient sample water for biological studies. 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 (at least 8000m) and a functioning spare winch. Approximate station locations are listed below. The science party will provide one person to assist in the launching and recovery of the CTD and a CTD computer operator.

We require that the ship suspend pumping and dumping for the duration of each CTD cast while the ship is on station, and minimize trash burning. In extenuating circumstances, it should be suspended at minimum during the last 500m of the CTD upcasts, and upon notification to the chief scientist. The ship should also suspend any operations (e.g. 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 hangar during operations.

A map of the A16N cruise track is shown in Figure 1 and the station's locations are given in appendix A - Table 1.

B. Staging and Destaging:

Staging for most of the equipment for the cruise will be done in Newport, RI from January 30th to

February 1st, 2023. Three twenty-foot science van (CFC, DICE and PhOD) with equipment will be loaded on the ship See Appendix B for container details. Most gear will be in containers, or still palettized or in large D-containers and will need to be set up in Brazil. Some will be setup in Newport. All chemicals will be accompanied by MSDS. All chemicals, except compressed gasses and those packaged according to DOT regulations in the shipping/laboratory containers, will be stored in the HazMat locker. A list of equipment and chemicals brought aboard will be provided to the ship's Operations Officer.

Very little equipment will need to be loaded in Brazil/Spain. Liquid nitrogen (LN2) will be delivered to the science team to recharge a dewar (a container to fast freeze samples). Please check hazmat section for more details on the LN2.

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 Brazil. 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 A16N leg 1 will meet the ship in the port of Suape, Brazil and will plan to move aboard on the night before sailing, on March 5, 2023. We understand the galley may not be available for science party meals before sailing. Setup by science party 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 to assist with different tasks such as making terminations for the CTD as well as setting up of other science equipment. In particular, we might require help in setting up a separate seawater flowing line for the Bio GO-SHIP group if this was not completed in Newport, RI. All supplies will be brought by the scientists. The location of the pump, power supply and the path of the sw line has already been identified during the preparations of A13.5 in 2021. Assistance will be required to secure the pump and connect it to power.

On leg 2 there will be an exchange of cruise participants for several of the parameters being analyzed. Scientists will need access to the ship for a smooth transition of operations between leg 1 and leg 2. LN2 will be delivered in a similar fashion to leg 1, to replenish the dewar. Other than that we expect luggage and personal items from cruise participants but no major arrival of equipment.

Destaging of the gear will occur in the US port of Pascagoula, MS, tentatively on June 1 and 2, 2023. Some scientists might choose to ship their frozen samples out of Spain or Iceland but this will be determined at a later date and falls under the responsibility of the science party.

Full de-staging will occur in the US and all scientific equipment and remaining chemicals will be offloaded, including the three 20-foot containers (the DIC, CFC and PhOD Storage vans). We will arrange a shoreside crane for this task. Assistance from the ship to coordinate crane operations to facilitate destaging as quickly as possible would be appreciated.

C. Operations to be Conducted:

1. CTD profiles of depth along hydrographic transects. Approximately 150 stations will be completed to full water depth, with an estimated maximum of 6,067 meters. Additional casts might be performed once a day to ~1,000m for biological measurements.
2. Water samples collected in Niskin bottles for comparison with the CTD profiles.
3. Trace gasses (chlorofluorocarbons, sulfur hexafluoride) in the water samples collected with the bottles.
4. Full carbon characterization (inorganic and organic carbon system parameters and isotopes) of the water samples collected with the bottles.
5. Dissolved oxygen and nutrients in the water samples collected with the bottles.
6. Salinity of the water samples collected with the bottles.
7. Profiles of northward and eastward velocity from the LADCP.
8. Video Profiles from the Underwater Video Profiler (UVP)(not yet confirmed)
9. Continuous recording of ship mounted ADCP data.
10. Continuous recording of Thermosalinograph (TSG) and sea surface temperature (SST).
11. Continuous recording of Seabeam bathymetry requested (lead by ship Survey Dept.)
12. Deployment of 4-7 GO-BGC Argo floats
13. Deployment of 6-10 Core Argo floats
14. Deployment of 10 drifters
15. Collection of Sargassum at stations when present
16. Heading data from Teledyne TSS Surveyor Gyrocompass, Applanix POSMV V5, and Trimble ABX-TWO and the Applanix POSMV V5, Furuno GP150, and Trimble ABX-TWO system for correction and processing of shipboard ADCP data.
17. These activities will be performed by the science party, with assistance of ships survey for items 1 and 9 through 16.

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. (This statement must remain in all project instructions)

Dives are not planned for this project.

E. Applicable Restrictions

Conditions which preclude normal operations

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, captain and the chief scientist. The primary consideration is the safety of the ship's crew and scientists.

Possible mitigation strategies include pausing until conditions improve.

Unforeseen circumstances such as equipment failure may also cause a delay or cancellation of certain operations. Appropriate course 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.

Interrupting a CTD cast for a long period of time (e.g. for drills) can create risky situations (e.g. excessive tension on the cable, extended draft from the pull of the package, issues with temperature of the samples, changes to concentration of certain parameters, etc). We will coordinate with the ship when the drills are coming up to ensure the CTD is not put at risk.

III. Equipment (Hazardous materials are not to be listed here. They should be included in Hazardous Materials Section.)

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 the earliest possibility of malfunction or poor function of equipment.

1. Furuno Global Maritime Distress and Safety System (GMDSS)
2. Starlink, VSAT, Fleet Broadband
3. 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:

4. Furuno GP150 GPS
5. Teledyne Surveyor Gyro Unit
6. Furuno navigational radar
7. KongsbergDynamic Positioning System
8. Raytheon model DSN-450 Doppler Speed/distance log
9. NAVTEX receiving and printing the international automated medium frequency (518 KHz) weather warnings
10. 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 Knudsen 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. windbirds 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. Teledyne TSS Surveyor Gyrocompass for acquisition of heading data used by acoustic Doppler current profiler.
9. SeaBird 45 ThermoSalinograph
10. SeaBird 38 Temperature Sensor (SST) at the seawater intake
11. Science walk-in fridge set at ~ +4 degrees Celsius
12. Science walk-in freezer set at ~ -20 degrees Celsius
13. Ice-maker
14. 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.
15. 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. They will require full constant power and communications hookup. The third container must be accessible for storage of gear throughout the cruise. Compressed gas (non-flammable) cylinders will be used in ship's laboratories and laboratory vans. See Appendix C for container details.

1. Two 24 position rosette sampling with water sampling bottles of 12-liter volume, spare bottles and spare parts.
2. Complete CTD recording and processing system including 3 Sea-Bird 9Plus CTDs, 2 deck units, 5 full sets of sensors (Temperature, Oxygen, Conductivity, pumps), Transmissometer, 3 SBE32 carousels, Wetlabs Chlorophyll-A optical sensor, connectors/cabling, plumbing, spare parts, tools, and consumables.
3. Chemical analysis instrumentation including gas chromatographs, equilibrators, oxygen titration system, nutrient auto analyzer, coulometers, alkalinity titrators, 3 Autosals, salinity bottles.
4. Chemical reagents, compressed gasses (approximately 30 cylinders). A listing of chemicals is given in Appendix B and will be updated prior to departure from Brazil.
5. Two Benthos pingers with spare batteries, and 3 altimeters.
6. Rosette bail Strain gauge.
7. Milli-Q system, filters and replacement parts
8. (2) 150KHz ADCPs, (3) 300KHz ADCPs for LADCP configuration on Rosette. (3) Battery pack housings for ADCP power on the rosette. Ancillary equipment, tools, and spares.
9. 15 Computers and associated peripherals for use in data acquisition, data processing, and control of sample analysis equipment.

IV. Hazardous Materials

A. Policy and Compliance

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

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

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

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

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

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

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

B. Inventory

See attached Appendix B

C. Chemical safety and spill response procedures

See attached Appendix B

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. Use of radioactive isotopes in areas under the jurisdiction of other countries may require additional permits from the host countries. Port calls in other countries while the ship is carrying radioactive isotopes may also require special notification, compliance with host country regulations and consent from the host.

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

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

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

Sort the completed table by common name (in WORD: Click in the table, select Tab "Layout", select "Sort" (upper right), select "Common Name" and ensure "has header row" is checked .

Common Name Radioactive Material	**Concentration**	**Amount**	**Notes**
63-Ni	35.9 mCL	3	See attached approved letter below

F. Lithium batteries (beyond everyday household items)

Chief Scientist is responsible to

1. Provide a risk management plan to mitigate lithium battery concerns, including:

   a. Packaging. How will system/battery be packaged?

   The batteries are contained in the Argo floats (regular, BGC). They are hermetically sealed cells, which are not hazardous when used according to the recommendations of the manufacturer and provided that the integrity of the cells is maintained. All the lithium battery packs are all internally fused so, in principle, protected against shorting and overheating.

   b. Storage facilities. How will system/battery be stored from delivery to disposal?

   The batteries are stored in the floats until and after deployment.

   c. Transportation methods

   They are transported in the floats.

   d. Operational use scenario (Include a complete description of how the system/batteries will be handled and used; what platform(s) will carry or deploy the system; location of recharging operations; recovery operations; number of units anticipated to be used; and, where appropriate, the sequence of events before system use/activation/deployment, etc.).

   The batteries will never be manipulated. The floats will be gently lowered to the surface of the water using ropes. We plan to deploy 6-10 regular Argo floats and 4-7 BGC.

   e. Disposal information

   The floats are not recovered. See here for the environmental impact of the Argo program.

2. Provide scientific party and Ship's Command with relevant SOPs related to equipment containing lithium batteries.

3. Include Safety Data Sheets and/or Technical Data Sheets in the hazardous materials inventory that is transmitted to the ship.

4. Notify ship's Command/ECO when equipment arrives on-scene.

   Floats will be loaded in Newport, RI prior to the transit..

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, PMEL, and GML.

Principal investigator and 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. The two instruments measure the surface pCO_2 in the seawater and the atmosphere. These 2 systems of different design are being compared to each other. 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 B.

2) Float and drifter deployment

A number of drifters,GO-BGC and Core 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. Depending on the weather conditions, the assistance of a crew member might be requested

3) Opportunistic Sampling of the Great Atlantic Sargassum Belt

If present, samples of Sargassum seaweed will be collected on stations, or near arrival/departure at station, to test for evidence of a long-term shift in the elemental stoichiometry of the seaweed (particularly N:P), which may reflect changes in nutrient supply fueling these blooms. Seaweed sampling is to be conducted by dipnet affixed to a standard recovery pole. A standard sample is 30-40g, an amount that fits easily into a quart-sized Ziploc bag. Depending on the weather conditions, the assistance of a crew member might be requested. The rest of the operation does not introduce any added ship logistic requirements. The samples will be dried at low temperatures in a small oven provided by the PI.They will then be stored in ziploc bags and stored in the walk-in freezer on the ship.

B. NOAA Fleet Ancillary Projects

No NOAA Fleet Ancillary Projects are planned

VI. Disposition of Data and Reports

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

A. Data Classifications: *Under Development*

a. OMAO Data

b. Program Data

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. Operational Meetings: The science party requests that daily meetings be held between The Commanding Officer, the Operations Officer, the Chief Bosun, the Chief engineer and the Chief Scientist, at the minimum, to discuss operations for the coming day, on one hand, and issues and their possible mitigations of the day passed, on the other hand. The times of the meetings will be agreed upon by the Commanding Officer and the Chief Scientist and will be adjusted if necessitated by the daily activities.

D. Post-Project Meeting: The Commanding Officer is responsible for conducting 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.

E. 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. The scientific party would like to request that hot meals be also made available to the night shift participants (keeping in mind that some might be vegetarians), like it was done during GOMECC-4.

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 in port. 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).

The completed forms should be sent to 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

All personnel who embark are to fully support and comply with NOAA Administrative Order 202-1106: NOAA Sexual Assault and Sexual Harassment Prevention and Response Policy. The at-sea working/living environment is particularly sensitive and it is incumbent upon all personnel to uphold a positive and professional workplace dynamic in order to successfully accomplish cruise objectives.

Surge protectors, power strips and Uninterrupted Power Sources (UPS) must be approved for marine/shipboard use, removed from service if hot to the touch, regularly inspected for damage or wear, limited to one surge protector per duplex receptacle (i.e., "outlet"), and never daisy chained. The equipment must meet MIL Performance Specification MIL-PZRF-32167A, which incorporates ASTM F1507 (Standard Specifications for Surge Suppressors for Shipboard Use) and UL 1449 (Safety Standards for Surge Protective Devices).

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 5376K, Shore to Ship/1536K Ship to Shore 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.

F. IT Security

The applicable sections below are required prior to boarding the ship.

a. Guest Scientist Access to Ship Science Systems

1. IT Security Awareness Training:
    a. It is recommended that guests complete the course 3 days before embarking, but must be completed prior to use of or accessing any NOAA ship science computer or network resources guest scientists must complete NOAA's IT Security Awareness Course.
2. Guest scientists must review and sign the Rules of Behaviour (ROB)
3. For Foreign Nationals see section 8.F.

b. Connecting Guest Scientist Computer Systems to NOAA Ships Science Network

1. 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:
2. A virus protection program must be installed, even on Apple Products. For Win-10, Windows Defender is good.
3. Installation of the latest critical operating system security patches.
4. No external public Internet Service Provider (ISP) connections.
5. No Kaspersky products are allowed
6. 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, Windows 7, Server 2003, and Server 2008.

c. Guest Personal Devices, use of Public WiFi

At any time, NOAA OMAO may monitor and/or audit user activity and/or network traffic. In addition, NOAA OMAO may access your system and disclose information obtained through audits to third parties, including law enforcement authorities.

1. Guests must review and sign the Rules of Behaviour
2. No Kaspersky products are allowed

References: *OMAO Fleet IT Security Policy* 1.1 (November 4, 2005), NOAA220 Rules of Behaviour for Public Wifi, NOAA220 Rules of Behaviour for LAN.

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). All Line Office personnel will use the Foreign National Registration System (FNRS) to submit requests for access to NOAA facilities and ships. FNRS does not route through OMAO for access to OMAO facilities and platforms or for access to OMAO Information Technology systems. Therefore OMAO also requires an additional form "Request for Foreign National Access to OMAO Facilities and Platforms" attached to RADM Silah's Memo for NOAA Departmental Sponsors dated OCT 04 2019. 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 Line Office Controlled Technology Coordinators to assist with the process.

Foreign National access must be sought not only for access to the ship involved in the project but also for any Federal Facility access (NOAA Marine Operations Centers, NOAA port offices, USCG Bases) that foreign nationals might have to traverse to gain access to and from the ship. The following are basic requirements.

Full compliance with NAO 207-12 is required.

Responsibilities of the Chief Scientist:

1. Provide the Commanding Officer with the email generated by the Servicing Security Office granting approval for the foreign national guest's visit. 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 Servicing Security Office email

granting approval for the foreign national guest's visit. OMAO CTC will email the CO when access to the platform and IT assets has been approved.

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 Departmental 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 NAO 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. COVID-19 Contingency Plan for Scientific Party (**DRAFT**)

In the event of a non-negative test result for any member of the scientific party, or the identification of recent close contact with a positive COVID-19 case through contact tracing:

- the member will not be cleared to board the ship, and lodging will be provided at a hotel still to be determined in the port of departure (Suape or Rota) at the respective Principal Investigator's expense until the person can fly back to the US.
- The Chief Scientist will be notified of any mission personnel who are not cleared to sail.
- The Chief Scientist will determine, in consultation with the ship's command and appropriate parties, whether the mission will continue without the uncleared personnel.
- Subsequent testing will be sought using quick antigen tests.

In the event a member of the scientific party develops symptoms of possible COVID-19 while underway, OMAO protocols will be followed.

- Once ashore, all logistics and support for the affected scientist(s) will be coordinated through shoreside Point of Contact:

  For leg 1:

  Name: Leticia Barbero
  Title & organization: AOML
  24/7 phone: 305-361-4453
  Email: leticia.barbero@noaa.gov
  Location/Time Zone: EST

For leg 2:

Name: Denis Pierrot
Title & organization: AOML
24/7 phone: 305-361-4441
Email: denis.pierrot@noaa.gov
Location/Time Zone : EST

- Duties of the shoreside support person/team may include coordination of:
  - further testing
  - daily well-being check-in & symptom screening
  - travel
  - lodging
  - medical support
  - on site support as needed
  - notify **the scientist's host institution**

If the affected scientist is in a foreign port, the shoreside POC shall contact **the U.S. Embassy (or consulate, or appropriate Dept. of State entity)** to request help and if necessary, translation support.

DOS contact information by port for this expedition:

X. Appendices

APPENDIX A: FIGURES, MAPS, TABLES

Table 1. Station/Waypoint List (coordinates in Latitude, Longitude: degree-minutes). Waypoints and Test Cast locations can be changed.

Station	Lat deg	Lat min		Lon deg	Lon min		Depth (m)
STA 1	5.9982	25	S	24	59.97	W	5808
STA 2	5.4995	25	S	25	0.1	W	5666
STA 3	4.9995	25.001	S	25	0.68	W	5721
STA 4	4.4989	25	S	25	0.25	W	5547
STA 5	3.9999	24.998	S	25	0.01	w	5398
STA 6	3.4996	24.999	S	25	0.03	W	5571
STA 7	2.9998	25	S	25	0.13	W	5322
STA 8	2.6669	25	S	25	0.02	W	5377
STA 9	2.3332	25	S	25	0.08	W	5018
STA 10	1.9992	24.999	S	25	0.02	W	4951
STA 11	1.6654	25	S	24	59.95	W	4931
STA 12	1.3326	25	S	25	0.01	W	4731
STA 13	0.9959	24.998	S	25	0.05	W	3218
STA 14	0.6661	25.001	S	25	0.03	W	3220
STA 15	0.3323	25.002	S	25	0.09	W	3059
STA 16	0.0008	24.99	S	25	0.01	W	3163
STA 17	0	20.28	N	25	0.16	W	3565
STA 18	0	40.3	N	24	59.84	W	4520
STA 19	1	0.58	N	24	59.75	W	3356
STA 20	1	20.04	N	25	0.02	W	3642
STA 21	1	39.98	N	25	0.01	W	3829
STA 22	2	0.01	N	25	0.02	W	3887
STA 23	2	20	N	25	0	W	3769
STA 24	2	40.05	N	25	0.02	W	4105
STA 25	3	0.42	N	24	59.73	W	4403
STA 26	3	29.97	N	25	15.05	W	4059
STA 27	3	59.62	N	25	30.23	W	4040
STA 28	4	30.04	N	25	44.94	W	4094
STA 29	4	59.98	N	26	0	W	4520

STA 30	5	29.92	N	26	14.95	W	4251
STA 31	6	0.02	N	26	29.96	W	4298
STA 32	6	30.04	N	26	44.98	W	4647
STA 33	7	0.04	N	26	59.94	W	4365
STA 34	7	30.05	N	27	15.03	W	4638
STA 35	8	0	N	27	30.05	W	5086
STA 36	8	29.97	N	27	45.05	W	4934
STA 37	8	59.99	N	28	0	W	5203
STA 38	9	29.96	N	28	15.04	W	5406
STA 39	9	59.95	N	28	29.95	W	5334
STA 40	10	29.99	N	28	44.99	W	5393
STA 41	11	0.05	N	29	0.02	W	5974
STA 42	11	29.98	N	28	59.96	W	5944
STA 43	12	8.26	N	28	59.98	W	5680
STA 44	12	29.4	N	29	0.01	W	5627
STA 45	13	0	N	29	0.05	W	5712
STA 46	13	29.99	N	28	59.98	W	5540
STA 47	13	59.97	N	28	59.9	W	5446
STA 48	14	29.99	N	29	0	W	5382
STA 49	14	59.99	N	29	0	W	5299
STA 50	15	29.96	N	28	59.99	W	5268
STA 51	15	59.99	N	29	0	W	4468
STA 52	16	30	N	29	0.03	W	4873
STA 53	16	59.99	N	29	0.01	W	4884
STA 54	17	30.03	N	29	0.04	W	4615
STA 55	17	59.97	N	28	59.93	W	4554
STA 56	18	29.96	N	29	0.01	W	4693
STA 57	19	0.02	N	29	0.03	W	4571
STA 58	19	30.23	N	29	0.02	W	4959
STA 59	20	0.04	N	29	0.02	W	4800
STA 60	20	29.97	N	28	43.23	W	5149
STA 61	20	59.99	N	28	26.21	W	5031
STA 62	21	30	N	28	9.4	W	5364
STA 63	21	59.95	N	27	52.57	W	5434
STA 64	22	30.02	N	27	35.63	W	5488
STA 65	22	59.95	N	27	18.8	W	5517
STA 66	23	29.97	N	27	1.97	W	5502
STA 67	23	59.95	N	26	44.99	W	5460
STA 68	24	34.08	N	26	25.79	W	5424
STA 69	25	0.04	N	26	11.05	W	5398
STA 70	25	30.01	N	25	54.47	W	5354
STA 71	25	59.99	N	25	37.53	W	4277
STA 72	26	29.94	N	25	20.65	W	5243
STA 73	27	0	N	25	3.83	W	5244
STA 74	27	29.99	N	24	46.87	W	5206
STA 75	28	0	N	24	29.97	W	5217

STA 76	28	30.03	N	24	13.13	W	5201
STA 77	28	59.97	N	23	56.2	W	5189
STA 78	29	29.94	N	23	39.39	W	5242
STA 79	**30**	**0.02**	**N**	**23**	**22.49**	W	5243
STA 80	**29**	**59.93**	**N**	**23**	**22.47**	W	5242
STA 81	30	30	N	23	5.61	W	5284
STA 82	30	59.95	N	22	48.85	W	5247
STA 83	31	30.02	N	22	31.94	W	5224
STA 84	32	0.01	N	22	15.05	W	5170
STA 85	32	30	N	21	58.11	W	5212
STA 86	33	0.01	N	21	41.2	W	5258
STA 87	33	30	N	21	24.43	W	5336
STA 88	33	59.95	N	21	7.52	W	5236
STA 89	34	29.99	N	20	50.61	W	5169
STA 90	34	59.94	N	20	33.77	W	5141
STA 91	35	29.98	N	20	16.92	W	5280
STA 92	35	59.99	N	20	0	W	5348
STA 93	36	29.99	N	20	0.1	W	5157
STA 94	36	59.88	N	20	0.04	W	3797
STA 95	37	30.04	N	19	59.99	W	4845
STA 96	38	0.02	N	20	0.09	W	5134
STA 97	38	29.88	N	20	0.04	W	4147
STA 98	39	0.11	N	19	59.95	W	4750
STA 99	39	29.97	N	20	0.03	W	4657
STA 100	40	0.02	N	20	0.13	W	4759
STA 101	40	29.97	N	20	0.09	W	4920
STA 102	41	0.01	N	20	0.01	W	4708
STA 103	41	29.76	N	20	0.14	W	2559
STA 104	42	0.03	N	20	0.04	W	2349
STA 105	42	29.92	N	19	59.92	W	4150
STA 106	42	59.97	N	20	0.08	W	5539
STA 107	43	30.12	N	19	59.97	W	3975
STA 108	43	59.92	N	20	0.03	W	4001
STA 109	44	30	N	20	0	W	4242
STA 110	44	59.9	N	19	59.8	W	4332
STA 111	45	30.07	N	20	0.01	W	4546
STA 112	46	0.14	N	20	0.09	W	4842
STA 113	46	29.86	N	19	59.96	W	4864
STA 114	47	0.01	N	19	59.88	W	4535
STA 115	47	28.71	N	19	59.86	W	4552
STA 116	48	0.06	N	19	59.8	W	4362
STA 117	48	30	N	19	59.96	W	4046
STA 118	49	0.22	N	20	0.1	W	4415
STA 119	49	30.1	N	20	0	W	3869
STA 120	49	59.97	N	20	0.07	W	4402

STA 121	50	30.01	N	19	59.97	W	3933
STA 122	51	0.03	N	20	0.02	W	3658
STA 123	51	30	N	19	59.92	W	3627
STA 124	52	0.11	N	19	59.97	W	3772
STA 125	52	29.97	N	20	0.01	W	2781
STA 126	52	59.99	N	19	59.99	W	2677
STA 127	53	30.14	N	19	59.96	W	2288
STA 128	54	0.01	N	19	59.9	W	1417
STA 129	54	30.08	N	19	59.97	W	1384
STA 130	55	0.15	N	19	59.98	W	1611
STA 131	55	30.03	N	20	0.03	W	1090
STA 132	56	0.1	N	19	59.94	W	1464
STA 133	56	30.18	N	20	0.1	W	1375
STA 134	56	59.98	N	19	59.97	W	972
STA 135	57	29.98	N	20	0.09	W	1168
STA 136	58	0.08	N	19	59.87	W	1638
STA 137	58	30.05	N	20	0.02	W	2570
STA 138	58	59.91	N	19	59.96	W	2842
STA 139	59	30	N	19	59.84	W	2768
STA 140	59	59.99	N	20	0.09	W	2724
STA 141	60	30.04	N	20	0	W	2528
STA 142	61	0.04	N	20	0.11	W	2411
STA 143	61	20.01	N	19	59.93	W	2358
STA 144	61	36.78	N	20	0	W	2060
STA 145	61	49.97	N	19	59.95	W	1711
STA 146	62	20	N	19	59.99	W	1799
STA 147	62	44.91	N	20	0.02	W	1412
STA 148	63	7.49	N	19	59.95	W	1005
STA 149	63	12.84	N	19	59.63	W	554
STA 150	63	17.58	N	20	0.2	W	264

CTD Operations: CTD casts will include the CTD/O2 unit, a Rosette sampler and 24, 12-L bottles on the Rosette frame. Approximately 145 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.

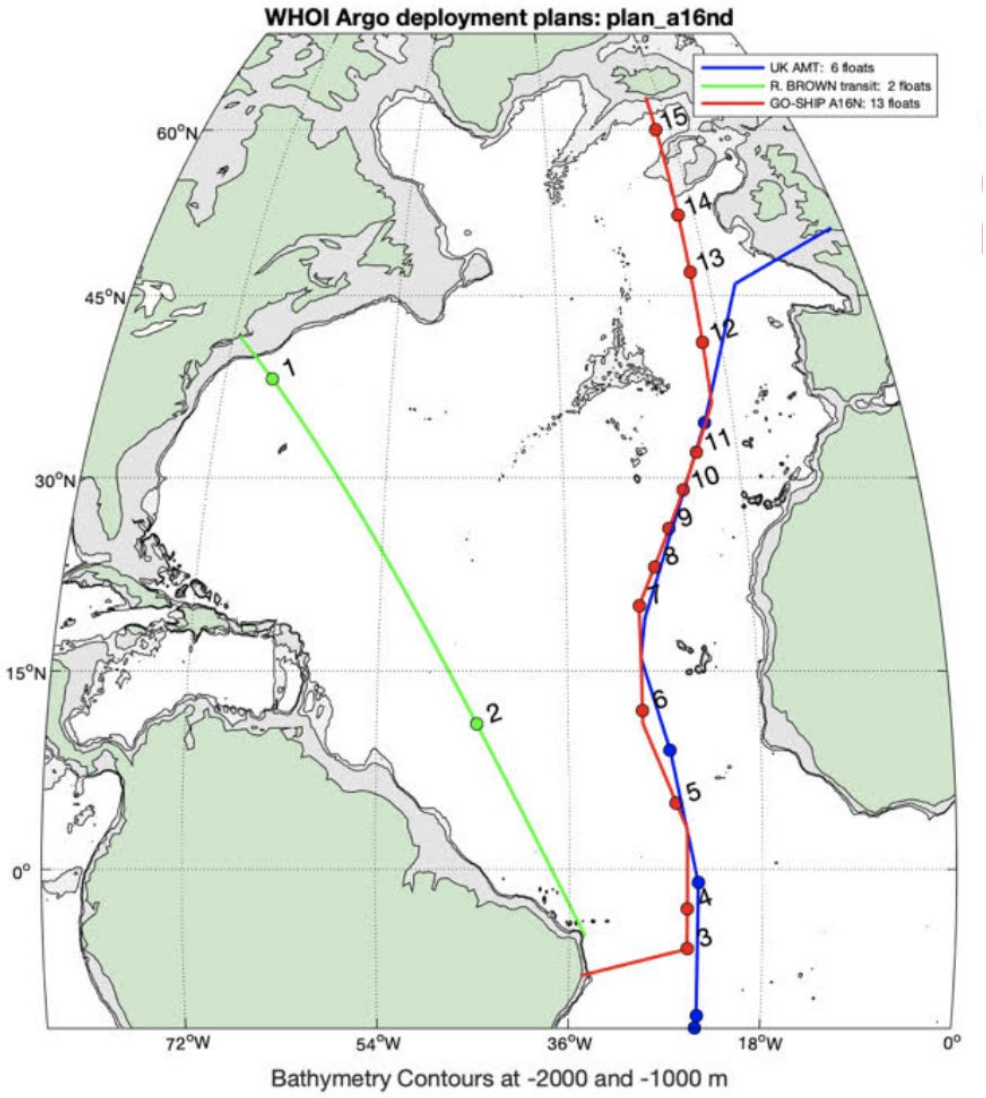

Figure 2. Approximate location for Argo float deployments during the transit leg (no need to slow down ship for Core Argos. GO-BGC will be deployed at stations).

Number and position of floats to be determined soon.

APPENDIX B: HAZMAT list, Spill cleaning procedures and Spill kit list.

A list has been provided to the ship

Inventory

Chemical safety and spill response procedures

A: ACID

- Wear appropriate protective equipment and clothing during clean-up. Keep upwind. Keep out of low areas.
- Ventilate closed spaces before entering them.
- Stop the flow of material, if this is without risk. Dike the spilled material, where this is possible.
- **Large Spills**: Dike far ahead of spill for later disposal. Use a non-combustible material like vermiculite, sand or earth to soak up the product and place into a container for later disposal.
- **Small Spills**: Wipe up with absorbent material (e.g. cloth, fleece). Clean surface thoroughly to remove residual contamination.
- Never return spills in original containers for re-use.
- Neutralize spill area and washings with soda ash or lime. Collect in a non-combustible container for prompt disposal.
- J. T. Baker NEUTRASORB® acid neutralizers are recommended for spills of this product.

M: Mercury

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

F: Formalin/Formaldehyde

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

Inventory of Spill Kit supplies

Product Name	Amount	Chemicals it is useful against	Amount it can clean up

APPENDIX C: VAN DIMENSIONS, LOCATIONS AND REQUIREMENTS

1) CFC van. Needs phone (and Ethernet).

weight 13,000 lbs

size 8' x 8' x 20'

power input	440V, 3 phase
location	main deck, aft inside space
Door:	Left side of van near double doors
Contract Person:	Rolf Sonnerup, PMEL ()

2) DICE van. Needs compressed air, fresh water available, phone and Ethernet.

weight	14,000 lbs
size	8' x 8' x 20'
power input	30 amps, 3 phase, and 440v.
location	main deck aft outside space
Door:	center, right side of van
Contact Person:	Charles Featherstone, AOML (Charles.Featherstone@noaa.gov)

3) Storage van

weight	15,000 lbs
size	8' x 8' x 20'
power input	none
location	flexible
Door:	aft
Contact Person:	Andy Stefanick, AOML (Andrew.Stefanick@noaa.gov)

APPENDIX D: PACKAGE RADIATION SAFETY LETTER

NOAA Form 57-07-02
(3-12) Page 1 of 2

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

REQUEST TO USE RADIOACTIVE MATERIAL ABOARD A NOAA SHIP

INSTRUCTIONS: Complete sections 1-5. Submit to the Marine Operations Center with indicated attachments at least 3 months in advance of a domestic project or at least 8 months in advance of a foreign project start date.

Section 1 - Project and Contact Information

NOAA SHIP	PROJECT TITLE	PROJECT START DATE	PROJECT END DATE
Ron Brown	Go-Ship A16N	03/06/2023	05/09/2023
NAME of DIRECTOR	**LABORATORY or INSTITUTION**	**E-MAIL ADDRESS**	
Michelle McClure	NOAA Pacific Marine Environmental Lab	michelle.mcclure@noaa.gov	
NAME of RADIATION SAFETY OFFICER	**LABORATORY or INSTITUTION**	**E-MAIL ADDRESS**	
Lucia Upchurch	UW/CICOES & NOAA/PMEL	lucia.upchurch@noaa.gov	
NAME of AUTHORIZED USER	**LABORATORY or INSTITUTION**	**E-MAIL ADDRESS**	
Bonnie Chang	UW/CICOES & NOAA/PMEL	bxc@uw.edu	
NAME of CHIEF SCIENTIST	**LABORATORY or INSTITUTION**	**E-MAIL ADDRESS**	
Denis Pierrot/Leticia Barbero	NOAA/AOML & U. Miami/CIMAS	denis.pierrot@noaa.gov/leticia.barbero@	

Section 2 - License and Experiment Protocols

RADIOISOTOPE - ELEMENT and MASS NUMBER	RADIOISOTOPE - CHEMICAL or PHYSICAL FORM	LICENSE NUMBER	EXPIRATION DATE
63-Ni	plated sources in detector cells	46-23463-01	03/31/2026
PURPOSE FOR WHICH RAM WILL BE USED			
The detectors are used in gas chromatographic analyses for tracing ocean water masses, a critical long-term measurement.			
RADIOISOTOPE - MAXIMUM AMOUNT TO BE BROUGHT ABOARD (µCi)	**RADIOISOTOPE - MAXIMUM AMOUNT TO BE USED PER EXPERIMENT (µCi)**		
35.9 mCi	N/A no waste generated		
RADIATION EQUIPMENT USED FOR SURVEYS, SPILLS, and WIPE TESTS			**CALIBRATION DATE**
Wipe/Leak tests will be performed prior to shipment to the vessel and upon return from the cruise.			

Section 3 - Logistics

RAM LOAD DATE	RAM LOAD PORT	METHOD RAM WILL BE LOADED
02/03/2023	Newport, RI	Secured inside 20' Conex loaded by crane onto the ship. RAM will stay inside Conex
WILL THE AUTHORIZED USER BE ON BOARD THE VESSEL FROM THE LOAD DATE UNTIL THE OFFLOAD DATE? IF NO, EXPLAIN BELOW.		
○ YES ◉ NO The Conex will be locked and secured for sea while the AU is not on board.		
LABORATORY IN WHICH RAM WILL BE STORED		**LABORATORY or AREA IN WHICH RAM WILL BE USED**
Inside the Conex, DOCU 000101-2		Only in Conex.
MAXIMUM AMOUNT of RADWASTE TO BE GENERATED		**TYPE of RADWASTE TO BE GENERATED**
N/A		N/A
RAM OFFLOAD DATE	**RAM OFFLOAD PORT**	**METHOD RAM and RADWASTE WILL BE OFFLOADED**
06/01/2023	Pascagoula, MS	Secured inside Conex

Section 4 - Radiation Workers

NAME	INSTITUTION	REPORT DATE	DETACH DATE
Bonnie Chang	UW/CICOES & NOAA/PMEL	03/02/2023	05/10/2023
NAME	INSTITUTION	REPORT DATE	DETACH DATE
NAME	INSTITUTION	REPORT DATE	DETACH DATE
NAME	INSTITUTION	REPORT DATE	DETACH DATE

REQUEST TO USE RADIOACTIVE MATERIAL ABOARD A NOAA SHIP

Section 5 - Certification Statements

- The Radiation Safety Officer, Authorized User and Radiation Workers listed above are authorized to possess and use the indicated radioisotope.
- All personnel have had proper training in handling radioisotopes.
- All personnel have prior experience working with radioisotopes.
- All necessary precautions for the safe transport, handling and disposal of radioactive waste, in accordance with applicable regulations, will be followed.
- Radioactive waste will not be disposed of at sea.
- OMAO shipboard personnel are not authorized to use radioactive materials and are not to be held responsible under any circumstance for the handling, transport or disposal of said materials.
- All radioisotope work will be confined to the portable laboratory van or the immediately adjacent weather deck area.
- A waiver to use radioactive materials in any interior ship space must be obtained from the Director, OMAO.
- The primary Authorized User is responsible for the clean-up of any radioisotope spill.
- The Chief Scientist will furnish a copy of the Shipboard Radioisotope Usage Form (NOAA Form 57-07-03) to the Commanding Officer/Master upon completion of the work.

	NAME	SIGNATURE	DATE
Director	Michelle McClure	MCCLURE.MICHELLE.MARIE.1365819889 Digitally signed by MCCLURE.MICHELLE.MARIE.1365819889 Date: 2022.11.02 12:21:13 -07'00'	11/2/2022
Radiation Safety Officer	Lucia Upchurch	UPCHURCH.LUCIA.MAY.1468403117 Digitally signed by UPCHURCH.LUCIA.MAY.1468403117 Date: 2022.11.02 12:12:15 -07'00'	11/2/2022
Authorized User	Bonnie Chang	Date: 2022.11.01 14:14:09 -07'00'	11/01/2022
Chief Scientist	Denis Pierrot/Leticia Barbero	Digitally signed by PIERROT.DENIS.PIERRE.1382885763 Date: 2022.11.27 12:54:11 -05'00'	11/27/2022

Section 6 - Authorization

	NAME	SIGNATURE	DATE
Commanding Officer, MOC	CDR Amanda Goeller, NOAA	GOELLER.AMANDA.LYNNE.1267671644 Digitally signed by GOELLER.AMANDA.LYNNE.1267671644 Date: 2023.01.23 09:30:49 -05'00'	1/23/2023

Attachments: Draft Cruise Instructions
Materials License, NRC Form 374 and attachments, or State License and attachments
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)
Material Data Safety Sheet (MSDS)
Experiment or Usage Protocols, including spill clean-up procedures
Waiver Request (if applicable)

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