U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration

MEMORANDUM FOR: Captain Robert Kamphaus, NOAA
Commanding Officer, NOAA Ship *Ronald H. Brown*

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

SUBJECT: Project Instruction for RB-16-05
Ocean Observatories Initiative, Station PAPA 2016

Attached is the final Project Instruction for RB-16-05, Ocean Observatories Initiative, Station PAPA 2016, which is scheduled aboard NOAA Ship *Ronald H. Brown* during the period of June 22 – July 8, 2016. Of the 17 DAS scheduled for this project, 17 days are funded by NSF OOI Program. This project is estimated to exhibit a Medium Operational Tempo. Acknowledge receipt of these instructions via e-mail to **ChiefOps.MOA@noaa.gov** at Marine Operations Center-Atlantic.

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FINAL Project Instructions

Date Submitted: June 8, 2016

Platform: NOAA Ship *Ronald H. Brown*

Project Number: RB-16-05 (OMAO)

Project Title: Ocean Observatories Initiative, Station Papa 2016, Deployment 4

Project Dates: June 22, 2016 to July 8, 2016
Must encompass transits to/from project ports as well as the actual project days themselves.

Prepared by: _____ Dated: June 8, 2016
Edward Dever
Chief Scientist
Oregon State University

Approved by: _____ Dated: June 14, 2016
Paul Matthias
~~UOI~~ CGSN Project Manager
Woods Hole Oceanographic Institution

Approved by: _____ Dated: 6/14/16
Commander Scott M. Sirois, NOAA
Commanding Officer Marine
Operations Center – Atlantic

I. Overview

A. Brief Summary and Project Period

This cruise is the fourth deployment (third turnaround) for the Station PAPA of the National Science Foundation's Ocean Observatories Initiative (OOI; http://www.oceanobservatories.org). The Station PAPA Array includes a network of moorings and gliders to monitor waters in the data sparse high latitudes of the Gulf of Alaska. The moorings and the gliders give the array the capability to address the role of the mesoscale flow field in ocean dynamics (*3203-00007 CGSN Site Characterization: Station PAPA*).

The cruise originates at the US Coast Guard Base Seattle, WA where equipment will be loaded and the science party will join.

The Station PAPA cruise objectives include the recovery and deployment of the Global Hybrid Profiler Mooring and the Mesoscale Flanking Moorings A and B, the recovery of three and deployment of five gliders: three perimeter gliders with modems and two profiling gliders, and CTD casts with water sampling at the mooring sites for instrument calibration and data verification. In addition, intercomparisons of shipboard and moored sensors will be carried out as well as various shipboard oceanographic and atmospheric sampling.

After the work at the OOI Papa mooring sites, the cruise will end at the US Coast Guard Base, Seattle WA and equipment will be shipped back from there.

B. Days at Sea (DAS)

Of the _17_ DAS scheduled for this project, _17_DAS are Other Agency funded (NSF OOI program). This project is estimated to exhibit a ____ Operational Tempo.

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

The Station Papa Global Observatory site is located at 50° N, 145° W in the northeastern Pacific. The water depth is nominally 4250 meters (Figure 1). Full ocean depth CTD profiles will be done near each mooring. Mooring site locations and water depths of the currently deployed platforms are provided in Appendix A. Exact deployment locations for RB 16-05 are being determined in consultation with NOAA personnel responsible for the June 2016 NOAA Station Papa turn cruise on board the CCGS John P. Tully. The Tully will turn the NOAA Station Papa mooring and return the week before RB 16-05.

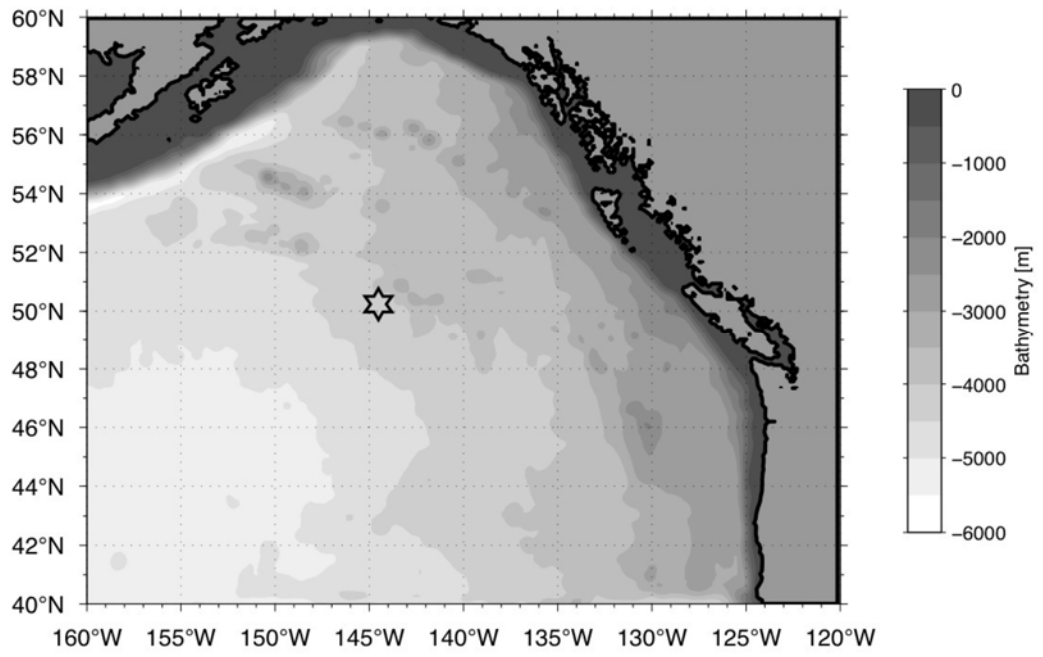


Figure 1 Large scale map of the Station PAPA region in the Gulf of Alaska.

D. Summary of Objectives

The high level cruise objectives are:

• To recover the three moorings Ocean Observatories Initiative (OOI) mesoscale flanking mooring A (GP03FLMA-00003), the hybrid profiler mooring (GP02HYPM-00003), and mesoscale flanking mooring B (GP03FLMB-00003) deployed in 2015

• To deploy the three replacement moorings (GP03FLMA-00004, GP02HYPM-00004, GP03FLMB-00004)

• To recover the three remaining glider(s) deployed in 2015

• To deploy five gliders (3 Open Ocean Gliders, and 2 Global Profiling Gliders)

• To collect ancillary data for calibration and validation of the glider and mooring sensors. These data are ship-based CTD casts with water samples, and ship ADCP and meteorology data.

E. Participating Institutions

- Woods Hole Oceanographic Institution (WHOI) – lead mooring integration and deck operations
- Oregon State University (OSU) – assist mooring integration and deck operations, lead glider deployments and recoveries, water sampling, science oversight
- University of Washington (UW) – CTD technician

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

Name (Last, First)	Title	Date Aboard	Date Disembark	Gender	Affiliation	Nationality
Dever, Edward	Chief scientist	22 June 2016	8 July 2016	M	OSU	USA
Dunn, James	Mooring lead technician	22 June 2016	8 July 2016	M	WHOI	USA
Murphy, Stephen	Mooring technician	22 June 2016	8 July 2016	M	WHOI	USA
Donahue, Megan	Mooring technician	22 June 2016	8 July 2016	F	WHOI	USA
Pearce, Stuart	Glider and water sampling technician	22 June 2016	8 July 2016	M	OSU	USA
Black, Ian	Mooring technician (student)	22 June 2016	8 July 2016	M	OSU	USA
Whitefield, Jonathan	Mooring technician	22 June 2016	8 July 2016	M	OSU	UK (US permanent legal resident (green card holder)
Lambert, Steven	Mooring technician	22 June 2016	8 July 2016	M	OSU	USA
Murphy, Brandi	CTD technician	22 June 2016	8 July 2016	F	UW	USA

G. Administrative

1. Points of Contact:

Chief Scientist: Edward Dever, edever@ceoas.oregonstate.edu, (541) 908-2119, 104 CEOAS Admin Bldg, Oregon State University, 97331

Staging and De-Staging: John Kemp, jkemp@whoi.edu, (508) 289-2241, MS 02 Woods Hole Oceanographic Institution, Woods Hole, MA, 02543

Deck Operations: James Dunn, jdunn@whoi.edu, (508) 289-2999, MS 02 Woods Hole Oceanographic Institution, Woods Hole, MA, 02543

Scheduling and Port Logistics: Eric Benway, ebenway@whoi.edu, (508) 289-3770, MS 37 Woods Hole Oceanographic Institution, Woods Hole, MA, 02543

2. Diplomatic Clearances

None Required. Data acquisition systems will be turned off while transiting Canadian EEZ.

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.

The Chief Scientist (CS) will follow the Project Instruction in order to accomplish, to the extent practicable, programmatic and scientific objectives as described. The ship's Commanding Officer and the CS have discretion to alter the order of operations as well as determine that some operations cannot be accomplished safely or effectively, based on conditions encountered at sea.

The tasks and responsibilities for the cruise have been discussed beforehand, but will be talked about again while on transit to the site so every member of the team has a clear idea of the expectations. The CS will guide the team in troubleshooting any failures and will make the final call on actions to be taken with regards to the platforms to be recovered and/or deployed. Significant modifications to the cruise objectives (e.g. inability to deploy/recover a platform), or changes to the Project Instruction anticipated to have significant financial impacts, will be communicated to the OOI Coastal Global Scale Nodes project manager at the earliest opportunity. Incidents involving injury or damaged/lost equipment will follow established Program protocols (NOAA policies, OOI Incident Reporting Process). Anomalies, suspected failures and confirmed failures will be handled according to the OOI Equipment Notification and Escalation Process.

A. Project Itinerary:

B. Staging and Destaging:

Staging will start at the Seattle, WA US Coast Guard Base starting 10 June. Loading will be done at Seattle, WA US Coast Guard Base during 20-21 June. A shore crane will be hired to load all the OOI heavy equipment such as the Lebus winch, the anchors and the ragtop container with glass balls (see load list and proposed deck plan, Appendix C). The ship's crane should be suitable for loading the remaining science gear if needed. By the 21st all of the gear should be on board, and the day will be spent securing it for transit. A deck plan listing weights and locations of major mooring equipment and hardware is provided in Appendix C.

Destaging and offloading of scientific equipment will take place at the US Coast Guard Base, Seattle, WA starting at the end of the cruise on 8 July. Arrangements will be made to have a shore

crane to offload all heavy equipment and the ship's crane should be suitable for offloading all other science gear as necessary. Offloading of scientific equipment will be completed on 9 July.

C. Operations to be Conducted:

1. Release Tests

At a convenient time prior to deployment of the moorings, the science party will perform release tests. The release tests involve lowering multiple acoustic releases, to one or more depths between 3500 m and the surface and held there while being interrogated acoustically. The science party will bring an acoustic transceiver that can be lowered over the rail with a cable run to the main lab and connected to a transceiver controller.

2. Mooring Operations

WHOI's Jim Dunn will be the Deck Lead for Mooring Operations, and will be running the deck in coordination with the ship's crew involved such as boatswain, bridge personnel, etc. Science party personnel will be familiar with mooring deployment and recovery, and will assist in the operations as directed and with other observation and data collection activities as needed.

Mooring recovery and deployment procedures are described in Appendices E (Flanking Mooring Recovery, F (Flanking Mooring Deployment), G (Hybrid Profiler Mooring Recovery), and H (Hybrid Profiler Mooring Deployment). Mooring deck drawings are attached as Appendices I (Flanking Mooring A), J (Hybrid Profiler Mooring), and K (Flanking Mooring B).

As deployed mooring locations for 2015 are attached as Appendix A. Planned mooring locations are attached as part of Appendix B. A map of 2015 mooring locations is shown in Figure 2. At each mooring site, the 2015 mooring will first be recovered and the 2016 mooring will then be

deployed. 2016 mooring locations will be as close as to 2015 locations (station waypoint list Appendix B) as practicable.

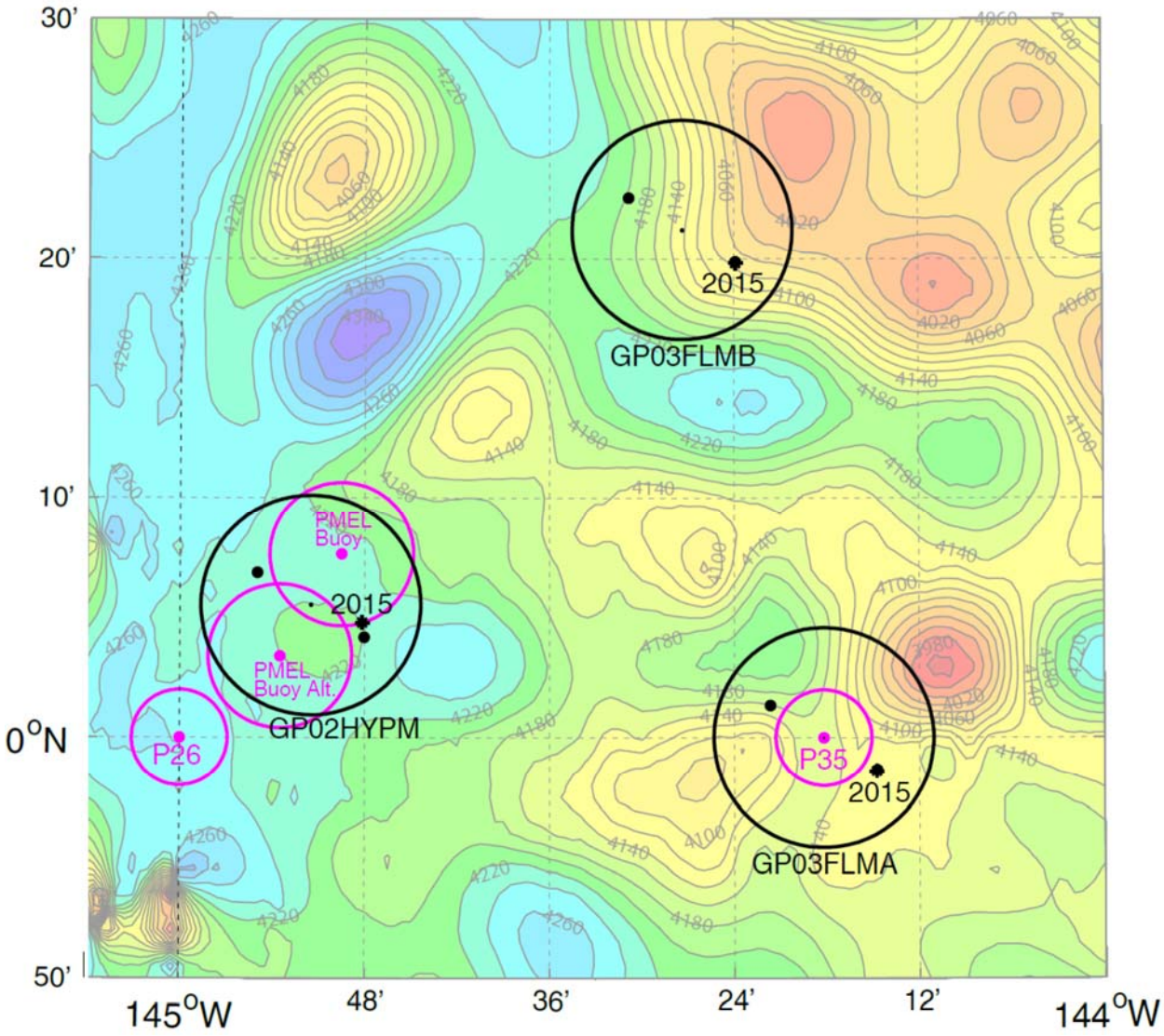


Figure 2 OOI Station Papa mooring locations. Mooring locations are indicated in black. 2016 mooring sets will be close to 2015 locations black asterisks). Magenta circles indicated Canadian Line P CTD stations. The NOAA PMEL buoy is also indicated in magenta

The planned order of mooring operations is

1. Recover 2015 Flanking Mooring A
2. Deploy Flanking Mooring A
3. Recover 2015 Hybrid Profiler Mooring
4. Deploy Hybrid Profiler Mooring
5. Recover 2015 Flanking Mooring B

6. Deploy Flanking Mooring B

A more detailed mooring operations itinerary is included as part of Appendix B. While this is the planned order of mooring operations, the actual order of mooring operations may be modified with the consent of the commanding officer based on weather, equipment readiness etc.

3. Glider Operations

Glider deployments and recoveries will be done using the ship's crane and handling equipment supplied by the science party. OSU's glider Subject Matter Expert (SME) Stuart Pearce will lead the glider operations and will instruct the science party personnel on deployment and recovery operations, so that he can get assistance as needed on such operations in cooperation with the ship's crew. The CS will work with the glider SME in order to carry out glider sensor and acoustic modem communications tests and accomplish the successful recovery of the one glider and deployment of the five units that will be left at the site. When a glider is deployed, it will be directed away from the area before mooring operations. The gliders will be directed to perform a dive while a CTD cast is done simultaneously for calibration/verification purposes.

4. Anchor Surveys

Once the anchor is released at each site, it will be ranged acoustically to determine when it has settled on the bottom. After this happens, an acoustic survey will be performed on one of the releases to determine position.

5. CTD casts

CTD casts will be conducted using the Seabird 9-11 CTD sensors, 24 bottle rosette frame, and deck box. The CTD will be supplied by the R/V Thompson. CTD operations will be supervised by a marine technician from University of Washington while the science party will supply line handlers and a lab operator. Water sampling and analysis will be handled by the science party.

6. Sensor Performance Evaluation

Sensor evaluation operations will be conducted before the deployment of the platforms. The primary means of evaluation will be CTD casts with the instruments attached to the rosette and measuring at a high sampling rate. The data from these casts will be reviewed to determine if the instrument is functioning properly, and if it is ready for deployment. Water samples will be collected from these casts for analysis (some on board, other variables after the cruise), and to determine coefficients to apply to the time series. Recovered instruments will also be attached to the CTD rosette for CTD casts with water samples, to obtain post-recovery calibration coefficients. In the case of the gliders, they will be directed to congregate at a common spot and a CTD cast will be done as close as possible to the area, for validation purposes.

7. Bathymetry surveys

The OOI station Papa mooring array includes alternate deployment locations. However, these alternate deployment locations lack a good local bathymetry record. Following each mooring deployment, time is allowed in the cruise plan to gather local bathymetry data at each of the alternate deployment locations.

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:

In the case of a recovery operation, the ship will maneuver to the item to be retrieved and grappling lines and/or pick up poles will be used. Mooring activities may be restricted by severe weather or equipment failure. Severe weather would result in postponement until conditions eased. Failure of a given piece of Project equipment (*e.g*. winch, air tugger) can typically be compensated by use of an alternative approach. Failure of ship's equipment (*e.g.* electrical or hydraulic system) would result in postponement of operations until the failure was addressed. If possible, operations will be delayed until any issue that may have arisen is resolved and conditions are more favorable. The sequence of operations will depend on the weather and any other ship operations in the area which could overlap with the timing of the cruise.

The use of a work boat may be requested, at the discretion of the ship, for glider recovery or attending to unforeseen problems that would require physical access to a mooring component on the surface. There is currently not an expectation that this will be a need and the ship's Commanding Officer and the CS will discuss any such type operations needed. Small boat activities may be restricted by weather.

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

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

a. Shipboard Underway Data

The ship's meteorological system will be used to continuously monitor weather conditions, and the ship's ADCP systems will be used to continuously measure the currents in the upper ocean. Sea surface temperature and salinity will be recorded continuously, using the ship's thermosalinograph.

b. Shipboard Multi-beam Bathymetry

The ship's multibeam system will be used to confirm the bathymetric surveys performed in previous years, and to study in more detail the deployment locations, if needed. Nominal waypoints for each survey will be provided to the bridge as needed, and cruising speed, leg length, and leg spacing will be adjusted as needed to ensure adequate data overlap and good system performance.

B. Equipment and Capabilities provided by the scientists (itemized)
   a. CTD with auxiliary sensors and 24 place rosette
   b. Lebus Winch

IV. Hazardous Materials (see Appendix D)

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: (see Appendix D)

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

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

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

Upon departure from the ship, scientific parties will provide the CO or their designee an inventory showing that all chemicals were removed from the vessel. The CO's designee will

maintain a log to track scientific party hazardous materials. MSDS will be made available to the ship's complement, in compliance with Hazard Communication Laws.

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

B. Inventory

(See attached Appendix D)

C. Chemical safety and spill response procedures

(See attached Appendix #)

D. Radioactive Materials

No Radioactive Isotopes are planned for this project. (Replaces all below under IV. D-E)

E. Inventory (itemized) of Radioactive Materials

No Radioactive Isotopes are planned for this project.

V. Additional Projects

A. Supplementary ("Piggyback") Projects

No Supplementary Projects are planned.

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. 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 short comings of the project. Concerns regarding safety, efficiency, and suggestions for future improvements shall be discussed and mitigations for future projects will be documented for future use. This meeting shall be attended by the ship's officers, applicable crew, the Chief Scientist, and members of the scientific party and is normally arranged by the Operations Officer and Chief Scientist.

D. Project Evaluation Report

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

VIII. Miscellaneous

A. Meals and Berthing

The ship will provide meals for the scientists listed above. Meals will be served 3 times daily beginning one hour before scheduled departure, extending throughout the project, and ending two hours after the termination of the project. Since the watch schedule is split between day and night, the night watch may often miss daytime meals and will require adequate food and beverages (for

example a variety of sandwich items, cheeses, fruit, milk, juices) during what are not typically meal hours. Special dietary requirements for scientific participants will be made available to the ship's command at least seven days prior to the project.

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

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

All persons boarding NOAA vessels give implied consent to comply with all safety and security policies and regulations which are administered by the Commanding Officer. All spaces and equipment on the vessel are subject to inspection or search at any time. All personnel must comply with OMAO's Drug and Alcohol Policy dated May 17, 2000 which forbids the possession and/or use of illegal drugs and alcohol aboard NOAA Vessels.

B. Medical Forms and Emergency Contacts

The NOAA Health Services Questionnaire (NHSQ, NF 57-10-01 (3-14)) must be completed in advance by each participating scientist. The NHSQ can be obtained from the Chief Scientist or the NOAA website http://www.corporateservices.noaa.gov/noaaforms/eforms/nf57-10-01.pdf.

All NHSQs submitted after March 1, 2014 must be accompanied by NOAA Form (NF) 57-10-02 - Tuberculosis Screening Document in compliance with OMAO Policy 1008 (Tuberculosis Protection Program).

The completed forms should be sent to the Regional Director of Health Services at the applicable Marine Operations Center. The NHSQ and Tuberculosis Screening Document should reach the Health Services Office no later than 4 weeks prior to the start of the project to allow time for the participant to obtain and submit additional information should health services require it, before clearance to sail can be granted. Please contact MOC Health Services with any questions regarding eligibility or completion of either form. Ensure to fully complete each form and indicate the ship or ships the participant will be sailing on. The participant will receive an email notice when medically cleared to sail if a legible email address is provided on the NHSQ.

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

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

Contact information: Include only the Pacific OR Atlantic Office as applicable.

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

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

C. Shipboard Safety

Hard hats are required when working with suspended loads. Work vests are required when working near open railings and during small boat launch and recovery operations. Hard hats and work vests will be provided by the ship when required.

Wearing open-toed footwear or shoes that do not completely enclose the foot (such as sandals or clogs) outside of private berthing areas is not permitted. At the discretion of the ship CO, safety shoes (i.e. steel or composite toe protection) may be required to participate in any work dealing with suspended loads, including CTD deployment and recovery. The ship does not provide safety-toed shoes/boots. The ship's Operations Officer should be consulted by the Chief Scientist to ensure members of the scientific party report aboard with the proper attire.

D. Communications

A progress report on operations prepared by the Chief Scientist may be relayed to the program office. Sometimes it is necessary for the Chief Scientist to communicate with another vessel, aircraft, or shore facility. Through various means of communications, the ship can usually accommodate the Chief Scientist. Special radio voice communications requirements should be listed in the project instructions. The ship's primary means of communication with the Marine

Operations Center is via email and the Very Small Aperture Terminal (VSAT) link. Standard VSAT bandwidth at 128kbs is shared by all vessels staff and the science team at no charge. Increased bandwidth in 30 day increments is available on the VSAT systems at increased cost to the scientific party. If increased bandwidth is being considered, program accounting is required 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.

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

Foreign National access to the NOAA ship or Federal Facilities is not required for this project. (Replaces all below under VIII. F)

VIII. Appendices (all that apply)

A. 2015 Target and Actual Mooring Locations

Mooring	Target Position	Actual Position	Deployment Date & Time (UTC)
GP02HYPM-00003	50° 04.82' N 144° 48.03' W	50° 04.79' N 144° 48.18' W	2015-06-04 23:38
GP03FLMA-00003	49° 58.65' N 144°14.74' W	49° 58.60' N 144°14.77' W	2015-06-06 22:40
GP03FLMB-00003	50° 19.88' N 144° 23.85' W	50° 19.82' N 144° 23.90' W	2015-06-08 21:25

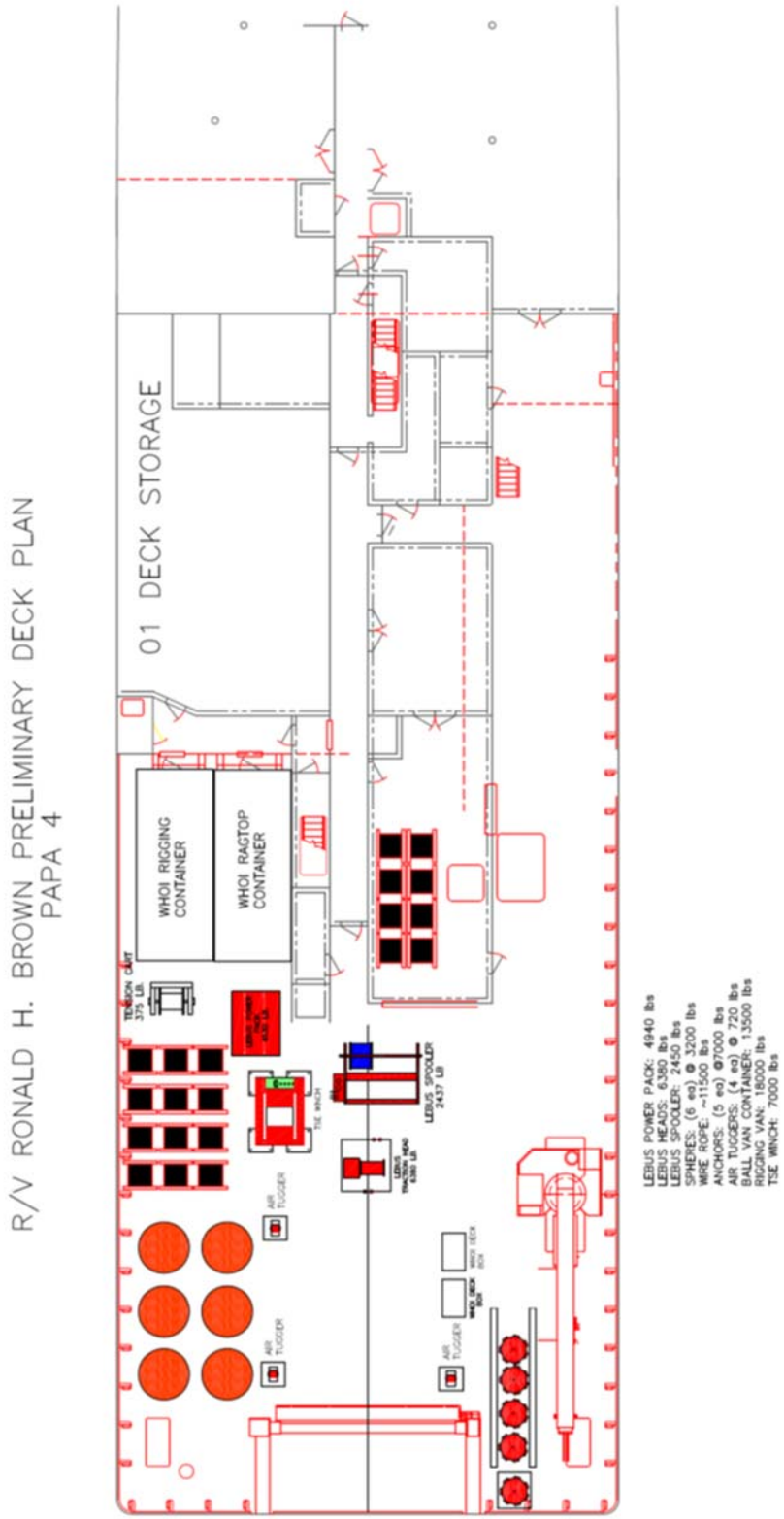
Appendix B Station/Waypoint List (coordinates in Latitude, Longitude: degree-minutes)

activity	lat deg	lat min	N	lon deg	lon min	W	arrive date/time (PDT)	depart date/time (PDT)
depart USCG base Seattle	47	35.408	N	122	20.408	W		6/22/16 8:00
harbor transit, exit Seattle, begin transit to flanking mooring A site	48	29.200	N	124	47.100	W	6/22/16 20:00	6/22/16 20:00
turn on sensors after entering international waters	49	12.000	N	133	40.000	W	6/24/16 6:00	6/24/16 6:00
pre-deployment (test) CTD (P15)	49	12.000	N	133	40.000	W	6/24/16 6:00	6/24/16 8:00
acoustic release test (9 to be tested, multiple lowerings)	49	12.000	N	133	40.000	W	6/24/16 8:00	6/24/16 16:00
continue transit to flanking mooring A (GP03FLMA) site	49	12.000	N	133	40.000	W	6/24/16 16:00	6/24/16 0:00
arrive at flanking mooring A (GP03FLMA) site	50	0.000	N	144	18.198	W	6/26/16 6:00	6/26/16 6:00
test acoustic communications with old flanking mooring A (GP03FLMA)	49	59.000	N	144	15.000	W	6/26/16 6:00	6/26/16 8:00
transit 10 km to array center	50	10.000	N	144	30.000	W	6/26/16 8:00	6/26/16 8:30
recover 1-3 gliders (to be modified based on positions of gliders)	50	10.000	N	144	30.000	W	6/26/16 8:30	6/26/16 10:30
deploy 4-5 gliders	50	10.000	N	144	30.000	W	6/26/16 10:30	6/26/16 16:30
CTD cast with colocated gliders, water samples	50	10.000	N	144	30.000	W	6/26/16 16:30	6/26/16 19:30
return transit to flanking mooring A (GP03FLMA)	49	58.600	N	144	14.770	W	6/26/16 19:30	6/26/16 20:00
pre-recovery CTD cast near old flanking mooring A (GP03FLMA) with water samples	49	59.000	N	144	15.000	W	6/26/16 20:30	6/27/16 0:00
bathymetry survey around alternate flanking mooring A (GP03FLMA) sites	50	0.000	N	144	18.198	W	6/27/16 0:00	6/27/16 6:00
prepare deck for recovery	49	58.600	N	144	14.770	W	6/27/16 6:00	6/27/16 8:30
drift test, release flanking mooring A (GP03FLMA)	**49**	**58.600**	**N**	**144**	**14.770**	**W**	6/27/16 8:30	6/27/16 8:30

recovery of flanking mooring A (GP03FLMA)	49	58.600	N	144	14.770	W	6/27/16 8:30	6/27/16 16:30
clean deck, drift test, prepare for deployment	49	58.600	N	144	14.770	W	6/28/16 6:00	6/28/16 8:30
deployment of flanking mooring A (GP03FLMA)	**49**	**58.650**	**N**	**144**	**14.740**	**W**	6/28/16 8:30	6/28/16 16:30
post-deployment CTD cast near flanking mooring A (GP03FLMA) with water samples	49	59.000	N	144	15.000	W	6/28/16 16:30	6/28/16 20:00
test acoustic communications with new flanking mooring A (GP03FLMA)	49	58.650	N	144	14.740	W	6/28/16 20:00	6/28/16 23:00
transit to hybrid profiler mooring (GP02HYPM) site	50	4.820	N	144	48.030	W	6/28/16 23:00	6/28/16 23:30
arrive at Hybrid Profiler mooring (GP02HYPM) site	50	4.820	N	144	48.030	W	6/28/16 23:30	6/28/16 23:30
pre-recovery CTD cast near old hybrid profiler mooring (GP02HYPM)	50	5.000	N	144	48.000	W	6/28/16 23:30	6/29/16 3:00
test acoustic communications with old hybrid profiler mooring (GP02HYPM)	50	5.000	N	144	48.000	W	6/29/16 3:00	6/29/16 5:00
bathymetry survey around alternate hybrid profiler mooring (GP02HYPM) sites, prepare deck for recovery	50	5.526	N	144	51.498	W	6/29/16 5:00	6/29/16 8:30
drift test, release hybrid profiler mooring (GP02HYPM)	**50**	**4.820**	**N**	**144**	**48.030**	**W**	6/29/16 8:30	6/29/16 8:30
recovery of hybrid profiler mooring (GP02HYPM)	50	4.790	N	144	48.180	W	6/29/16 8:30	6/29/16 16:30
clean deck, drift test, prepare for deployment	50	4.820	N	144	48.030	W	6/30/16 5:30	6/30/16 8:30
deployment of hybrid profiler mooring (GP02HYPM)	**50**	**4.820**	**N**	**144**	**48.030**	**W**	6/30/16 8:30	6/30/16 16:30
post-deployment CTD cast near new hybrid profiler mooring (GP02HYPM)	50	5.000	N	144	48.000	W	6/30/16 16:30	6/30/16 19:30
test acoustic communications with new hybrid profiler mooring (GP02HYPM)	50	5.000	N	144	48.000	W	6/30/16 19:30	6/30/16 21:30
start transit to flanking mooring B (GP03FLMB) site	50	19.820	N	144	23.900	W	6/30/16 21:30	6/30/16 22:00

arrive at flanking mooring B (GP03FLMB) site	50	19.820	N	144	23.900	W	6/30/16 22:00	6/30/16 22:00
pre-recovery CTD cast near old flanking mooring B (GP03FLMB)	50	20.000	N	144	24.000	W	6/30/16 22:00	7/1/16 1:30
prepare deck for recovery, test acoustic communications with old flanking mooring B (GP03FLMB)	50	20.000	N	144	24.000	W	7/1/16 5:00	7/1/16 8:30
drift test, release flanking mooring B (GP03FLMB)	**50**	**19.820**	**N**	**144**	**23.900**	**W**	7/1/16 8:30	7/1/16 8:30
recovery of flanking mooring B (GP03FLMB)	50	19.820	N	144	23.900	W	7/1/16 8:30	7/1/16 16:30
clean deck, drift test, prepare for deployment	50	19.820	N	144	23.900	W	7/2/16 5:30	7/2/16 8:30
deployment of flanking mooring B (GP03FLMB)	**50**	**19.880**	**N**	**144**	**23.850**	**W**	7/2/16 8:30	7/2/16 16:30
post-deployment CTD cast near new flanking mooring B (GP03FLMB)	50	20.000	N	144	24.000	W	7/2/16 16:30	7/2/16 19:30
test acoustic communications with new flanking mooring B (GP03FLMB)	50	20.000	N	144	24.000	W	7/2/16 19:30	7/2/16 21:30
bathymetry survey at alternate flanking mooring B (GP03FLMB) sites	50	21.216	N	144	27.360	W	7/2/16 21:30	7/3/16 0:30
start transit to Seattle, USCG base	50	19.880	N	144	23.850	W	7/3/16 0:30	7/3/16 0:30
potential time for extra survey or glider recovery	TBD	TBD	N	TBD	TBD	W	7/3/16 0:30	7/5/16 0:00
turn off sensors after entering Canadian waters	49	12.000	N	133	40.000	W	7/6/16 14:00	7/6/16 14:00
harbor transit to USCG Seattle base	48	29.200	N	124	47.100	W	7/7/16 20:00	7/8/16 8:00
arrive at Seattle USCG base	47	35.408	N	122	20.408	W	7/8/16 8:00	

Appendix C Draft Load list and Deck Plan



Appendix D Hazardous materials list – to be reviewed and updated no later than 30 days prior to departure.

ITEM	DESCRIPTION	QTY.	UNIT	APPLICATION	COMMENTS
1	DENATURED ALCOHOL(ethyl)	1	qt.	lab use, cleaning agent	flammable liquid class 1B
2	ANTI FOULANT DEVICE (Sea-Bird)	16	7.14 g	installed on Sea Bird Conductivity Cells	Handle with gloves
3	SILICROIL	3	12 oz CAN	TOOL LUBRICANT/PENETRANT (aerosol)	
4	CONTACT CLEANER	2	20 oz CAN	ELECTRICAL CLEANING SOLVENT (aerosol)	CONSUMER COMMODITY ORM-D
5	MARINE CLEANER	1	20 oz CAN	HARDWARE CLEANING (aerosol)	CONSUMER COMMODITY ORM-D
6	BIO-GREASE	1	pt	ADCP HEADS	
7	SILICONE SPRAY	2	12 oz can	LUBRICATION	CONSUMER COMMODITY ORM-D
8	6-56 MULTI PURPOSE LUBRICANT	1	12 oz can	TOOL LUBRICANT/PENETRANT	CONSUMER COMMODITY ORM-D
10	SCOTCH COTE ELECTRICAL COATING	1	CAN	WATER TIGHT SPLICES	
11	Mercuric Chloride	50	ml	Dissolved Inorganic Carbon fixing reagent	
12	Manganese (II) Sulfate	1	liter	Winkler Reagent A	
13	Alkaline Iodide Azide solution	1	liter	Winkler Reagent B	
14	Sodium Thiosulfate	2	liter	Winkler titration reagent	
15	Sulfuric Acid	2	liter	Winkler titration fixing reagent	
16	Potassium Iodate	1	liter	Winkler titration Standard solution	
17	Lithium Metal Battery, Glider	5	1.17kg of lithium in 30kg battery	Battery packs are contained within gliders to be deployed	Similar depleted battery packs will be recovered from 3 OOI gliders presently at OOI Station Papa

18	Lithium Metal Battery, Subsurface Controller (clock and controller packs)	4	267.8 grams	Batteries installed in Titanium Controller Housing	Similar depleted batteries will be recovered from moorings presently at OOI Station Papa
19	Lithium Battery, Acoustic Modem	3	144.2 grams	Batteries installed in Acoustic Modem pressure vessel	Similar depleted batteries will be recovered from moorings presently at OOI Station Papa
20	Lithium Battery, MicroCats	24	8.4 grams	Contained in instrument pressure housing	Similar depleted batteries will be recovered from 2 mesoscale flanking moorings presently at OOI Station Papa
21	Lithium Metal Battery short pack, Global MMP	2	247.2 grams	Contained in instrument pressure housing	Similar depleted batteries will be recovered from profiler mooring presently at OOI Station Papa
22	Lithium Metal Battery long pack, Global MMP	2	494.4 grams	Contained in instrument pressure housing	Similar depleted batteries will be recovered from profiler mooring presently at Station Papa

Appendix E OOI Flanking Mooring Recovery Procedures

The Flanking moorings were designed to be recovered in two sections. The ship was positioned .2 miles down wind of mooring anchor position. The upper release was enabled, ranged on, and then released when the bridge was ready. The top sphere surfaced within a few minutes of sending the release command. The trawl winch wire was run through the Gifford block on the a-frame, around the starboard quarter to a position just aft of the starboard a-frame. Deck personnel were positioned along the starboard rail tending the trawl wire. The ship approached the sphere, bringing it down the starboard side. A (3) ton pickup hook was snapped into a lifting bail. The ship moved ahead allowing the sphere to come astern.

Once the top float was astern of the ship, the recovery commenced. The syntactic sphere was lifted on board using the trawl wire and air tuggers to control the swing of the sphere. Both the a-frame and ships crane were used together to level the sphere prior to lowering it into its stand. The sphere was secured to the stand with (4) ratchet straps. A pallet jack was used to move the sphere forward which allowed the bottom of the 5 meter EM chain and IM wire termination to be recovered using the 01 winch. A Yale was placed on the top shot of wire rope and then made fast using the stopper line. The IM termination was unbolted from the bottom of the EM chain, the sphere was moved out of the work area using a

pallet jack. The lebus winch leader was reeved through the travelling snatch block and shackled to the Yale grip. The winch took up the load, the stopper line was cleared. The 01 winch leader was shackled to the block and hauled in raising the block off the deck. Recovery of the 440 meter shot of IM cable commenced.

After over spooling 7 wraps of wire on the spectra reel, a Yale grip was installed on the high tension side of the winch. A stopper line was then connected into the eye of the Yale grip and made fast by a Nystron stopper line made fast to a deck cleat. (**Note:** This process of stopping off the mooring cables with a Yale grip on the high tension side of the winch is repeated at every wire rope connection. The installation of the Yale grip prevents slippage of the wire on the low tension side of the traction heads if the wire was to go slack for some unforeseen reason.)

An empty drum was installed on the spooler replacing the winch leader reel. Hauling resumed, the winch was stopped while the microcats were removed from the 440 meter shot and upper release float were recovered.

The ship repositioned .2 NM downwind for the recovery of the bottom half of the mooring. The release was enabled, ranged on, and then released. It took roughly 25 minutes for the sphere to surface. The trawl winch wire was run through the A-frame block, around the starboard quarter, to just aft of the starboard aframe. Deck personnel were positioned along the starboard rail tending the winch recovery line. The ship slowly approached the sphere brining it down the starboard side. A (3) ton pickup hook snapped into the sphere as the ship moved ahead to allowing the sphere to come astern. Once the top float was astern of the ship, the recovery commenced. The sphere was recovered using the ships 01 winch and air tuggers to control the swing of the buoy. Both trawl wire and ships crane was used together to level the sphere. The sphere was secure with (4) ratchet straps.

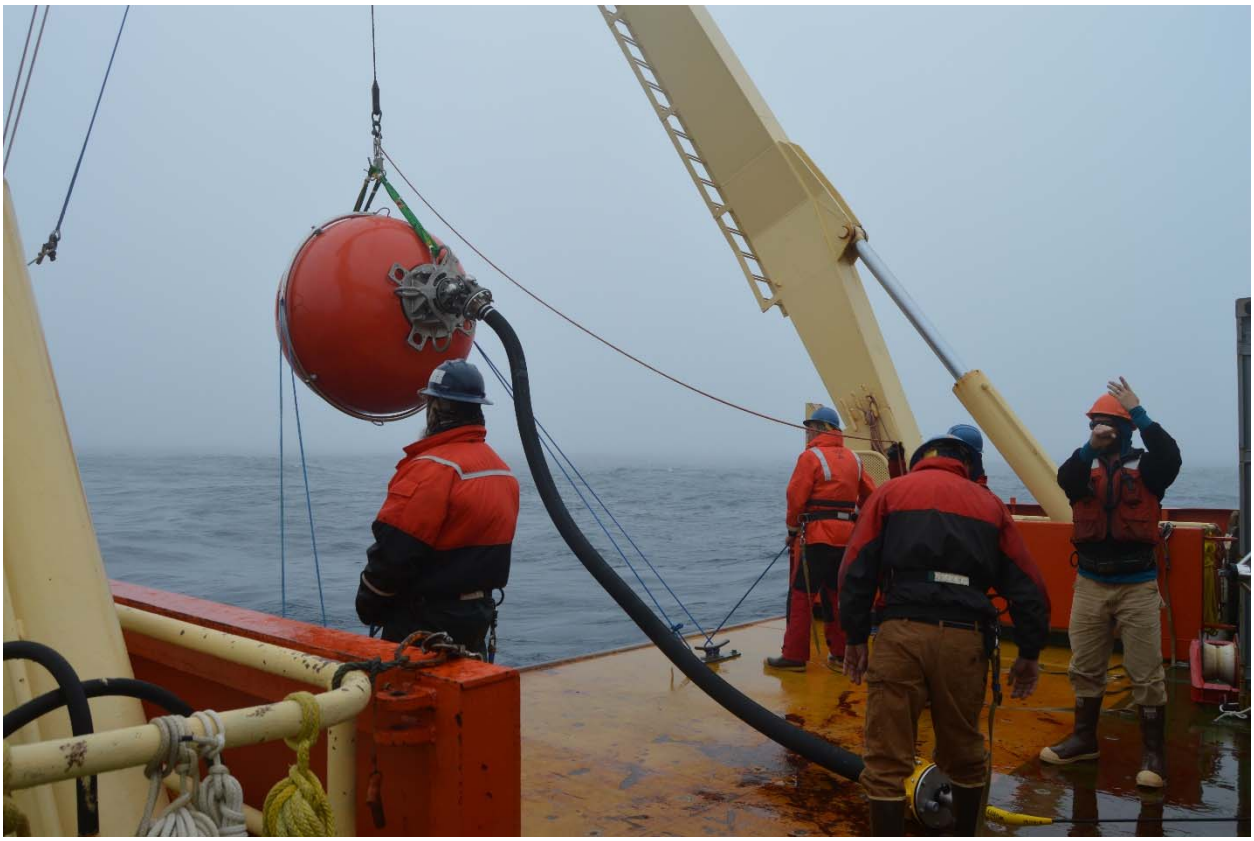
Once the buoy was secure on deck, a Yale was installed on the 1000 m shot of wire rope and then made fast using the stopper line. The IM termination was unbolted from the bottom of the buoy, the sphere was then moved out of the work area using a pallet jack. The lebus winch leader was reeved through the travelling snatch block and shackled to the yale grip. The winch took up the load, the stopper line was cleared. The 01 winch leader was shackled to the block and hauled in raising the block off the deck. Recovery of the 1000 meter shot of IM cable commenced. The 1000 meter IM shot was winched in while removing instruments at designated depths. The controller cage and (2) sets of glass balls were recovered using the ships trawl winch wire and Lebus winch.

At the junction of each section of wire rope, the mooring was stopped off using a yale grip on the high tension side of the Lebus winch. This allowed deck personnel change reels on the take-up spooler. This process was repeated for the recovery of all the shots of wire rope. The glass balls were lifted on board the ship using the Lebus winch. Once on deck, the cluster of balls were stopped off using a Nystron stopper. The remaining strings of balls along with the acoustic releases were lifted on board using the a-frame and trawl winch wire. Once the balls were disconnected they were craned in the rag top container using the ships crane.

Appendix F OOI Flanking Mooring Deployment Procedures

The deployment start locations are determined by the ship performing a set and drift prior to the start of the deployment. Once the set and drift has been determined, the ship will steam 6 – 8 nautical miles downwind (distance = deployment time x 1.5 knots) of the nominal anchor target site. Typical deployment speed is between 1.0 – 1.5 knots. Prior to the start of mooring operations the upper top sphere was positioned center line between the A-frame. The 440 meter shot was paid out from the winch and the IM connection made to EM chain. An additional 10-20 meters of wire rope was faked out on deck to allow mounting of upper instruments. The trawl winch was reeved through a block on the A-frame then attached to the quick release, (2) ten foot green slings were reeved through the lifting bails of the sphere and attached to the quick release. Two blue slip lines were attached to the sphere, these lines were used to control the sphere while being deployed.

The trawl wire is used to lift the sphere from the stand while the A-frame is boomed out. The EM chain was slipped into the water. When the sphere was clear of the stern, the winch lowered the sphere into the water. The west coast release was tripped and the wire rope that had been faked out on deck was paid out by hand. The wire was then placed into the traveling snatch block which was then raised off the deck using the trawl winch. Once the traveling block had secured, we slowing eased out two blue slip lines to prevent snap loading on the wire rope. Payout of the wire resumed. The winch was stopped at location marks on the wire rope to attach instrumentation.

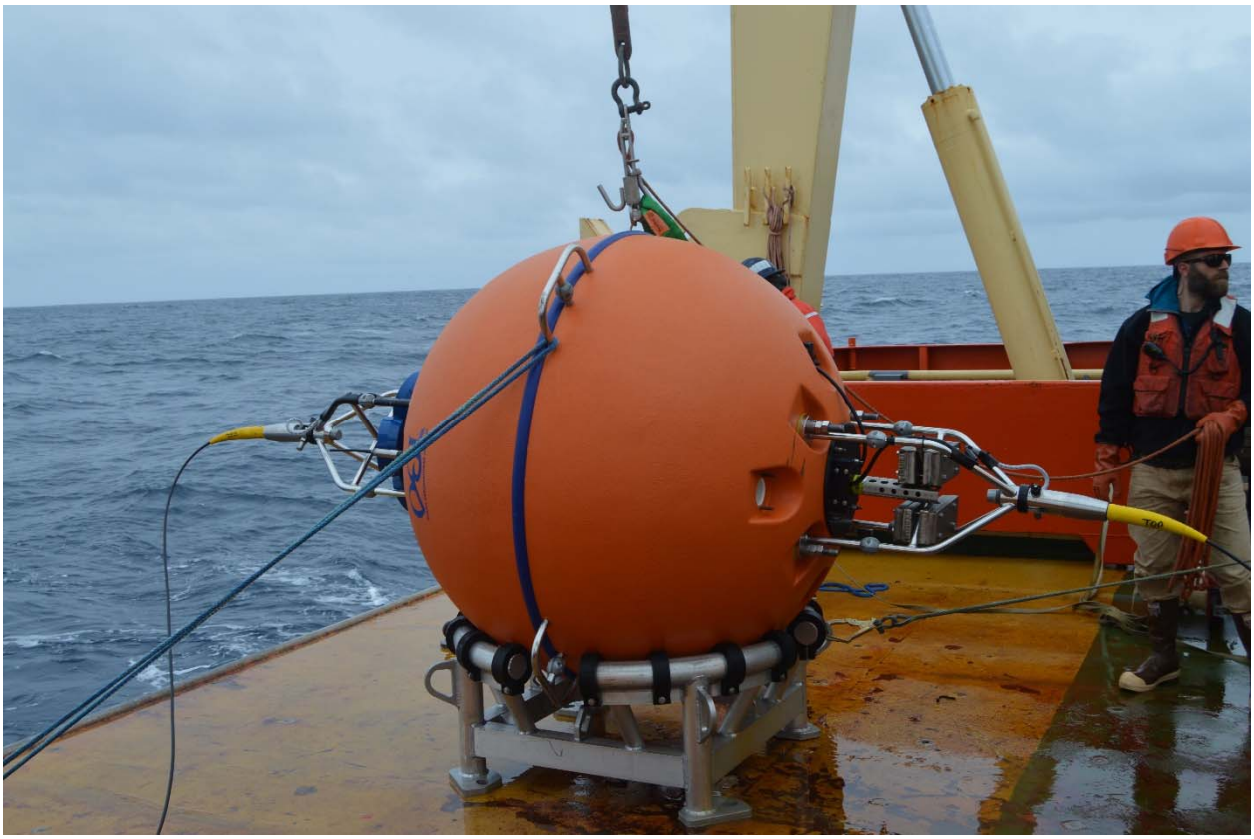


(Deployment of top sphere)

At the end of the 440 m IM shot, the winch was stopped with 8 -10 wraps remaining on the wooden reel, a Yale grip was installed on the high tension side of the winch. A stopper line was then connected into the eye of the Yale grip and made fast by a Nystron stopper line made fast to a deck cleat. The remaining wraps of wire were removed from the drum prior to installing a new reel with a 1000 meter shot of IM cable onto the spooler. (**Note:** This process of stopping off the mooring cables with a Yale grip on the high tension side of the winch is repeated at every wire rope connection. The installation of the Yale grip prevents slippage of the wire on the low tension side of the traction heads if the wire was to go slack for some unforeseen reason.)

The syntactic release float was moved in position under the a-frame, the lower end of the 440 meter shot was connected. The 20 meter IM cable was connected on the lower end of the Edgetech acoustic release. A Yale grip was attached 2 meters up from the lower termination, then shackled to the Lebus winch leader. Once all the connections were made, slack in the 20 meter shot was taken up by the Lebus winch. A West coast quick release was attached to the end of the 01 winch line, then hooked into the lifting bail on the float. The float was then lifted off the deck, kept level as the a-frame boomed out. Once clear of the transom, the float was lowered in to water, the load was transferred to the Lebus winch prior to pulling the quick release. The 20 M IM shot was paid out until the lower Yale grip could be stopped off with the Nystrom deck stopper.

The lower 62” syntactic sphere was moved into launch position using a pallet jack. The a-frame was boomed back inboard over the lower 62” syntactic sphere. One 4’ green sling was reeved through the lifting bail of the sphere and attached to the quick release. Two blue slip lines were used to control the sphere while being deployed. The lower end of the 20 m IM cable was connected to the top of the sphere, the upper end of the lower 1000 m IM cable was connected to the bottom of the sphere. Prior to deploying the sphere, the deck stopper holding the lower end of the 20 m IM shot was slacked, transferring the mooring load to the 62” sphere. The trawl wire then lifted the sphere from the stand while the A-frame boomed out. When the sphere was clear of the stern, the 01 winch lowered the sphere into the water. The quick release was tripped and the wire rope that had been faked out on deck was paid out by hand. The 1000 m wire was then placed into the traveling snatch block which was then raised off the deck using the 01 winch. Once the traveling block had secured, we slowing eased out two blue slip lines to prevent snap loading on the wire rope. Payout of the wire resumed. The winch was stopped at location marks on the wire rope to attach instrumentation.



(Lower flotation sphere prior to deployment)

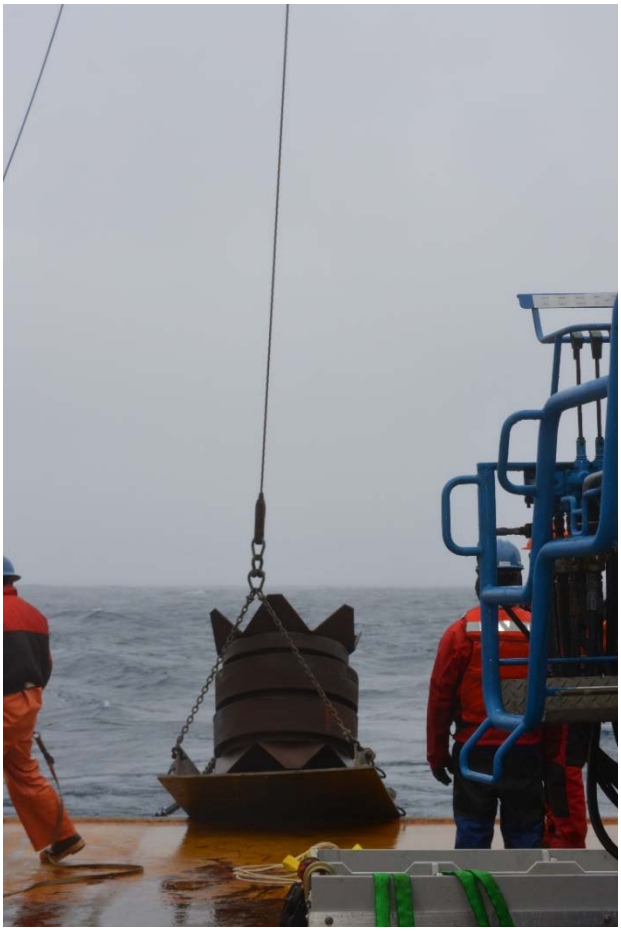
At the lower end of the 1000 meter IM shot, the wire was stopped off with a Yale grip prior to changing reels on the spooler. The lower end of the 1000 m IM cable was connected to the controller cage and a 5 meter shot of chain was installed on the lower end of the cage. The first 1000 m wire rope shot was temporarily connected to the 5m chain below the controller cage. The controller cage was deployed using the 01 winch, a-frame and chain hook in the same manner as the upper float package. When the connection between the 5m chain and 1000 m shot reached the transom, the connection was stopped off using the Nystron deck stopper made fast to a deck cleat. Two sets of (4) glass balls were installed between these components. Once connected, tension was taken with the Lebus winch, the deck stopper was slacked, then removed allowing this section of glass balls to be paid out. After the balls were deployed, the traveling block was lowered to deck so the mooring wire could be lifted into the block. Once the block was lifted off the deck, payout of the wire could resume.

At the end of the first 1000 m shot, the wire was stopped off using a Yale grip so the next reel of wire could be loaded onto the spooler. This process was repeated for all the remaining shots of wire rope. Once all the wire had been deployed, the mooring was stopped off with the Nystrom deck stopper.

A 5m shot of ½" chain was shackled into last wire rope termination, tension was taken up by the Lebus winch. The deck stopper was slacked then removed allowing the winch to pay out 5m shot. The hardware connection at the end of the 5 meter shot was stopped off near the transom. Two sets of glass

balls were connected to the 5 meter chain shot, the Lebus winch leader was connected to the forward end of the string of glass balls. One connected, tension was taken up by the winch, and the deck stopper was slacked and removed allowing the winch to pay out. Once the connection between the upper string of balls and the winch leader reaches the transom, it is stopped off using the Nystron deck stopper. This process was repeated for the deployment of the remaining (9) strings of glass balls.

The dueled Edgetech releases were moved into position under the a-frame. The releases were shackled to the 5 m shot of chain below the glass balls, the 5m shot of chain and 20 m shot of Nystron rope were shackled into the master link below the release. Once all the connections had been made, a slip line was reeved through the 7/8 end link at the lower end of the 1" Nystron, the bitter ends were made fast to the Lebus winch line using bowline knots. Once all the connections were made, the slip line and 20 m shot of 7/8" Nystron were wound on the Lebus winch. With 400 meters to go to the anchor drop position, the releases were lifted over the stern using a chain hook that was connected to the 01 winch. Once the releases were deployed, the crane was positioned over the mooring anchor. The crane wire was attached to the chain bridle on the tip plate, slack was removed. The lebus winch slowly paid out the 20 m shot of 7/8" Nyston until the lower hardware connection was close enough to the anchor to attach the ¾" chain to the lower 7/8" end link. Once this connection was made, the winch paid out the slip line transferring the mooring load to the anchor. The slip line was removed by untying one of the bowlines. As the ship passed over the anchor drop site, the back stay was removed (cut); the crane wire was hauled in raising the tip plate off the deck just enough allowing the anchor to freefall into the water.



(Flanking mooring anchor being tipped over the stern)

Appendix G OOI Hybrid Mooring Recovery Procedures

The Hybrid mooring was designed to be recovered in two sections. The ship was positioned .2 miles down wind of moorings position. The upper release was enabled, then released when the bridge was ready. The top sphere surfaced approximately 25 minutes after sending the release command. The trawl winch wire was run through the traveling A-frame block, around the starboard quarter, to a position just aft of the starboard a-frame. Deck personnel were positioned along the starboard rail tending the trawl winch wire. The ship approached the sphere bringing it down the starboard side. A (3) ton pickup hook was snapped into a lifting bail. The ship moved ahead allowing the sphere to come astern.

Once the top float where centered astern of the ship, hauling began. When the sphere was positioned over the stand, the ships crane was shackled to the bail. Both the trawl winch and ships crane was used together to level the sphere. The sphere was secure with ratchet straps. A pallet jack was used to move the sphere forward which allowed the bottom of the 5 meter EM chain to be shackled to the winch leader. A yale was placed on the top shot of wire rope and then made fast using the stopper line. The IM termination was unbolted from the bottom of the EM chain. The lebus winch leader was reeved through the snatch block and shackled to the yale grip. The winch to the load and the stopper line was cleared. The 01 winch leader was shackled to the block and hauled in raising the block off the deck. The Lebus winch started hauling in the 2080 meter shot. A yale grip was placed on the high tension side of

the lebus heads after having 7 wraps on the spectra reel, then made fast with the deck stopper. An empty reel replaced the spectra. Hauling continued until the MMP and upper float package was recovered.

The ship repositioned .2 NM downwind for the recovery of the bottom half of the mooring. The release was enabled then released. It took roughly 25 minutes for the sphere to surface. The 01 winch leader was run through the A-frame block, around the starboard quarter, to just aft of the starboard aframe. Deck personnel were positioned along the starboard rail tending the winch recovery line. The ship slowly approached the sphere brining it down the starboard side. A (3) ton pickup hook snapped into the sphere as the ship moved ahead to allowing the sphere to come astern. Once the top float was centered astern of the ship, hauling began. The sphere was recovered using the ships 01 winch and air tuggers to control the swing of the buoy. Both the trawl wire and ships crane was used together to level the sphere. The sphere was secure with (4) ratchet straps.

Once the buoy was secure on deck, the lebus winch leader and yale grip were used to stop off the 2080 meter shot below the sphere. The sphere was moved out of the work area allowing for the recovery of the lower section of the mooring to begin. The 2080 meter IM shot was winched in until 8 wraps were wound on the winch leader reel. The mooring was stopped off using a yale grip on the high tension side

of the Lebus winch allowing deck personnel to install an empty on the take-up spooler. The backup recovery glassballs and acoustic releases were lifted aboard using the ships trawl winch and lebus blue spectra working line.

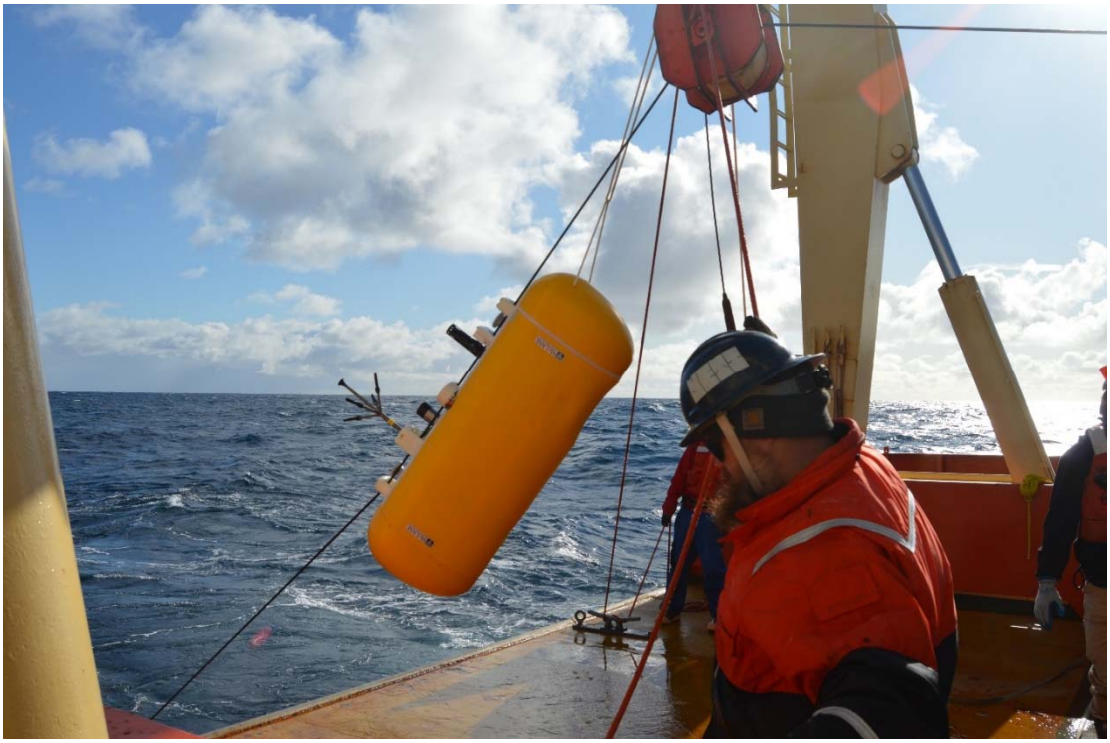
Appendix H OOI Hybrid Mooring Deployment Procedures

The deployment start location is determined by a set and drift prior to the start of the deployment. Once the set and drift has been determined, the ship will steam 6 – 8 nautical miles downwind (distance = deployment time x 1.5 knots) of the nominal anchor target site. Typical deployment speed is between 1.0 – 1.5 knots.

Prior to the start of mooring operations the upper top sphere was positioned center line between the A-frame. The 2080 meter shot was paid out from the winch and the IM connection made to EM chain. An additional 10-20 meters of wire rope was faked out on deck to allow mounting of upper instruments. The trawl winch was reeved through a block on the A-frame then attached to the quick release, (2) ten foot green slings were reeved through the lifting bails of the sphere and attached to the quick release. Two blue slip lines were used to control the sphere while being deployed.

The trawl winch wire lifted the sphere from the stand while the A-frame boomed out. The EM chain was slipped into the water. When the sphere was clear of the stern, the winch lowered the sphere into the water. The release was tripped and the wire rope that had been faked out on deck was paid out by hand. The wire was then placed into the traveling snatch block which was then raised off the deck using the 01 winch leader

With approximately 1000 meters of wire paid out, the winch was stopped so the MMP could be installed on the wire rope. The a-frame was boomed in and the traveling block lowered to allow the wire to pass through the MMP motor and clamps. A 3/8" Dacron slip line was reeved through the rope handle on the MMP, then tied to the traveling block with a bowline. The a-frame was then boomed out enough so the MMP could be slipped slowly into the water. (Note: The deployment of the lower MMP was done using the same procedures.)



(Deployment of MMP)

At the end of the 2080 m IM shot, the winch was stopped with 8 -10 wraps remaining on the wooden reel, the lebus was stopped and a Yale grip installed on the high tension side of the winch. A stopper line was then connected into the eye of the Yale grip and made fast by a Nystron stopper line made fast to a deck cleat. The remaining wraps of wire were removed from the drum prior to installing a new reel with the 2080 meter shot of IM cable onto the spooler. (**Note:** This process of stopping off the mooring cables with a Yale grip on the high tension side of the winch is repeated at every wire rope connection. The installation of the Yale grip prevents slippage of the wire on the low tension side of the traction heads if the wire was to go slack for some unforeseen reason while changing reels on the spooler.)

The upper syntactic release float was moved in position under the a-frame, the lower end of the 440 meter shot was connected. The 20 meter IM cable was connected on the lower end of the Edgetech acoustic release. A Yale grip was attached 1 meter up from the lower termination, then shackled to the Lebus winch leader. Once all the connections were made, slack in the 20 meter shot was taken up by the Lebus winch. A West coast quick release was attached to the end of the trawl wire, then connected to the floats lifting bail. The float was then lifted off the deck, kept level as the a-frame boomed out. Once clear of the transom, the load was transferred to the Lebus winch, the float was lowered in to water prior to pulling the quick release. The 20 M IM shot was paid out until the lower yale grip could be stopped off with the Nystron deck stopper.

(Deployment of Upper Release Module)

The lower 62” syntactic sphere was moved into launch position using a pallet jack. The a-frame was boomed back inboard over the lower 62” syntactic sphere. One 4’ green sling was reeved through the lifting bail of the sphere and attached to the quick release. Two blue slip lines were used to control the sphere while being deployed. The lower end of the 20 m IM cable was connected to the top of the sphere, the upper end of the lower 2080 m IM cable was connected to the bottom of the sphere. Prior to deploying the sphere, the deck stopper holding the lower end of the 20 m IM shot was slacked, transferring the mooring load to the 62” sphere. The trawl winch wire then lifted the sphere from the stand while the A-frame boomed out. When the sphere was clear of the stern, the 01 winch lowered the sphere into the water. The quick release was tripped and the wire rope that had been faked out on deck was paid out by hand. The 2080 m wire was then placed into the traveling snatch block which was then raised off the deck using the 01 winch. Once the traveling block had secured, we slowing eased out two blue slip lines to prevent snap loading on the wire rope. Payout of the wire resumed, MMP was installed as noted.

At the lower end of the 2080 meter IM shot, the wire was stopped off with a Yale grip prior to changing reels on the spooler. The lower end of the 2080 m IM cable was connected to the controller cage and a 5 meter shot of chain was installed on the lower end of the cage and temporally connected to the Lebus winch leader. The controller cage was deployed using the 01 winch, a-frame and chain hook in the same manner as the upper float package. When the connection between the 5m chain and winch leader reached the transom, it was stopped off with a Nystron rope stopper made fast to a deck cleat. Two sets of (4) glass balls were installed between this connection. Once connected, tension was taken with the Lebus winch, the deck stopper was slacked, then removed allowing this section of glass balls to be paid

out until the lower connection to be stopped off again using the Nystron deck stopper. This process was repeated for the deployment of the remaining (10) strings of glass balls.

(Backup Recovery Flotation and Releases)

Once the mooring was stopped off, the dueled Edgetech releases were moved into position under the a-frame. The releases were shackled to the 5 m shot of chain below the glass balls, the 5m shot of chain and 20 m shot of Nystron rope were shackled into the master link below the release. Once all the connections had been made, a slip line was reeved through the 7/8 end link at the lower end of the 1" Nystron, the bitter ends were made fast to the Lebus winch line using bowline knots. Once all the connections were made, the slip line and 20 m shot of 7/8" Nystron were wound on the Lebus winch. With 400 meters to go to the anchor drop position, the releases were lifted over the stern using a chain hook that was connected to the 01 winch. The ships crane wire was attached to the chain bridle on the tip plate, slack was removed. The lebus winch slowly paid out the 20 m shot of 7/8" Nyston until the lower hardware connection was close enough to the anchor to attach the ¾" chain to the lower 7/8" end link. Once this connection was made, the winch paid out the slip line transferring the mooring load to the anchor. The slip line was removed by untying one of the bowlines. As the ship passed over the anchor drop site, the back stay was removed (cut); the crane wire was hauled in raising the tip plate off the deck just enough allowing the anchor to freefall into the water.

Appendix I Global Papa Flanking Mooring A (GP02FMLA) Deck Drawing

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Global PAPA MFM-A 2014 Deck Drawings
designed for 4127m Depth

By: P. Chua	05-Aug-2014	DCN: 3603-40003	REV: B	REF.DES. GP02FLMA

Source: 05-Aug-2014 14:07:23, ...\Paul's m-files\OOI\PAPA2014Deploy\gp2014FLMAdeckdrawing.cfg
Author: 05-Aug-2014 16:54:42, pchua@(PCWIN64)

depth (incl. stretch)	component	instruments	rope # & Length	Distance from Upper / Lower rope end

06-19-2014

	64" Sphere 1000m	Sable GPS #_____ XEOS XMB #____		1180kg Net Buoyancy incl. 50kg payload
29 m	DOSTA-D FLORT-D PHSEN-F CTDMO-G P1000m	XEOS XMF #_____, _____MHZ FLBB2 #_____ Optode #____ SAMI_pH #_____ SBE37-IM #_____ Controller #_____	U-Joint #1 5m 1/2" EW chain	upper SW ground coilcord conductor bypass
40 m	CTDMO-G P1000m	SBE37-IM #_____	#2 440m 5/16" NILSPIN	3.0 437.0
60 m	CTDMO-G P1000m	SBE37-IM #_____		23.0 417.0
90 m	CTDMO-G P1000m	SBE37-IM #_____		53.0 387.0
130 m	CTDMO-G P1000m	SBE37-IM #_____		93.0 347.0
180 m	CTDMO-G P1000m	SBE37-IM #_____		143.0 297.0
251 m	CTDMO-G P1000m	SBE37-IM #_____		213.0 227.0
351 m	CTDMO-G P1000m	SBE37-IM #_____		313.0 127.0
			#2 bottom	
479 m	Release Float	ORE8242 #_____	coupler ec / coupler ec	Ind. term bypass E:____ D:____ R:____ bypass, must break upon release
480 m	CF14-1000		#3 20m 5/16" NILSPIN	Ind. term 13 kg Buoyancy
501 m	FL62" 1500m ADCPS-L CTDMO-G P1000m	Sable GPS #_____ XEOS XMB #_____ XEOS XMF #_____, _____MHZ ADCP-LR #_____	#4 1000m 5/16" NILSPIN	Ind. term bypass 750kg Net Buoyancy incl. 70kg payload Ind. term bypass
749 m	CTDMO-H P3500m	SBE37-IM #_____ SBE37-IM #_____		245.0 755.0
1000 m	CTDMO-H P3500m	SBE37-IM #_____		495.0 505.0
1501 m	CTDMO-H P3500m	SBE37-IM #_____		995.0 5.0
			#4 bottom	
1507 m	Load Cage	Controller #___/_____ ATM #ID___/_____	chain 2.0m 1/2" HR	Ind. term lower SW ground 60 kg Wet Weight incl. 20kg payload
1513 m	8 17" Glass Spheres (8m)		PL 3t 3/4" AS 3t 5/8"	

Global PAPA MFM-A 2014 Deck Drawings

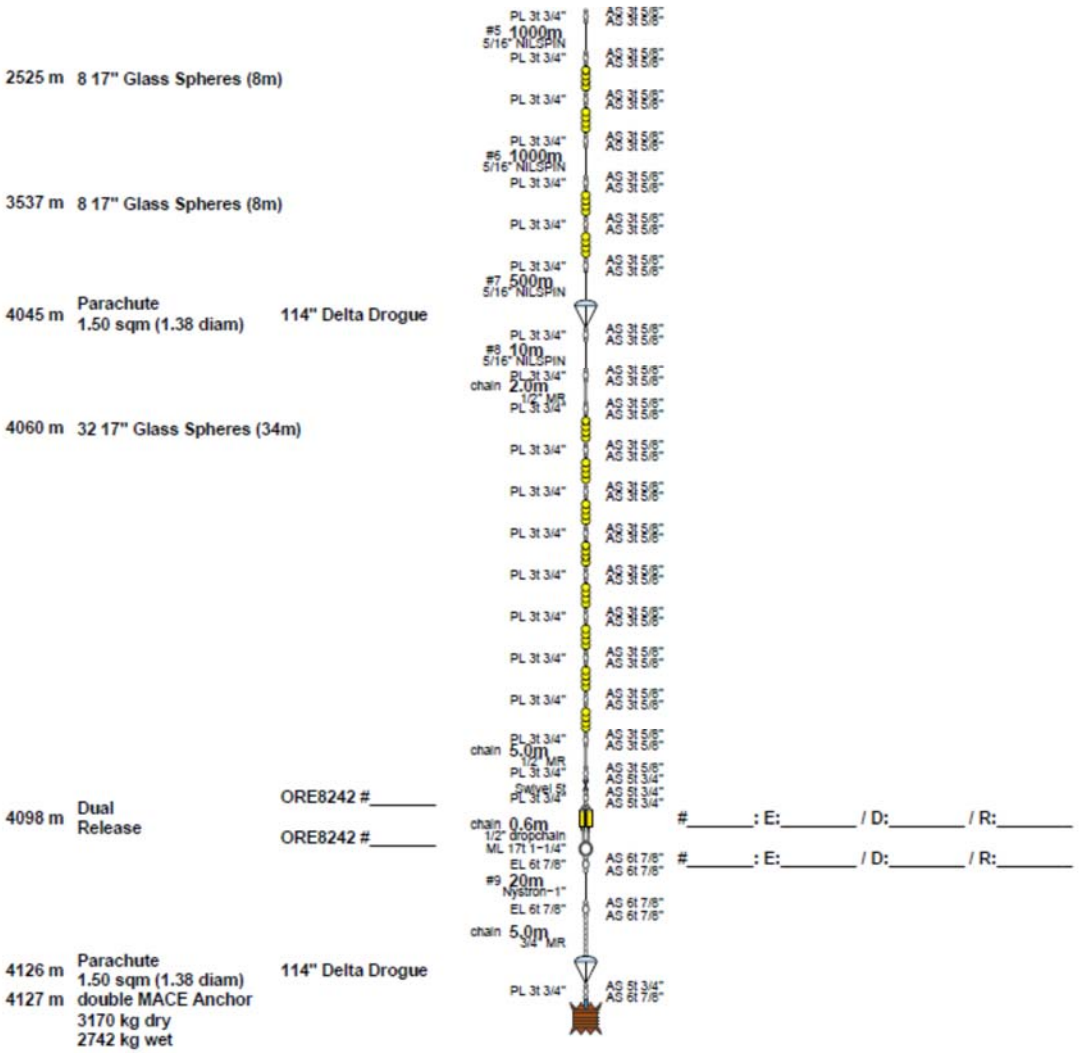
designed for 4127m Depth

By: P. Chua	05-Aug-2014	DCN: 3603-40003	REV: B	REF.DES. GP02FLMA

Source: 05-Aug-2014 14:07:23, ...\Paul's m-files\OOI\PAPA2014Deploy\gp2014FLMAdeckdrawing.cfg
Author: 05-Aug-2014 16:54:42, pchua@(PCWIN64)

depth (incl. stretch)	component	instruments	rope # & Length	Distance from Upper / Lower rope end

06-19-2014



Appendix J Global Papa Hybrid Profiler Mooring (GP02HYPM) Deck Drawing

pchua@(PCWIN64): 28-Jul-2014 17:05:47

Sheet # 1 / 2 Page # 3 / 54

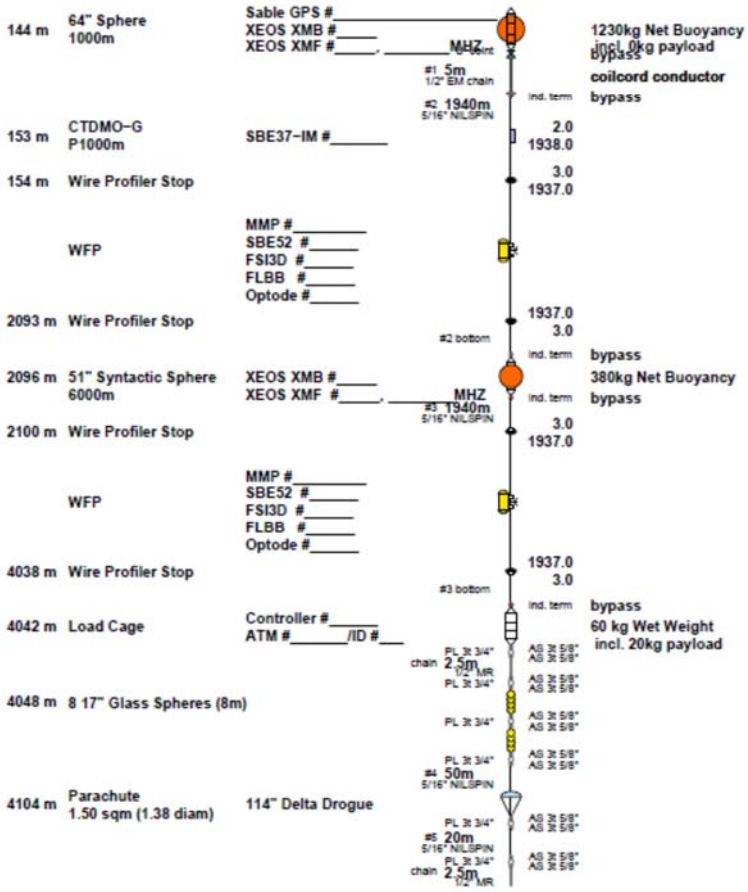
Global PAPA HYPM 2014 Deck Drawing
designed for 4219m Depth

By: P. Chua	28-Jul-2014	DCN: 3603-40002	REV: C	REF.DES. GP02HYPM

Source: 28-Jul-2014 17:01:59, ...\Paul's m-files\OOI\PAPA_revc\gp2014hypmdeckdrawing.cfg
Author: 28-Jul-2014 17:05:33, pchua@(PCWIN64)

depth (incl. stretch)	component	instruments	rope # & Length	Distance from Upper / Lower rope end

22-Jun-2014 ??-??-201



Global PAPA HYPM 2014 Deck Drawing

designed for 4219m Depth

By: P. Chua	28–Jul–2014	DCN: 3603–40002	REV: C	REF.DES. GP02HYPM

Source: 28–Jul–2014 17:01:59, ...\Paul's m–files\OOI\PAPA_revc\gp2014hypmdeckdrawing.cfg
Author: 28–Jul–2014 17:05:33, pchua@(PCWIN64)

depth (incl. stretch)	component	instruments	rope # & Length	Distance from Upper / Lower rope end

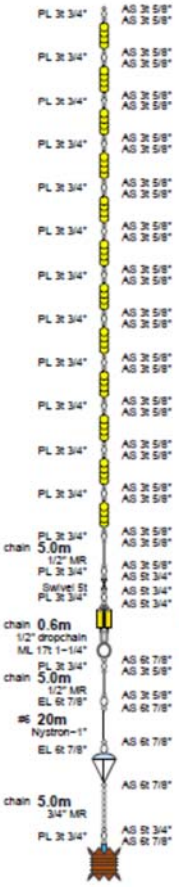
22–Jun–2014 ??–??–201

4130 m 48 17" Glass Spheres (51m)

4185 m Dual Release
ORE8242 #_____
ORE8242 #_____

4213 m Parachute 1.50 sqm (1.38 diam)
114" Delta Drogue

4219 m double MACE Anchor
3170 kg dry
2742 kg wet



#_____: E:_____ / D:_____ / R:_____

#_____: E:_____ / D:_____ / R:_____

Appendix K Global Papa Flanking Mooring B (GP02FMLB) Deck Drawing

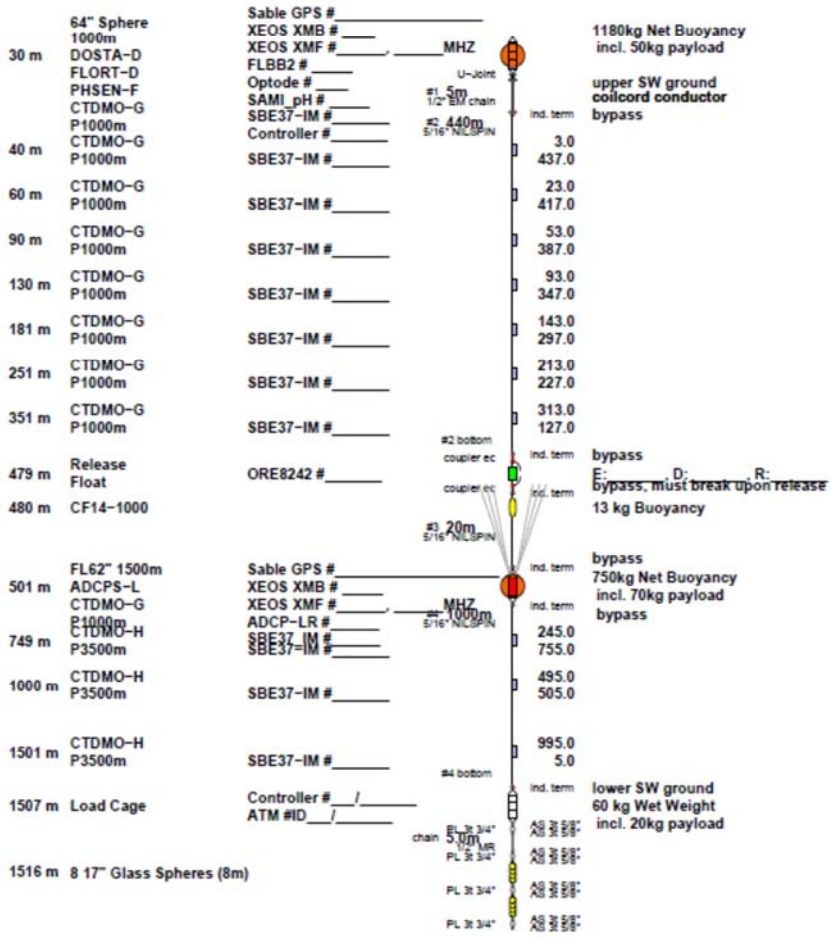
Sheet # 1 / 2 Page # 3 / 19

Global PAPA MFM B 2014 Deck Drawing
designed for 4145m Depth

By: P. Chua	05–Aug–2014	DCN: 3603–40004	REV: B	REF.DES. GP02FLMB

Source: 05–Aug–2014 16:57:32, ...\Paul's m–files\OOI\PAPA2014Deploy\gp2014FLMBdeckdrawing.cfg
Author: 05–Aug–2014 16:57:41, pchua@(PCWIN64)

06–18–2014 ??–??–2015



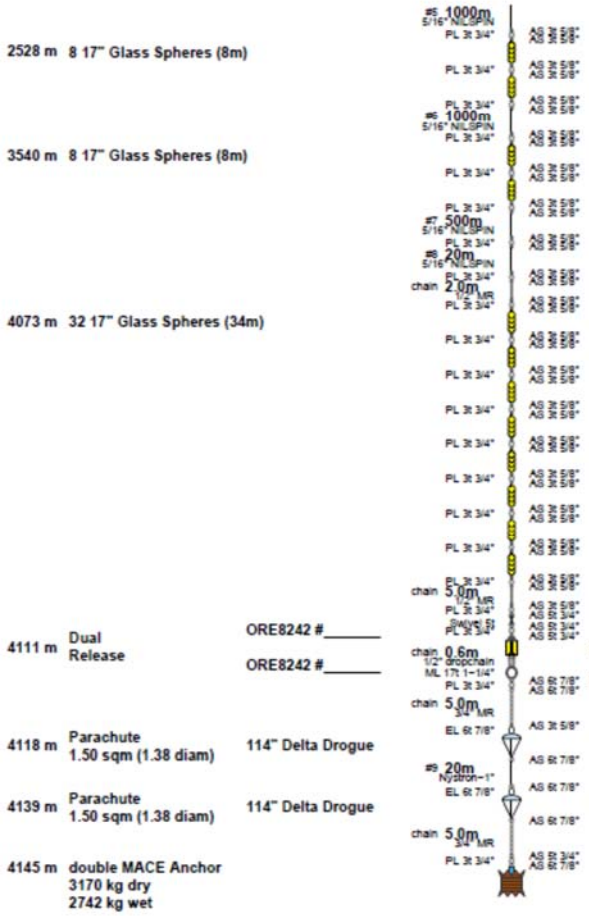
Global PAPA MFM B 2014 Deck Drawing
designed for 4145m Depth

By: P. Chua	05-Aug-2014	DCN: 3603-40004	REV: B	REF.DES. GP02FLMB

Source: 05-Aug-2014 16:57:32, ...\Paul's m-files\OOI\PAPA2014Deploy\gp2014FLMBdeckdrawing.cfg
Author: 05-Aug-2014 16:57:41, pchua@(PCWIN64)

depth (incl. stretch)	component	instruments	rope # & Length	Distance from Upper / Lower rope end

06-18-2014 ??-??-2015



2528 m 8 17" Glass Spheres (8m)

3540 m 8 17" Glass Spheres (8m)

4073 m 32 17" Glass Spheres (34m)

4111 m Dual Release — ORE8242 #_____ / ORE8242 #_____ — #_____: E:_____ / D:_____ / R:_____ / #_____: E:_____ / D:_____ / R:_____

4118 m Parachute 1.50 sqm (1.38 diam) — 114" Delta Drogue

4139 m Parachute 1.50 sqm (1.38 diam) — 114" Delta Drogue

4145 m double MACE Anchor
3170 kg dry
2742 kg wet