Cruise Plan
Southern Ocean 3 Deployment
R/V *Palmer* NBP16-10
18 November – 18 December 2016

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Coastal and Global Scale Nodes
Ocean Observatories Initiative
Woods Hole Oceanographic Institution

Revision History

Version	Description	Originator	Release Date
0-01	Draft	R.Curry	
0-02	Minor editing/formatting changes	R. Travis	
0-03	Updates by E.Benway	E.Benway	
0-04	Updates by S. N .White	S.N. White	
0-05	Updates during IRR by R. Travis	R.Travis	
0-06	Updates glider recoveries per R. Curry	R.Travis	
1-00	Initial release	P. Matthias	2016-11-15

Table of Contents

List of Figures

List of Tables

1.0 Introduction

1.1. Scope

This document describes the plan for the third cruise to the Southern Ocean Global Array of the National Science Foundation's Ocean Observatories Initiative (OOI). It includes objectives, logistical details, strategies for recovery and deployment of assets, and a proposed timeline for accomplishing these tasks.

1.2. Purpose

Located southwest of Chile near 55°S, 90°W, the Southern Ocean Global Array is comprised of four moorings set in water depths of approximately 4800 m, and a combination of patrol and profiling gliders. The array was first deployed in March 2015 aboard R/V *Atlantis*, cruise AT 26-30, then replaced with new moorings and gliders in December 2015 on *R/V Nathaniel B. Palmer*, cruise NPB15-11. Those assets will be recovered and replaced on the present cruise, NBP16-10, and shipboard measurements will be acquired and used for calibration of the existing and newly deployed moorings. A Wave Glider will additionally be deployed in the vicinity of the array in support of an ancillary project conducted by University of Washington researchers.

This site was chosen for its strong atmospheric forcing, high amplitude waves and vigorous mesoscale flows. Successions of storm systems typically move across the region from west to east on 3-5 day timescales, providing year-round opportunities to study the effects of this forcing on ocean properties. Winter-time conditions are particularly extreme leading to convective formation of Antarctic Intermediate Water, an important component of the global meridional overturning circulation, as well as enhanced carbon dioxide uptake and export into the ocean interior. Ocean eddies not only affect horizontal transports, but also modulate mixing in the water column and vertical exchanges with the atmosphere. From the biogeochemical perspective, this site offers sharp contrasts to the Argentine Basin: e.g. remotely-sensed ocean color implies very low productivity at this site suggesting a nutrient-limited environment. The combination of moored instruments and gliders will enable investigation of the role of physical and biogeochemical processes at mesoscale and sub-mesoscale horizontal length scales. The moored array will sample the full water column, from the sea surface to the sea floor, and the surface mooring will provide unique new observations of surface meteorology and air-sea fluxes

2.0 Reference Documents

A list of OOI documents describing the Global Node Array, mooring configuration and layouts is provided in Table 2-1. These are stored in Vault and released to Alfresco.

Table 2-1 Reference Documents

Document Identification	Document Title
3201-00007	CGSN Site Characterization: Southern Ocean
3304-00160	OOI Open Ocean Gliders - Functional Check-Out Procedure
3304-00170	OOI Global Profiling Gliders - Functional Check-Out Procedure
3601-40001	Global Southern Ocean Surface Mooring Deck Drawing
3601-40101	Global Southern Ocean Surface Mooring Design Spreadsheet
3601-40002	Global Southern Ocean Hybrid Profiler Mooring Deck Drawing
3601-40102	Global Southern Ocean Hybrid Profiler Mooring Design Spreadsheet
3601-40003	Global Southern Ocean Flanking Mooring Deck Drawing
3601-40103	Global Southern Ocean Flanking Mooring Design Spreadsheet

3.0 Definitions & Acronyms

ADCP	Acoustic Doppler Current Profiler
CGSN	Coastal and Global Scale Nodes
CS	Chief Scientist
CTD	Conductivity, temperature, and depth instrument
CTDMO	Inductive CTD
DIC	Dissolved inorganic carbon
EEZ	Exclusive Economic Zone
FLMA (FLMB)	Flanking Mooring A (B)
HYPM	Hybrid Profiler Mooring
NSF	National Science Foundation
OOI	Ocean Observatories Initiative
PAR	Photosynthetically Active Radiation
PM	Program Manager
RFM	Radio frequency modem
SOCCOM	Southern Ocean Carbon and Climate Observations and Modeling
SUMO	Surface Mooring
USAP	United States Antarctic Program
WFP	Wire-Following Profiler

4.0 Cruise Plan

4.1. Objectives and Locations

The Southern Ocean Global Array deployment cruise (SO-3) has the following primary objectives:

1. Deploy four new moorings: 1- Surface Mooring (GS01SUMO-00003); 1-Profiler Mooring (GS02HYPM-00003); 2- Flanking Moorings (GS03FLMA-00003, GS03FLMB-00003)

2. Recover four existing moorings: GS01SUMO-00002, GS02HYPM-00002, GS03FLMA-00002, GS03FLMB-00002.

3. Deploy new mobile assets (GS05MOAS): 2 Open Ocean Gliders tasked to patrol around the moored array, and 2 Global Profiling Gliders to profile in the vicinity of the Hybrid Profiler Mooring.

4. Recover existing gliders if possible: 3 vehicles from SO-2 are well outside the array site, but will be chased if time permits.

5. Conduct CTD casts: a) to test acoustic releases; b) at all mooring sites and near gliders (with water sampling) for instrument calibration; and c) full-depth casts (no sampling) to verify seafloor depth prior to deploying new moorings.

An ancillary objective is the deployment of one Wave Glider for the Applied Physics Lab (APL) of University of Washington.

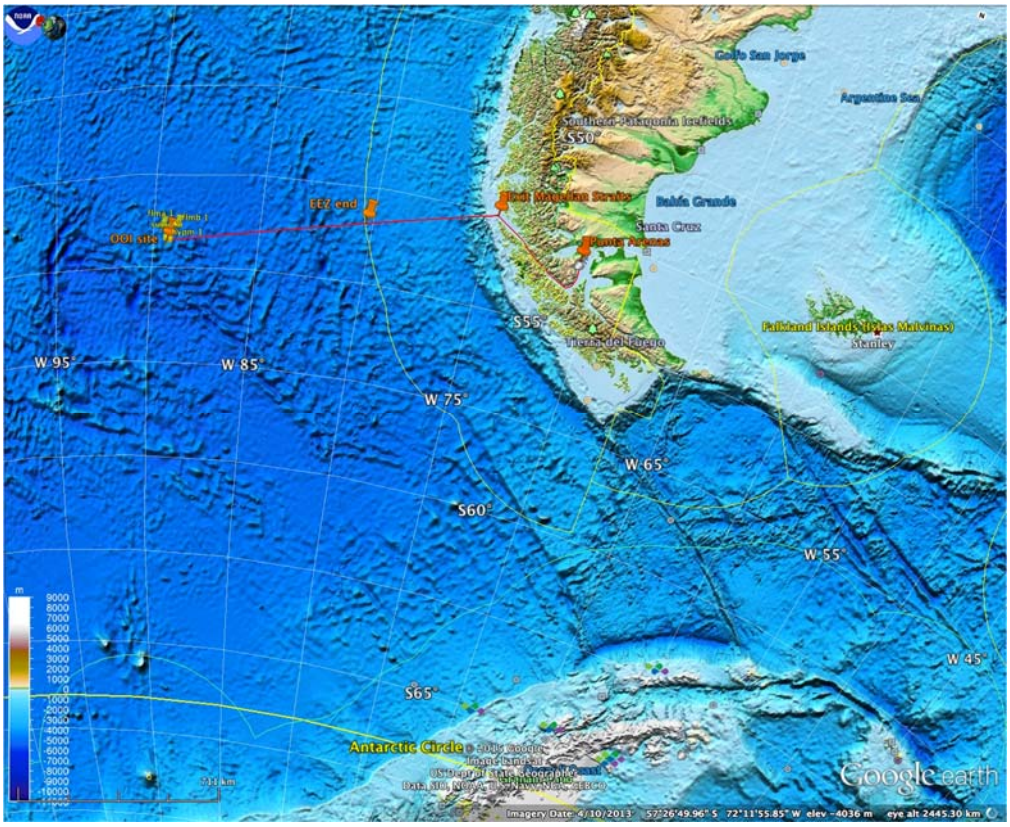


Figure 4-1 Location of the Global Southern Ocean Array and cruise track for NBP16-10

The regional setting and geographic locations of the array, EEZ and ship track from the Southern Ocean 2 Deployment (SO-2) are shown in Figure 4-1. The outbound leg may deviate to recover one of the SO-2 gliders presently well east of the array. The design and layout of the array elements are schematically depicted in Figure 4-2, with detailed locations for each mooring shown in Figure 4-3. On that map, existing moorings are denoted by red symbols while target locations for this deployment are depicted by green symbols. The red line delineates a multi-beam bathymetric survey conducted during the AT26-30 cruise in year 1 of the field program. The positions and depths of existing moorings and target locations are listed in Table 4-1.

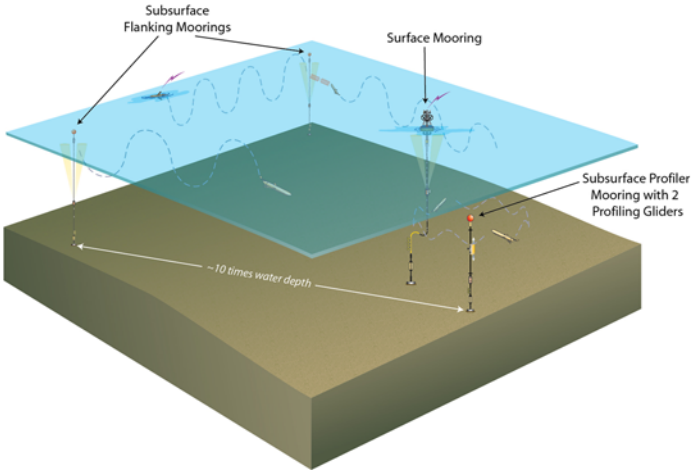
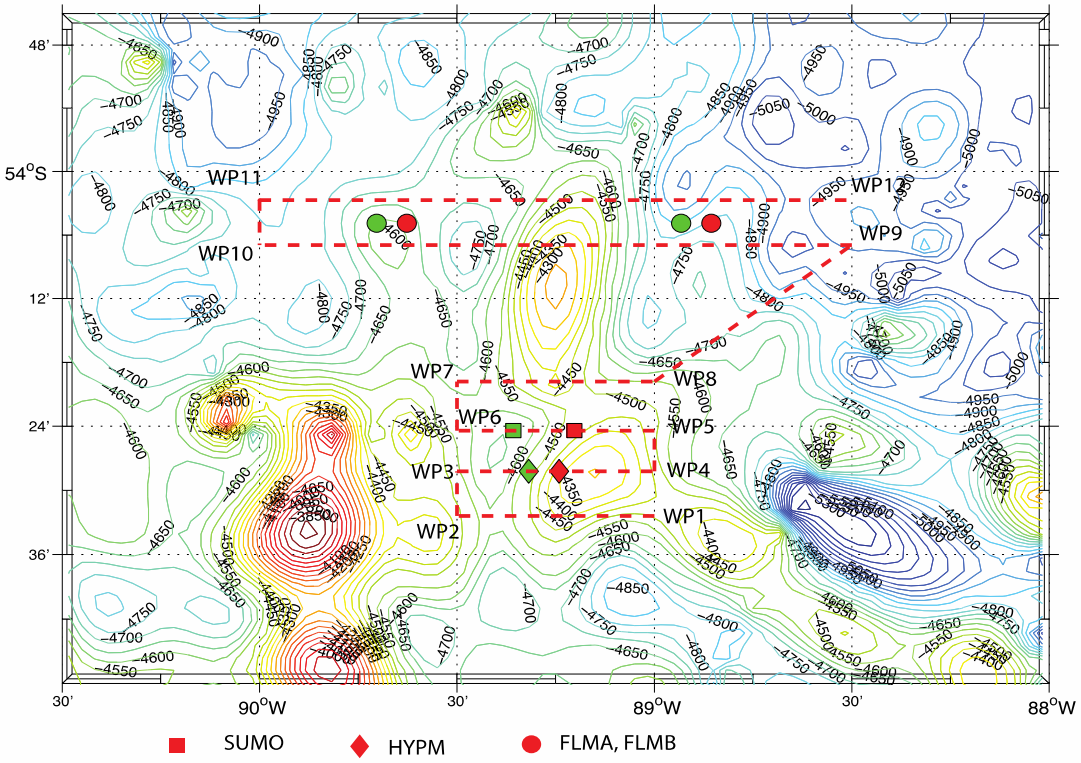


Figure 4-2. Schematic drawing of Southern Ocean Global Array



GS01SUMO-00002	14 Dec 2015	54° 24.245'S	89° 12.415'W	4588
GS01SUMO-00003 Target:	Nov 2016	54° 24.408'S	89° 21.402'W	4611
GS02HYPM-00002	15 Dec 2015	54° 28.207'S	89° 14.400'W	4515
GS02HYPM-00003 Target:	Nov 2016	54° 28.224'S	89° 19.092'W	4650
GS03FLMA-00002	17 Dec 2015	54° 07.538'S	89° 33.176'W	4705
GS03FLMA-00003 Target	Nov 2016	54° 04.884'S	89° 42.204'W	4632
GS03FLMB-00002	18 Dec 2015	54° 04.944'S	88° 51.543'W	4942
GS03FLMB-00003 Target	Nov 2016	54° 04.884'S	88° 55.926'W	4932

4.2. Overall Strategy

Southern Ocean 3 (SO-3) will be deployed in November – December 2016 on NBP16-10, departing from Punta Arenas, Chile on November 18 and returning to that port on December 18. The instruments and moorings were fabricated and tested in Woods Hole, then disassembled and shipped to Punta Arenas in August 2016. They will be re-assembled and tested in port, utilizing the USAP dockside facilities, during a 2-week period prior to the cruise. Loading onto the ship will take place November 16-17, with Demobilization scheduled for Dec 18-20. Final testing of instruments and communication systems will be conducted on the ship while transiting to the work site, and again just prior to the actual deployments.

This cruise plan was developed to accommodate several logistical aims:

- Deploy the surface mooring (GS01SUMO-00003) first to open up deck space for further recovery and deployment operations.
- Deploy the Wave Glider as soon as possible in the work schedule. It will be piloted in patterns around the SUMO moorings for testing and validation for the duration of the work period, enabling, if needed, opportunities for repairs and/or recovery by the ship.
- Deploy the gliders early in the work period into a designated “safe zone” to permit testing and allow, if needed, for recovery and redeployment by the ship.
- Allow overlap between existing and new moorings for cross-calibration.
- Assess the integrity of acoustic communication systems for each mooring from ship
- Obtain shipboard measurements to calibrate and validate moored instruments, particularly for the meteorological sensors, ADCP and CTD instruments.

Although it is desirable (for instrument inter-calibrations) to deploy all 4 new moorings to achieve an overlap with the existing ones, short distances between the new and existing sites may limit the ability to do so. Ultimately, wind and current conditions will guide the actual deployment plan.

On the transit to the work site, testing of the acoustic releases and CTD rosette system will be conducted. To facilitate calibration and evaluation of the moored instrumentation, a full-depth CTD cast with water samples will be acquired in advance of each mooring recovery, and following each mooring deployment. Additionally, testing and evaluation of the moored instruments via acoustic communications will be conducted immediately after deployment, and periodically throughout the cruise as time permits. One or more CTD casts will also be conducted to verify ballasting of the gliders prior to their deployment, and to provide baseline calibration profiles for the glider sensors.

4.3. Responsibilities and Lines of Communication

The Chief Scientist (CS) will execute the cruise according to the direction of the Program Manager (PM) in order to accomplish, to the extent practicable, programmatic and scientific objectives. The ship’s Master 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 CS and PM have discussed tasks and responsibilities for the cruise, have reviewed likely at-sea failure modes and actions, have reviewed guiding principles for at-sea decision making, and have established communication pathways for both routine reporting (e.g. email) and emergency contact (e.g. satellite telephone).

The CS and PM will communicate frequently (typically daily by email) during the cruise to exchange status information and to assess the potential impact of at-sea decisions driven by weather or technical issues. Significant modifications to the cruise objectives (e.g. inability to deploy/recover a platform) or changes to the cruise plan anticipated to have significant financial impacts (e.g. additional ship days) will be communicated to the PM at the earliest opportunity. Incidents involving injury or damaged/lost equipment will follow established Program protocols (UNOLS policies, OOI Incident Reporting Process). Anomalies, suspected failures and confirmed failures will be handled according to the OOI Equipment Notification and Escalation Process.

4.4. Cruise Activities

The ship is scheduled to depart on November 18, and will navigate through the Straits of Magellan, then head west to the Southern Ocean work site. On the way, the ship will attempt to recover one of the SO-2 gliders which has been swept eastward (Figure 4-4). Once the ship is clear of Chile’s EEZ, the ship will stop to test CTD and acoustic releases with 3 separate casts. A general timeline of activities is provided in Appendix A, including 5 days

transit each way, plus 16 work-days on site to accomplish the cruise objectives. That timeline will need to be flexible in order to accommodate weather conditions that either make it difficult to do some of the work or present a window of opportunity to capitalize on favorable weather conditions by adjusting the order of the planned work. The timeline affords 5 days for unworkable conditions over the 30-day total.

4.4.1. New Moorings

For each new mooring, the following work is planned:

- Verify the bottom depth and target region to identify as the anchor drop site;
- Assess currents, winds, and sea state and identify an initial point for the deployment of the top end of the mooring and a course heading;
- Steam toward the anchor target site, paying out the mooring and attaching instruments;
- Overshoot the anchor target by a fraction of the water depth to allow for fall-back of the mooring and drop the anchor;
- Allow mooring to settle and conduct a 3-point acoustic survey to determine coordinates of the anchor; and
- Carry out validation and verification of the function of the moored instrumentation. Set up for a deployment and staging of instrumentation will occur the day before deployment. Deployment will begin after breakfast and continue through the day.

4.4.2. Existing Moorings

For each existing mooring deployed in December 2015, the following work is planned:

- Assess functionality by telemetry and acoustic communication where possible,
- Recover and document recovered condition,
- Download data
- Preliminary cleaning of instruments and mooring gear.

4.4.3. CTD profiling and water sampling

The CTD/rosette package is needed to verify glider ballasting, establish sound velocity profiles for the multi-beam and Knudsen echo sounders, confirm seafloor depth at each new mooring location, and provide data to calibrate moored instrumentation. Water samples will be collected and processed to calibrate the CTD and for validation of moored sensors. CTDs will be conducted:

- Prior to glider deployments and recoveries
- Before each existing mooring is recovered
- Prior to deployment of the new profiling and flanking moorings (water depth check)
- After new moorings are deployed

4.4.4. Gliders

Two Open Ocean Gliders (OOG, #560 and #561) and one Global Profiling Glider (GPG, #565) are presently in the water but have been carried away from the array site (Figure 4-4). Glider #561 has disappeared from tracking and an attempt to recover this glider will not occur. The positions of the remaining two gliders – OOG (#560) and GPG (#565) – may permit the ship to rendezvous with one or more of them on the outbound and/or inbound transits, and assessments will be made for recovery once the cruise is underway.

Two OOGs will be deployed and used in patrol mode around the array, and to acquire and retransmit data from the Flanking Moorings. Two GPGs will be used to make upper water column profiling measurements in the vicinity of the HYPM. Deployments will be conducted simultaneously within a designated “Safe Zone” out of the general work area to avoid ship/glider collisions. Glider deployments will be undertaken with close coordination between

the ship and shore teams and followed by functionality testing and testing of the acoustic data communications and relay. The shore pilot team will perform the majority of final checkouts via Iridium and will also provide the final green light indicating gliders are ready to be deployed.

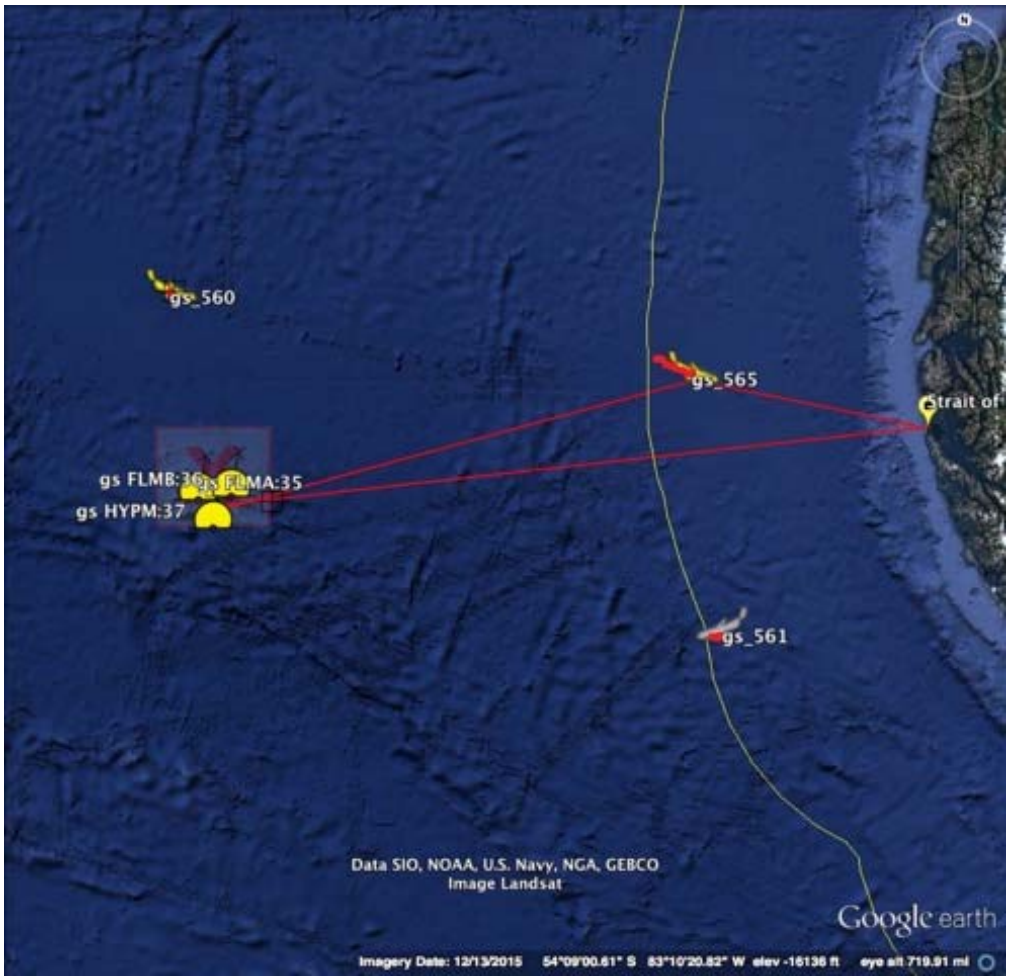


Figure 4-4 Location of gliders relative to Southern Ocean Array on 09 November 2016

4.4.5. Ancillary activities

In support of a project conducted by researchers at the Applied Physics Lab (APL) of University of Washington, a Liquid Robotics Wave Glider (WG) will be deployed by two APL technicians who will be aboard NBP16-10. The plan is to deploy the vehicle as early as possible in the cruise schedule, and to have the ship standby for a few hours to assess its functionality and to act upon any needs that might arise. For the first several weeks, the WG will be piloted along a square track around the SUMO-2 buoy in contact with shore by Iridium and at times with the ship through FreeWave.

4.5. Specific Operations

4.5.1. Acoustic Release Tests

At a convenient time prior to deployment of the moorings, the science party will test the acoustic releases by mounting the instruments on the CTD package lowering them to 1500 m interrogating them periodically. The science party will supply an acoustic transceiver that can be lowered over the rail with a cable run to the main lab and connected to a transceiver controller. Alternatively, the controller can be connected directly to a 12 kHz hull transducer mounted on the ship's hull.

4.5.2. Mooring Operations

Mooring deployments and recoveries will be done in stages using the ship's A-frame and an Effer crane and winches supplied by the science party. Science personnel will be familiar with mooring deployment and recovery, and capable of directing operations in cooperation with the ship's crew. Additional science personnel will assist with mooring operations, MET watches, and other observation and data collection activities.

4.5.3. Glider Operations

Glider deployments (and recoveries if necessary) will be done using the ship's starboard side A-frame and handling equipment supplied by the science party. Science party personnel will be familiar with glider deployment and recovery, and capable of directing operations in coordination with the ship's crew during all phases of glider operations.

4.5.4. Anchor Surveys

Once the anchor has settled on the bottom, R/V *Palmer* will occupy three stations 0.3 to 1.5 nm from the anchor drop point in a triangular pattern. At each station the slant range to the acoustic release will be determined. Ranging from 3 stations will enable triangulation of the release position, and thus a reasonably accurate estimate of the anchor position.

4.5.5. CTD casts

CTD casts will be conducted using the ship's 9-11 CTD sensors, 24 bottle rosette frame, and deck box. Sensors requested in addition to conductivity, temperature and pressure are dissolved oxygen, chlorophyll fluorometer, transmissometer, and PAR. CTD operations will be supervised by shipboard SSSG technicians – the science party will supply line handlers and a lab operator. Water sampling and any onboard analysis will be handled by the science party. Water samples and filtered samples will be preserved for analyses on shore.

4.5.6. Sensor Performance Evaluation

Sensor evaluation operations will be conducted at each mooring deployment site and glider deployment site. The primary means of evaluation will be CTD casts obtained in near proximity (e.g. 0.25 nm) to the mooring or glider. For validation of meteorological and sea surface variables the ship will establish and hold a position, with bow into the wind, approximately 0.10 nm downwind of a buoy. This station will be held, and adjusted if necessary, while the science party evaluates data received from the buoy. During this period, the ships underway data will be continuously recorded and the science party may make periodic observations with hand-held meteorological sensors. At a convenient time during the cruise, the ship may make a close approach to buoys to allow visual inspection, determination of the water line, and photographs.

4.5.7. Shipboard Underway Data

The ship's meteorological system will be used to continuously monitor weather conditions while underway and for evaluation of buoy meteorology during the intercomparison period. The ship's ADCP systems will be used to continuously measure the currents in the upper ocean while. Sea surface temperature and salinity will be recorded continuously, using the ship's thermosalinograph.

4.5.8. Small Boat Operations

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 buoy tower. Expected duration of use is approximately 0.5 to 1.5 hr. Work boat operations would be within 0.5-1.0 nm of the ship.

4.5.9. Potential Restrictions

Small boat activities may be restricted by weather. 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. Deployment and recovery activities may be restricted by the presence of multiple fixed objects (e.g., fishing gear) in the deployment area or along the deployment/recovery track. If possible, operations will be delayed until conditions are more favorable (e.g., change in prevailing wind direction allowing deployment approach along a different, unobstructed course).

4.6. Staging and De-staging

4.6.1. At WHOI, Preparation and Staging

Initial phases of assembly, testing, and staging were undertaken at the Woods Hole Oceanographic Institution (WHOI). Shipments of the WHOI gear left from Woods Hole in August 2016. WHOI staff arrived in Punta Arenas for final assembly and testing prior to loading on the R/V *Palmer* in early November, 14 days prior to cruise departure date.

4.6.2. In Punta Arenas, Preparation and Staging

Final assembly and testing will be done in Punta Arenas prior to loading on the R/V *Palmer*. WHOI personnel will begin arriving in Punta Arenas on Nov 3 and Mobilization will run from Nov 4-17 at a warehouse facility near the USAP support facility. The R/V *Palmer* is scheduled to arrive in Punta Arenas following the Argentine Basin cruise on Nov 15. Unloading from that cruise and loading of the Southern Ocean cruise will occur in the intervening time from Nov 15-18. A deck plan for storage and utilization of the ship's spaces is supplied in Appendix B.

Surface mooring:

- Populate the buoy well.
- Visually inspect well internals for shipping damage.
- Populate the halo telemetry and instruments (halo on temporary stand).
- Set up line-of-sight (LOS) communications (WiFi; RFM).
- Run halo cables to instrument well J-boxes.
- Boot up instrument well (remove magnet).
- Establish LOS communications.
- Burn-in testing.
- Verify sensor operation: each science sensor needs to be verified for proper data collection directly from buoy operations and the shore side Command and Control station.
- Power verification: after complete assembly, power generation needs to be verified. While complete mooring is outside and vertical, power generation capability is tested.

Gliders:

After the gliders arrive in port, they will undergo functional testing that requires approximately 4 hours to complete for each glider. The following procedures are used to confirm full functionality:

- 3304-00160 OOI Open Ocean Gliders - Functional Check-Out Procedure

- 3304-00170 OOI Global Profiling Gliders - Functional Check-Out Procedure

Profiler and Flanking Moorings:

All equipment and to-deploy and spare sensors will be unpacked and visually inspected on dock. Each sensor will be installed, programmed, and connected to its respective platform. They will then be integrated on an inductive loop.

- Profiler and flanking moorings post-shipment integrity assessment:
    - Wire-following Profilers (WFPs) will be connected on inductive loop to the HYPM controller. The WFPs will be set to perform the planned profiling schedule.
    - Flanking mooring bio-package sensors will be programmed and connected to secondary controller.
    - Controllers, ADCP, and all CTDMOs will be connected to the inductive loop.
    - A total of three separate inductive loops for each mooring and their respective sensor sets will be created on the dock.
    - All platforms will run without interruption until day of deployment.

- Platform Data Integrity Check:
    - An initial quick look at the data downloaded using a serial cable will allow software engineers to detect any early anomalies.
    - Every 24 hours, a dataset will be downloaded using all modes of transfer:
        - serial cable to controller (full dataset)
        - serial cable to acoustic modem (decimated dataset)
        - remote modem to acoustic modem (decimated dataset).
    - Remote modem download mode will be tested using an acoustic deck unit, a glider simulator, and a glider.

Integration of gliders and acoustic communications on profiler and flanking moorings will be done in port; the checklist of communication tests includes verifying communication between each glider and the target modem [Modem ID: FLMA = 31, FLMB = 32, HYPM = 33].

- Recovery Aids and Emergency Beacons:
    - (Radios, Flashers, GPS Sable Beacon) All recovery aids will be assigned and installed on HYPM 64” Sphere, FLMA/B 64” Sphere, and 62” ADCP Sphere.

Dual Release Assembly:

Dual releases will be assembled and prepared for testing on the CTD frame.

4.6.3. In Punta Arenas, Cruise Wrap-up and De-staging

Upon return of NBP16-10, de-staging and offloading of scientific equipment will occur in Punta Arenas from December 18-20. Because of the holidays, a subset of team members will return in December or January to complete the process. All equipment will be loaded in containers for shipment. This includes some of the water samples. Time-sensitive samples will be air shipped before the holidays. The project will make arrangements for a shore-side crane if needed for offloading.

Appendix A - Proposed Cruise Timeline

Day	Date	Activity
-14 : -2	3 – 15 Nov	Staging in Punta Arenas
-2 : -1	16 – 17 Nov	MOB on R/V Palmer
1 : 5	18 - 22 Nov	Depart P.A. transit to Array site. Recover glider #565 enroute (located well east of the array). When out of EEZ, stop for 3 CTD casts to test acoustic releases.
6	23 Nov	Arrive in work area; proceed to **SUMO2** for visual Inspection; CTD cast to bottom with water samples for sound velocity profile and calibration. **Deploy Wave Glider**. Head to SUMO3 site; Full depth CTD cast with altimeter check for accurate bottom depth;
	Weather Dependent TBD	Set up deck for SUMO3 deployment including drift test for 30 mins. **Deploy SUMO3.** Full depth CTD cast with water samples for calibration. Anchor survey.
	TBD	**Deploy 4 gliders** / standby for possible recovery (~12 hours). CTD cast to 1000 m with water samples for calibration of glider sensors. Proceed to HYPM3 site; conduct full-depth CTD (no water samples) to check water depth.
	TBD	**Deploy HYPM3;** Anchor survey
	TBD	CTD cast with water samples near HYPM3; Acoustic data download
	TBD	**Deploy FLMA3**; Anchor survey; CTD cast with water samples.
	TBD	**Deploy FLMB3**; Anchor survey; CTD cast with water samples for calibration.
	TBD	Recover glider #560 (~1 day R/T steam to north for rendezvous); CTD cast to 1000 m with water samples for calibration of glider sensors
	TBD	CTD casts with water samples near FLMA2; Acoustic data download from FLMA3
	TBD	**Recover FLMA2**
	TBD	CTD casts with water samples near FLMB2; Acoustic data download from FLMB3
	TBD	**Recover FLMB2**
	TBD	Swing by SUMO3 for visual inspection and met sensor comparisons. Head to SUMO2 and collect shipboard ADCP and Met data.
	TBD	CTD casts with water samples near HYPM2; **Recover HYPM2**
	TBD	Acoustic data download from HYPM3
	TBD	**Recover SUMO2.**
26 : 31	13-18 Dec	Transit back to Punta Arenas for arrival by Dec 18

Appendix B – Schematics of *R/V N.B. Palmer* Deck Layout

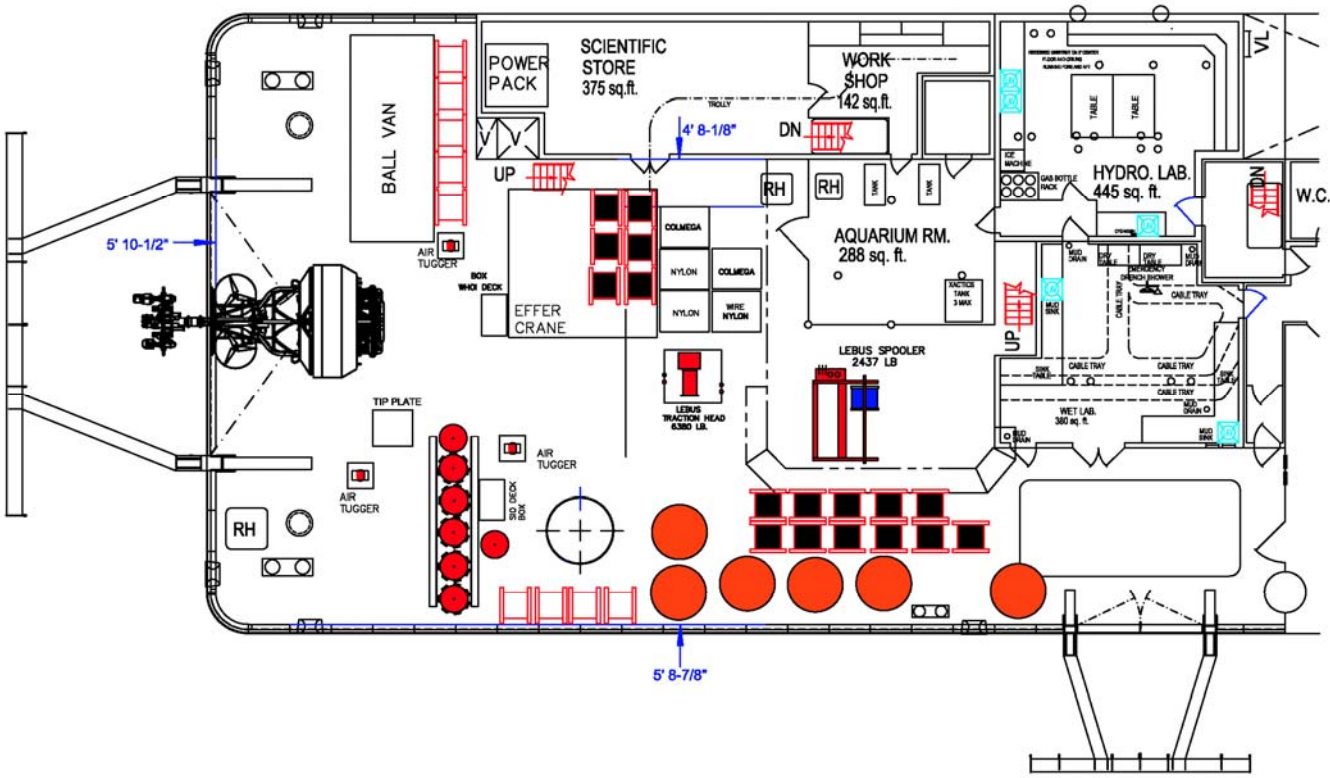


Figure B-1 Main Deck

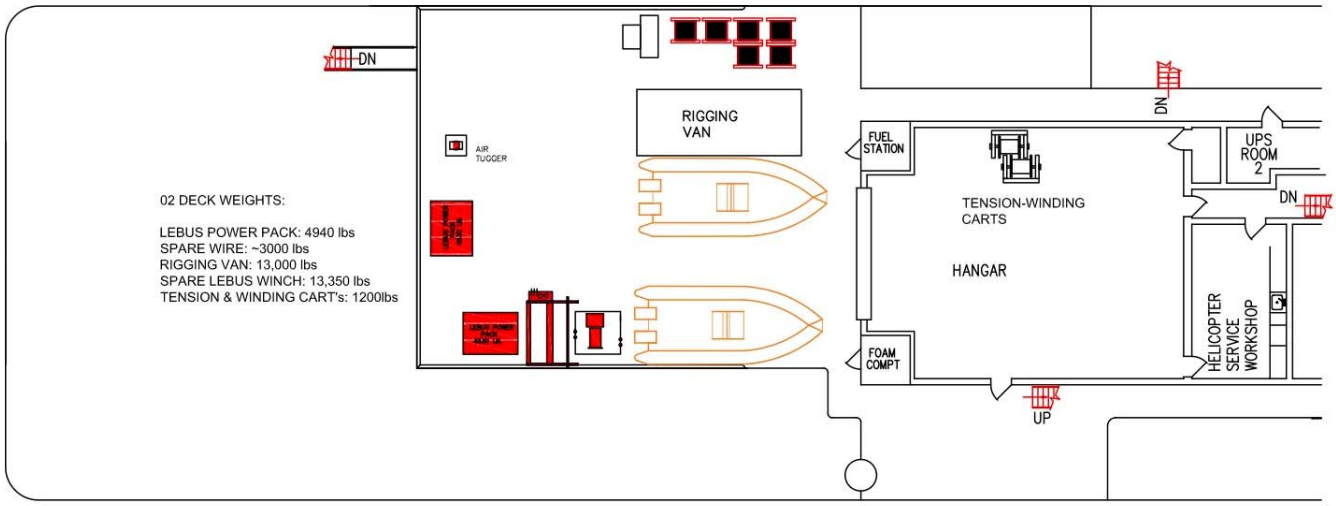


Figure B-2 Heliport Deck

Appendix C – Cruise Science Participants

Name	Employer	Email	Responsibility
Ruth Curry	WHOI	rcurry@whoi.edu	Chief Scientist
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Aidan Alai	WHOI	aalai@whoi.edu	Instrumentation
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Steve Caldwell	WHOI	scaldwell@whoi.edu	Surface moorings
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Avery Snyder	APL	asnyder@apl.washington.edu	Wave Glider
Alex de Klerk	APL	adeklerk@apl.washington.edu	Wave Glider

Appendix D – Glider Operations and Predeployment Timeline

Deployments

A general time line for the glider deployments is as follows:

T_0: 0600 (or daylight):

Five gliders secured in carts on deck, clear sky view and green plug inserted (ON). Communication with shore-side pilots should be established through Peter Brickley. The shore team will have three pilots available.

T_0+4 hours

Shore pilots complete pre-deployment checklist and signal ready for launch via satellite phone communication with deck ops lead. We should allow up to 4 hours to complete this task. The launches will be staggered and may take longer to complete.

T_0+10 hours

Each glider requires 3-6 hours to complete basic functional dive checks to their full rated depth of 1000 m. Each glider must first complete a dive to 500 m before attempting 1000 m. We will attempt to keep the gliders on station, subject to weather and currents.

Example dive time deltas:

50 and 100 m dives - 30 – 60 min

500 m hold position– 2.5 hours

1000 m hold position - requires up to 5 hours

T_0+12+ hours

A CTD cast will be conducted ~1 km away following as soon as possible following the glider deployments

Communications

Communications between the ship- and shore-based teams are extremely important, including a clear set of rules for close approaches between the ship and gliders. The Chief Scientist, ship's officers and shore pilots will establish this before commencing glider operations.

A mobile Fleet Broadband (FBB) system will augment the ship's FBB capabilities to support satellite communications during the cruise. Glider positions will be relayed to the ship in 3 modes:

- Emails to the Chief Sci and Glider Tech from the shore-based dockserver
- Via Google Earth KML files that update glider positions regularly (requires FBB)
- Science-supplied satellite phones with voice and texting capabilities

Ship positions will be tracked by the shore team via a GPS Xeos beacon (secured on a high deck rail).

The Chief Scientist will forward the Plan of the Day to the shore-based team.