WOODS HOLE OCEANOGRAPHIC INSTITUTION

Project Instructions

Date Submitted: 8 June 2016

Platform: NOAA Ship *Hi'ialakai*

Project Number: HA-16-05

Project Title: WHOI Hawaii Ocean Timeseries Station (WHOTS)

Project Dates: June 25, 2016 – July 3, 2016

Prepared by: [signature] Dated: 6/13/16
Albert J. Plueddemann
Chief Scientist
Woods Hole Oceanographic Institution

Approved by: [signature] Dated: 6/13/16
Albert Plueddemann
Chair
Department of Physical Oceanography
Woods Hole Oceanographic Institution

Approved by: [signature] CDR/NOAA Dated: 6/16/16
Commander Matthew J. Wingate, NOAA
Commanding Officer
Marine Operations Center – Pacific Islands

Project Instructions

WHOTS-13
WHOI Hawaii Ocean Timeseries Station (WHOTS): Thirteenth Setting

Project HA-16-05

NOAA Ship *Hi'ialakai*
Chief Scientist: Albert J. Plueddemann

I. Overview

A. Brief Summary and Project Period

NOAA Ship *Hi'ialakai* (*HA*) will participate in mooring operations associated with the Woods Hole Oceanographic Institution (WHOI) Hawaii Ocean Timeseries Station (WHOTS) project. There are multiple specific objectives for the project, associated with recovery and re-deployment of the WHOTS mooring, CTD casts, and data collection from Project-provided and shipboard sensors while in near proximity to the WHOTS moorings. The cruise will begin June 25, 2016 and end July 3, 2016.

B. Days at Sea (DAS)

Of the 9 DAS scheduled for this project, 9 DAS are funded by an OMAO allocation. This project is estimated to exhibit a medium Operational Tempo.

C. Operating Area

The WHOTS operating area is north of the Hawaiian island of O'ahu, within the region bounded by approximately 21° – 23° N and 157° – 159° W. Mooring locations and maps are provided in Appendix E.

D. Summary of Objectives

Upon completion of mobilization activities, *HA* will depart from the NOAA Marine Facility on Ford Island, HI and occupy an initial station near 21° 28'N, 158° 21'W (>1000 m water depth) for testing of acoustic releases and the CTD. The main operations of the cruise will be conducted within the Hawaii Ocean Timeseries (HOT) Station ALOHA circle (6 nm radius centered at 22° 45'N, 158° 00'W, Fig. E1). The WHOTS-13 mooring will be deployed first, and the anchor position determined by acoustic ranging. After the anchor survey, a "sensor intercomparison" period will begin. During this period *HA* will alternately stand off at close range from the newly deployed WHOTS-13 buoy and the WHOTS-12 buoy (separated by ~6 nm). Data from shipboard meteorological and hull sensors, as well as from Project-supplied meteorological sensors, will be logged and evaluated during this period. A sequence of CTD casts will be performed near the moorings and near the center of the Station ALOHA circle using instrumentation supplied by the science party. At the end of the intercomparison period, the WHOTS-12 mooring will be recovered. The buoy will be inspected and mooring instrumentation will be cleaned and transferred to the lab.

When WHOTS-12 recovery operations are complete, *HA* will return to Ford Island. However, if time permits, additional CTD stations may be occupied in the vicinity of Station ALOHA and along portions of the return route.

Nominal times for these activities are given in the Project Timeline (Appendix D). Site locations are listed in Appendix E.

The primary objectives are:

Objective 1. To deploy the WHOTS-13 mooring.

Objective 2. To simultaneously log data from the WHOTS-13 buoy, the WHOTS-12 buoy, Project-supplied meteorological sensors, and *HA* shipboard instruments during a ~48 hr intercomparison period during which a sequence of CTD casts will also be made.

Objective 3. To recover the WHOTS-12 mooring.

Objective 4. To obtain hydrographic data (CTD casts and ADCP profiles) at or near the center of Station ALOHA.

E. Participating Institutions

Woods Hole Oceanographic Institution (WHOI)
University of Hawaii (UH)
NOAA Earth System Research Laboratory, Physical Sciences Division (ESRL/PSD)
North Carolina State University (NCSU)

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

The Chief Scientist is Dr. Albert J. Plueddemann, affiliated with the Woods Hole Oceanographic Institution (WHOI). There will be 13 participants in the science party; a list is given in the table below. All participants will submit a medical history form and be medically approved before embarking.

Name (Last, First)	**Title**	**Date Aboard**	**Date Disembark**	**Gender**	**Affiliation**	**Nationality**

Berry, Katrina	Technician	6/24/2016	7/3/2016	F	UH	USA
Carter, Glenn	Professor	6/25/2016	7/3/2016	M	UH	New Zealand*
Cole, Rick	Marine Technician	6/25/2016	7/3/2016	M	RDSea	USA
Deppe, Robert Walter	Research Associate	6/25/2016	7/3/2016	M	UH	USA
Harvey, Julia	Teacher at Sea	6/25/2016	7/3/2016	F	S. Eugene High Sch.	USA
McCoy, Daniel	Research Associate	6/25/2016	7/3/2016	M	UH	USA
Meskhidze, Nicholas	Professor	6/25/2016	7/3/2016	M	NCSU	USA
Plueddemann, Albert	Senior Scientist	6/25/2016	7/3/2016	M	WHOI	USA
Rosburg, Kellen	Research Associate	6/25/2016	7/3/2016	M	UH	USA
Royalty, Taylor	Student	6/25/2016	7/3/2016	M	NCSU	USA
Santiago-Mandujano, Fernando	Research Associate	6/25/2016	7/3/2016	M	UH	USA
Smith, Jason	Engineering Assistant	6/25/2016	7/3/2016	M	WHOI	USA
Snyder, Jefrey	Marine Technician	6/25/2016	7/3/2016	M	UH	USA

* Green card holder

G. Administrative

1. Points of Contacts:

Scientists and other project participants should check with the Marine Operations Center - Pacific Islands at 808-725-5761 for updates on planned arrival and departure times of *Hi'ialakai*. Travelers should allow for possible flight delays due to weather, holidays, or other considerations. The ship's Operations Officer's e-mail address is Ops.Hiialakai@noaa.gov.

Ship Operations:

Marine Operations Center, Pacific Islands
CDR Matthew J. Wingate, NOAA
1897 Ranger Loop, Building 184
Pearl Harbor, HI 96818
808-725-5761
CO.MOC.PIAC@noaa.gov

Science Operations:

Dr. Albert J. Plueddemann
202A Clark Lab, MS-29
Woods Hole Oceanographic Institution
Woods Hole, MA 02543-1541
508-289-2789 (voice), 508-457-2181 (fax)

aplueddemann@whoi.edu

Logistics:
Ben Pietro
183 Clark Lab, MS-30
Woods Hole Oceanographic Institution
Woods Hole, MA 02543-1541
508-289-2732 (voice), 508-457-2181 (fax)
bpietro@whoi.edu

NOAA Ship *Hi'ialakai*
LT Faith O. Knighton
Operations Officer, Hi'ialakai
1897 Ranger Loop, Building 184
Honolulu, HI 96818
At Sea: 808-684-3235, In Port: 808-725-5780
Ops.hiialakai@noaa.gov

2. Diplomatic Clearances

None Required.

3. Licenses and Permits

A permit for the WHOTS mooring has been obtained from the US Army Corps of Engineers, Honolulu District. The buoy is marked according to US Coast Guard Private Aid to Navigation (PATON) regulations.

II. Operations

The Chief Scientist is responsible for ensuring the scientific staff are trained in planned operations and are knowledgeable of project objectives and priorities. The Commanding Officer is responsible for ensuring all operations conform to the ship's accepted practices and procedures.

A. Project Itinerary:

A project itinerary is provided in Appendix D. A speed of 9 knots has been assumed for transit.

A list of principal waypoints and selected details of the project track are included in Appendix E.

B. Staging and Destaging:

Staging, loading and other preparation of scientific equipment for this project will take place at the NOAA facility on Ford Island, HI on 16-24 June 2016, and the Project requests shoreside staging space for equipment preparation during that period. The expectation is for the scientific equipment to be loaded on 23-24 June. A shore crane will be contracted for heavy lifts (winch, anchor). The winch and capstan require electrical connections (see Sec. III.A.5) which we would like to have completed on 23 June. The buoy would be loaded by the ship's crane on 24 June.

Copies of equipment lists will be provided to the Operations Officer (OPS) by the Chief Scientist if needed. The Project will arrange for shipping their equipment to *HA*, including all customs requirements, documentation, and transfers between the receiving dock and the ship. The project, in coordination with the Operations Officer, will make arrangements for a shoreside crane and forklift as needed for preparation and loading. A drawing of the proposed deck layout is provided in Appendix B along with a list of the major items of scientific equipment that will be used on deck and in the main lab. All HAZMATs will be declared and handled according to NOAA regulations (see Appendix C).

Prior to loading of the scientific equipment, WHOI will work with the Port Engineers to position equipment on the deck of the HA, including the use of adapter plates (utilizing the ship's 4x4 deck mounts). Baxter bolts in the deck will be used for anchor tie-down. A mooring winch, capstan, air tuggers, cleats, bits, etc. will be set in place. WHOI will provide adapter plates and sockets for this purpose. In addition, ESRL will work with Port Engineers to position a meteorological mast on the bow of the *HA*. The mast is assembled in pieces that can be hand-carried aboard the ship. If needed, the crane scheduled for loading the WHOI winch and anchor will be used. A base for this mast is already in place.

Due to the size and quantity of handling gear necessary for mooring operations (see Appendix B) it is anticipated that work boats, dive gear, ethanol STBD hip tank, and other ancillary equipment will need to be removed from the deck prior to loading of WHOTS gear. The details of these deck preparations will be worked out with the Operations Officer and Bos'n.

Because high-quality meteorological data are critical to the Project, a project-supplied meteorological system will be installed on the HA prior to the cruise. The system was developed by the ESRL/PSD group, and referred to as the turbulent flux system. The turbulent flux system is comprised of multiple elements (Appendix A). An addition to the flux system for WHOTS-13 will be sea spray aresol system (Appendix A) The majority of sensors are mounted on a 30' tower to be installed on the bow just aft of the ship's jack staff. During assembly, the mast is pivoted on hinges and laid horizontally on the forward deck. Sensors and cabling are attached prior to the tower being raised into place. It is unlikely, but possible, that the tower will need to be climbed after installation. In this event, a qualified, permitted climber will request access from the ship. A sea surface temperature sensor is mounted over the side using an outrigger and an electronics box is lashed above the pilot house.

Destaging and offloading of scientific equipment, including recovered mooring components, will be conducted on 3 July 2016. The location for this activity is Ford Island, HI.

The Project will arrange for shipping their equipment from *HA*, including all customs requirements, documentation, and transfers between the receiving dock and the ship. The project, in coordination with the Operations Officer, will make arrangements for a shoreside crane as needed for offloading or shifting gear in port.

C. Operations to be Conducted:

A proposed timeline for principal operations during the project is provided in Appendix D. Selected project track details are shown along with a list of principal way points in Appendix E.

1. Release Tests and CTD trials

At a convenient time during transit *HA* will stop and hold station to allow the science party to perform release tests and a trial CTD cast. The proposed location is provided in Appendix E; the actual position should have water depth of at least 1500 m. The release tests involve attaching multiple acoustic releases to a winch wire or CTD wire. The releases will be lowered to one or more depths between 1000 m and 500 m and held at that depth while being interrogated acoustically. After successful completion of the interrogations the releases will be raised to the surface and brought aboard. For interrogation of the releases, the science party will bring an acoustic transceiver than can be lowered over the rail with a cable run to the lab and connected to a transceiver controller.

The CTD trial will serve to test the system from end-to-end, and to obtain several water samples to calibrate the conductivity sensors. Ideally, this CTD cast will be to a depth of 1000 m. Elapsed time for a combined release and CTD test (releases attached to rosette) is expected to be about 2 hours if no problems are encountered.

2. WHOTS Mooring Deployment

The WHOTS mooring is an inverse catenary design utilizing wire rope, chain, nylon and colmega line. The surface element is a 2.7-meter diameter Surlyn foam buoy with a watertight electronics well and aluminum instrument tower. Meteorological sensors are attached to the upper section of the two-part aluminum tower at a height of about 3 m above the water line. A mooring drawing, specifying the mooring components and location of the attached instrumentation, is provided in Appendix F.

A typical mooring deployment sequence is described below. These operations will be modified as necessary in consultation with the Operations Officer and Bos'n.

The mooring is deployed in several stages. The first stage is the lowering of the upper 40 meters of the mooring over the starboard side of the ship. The instruments and adjacent chain sections are made up ahead of time and stored on deck to increase the efficiency of this step. Instruments and chain sections from 40 meters to the surface are deployed off the starboard side using the crane to lift them into the water. Wire handlers on the rail tend a hauling wire, paid out from the WHOI TSE winch and passed through the A-frame and around the aft starboard quarter, as instruments are lowered into the water. Once the upper 40 m of the mooring is in the water, the upper chain shot is secured to a cleat until the buoy goes over the side.

The next stage of the operation is the launching of the surface buoy. Slip lines are rigged on the buoy and the ship's crane is attached to the quick release hook. The slack chain from the upper section of mooring line is connected to the buoy bridle. The slip line holding the 40 meters of instrumented mooring line is eased off to transfer the load to the buoy. The buoy is then raised up, swung outboard and lowered to the water. Once the buoy settles into the water (approximately 15 ft. from the side of the ship), and the crane line goes slack, the quick-release hook is tripped. The ship then maneuvers slowly ahead to allow the buoy to pass around the stern. The 80-meter length of paid out mooring wire and instrumentation provides adequate scope for the buoy to clear the stern.

The remainder of the mooring is deployed over the stern. Once the buoy is behind the ship, speed is increased to about 1 knot and the hauling wire is pulled up on the winch. Instruments and mooring components are added to the 40 meters previously deployed. The winch and stopper lines on cleats are used to parcel out shots of wire, chain, and instruments. The long lengths of wire and nylon are then paid out. When the winch drum is empty, the end of the nylon is stopped off to a deck cleat and connected to the first shot of nylon in the wire baskets. An H-bit cleat, positioned in front of the winch is used to slip the 3500-meter shot of nylon/Colmega line stowed in three wire baskets. While the nylon and Colmega line is being paid out, the 80 glass balls are staged for deployment.

With approximately 30 meters of polypropylene line behind the H-bit, payout is stopped and the termination is connected to the winch leader. The mooring is stopped off using a Yale Grip. The glass balls are then shackled into the mooring line and eased over the transom with the winch, followed by the releases, trawler chain, and 20 m Samson anchor pennant. The end of the anchor chain is shackled to the anchor and the crane is positioned so the whip hangs over and slightly aft of the anchor. The crane whip hook is secured to the anchor tip plate and tension is transferred to the anchor by releasing the slip line. The crane is whip raised, lifting the tip plate, causing the anchor to slide over board. As alternatives picking the tip plate with the crane, it is also possible to rig a block from the A-frame and use the winch to lift the tip plate.

3. WHOTS Buoy Tracking and Anchor Survey

HA will hold station approximately 0.25 nm away from the anchor drop point immediately following release of the anchor from the fantail. In consultation with the Bridge, the science party will observe the movement of the buoy towards the anchor drop point on the ship's radar. It is expected to take about 50 min for the anchor to reach the bottom, after which the buoy position will settle-out within the watch circle.

Once the anchor has settled on the bottom, *HA* will occupy three stations approximately 2.5 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 three stations will allow the release position, and thus the mooring anchor position, to be determined by triangulation.

4. WHOTS Sensor Inter-comparison

Intercomparison operations will be conducted with two WHOTS buoys (newly deployed and to be recovered). *HA* will establish and hold a position, with bow into the wind, approximately 0.15 nm downwind of one of the buoys. This station will be held, and adjusted if necessary, while the science party confirms data reception from Argos uplink receivers that will acquire, decode, and record the meteorological data transmitted by the buoy. On a schedule set by the Chief Scientist, *HA* may shuttle between buoys, alternately standing off alternate buoys. During the intercomparison period, data from the Project-supplied PSD turbulent flux system (Appendix A) will be monitored, *HA* shipboard sensors will be continuously recorded and the science party may make periodic observations with hand-held meteorological sensors.

The intercomparison period will include CTD casts which require the ship to maneuver to a position approximately 0.25 nm downwind of a buoy (for shallow casts), or to the center of the Station ALOHA circle (for deep casts). The Chief Scientist in consultation with the Operations Officer will set a CTD operator schedule for the science party to assist and cover CTD operations as needed relative to the ST's workload.

During daylight hours of the inter-comparison period, *HA* will make a close approach to the WHOTS buoys to allow visual inspection of buoy and sensor condition, determination of the water line, and photographs. A typical scheme includes an upwind pass with the buoy along the starboard rail.

5. WHOTS Mooring Recovery

A typical mooring recovery sequence is described below. These operations will be modified as necessary in consultation with the Operations Officer and Bos'n.

Recovery is initiated with the ship positioned approximately 0.25 mi downwind of the mooring anchor location while the acoustic release is fired. When the glass-ball floatation surfaces and is sighted, the ship begins its approach. If weather conditions permit, a small boat is launched to attach a recovery line to the balls. Otherwise, they are grabbed using a hook or grapnel. The flotation cluster is secured to the mooring winch line, the ship steams upwind of the cluster and the floats are pulled up on the A-Frame. Using available capstans, tuggers and stopper lines, the entire cluster is pulled on deck through the A-frame. The mooring line above the floats is stopped off and secured and the acoustic release is pulled up the transom and removed from the mooring. Once the glass balls are secured, the mooring line is transferred to the winch and recovery of line begins. The ship may steam ahead slowly (0.5 – 1.0 kt) while the winch hauls in the mooring. The hauling operation is stopped periodically to offload mooring line and wire that has accumulated on the winch drum. As instruments surface and are pulled up through the a-frame, loads are transferred to stopper lines and the instruments are removed from the mooring line.

When about 40 meters of mooring line remain before the buoy, the line is cut and the buoy is cast adrift for recovery over the side. If weather conditions permit, a small boat is deployed to attach a lifting pennant to the buoy lifting eye (note, this may be done during the same small boat operation used to attach to the glass balls). Otherwise a line is attached to the buoy bale using a snap hook on a pole as the ship maneuvers to bring the buoy alongside the rail. Since there is minimal weight and drag under the buoy at this point, it can be lifted over the side of the ship using the crane. Tag lines connected to air tuggers and capstan are used to steady the buoy as it is brought on deck. Once the buoy has been secured on the deck, the remaining instruments are recovered using short picks with the crane. Stopper lines are used to transfer the load as instruments are pulled from the mooring line.

As subsurface instruments are brought aboard they will be moved to the CTD launch and recovery area for disassembly, documentation and initial cleanup. This will take several hours. Instruments will be removed from their load frames and, after removing fouling, will be brought to the wet lab for further cleanup and evaluation, data download, and shutdown. With the surface buoy secured to the deck, initial instrument evaluation and cleanup will begin. After buoy hull instruments have been removed and the hull cleaned, buoy tower instrumentation will go through evaluation, data download and shutdown. These operations will commence after recovery and continue through the next day.

6. Shipboard data: The Chief Scientist will confer with the *HA* Operations Officer to select shipboard data that will be of interest for real-time display and/or acquisition during the cruise. Data of interest are navigation information, ship-mounted ADCP, sea surface temperature and salinity, bottom depth, and meteorology. To support the ESRL/PSD turbulent flux system an RS-

232 real-time feed from the ship's SCS system with a set of navigation and meteorological data is requested.

7. Small Boat Operations: A work boat is requested for two WHOTS mooring recovery operations 1) attach a hauling line to glass balls and 2) attach lifting pennant to the buoy. The expected duration of small boat use is about 60 minutes for each operation. Small boat operations can be conducted within ~0.5 nm of the ship. By running the workboat from the glass balls to the buoy (~3 nm) it is possible to combine the two operations into a single work boat deployment.

D. Dive Plan

Not applicable.

E. Applicable Restrictions

Small boat operations may be restricted by weather. In this case, the ship will maneuver to the item to be retrieved and grappling lines and/or pick up poles will be used. CTD and mooring operations 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. TSE winch, capstan, air tugger) can be compensated by use of an alternative approach. Failure of ship's equipment (e.g. electrical or hydraulic system) would result in postponement until the failure was fixed.

III. Equipment

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

1. Communications, including INMARSAT link for data, facsimile, and e-mail messages.

2. GPS Navigation

Navigation information will be recorded by the SCS system and made available to the Chief Scientist at upon completion of the Project. In the event of SCS failure, the bridge will record hourly GPS positions in the MOA. GPS position and time-base will be made available in real-time to the science workstations over the ship computer network. GPS data through an NMEA interface is requested for CTD data logging in the science laboratory.

3. Scientific Computer System (SCS)

The ship's Scientific Computer System (SCS) shall operate throughout the cruise, acquiring and logging data from navigation, meteorological and oceanographic sensors. The SCS data display nodes will provide scientists with the capability of monitoring sensor acquisition via text and graphic displays. Data will be archived to CD's and provided to the Chief Scientist at the end of the cruise.

4. Laboratory/work space

The project will require a variety of space in the main lab and wet lab. Intermittent use of the electronics/computer lab may be required.

5. Power:

The Chief Scientist will work with the Operations Officer to define Project power needs vs. power distribution available from the ship. A specific issue is routing power to the aft deck for the TSE winch, which typically requires the attention of the ship's engineer. In order to safely supply power to our mooring winch and capstan, we would like to see a power distribution box with two 440V, 40A, 3 phase circuits and a cut-off switch. The science party will bring pigtails and plugs for the installation. The location would be roughly amid ship, along the rail between the forecastle deck and platform deck. (i.e., just behind and to port of where the winch is to be located (See Fig. B-1).

6. SCS Data Streams:

Data streams output from SCS in RS-232 format will be made available as requested at the beginning of the cruise. The ship's ET will archive data from disk to tape (or CD) for delivery to Chief Scientist at the end of the cruise.

7. Network connections

The science party will require connections to the ship's Science computer network.

IT Security: Any computer that will be hooked into the ship's network must comply with the *OMAO Fleet IT Security Policy* prior to establishing a direct connection to the NOAA science network. See Sec. VII.E. IT Security, below.

8. Storage Requirements:

The research group will require storage space for science gear of various types. Various storage and work areas on deck were negotiated for the prior cruises in consultation with the Operations Officer and will be needed again. Instruments were staged in the CTD area both before mooring deployment and after mooring recovery. Access to the freezer at the starboard side of the wet lab (with the cooling turned off and shelving installed) was found to be essential and is requested.

9. CTD Equipment:

CTD instrumentation will be provided by the science party. These instruments are preferred because they provide a consistent calibration standard for observations at the HOT site. Unfortunately, the CTD rosette frame normally used by the science party is unavailable. The science party requests use of the ship's SBE-32 carousel water sampler ("CTD rosette frame"), niskin bottles, and supporting equipment (e.g. CTD deck box). The science team will provide the actual conductivity-temperature-pressure sensors to replace the ship's sensors and create a complete CTD package. The rosette should be available on the ship prior to departure, where the science party will install instrumentation. The ship's CTD winch will be used to deploy the CTD package. The capability of performing CTD casts to 1000 m is required. An electro-mechanical termination of the CTD wire suitable for connection to the science party CTD will be needed. A GPS connection for input to the CTD deck unit is needed.

B. Equipment and Capabilities provided by the scientists

A listing of the major items of science equipment is provided in Appendix B along with a proposed deck layout. The majority of equipment and instrumentation, including all components of the moorings to be deployed, deck gear (TSE winch, winding and tension carts, blocks, lines, launch and recovery gear), AutoIMET and turbulent flux systems, CTD (sensors and deck box; rosette frame and bottles are requested from the ship), and scientific equipment for the main lab (computers, RF and acoustic receivers, consumable supplies, printer paper and toner) will be provided by the Project. Exceptions are the work boat and facilities as noted in Sec. III.A. The TSE winch and capstan require 440 V electrical connections (see Sec. *III.A.5)*. Science party personnel will be familiar with mooring deployment and recovery and will be capable of directing operations in cooperation with the ship's crew during all phases of mooring operations. Science party personnel familiar with CTD operations will be available to staff CTD operations that may extend beyond the work-day limits of the ship's Survey Technician. Additional science personnel will assist with mooring operations, met watches, and other observation and data collection activities.

IV. Hazardous Materials

A. Policy and Compliance

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

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

- List of chemicals by name with anticipated quantity
- List of spill response materials, including neutralizing agents, buffers, and absorbents
- Chemical safety and spill response procedures, such as excerpts of the program's Chemical Hygiene Plan or SOPs relevant for shipboard laboratories
- For bulk quantities of chemicals in excess of 50 gallons total or in containers larger than 10 gallons each, notify 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 Appendix C for HAZMAT lists. An updated inventory will be sent to the ship at least two weeks prior to sailing. Material Safety Data Sheets will be organized in a notebook and delivered to the Operations Officer before loading commences.

Small quantities of HAZMAT substances will be used for buoy recovery and deployment operations. These items are listed in Appendix C. Typical lab supplies: alcohol, contact cleaner, contact cement, WD-40, etc. will be on hand for use as needed. A limited amount of anti fouling coatings will be used on the instruments and cages.

C. Chemical safety and spill response procedures

See Appendix C.

D. Radioactive Materials

Not applicable.

E. Inventory (itemized) of Radioactive Materials

Not applicable.

V. Additional Projects

A. Supplementary ("Piggyback") Projects

Not applicable.

VI. Disposition of Data and Reports

The Chief Scientist is responsible for the disposition, feedback on data quality, and archiving of data and specimens collected on board the ship for the primary project. As the representative of the Director, WHOI, the Chief Scientist is also responsible for the dissemination of copies of these data to participants in the cruise, to any other requesters, and to NESDIS (ROSCOP form completed within three months of cruise completion). The ship may assist in copying data and reports insofar as facilities allow.

The Chief Scientist is responsible for dissemination of data to nations in whose EEZ data are acquired and requested. The Chief Scientist will furnish the ship a complete listing of all data gathered by the primary scientific party, detailing types and quantities of data.

The Chief Scientist will receive all original data gathered by the ship for the primary project. This data transfer will be documented on NOAA form 61-29 "Letter Transmitting Data."

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

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.

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 https://docs.google.com/a/noaa.gov/forms/d/1a5hCCkgIwaSII4DmrHPudAehQ9HqhRqY3J_FXqbJp9g/viewform and provides a "Submit" button at the end of the form. Submitted form data is deposited into a spreadsheet used by OMAO management to analyze the information. Though the complete form is not shared with the ships', specific concerns and praises are followed up on while not divulging the identity of the evaluator.

VIII. Miscellaneous

A. Meals and Berthing

Meals and berthing are required for up to 14 scientists. Meals will be served 3 times daily beginning one hour before scheduled departure, extending throughout the cruise, and ending two hours after the termination of the cruise. Since the watch schedule is split between day and night, the night watch may often miss daytime meals and will require adequate food and beverages (for example a variety of sandwich items, cheeses, fruit, milk, juices) during what are not typically meal hours. Special dietary requirements for scientific participants will be made available to the ship's command at least seven days prior to the survey (e.g., Chief Scientist is allergic to fin fish).

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

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

All persons boarding NOAA vessels give implied consent to comply with all safety and security policies and regulations which are administered by the Commanding Officer. All spaces and equipment on the vessel are subject to inspection or search at any time. All personnel must comply with OMAO's Drug and Alcohol Policy dated May 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:

Regional Director of Health Services

Marine Operations Center – Pacific
2002 SE Marine Science Dr.
Newport, OR 97365
Telephone 541-867-8822
Fax 541-867-8856
Email MOP.Health-Services@noaa.gov

Prior to departure, the Chief Scientist must provide an electronic listing of emergency contacts to the Operations 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.

NOAA Ship Hi'ialakai Working Rules (15 March 2015)

For the purpose of promoting safety, proper footwear shall be worn at all times outside an individual's own stateroom except when in the immediate process of changing shoes (such as changing from dive boots to other suitable footwear when exiting one of the small boats).

Closed-toe footwear with a heel retainer shall be worn on the weather decks during all operations including loading and unloading small boats as addressed in Ship Specific Instruction 1701-06-HA Personal Protection Equipment. Use common sense regarding the wearing of sandals and "flip-flops" aboard ship under any circumstances, underway or in port. This style of footwear is substantially less suitable and less safe aboard ship than more protective styles.

Inside the house of the ship: Open-toed shoes may be worn by program personnel and off-duty ship's personnel in the lounge (except during meal hours), passageways, and to, at, and from smoking areas. Open-toed shoes include flip flops in good repair, which fit properly, have good traction, and provide coverage for the sole of the foot.

Outside the house of the ship and on weather decks: Open-toed shoes are not permitted except when the wearer is in the immediate process of embarking or disembarking the ship via the gangway. Sandals such as certain varieties of Keen brand shoes are popular among ship's personnel are permitted as they provide (1) very significant coverage of the toes, (2) a heel retainer, (3) traction on a wet platform, and (4) lateral stability for the foot. Flip-flops, Birkenstocks, Crocs, etc., which do not provide significant coverage of the toes, traction when wet, or much lateral stability are not suitable for wear outside the house of the ship and on weather decks. Dive boots are acceptable. Shoes will be in reasonable repair, fit properly, and provide coverage for the sole of the foot. **No flip-flops will be worn by crew or scientific personnel while alongside and loading or unloading gear**.

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 prior to embarking.

F. Foreign National Guests Access to OMAO Facilities and Platforms

All foreign national access to the vessel shall be in accordance with NAO 207-12 and RADM De Bow's March 16, 2006 memo (http://deemedexports.noaa.gov). National Marine Fisheries Service personnel will use the Foreign National Registration System (FNRS) to submit requests for access to NOAA facilities and ships. The Departmental Sponsor/NOAA (DSN) is responsible for obtaining clearances and export licenses and for providing escorts required by the NAO. DSNs should consult with their designated Line Office Deemed Export point of contact to assist with the process.

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

Full compliance with NAO 207-12 is required.

Responsibilities of the Chief Scientist:

1. Provide the Commanding Officer with the email generated by the Servicing Security Office granting approval for the foreign national guest's visit. (For NMFS-sponsored guests, this email will be transmitted by FNRS.) This email will identify the guest's DSN and will serve as evidence that the requirements of NAO 207-12 have been complied with.
2. Escorts – The Chief Scientist is responsible to provide escorts to comply with NAO 207-12 Section 5.10, or as required by the vessel's DOC/OSY Regional Security Officer.
3. Ensure all non-foreign national members of the scientific party receive the briefing on Espionage Indicators (NAO 207-12 Appendix A) at least annually or as required by the Servicing Security Office.
4. Export Control - Ensure that approved controls are in place for any technologies that are subject to Export Administration Regulations (EAR).

The Commanding Officer and the Chief Scientist will work together to implement any access controls necessary to ensure no unlicensed export occurs of any controlled technology onboard regardless of ownership.

Responsibilities of the Commanding Officer:

1. Ensure only those foreign nationals with DOC/OSY clearance are granted access.
2. Deny access to OMAO platforms and facilities by foreign nationals from countries controlled for anti-terrorism (AT) reasons and individuals from Cuba or Iran without written approval from the Director of the Office of Marine and Aviation Operations and compliance with export and sanction regulations.
3. Ensure foreign national access is permitted only if unlicensed deemed export is not likely to occur.
4. Ensure receipt from the Chief Scientist or the DSN of the FNRS or Servicing Security Office email granting approval for the foreign national guest's visit.
5. Ensure Foreign Port Officials, e.g., Pilots, immigration officials, receive escorted access in accordance with maritime custom to facilitate the vessel's visit to foreign ports.
6. Export Control - 8 weeks in advance of the project, provide the Chief Scientist with a current inventory of OMAO controlled technology onboard the vessel and a copy of the vessel Technology Access Control Plan (TACP). Also notify the Chief Scientist of any OMAO-sponsored foreign nationals that will be onboard while program equipment is aboard so that the Chief Scientist can take steps to prevent unlicensed export of Program controlled technology. The Commanding Officer and the Chief Scientist will work together to implement any access controls necessary to ensure no unlicensed export occurs of any controlled technology onboard regardless of ownership.
7. Ensure all OMAO personnel onboard receive the briefing on Espionage Indicators (NAO 207-12 Appendix A) at least annually or as required by the Servicing Security Office.

Responsibilities of the Foreign National Sponsor:

1. Export Control - The foreign national's sponsor is responsible for obtaining any required export licenses and complying with any conditions of those licenses prior to the foreign

national being provided access to the controlled technology onboard regardless of the technology's ownership.

2. The DSN of the foreign national shall assign an on-board Program individual, who will be responsible for the foreign national while on board. The identified individual must be a U.S. citizen and a NOAA or DOC employee. According to DOC/OSY, this requirement cannot be altered.
3. Ensure completion and submission of Appendix C (Certification of Conditions and Responsibilities for a Foreign National

VIII. Appendices

Appendix A: The ESRL/PSD Turbulent Flux System

The PSD Turbulent Flux Measurement System consists of six components (Table 1):

1. A turbulent wind measurement system with motion correction mounted on the top of a 30' high portable tower located near the foremast.
2. Solar and infrared radiation sensors. Radiometers are mounted on top of bridge house by the port side.
3. Bulk Meteorology sensors (air temperature, relative humidity, sea surface temperature and precipitation). These instruments are mounted on the top of a 30' high portable tower. The sensors are:
4. A CO2/H2O gas analyzer - mounted on the top of a 30' high portable tower located near the foremast.
5. One differential GPS units measuring heading and pitch information. These instruments are usually installed on top of a sea container.
6. A sea surface temperature measurement made with a floating thermistor deployed off a port or starboard side with outrigger.

Table 1. Instruments and measurements for air-sea interaction studies

Item	System	Measurement
1	Air-sea flux system	Motion corrected turbulent fluxes
2	Pyranometer &Pyrgeometer	Downward solar radiative, IR flux
3	Bulk meteorology	Surface Water Temp, Air Temp, RH, Wind Speed, Rain rate
4	Open Path LI-7500 Analyzer	CO2 and HO2
5	GPS	Ship Heading, pith and roll.
6	"Sea Snake"	Near surface sea temperature

These instrument measurements are logged in a ship's lab or in a sea container supplied by ESRL. The systems will run continuously through the cruise. An RS-232 real-time feed from the ship's SCS system with a set of navigation and meteorological data (TBD, ASCII formatted) is requested. The best situation for obtaining flux data is with the ship going slow ahead and the wind within 45 degrees of the bow.

ESRL will mount items 1, 3, and 4 from Table 1 on a portable 30' tall meteorological tower at the bow of the HA (Fig. A-1). The tower has a base plate using 4 x 7/8-9 bolts on a 2-ft square pattern which has been previously welded to the deck, and will be used again (Fig. A-1). The radiometers, GPS (Table 1, items 2 & 5) and various electronics packages will be mounted above the pilot house (Fig. A-2). ESRL will also mount an outrigger to deploy the “sea snake”, a water temperature sensor (Table 1, item 6) that drags near the surface.

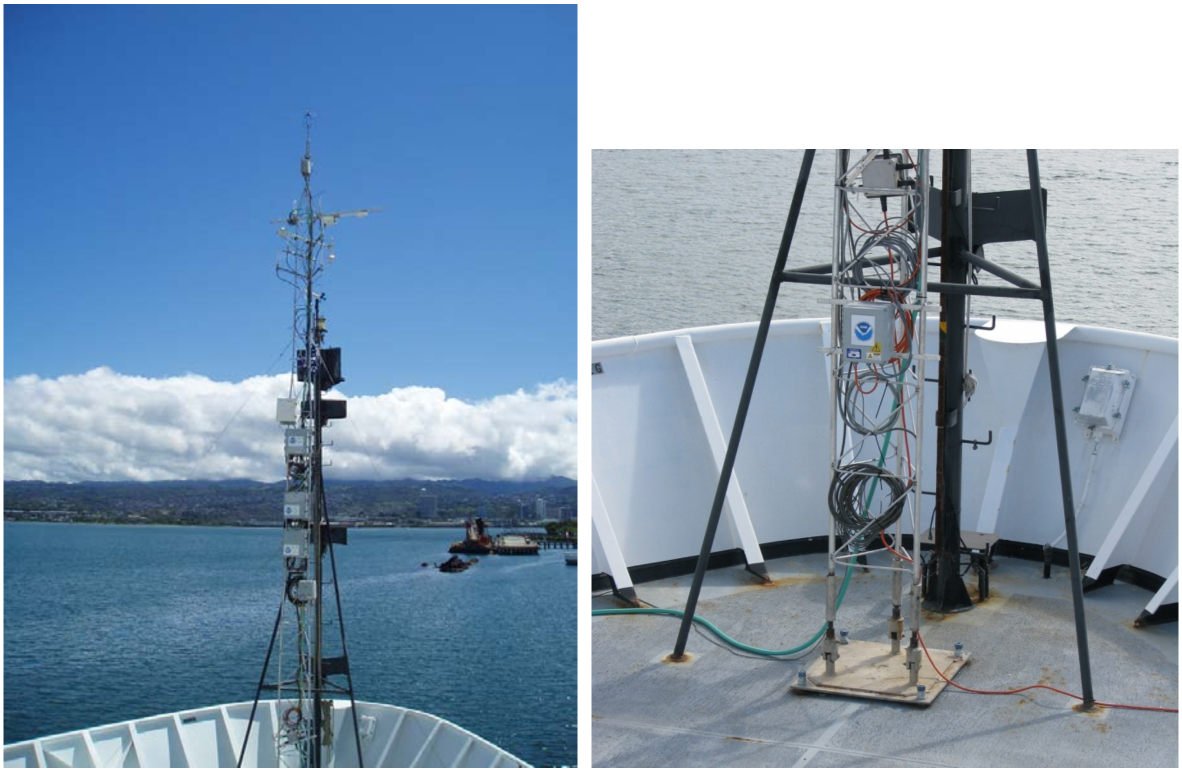


Figure A-1. ESRL/PSD mast mounted on the *Hi’ialakai*, showing the location and height of the tower relative to the ship’s forward mast (left) and attachment of the tower base to the deck via a welded plate (right).

Figure A-2. ESRL/PSD radiometers (left) mounted on deck above the pilot house and the “sea snake” (right) mounted port side of first deck on *Hi’ialakai*.

The NCSU Sea Spray Aerosol System

An addition to the ESRL flux system for WHOTS-13 will be the North Carolina State University sea spray aresol system, installed and operated by Nicholas Meskhidze. The goal of the project is to better understand sea spray aerosol fluxes and their climatic effects. Ambient air will be drawn continuously through an inlet located at the bow mast and transferred to the analysis system in the laboratory through 3/8 inch stainless steel tubing (estimated ~150 ft). Attempts will be made to measure vertical fluxes of sea spray as well as ambient aerosol number size distribution and hygroscopicity (ability to take up water under different relative humidity conditions) values. There are no special requirements for ship operations different from those necessary to achieve the primary WHOTS goals; all the measurements will be made during the ship's regular operations.

The following equipment will be mounted on the mast: R.M. Yong 3-D sonic anemometer (Moldel 81000), Inertial Measurement Unit (IMU) with GPS antenna (model number MTi 10-series), valve box with power connections.

The following equipment will be located in the lab (all instruments are rack mounted): Two Differential Mobility Analyzers (DMAs) (TSI model 3080), two Spellman power supplies for DMAs (Model number Spellman SL10N10), soft X-ray neutralizer (<9,5 KeV) (TSI model 3088), three Condensation Particle Counters (CPCs) (TSI model 3772, TSI model 302201, and TSI model 3788), three diaphragm pumps (GAST model 22D, GAST model DOA and GAST model DOL), Dell workstation, solenoid valves.

Appendix B: Equipment Inventory and Deck Plan

Figure B-1 shows a proposed deck layout for the major components associated with WHOTS operations on the Hi’ialakai. Table B-1 provides a list, with weights, of the major items of scientific equipment to be located on the deck. The estimated weight of lab gear is 2000 lb.

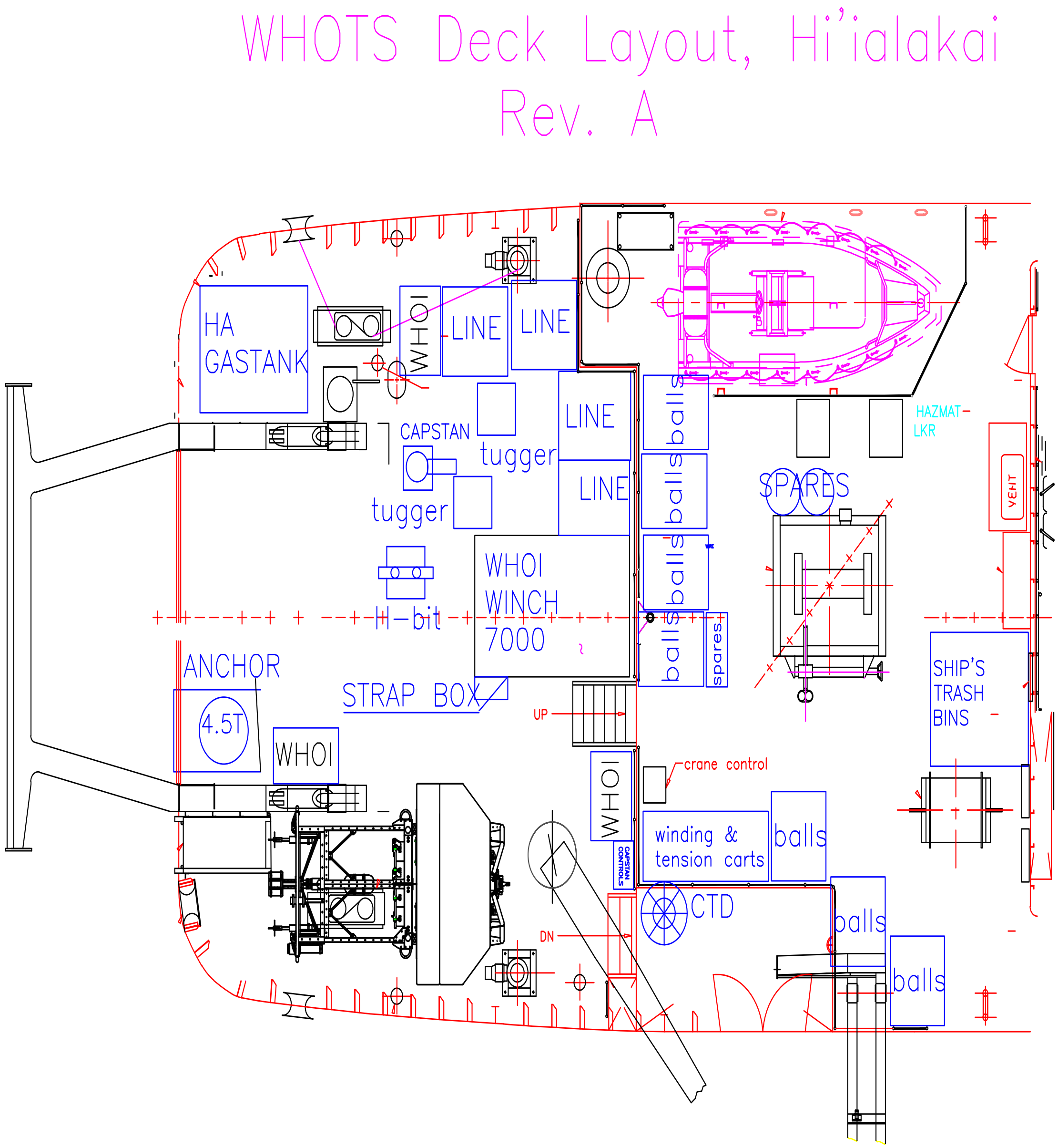


Figure B-1. Proposed deck plan for the HA.

Type	Description	Weight	Footprint
buoy	Complete buoy assembly	4000	108" diam-15' tall
glass balls	(6) Wire baskets w/ 12-16 glass	5600	6 ea 48" x48"
yellow box	Mooring Hardware	1200	28" x 48"
yellow box	Launch and Recover Gear	800	28" x 48"
yellow box	Aircraft strap box	250	18" x 36"
wire basket	7/8 Nylon 535 m 1" Col 426m	1100	48" x 48"
wire basket	1" Colmega 1075m	1100	48" x 48"
wire basket	7/8 nylon 1566 m	1000	48" x 48"
wire rope	7/16 TB wire shots- Loose	300	0 (in wire basket)
winch	TSE-2 winch and power cord with	8500	76" x 120"
cart	Winding cart	500	48" x 60"
cart	Tension cart	400	48" x 60"
anchor	Modular anchor tip plat	10000	50" x 60"
capstan	Electric capstan base	2300	28" x 48"
capstan	Capstan control box	150	18" x 36"
bit	H-bit	300	28" x 36"
tugger	Large air tugger	500	28" x 28"
tugger	Small Air tugger	300	28" x 28"
block	Ropemaster block	70	8" x 15"
block	AWN snatch block	150	8" x 24
loose	Pick up poles 16ft	10	0 (mount on rails)
loose	Wire Coiler	25	0 (in wire basket)
spare reel	3/8 100m wire to 7/8 200m nylon	600	36" diameter x 24"
spare reel	Spare 7/8 nylon 378m	400	36" diameter x 24"
spare reel	1" colmega 526.6	600	36" diameter x 24"
	Sub total	40155	Pounds
	Lab Gear, Tools, Instruments	5000	Pounds
	Total	45155	Pounds

Table B-1. List of major scientific equipment for the WHOTS cruise. Other notable equipment will be the subsurface instruments for the mooring, the shipboard meteorological sensors, and a CTD and rosette.

Appendix C: HAZMAT Inventory

U. Hawaii HAZMAT inventory and spill plan

Common Name of Material	Qty.	Notes	Trained Individual	Spill Control
Aqua Lube	2 g	Petroleum oil	Jefrey Snyder	A
CRC 2-26 Lubricant	11 oz	Hydrotreated light petroleum distillate	Jefrey Snyder	A
3in1 Silicone spray lubricant	11 oz	Petroleum solvent, propane, n-butane	Jefrey Snyder	A
Loctite thread locker	10 mL	Methacrylate resin, Cumene Hydroperoxide	Jefrey Snyder	A
MolyKote anti-seize	8 oz	Mineral oil, Nickel	Jefrey Snyder	A
CRC Cable Clean	454 g	1-Bromopropane (nPB), t-Butanol	Jefrey Snyder	B
QD Electronic Cleaner	11 oz	Hexane isomersm, 1-Difluoroethane	Jefrey Snyder	B
Loctite G-n Metal assembly paste	80 g	Zinc pyrophosphate, Aluminum phosphate	Jefrey Snyder	C
Marine-Tex epoxy	2 oz	Bisphenol A/Epichlorohydrin	Jefrey Snyder	D
Perma Oxy 2-part epoxy	1 oz	Part 1: Bisphenol A/Epichlorohydrin Part 2: Mercaptan amine blend mixture	Jefrey Snyder	E
Saft LS 14500 Li-SOCl2	192 g	Lithium, Thionyl chloride	Jefrey Snyder	F
Sea-Bird AF24173 anti-foulant device	30 32.5 cm cylinders	Bis (tributyltin) oxide	Jefrey Snyder	G
Triton X-100 (Not regulated for	3- 50 ml bottles	Octyl Phenol Ethoxylate Detergent - For cleaning	Jefrey Snyder	H

transportation)		conductivity cells		

Spill Control:

A: Aqua Lube, CRC 2-26 Lubricant, Loctite Thread Locker, MolyKote anti-seize

- Ventilate area
- Remove all sources of ignition
- Use appropriate protective equipment (goggles, gloves)
- Soak up with inert, absorbent material
- Place in a properly marked closed container for proper disposal
- For Aqua-Lube and CRD 2-26 Lubricant: Avoid strong oxidizers such as hydrogen peroxide bromine and chromic acid

B: CRC Cable Clean

- Dike area to contain spill
- Ventilate area
- Wear appropriate protective equipment (goggles, gloves)
- Recover or absorb spilled material using an absorbent designed for chemical spills
- Place absorbents into proper waste containers
- Avoid strong oxidizers and strong bases

C: Loctite G-n Assembly Paste

- Use appropriate protective equipment (goggles, gloves, respirator)
- Wipe up or scrape up and contain for salvage or disposal
- Final cleaning may require use of detergent
- Oxidizing material can cause a reaction

D: Marine-Tex epoxy

- Ventilate area
- Use appropriate protective equipment (goggles, gloves)
- Stop flow of material, if this is without risk
- Collect spillage
- Flush area with water
- Avoid fluorine

E: Perma Oxy 2-part epoxy

- Ventilate area
- Remove all sources of ignition
- Wear appropriate protective equipment (goggles, gloves)
- Take up with inert, absorbent material
- Place in a properly marked closed container for proper disposal

- Part 1: Avoid strong Lewis or mineral acids, strong oxidizing agents, strong mineral and organic bases
- Part 2: Avoid strong oxidizers, amines, peroxides, and sodium/calcium hypochlorite

F: Saft LS 14500 Li-SOCl2

- Remove personnel from area until fumes dissipate
- Do not breathe vapors or touch liquid with bare hands
- Wear appropriate protective equipment (goggles, gloves, apron)
- Use inert material to absorb any exuded material
- Seal leaking battery and contaminated absorbent material in plastic bag for disposal
- Avoid oxidizing agents alkalis, and water
- Fire fighting measures:
  - Use water or CO_2 on burning Li-$SOCl_2$ cells or batteries
  - Use class D fire extinguishing agent if raw lithium is exposed

G: Sea-Bird AF24173 anti-foulant device

- Wear appropriate protective equipment (goggles, gloves)
- Scoop or shovel spilled material into suitable labeled container with lid
- Secure container lid and move container to safe holding area
- Check area for residual material and repeat clean up if necessary
- Keep away from heat, sparks and flame
- Avoid acids and oxidizing agents

H: Triton X-100 detergent

- Wear appropriate protective equipment (goggles, gloves)
- Small spills:
  - Dilute with water and mop up
- Large spills:
  - Absorb with an inert dry material
  - Place in appropriate waste disposal container
  - Spread water on the contaminated surface

Inventory of Spill Kit supplies:

Name	Amount (Qty.)	Useful for:	Absorbs
16” x 20” pad	10 ea.	Liquid- universal	23 oz. each
Eco Absorb	4 qt. bag	Liquid - universal	1 gal.
Goggles	3	Eye protection	
Gloves	100 pr	Hand protection	

Respirator	5	Lung protection	
Suit	1	Chemical protect.	

Four quart bag Eco Absorb description: EcoAbsorb™ completely cleans any spill, leaving no residue, stain or odor behind. EcoAbsorb™ can absorb all paints, gas, motor oils, automotive fluids, body fluids including vomit or blood, grease and all chemicals except hydrofluoric acid. This lightweight superabsorbent cuts down on clean up time, disposal fees and leaves no residue behind. This OMRI listed and NSF Certified absorbent is safe in the home and workplace. EcoAbsorb™ is non–toxic and tested by EPA standards for landfill safety.

- Absorbs up to 6x its own weight and 15x more than clay absorbents
- Light weight powder; convenient size for moderate spills at work or home
- Absorbs instantly and leaves no slippery residue; minimizes slip & fall accidents
- Extremely efficient and effective

NCSU HAZMAT Inventory and spill plan:

A: n-Butanol

A small quantity of n-Butanol is used to operate TSI CPC model number 3772. Excess butanol vapors will be vented out of the lab. The total amount brought onboard is 1.5L.

Methods and materials for containment and cleaning up:

Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations.

Appendix D: Project Timeline

Start Date, Time	End Date, Time	Operation
25 Jun 1000		Depart Pearl Harbor for WHOTS operations area
		(approx 120 nmi at 9 kt = 13 hr transit)
25 Jun 1600	1800	Release tests and CTD cast, in water depth > 1500 m
		(approx location 21 28 N 158 21 W)
	26 Jun 0600	Arrive WHOTS-13 mooring site
26 Jun 0600		WHOTS-13 Deployment Operations
0600	0630	Set and drift, determine start position and course
0630	0730	Maneuver to deployment start position
0730	1600	WHOTS-13 mooring deployment
1600	1800	Clean up deck, stow gear
1800	2200	Anchor tracking and survey
26 Jun 2200		Begin WHOTS-13 Ship/Buoy met sensor comparison
		(Stand-off 0.15 nmi downwind of buoy, confirm Argos reception)
27 Jun 0600	0700	Shallow (200 m) CTD yo-yos, 0.25 nm downwind of buoy
1000	1100	Shallow (200 m) CTD yo-yos, 0.25 nm downwind of buoy
1400	1500	Shallow (200 m) CTD yo-yos, 0.25 nm downwind of buoy
1800	1900	Shallow (200 m) CTD yo-yos, 0.25 nm downwind of buoy
2200	2300	Shallow (200 m) CTD yo-yos, 0.25 nm downwind of buoy
27 Jun 2300	29 Jun 0000	Continue WHOTS-13 Ship/Buoy met sensor comparison
29 Jun 0000	29 Jun 0100	Transit to WHOTS-12 buoy
29 Jun 0100		Begin WHOTS-12 Ship/Buoy met sensor comparison
		(Stand-off 0.15 nmi downwind of buoy, confirm Argos reception)
29 Jun 0600	0700	Shallow (200 m) CTD yo-yos, 0.25 nm downwind of buoy
1000	1100	Shallow (200 m) CTD yo-yos, 0.25 nm downwind of buoy
1400	1500	Shallow (200 m) CTD yo-yos, 0.25 nm downwind of buoy
1800	1900	Shallow (200 m) CTD yo-yos, 0.25 nm downwind of buoy
2200	2300	Shallow (200 m) CTD yo-yos, 0.25 nm downwind of buoy

29 Jun 2300	01 Jul 0500	Continue WHOTS-12 Ship/Buoy met sensor comparison
01 Jul 0500		WHOTS-12 Mooring Recovery
0500	0600	Confirm acoustic Comm's, fire release, confirm release
0600	0800	Launch small boat, connect to glass balls
0800	1300	Mooring recovery operations
1300	1500	Launch small boat, connect pennant to buoy, recover buoy
1500	2200	Deck, buoy and instrument cleanup, begin data offload
02 Jul 0800	02 Jul 1700	HOT site CTDs
		(concurrent with continued instrument cleanup and data offload)
0800	1200	Full-depth CTD at HOT site
1200	1700	CTD time series at HOT site
02 Jul 1700		Depart WHOTS operations area for Sand Island
		(approx 120 nmi at 9 kt = 13 hr transit)
03 Jul 0600		Arrive at seabuoy
0700		Arrive Ford Island, offload of science gear

Appendix E: Selected Waypoints and Maps

WHOTS-13 Selected Waypoints

Way-point	Latitude	Longitude	Description
1	21° 28.0' N	158° 21.0' W	Release and CTD test station (water depth >1500 m)
2	TBD	TBD	WHOTS-13 deployment start [1]
3	22° 46.0' N	157° 54.0' W	WHOTS-13 anchor target [2]
4	TBD	TBD	Anchor tracking (~0.25 nm beyond anchor drop)
5	TBD	TBD	Anchor survey position S4 (1.5 nm to SE of anchor)
6	TBD	TBD	Anchor survey position S5 (1.5 nm to SW of anchor)
7	TBD	TBD	Anchor survey position S6 (1.5 nm to N of anchor)
8	22° 46.0' N	157° 54.0' W	WHOTS-13 met station [3], 0.15 nmi downwind of buoy
9	22° 40.0' N	157° 57.0' W	WHOTS-12 met station [3], 0.15 nmi downwind of buoy
10	22° 40.061' N	157° 56.965' W	WHOTS-12 anchor position (for mooring recovery)
11	22° 45.0' N	158° 00.0' W	HOT site

[1] Starting position TBD based on wind and current, ~6 nm from target.
[2] Anchor drop point will be 0.2 nm beyond the anchor target
[3] Approximate positions, actual location will vary depending on buoy watch circle.

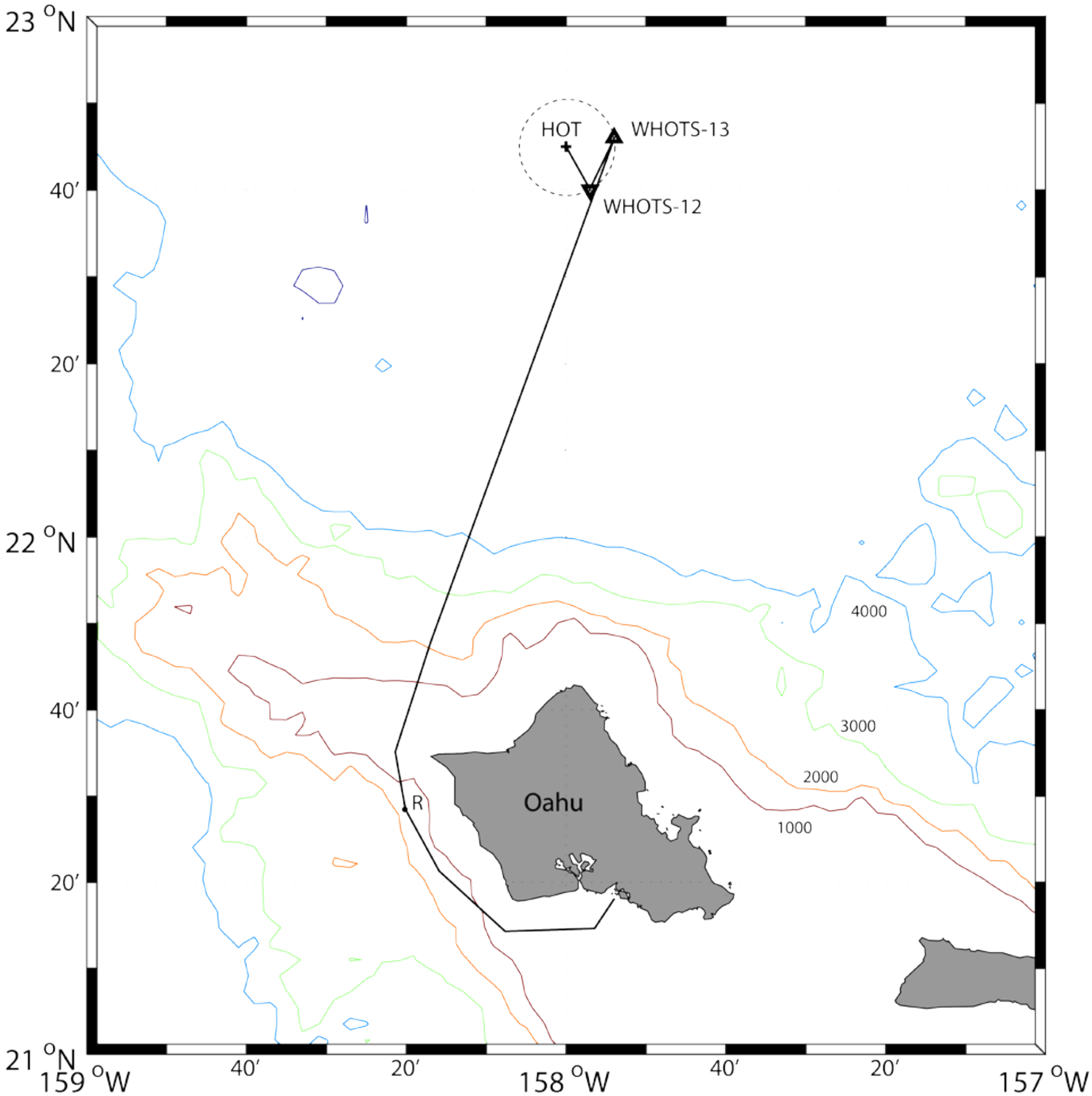


Figure E-1. Schematic of outbound cruise track.

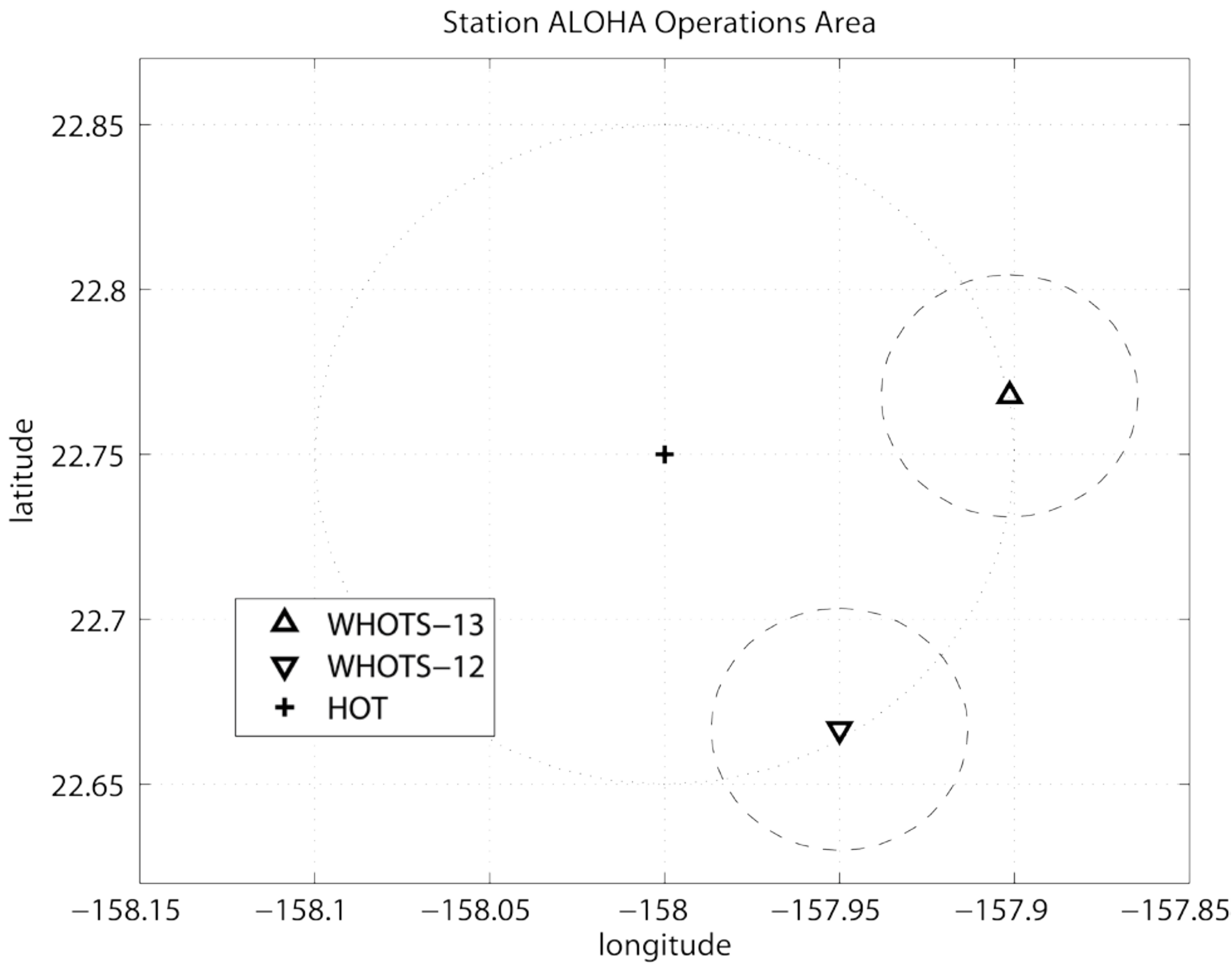
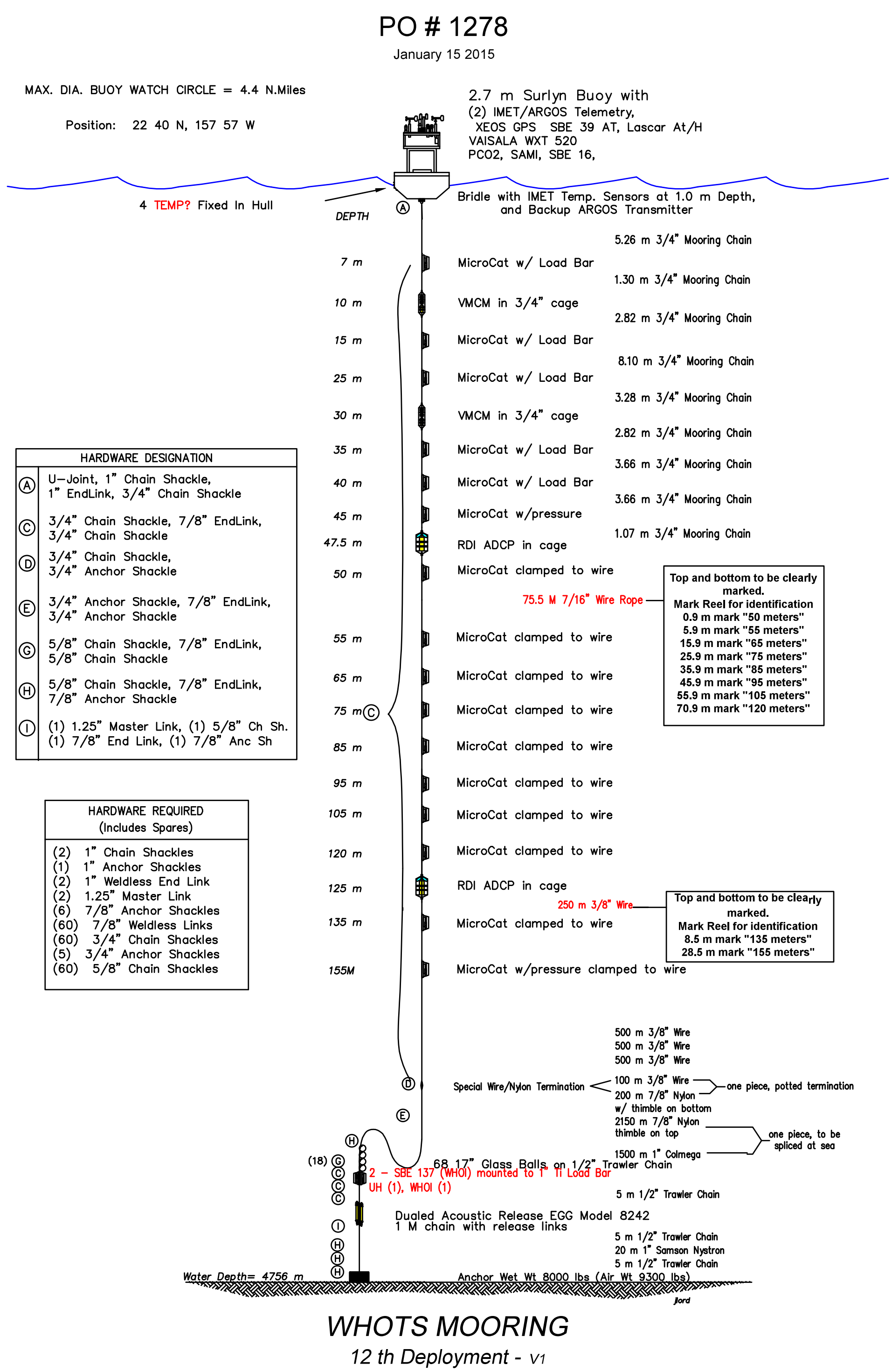
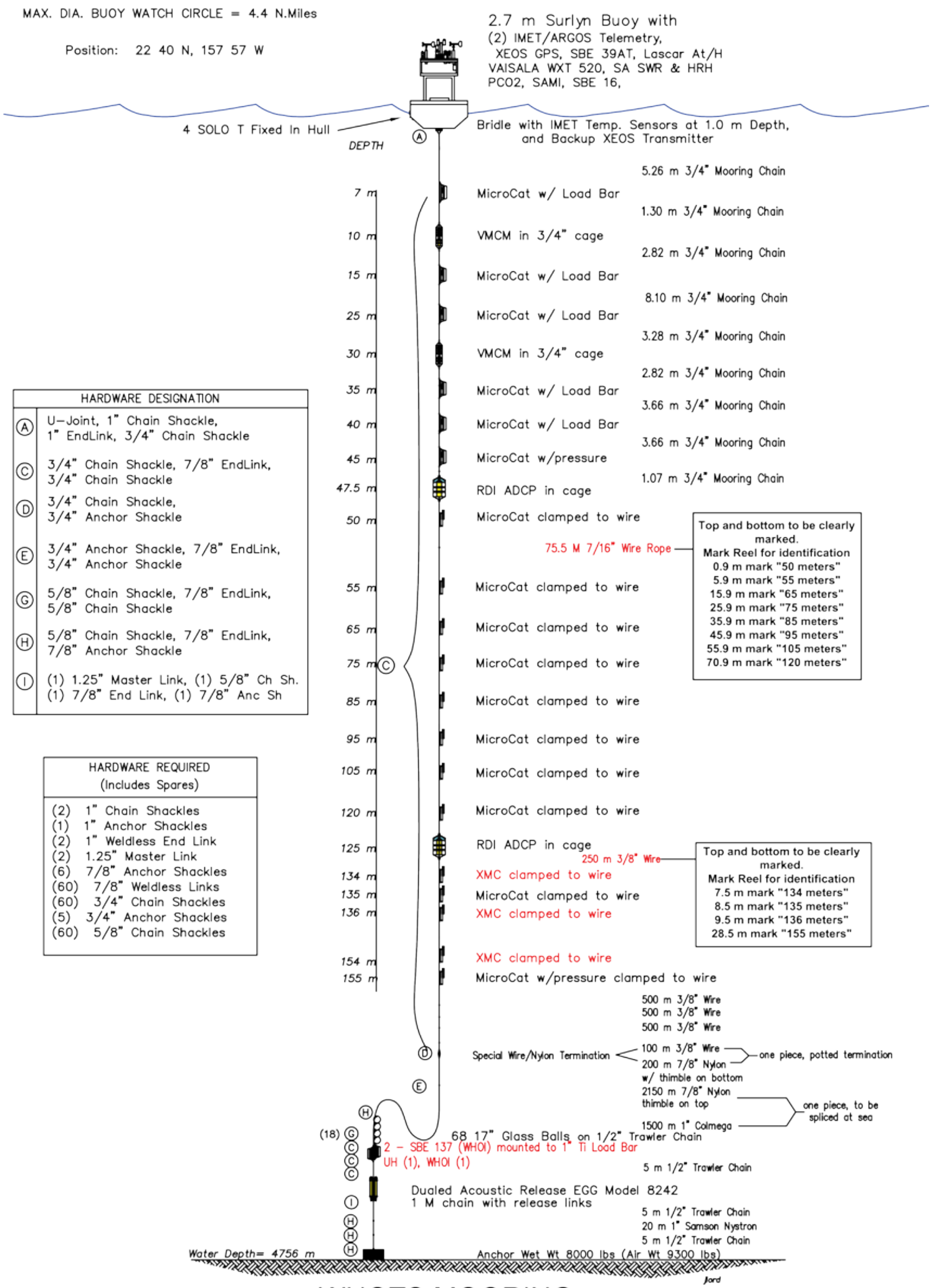


Figure E-2. Station Aloha operations area showing locations of WHOTS moorings (triangles) and the buoy watch circles (dashed) relative to the HOT site center (+).

Appendix F: Mooring Drawings



PO MOORING 1280
WHOTS 13



WHOTS MOORING
13 Deployment-V2