UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NOAA Marine and Aviation Operations
Marine Operations Center
439 W. York Street
Norfolk, VA 23510-1114

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

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

SUBJECT: Project Instruction for RB-17-02
Sixteenth Setting of the Stratus Ocean Reference Station

Attached is the final Project Instruction for RB-17-02, Sixteenth Setting of the Stratus Ocean Reference Station, which is scheduled aboard NOAA Ship *Ronald H. Brown* during the period of April 26 – May 20, 2017. Of the 25 DAS scheduled for this project, 25 days are funded by a Line Office Allocation. This project is estimated to exhibit a Medium Operational Tempo. Acknowledge receipt of these instructions via e-mail to **Opsmgr.MOA@noaa.gov** at Marine Operations Center-Atlantic.

Project Instructions

Date Submitted:	April 3, 2017
Platform:	NOAA Ship *Ronald H. Brown*
Project Number:	RB-17-02 Stratus 16
Project Title:	Sixteenth Setting of the Stratus Ocean Reference Station
Project Dates:	April 26, 2017 (Charleston) to May 20, 2017 (Arica, Chile)

Prepared by: Robert A Weller Dated: April 5, 2017
Dr. Robert A. Weller
Chief Scientist
Woods Hole Oceanographic Institution

Approved by: Al Plueddemann Dated: 4/5/17
Dr. Al Plueddemann
Chair, Physical Oceanography Department
Woods Hole Oceanographic Institution

Approved by: _____ Dated: 4/13/17
Captain Scott M. Sirois, NOAA
Commanding Officer
Marine Operations Center - Atlantic

Stratus 16

Cruise RB-17-02

NOAA Ship *Ronald H. Brown*

Charleston - Arica, April 26 – May 20, 2017

Chief Scientist: Robert A. Weller

I. Overview

A. Brief Summary and Project Period

Cruise RB-17-02 has the following objectives: 1) the recovery and redeployment of the Stratus Ocean Reference Station (ORS) in the region of persistent marine stratocumulus clouds off northern Chile at 20°S, 85°W, 2) overlapping the deployments of the old and new Stratus moorings to support intercalibration and merging of the old and new data records, 3) collection of shipboard data near the old and new Stratus moorings to perform end of deployment and beginning of deployment calibrations, 4) collection of data during underway and on station shipboard oceanographic and meteorological sampling, 5) deployment of surface drifting buoys for NOAA AOML, and 6) deployment of profiling Argo floats for the international Argo program. The ship will be loaded in Charleston. Scientific staff will board in Rodman, Panama. The ship will steam to the Stratus site, doing underway sampling and deploying surface drifters and Argo profiling floats when in international waters. The first mooring activity will be for the *R H Brown* to steam to inspect the old Stratus buoy, Stratus 15. A new surface buoy and mooring, Stratus 16, will then be deployed following assessment of the targeted deployment site. Two CTD profiles to 4,000 m will be obtained at each Stratus mooring. In addition, intercomparisons of shipboard and moored sensors will be carried out; staff from the NOAA Earth System Research Laboratory (ESRL), Boulder will be on board to collect shipboard meteorological and air-sea flux data. After several days of collection of data from both moorings, the Stratus 15 mooring will be recovered. After the work at the WHOI Stratus mooring site, *R H Brown* will head east to Arica, Chile. The cruise will end in Arica, Chile; and as required to provide space for subsequent cruises, equipment will be shipped back from there of necessary. To the extent possible, gear will remain in board to be offloaded in Key West. The planned cruise track going forward from Rodman, Panama, is shown in Figure 1.

B. Days at Sea (DAS)

Of the 25 DAS scheduled for this project, 0 DAS are funded by an OMAO allocation, 25 DAS are funded by a Line Office Allocation, 0 DAS are Program Funded, and 0 DAS are Other Agency funded. This project is estimated to exhibit a Medium Operational Tempo.

C. Operating Area

South-Eastern Pacific Stratocumulus Zone, with transit from Charleston through the Panama Canal, picking up the science party at Rodman, Panama and then steaming to the Stratus ORS site at ~20°S, 85°W off northern Chile. After work at Stratus site transit to Arica, Chile.

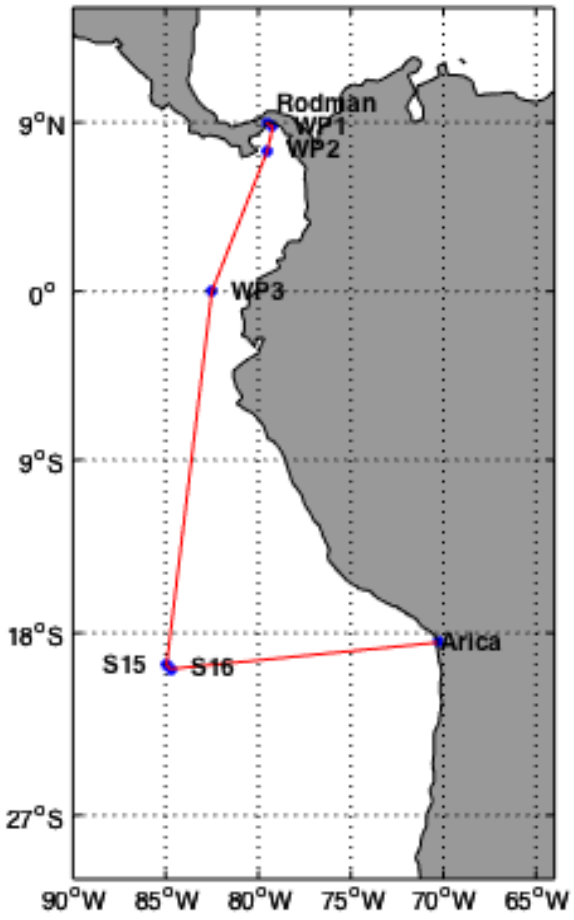


Figure 1. Cruise track (red) for RB-17-02 from Rodman, Panama forward. Waypoints are nominal transit points. S15 and S16 indicate the present and planned anchor locations of the Stratus moorings.

D. Summary of Objectives

1) the recovery and redeployment of the Stratus Ocean Reference Station (ORS) at ~20°S, 85°W,

2) coincident collection of data from both Stratus 15 and Stratus 16 mooring, supporting intercalibration and merging of data

3) collection of shipboard oceanographic and meteorological data to do in the field end point calibrations on Stratus 15 instruments and initial point calibrations on Stratus 16 instrumentation,

4) collection of meteorological and oceanographic data while underway,

5) deployment of surface drifting buoys for NOAA AOML, and

6) deployment of profiling Argo floats for the international Argo program.

E. Participating Institutions

Primary:

Woods Hole Oceanographic Institution (WHOI)

Earth Systems Research Laboratory (NOAA ESRL)

Secondary:

NOAA Atlantic Oceanographic and Meteorological Laboratory (AOML)

Geomar, Kiel, Germany

The science party will be six. WHOI will provide five; ESRL will provide one AOML will provide surface drifters to be deployed by the science party. WHOI will provide Argo floats to be deployed by the science party. Instrumentation from Geomar will be recovered from the Stratus 15 mooring.

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

Name (Last, First)	Title	Date Aboard	Date Disembark	Gender	Affiliation	Nationality
Bigorre, Sebastien	Res Asoc	5/4/2017	5/20/2017	M	WHOI	USA
Graham, Raymond	Eng Ass.	4/26/2017	5/20/2017	M	WHOI	USA
Hasbrouck, Emerson	Ocean tech	5/4/2017	5/20/2017	M	WHOI	USA
Pietro, Benjamin	Ocean tech	5/4/2017	5/20/2017	M	WHOI	USA
Weller, Robert	Ch Sci	5/4/2017	5/20/2017	M	WHOI	USA
Pezoa, Sergio	Meteo tech	4/26/2017	5/20/2017	M	ESRL	USA

G. Administrative

1. Points of Contacts:

Robert Weller (rweller@whoi.edu, 508 289 2508, MS 29, Clark 204a, WHOI, Woods Hole, MA 02543) will provide overall coordination and serve as Chief Scientist. Ben Pietro (bpietro@whoi.edu) will coordinate logistics for the WHOI work as well coordinate with AOML for loading surface drifters, WHOI for loading Argo floats, and TAO for coordination with following legs.

The Chief Scientist is authorized to revise or alter the scientific portion of the cruise plan as work progresses provided that, after consultation with the Commanding Officer, it is ascertained that the proposed changes will not: (1) jeopardize the safety of personnel or the ship; (2) exceed the overall time allotted for the cruise; (3) result in undue additional expenses; (4) alter the general intent of these instructions.

Scientists and other cruise participants should check with the Marine Operations Center - Atlantic (MOA) in Norfolk, VA (http://www.moc.noaa.gov/MOC-A/moa.html, Tel. 757-441-6842) or the ship's homepage (http://www.moc.noaa.gov/rb/index.html) for updates on planned arrival and departure times of *Ronald H. Brown*. Travelers should allow for possible flight delays due to weather, holidays, or other considerations.

The ship's e-mail address is Noaa.Ship.Ronald.Brown@noaa.gov. In addition, the Field Operations Officer's (OPS) e-mail address is: ops.ronald.brown@noaa.gov

Ship Operations:

Marine Operations Center, Atlantic
Lt. Joe Carrier
439 West York St.
Norfolk, VA 23510-1114

757-441-6842 (voice), 757-441-6495 (fax)
ChiefOps.MOA@noaa.gov

Science Operations:

Dr. Robert Weller
204A Clark Lab, MS-29
Woods Hole Oceanographic Institution (WHOI)
Woods Hole, MA 02543-1541
508-289-2508 (voice), 508-457-2181 (fax)
rweller@whoi.edu

Ronald H. Brown

In Charleston: USCG Vessel Support Facility, Pier P and Hobson Ave, 29405
843-693-2082 (OOD: 843-297-1835)
CAPT Robert A. Kamphaus co.ronald.brown@noaa.gov
CDR Richard Hester xo.ronald.brown@noaa.gov
LT Brian Elliot ops.ronald.brown@noaa.gov, brian.e.elliot@noaa.gov

Additional underway phone numbers can be found on the MOC web page at:
http://www.moc.noaa.gov/MOC/phone.html#RB.

Details on operations, safety, facilities, etc on RHB can be found at:
http://www.moc.noaa.gov/rb/science/welcome.html.

2. Diplomatic Clearances

None Required.

3. Licenses and Permits

None Required.

II. Operations

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

A. Project Itinerary:

Figure 2 shows the planned cruise track with EEZ boundaries indicated. Underway oceanographic sampling and deployment of floats and drifters is to be done in international waters. An estimate for the entry point into international waters is identified as EEZ1; departure from international waters after the mooring work is at a point identified as EEZ2.

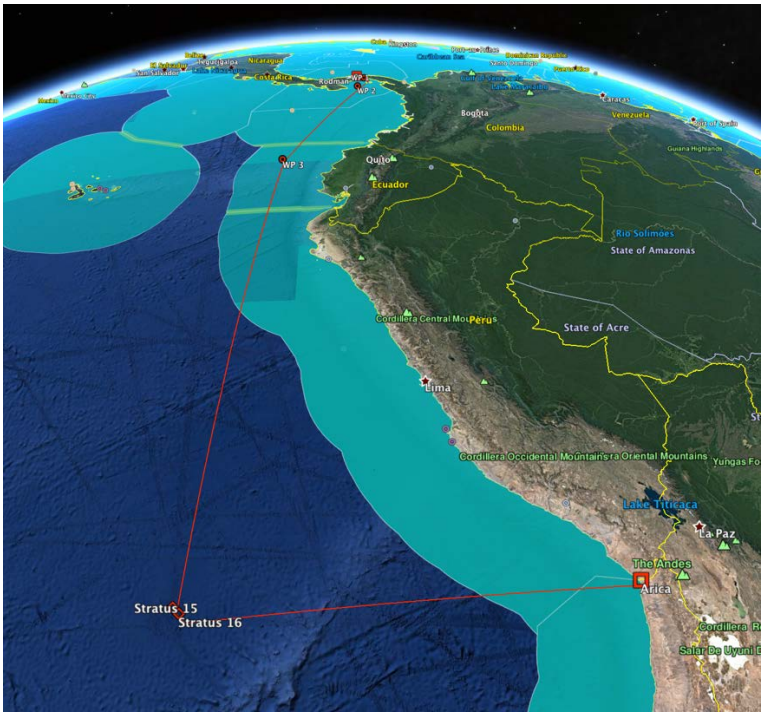


Figure 2. Planned track for NOAA Ship *R.H. Brown*.

Key Locations and Waypoints

Rodman, Panama	8° 57.3' N	79° 34.5' W
Waypoint 1	8° 45' N	79° 28' W
Waypoint 2	7° 30' N	79° 30'W
Waypoint 3	0°	82° 30' W
EEZ1	9° 8.956' S	83° 23.850' W
Stratus area	20° S	85° W
Stratus 15 anchor	19° 37.5734'S	84° 56.818'W
Stratus 16 target	19° 48.9713'S	84° 44.3744'W
EEZ2	19° 17.442' S	75° 27.306' W
Arica, Chile	18° 28.698' S	70° 18.748' W

Note: Waypoints 1, 2, and 3 are nominal and used to plan distances and time; ship will develop detailed cruise track for transit from Rodman to Stratus mooring site. Use 11.0 kts for transits.

Note: EEZ1 is estimated location to enter international waters outbound from Rodman to Stratus site. EEZ2 is estimated location to leave international waters when heading to Arica from the Stratus site.

Note: Drop points for NOAA surface drifters and Argo floats are given along the draft track line. Drop sites do not have to be precise, but should be along track near desired latitude outbound from Rodman and then near desired longitude inbound to Arica.

Transit Distances

Rodman – WP 1	25.5 nm
WP1 – WP2	76 nm
WP2 – WP 3	482.6 nm
WP3 - EEZ1	548.9 nm
WP3 – Stratus area	1203.6 nm
Stratus 15 – Stratus 16	16.3 nm
Stratus area - EEZ2	526 nm
Stratus area – Arica	840 nm

Itinerary

April 24-25, 2017		Load in Charleston
April 26, 2017		Depart Charleston
May 4, 2017		Embark science party in Rodman
May 5, 2017	1000 local	leave Rodman arrive WP1 1300
	2000 local	arrive WP2, 44 hour run to WP
May 6, 2017		transit to WP3
May 7, 2017		transit to WP3
	1600 local	arrive WP3, 110 hour transit to Stratus
May 8, 2017		underway to Stratus
May 9, 2017		underway to Stratus
May 10, 2017		underway to Stratus
	1100 local	reach EEZ1, begin deploying Argo floats, drifters. Stop to do test CTD, test acoustic releases, 6 hours on station start underway sampling (ADCP, TSG)
May 11, 2017		underway to Stratus
May 12, 2017	1200 local	arrive Stratus 15, visual check, two CTDs at Stratus 15
	2000 local	move to Stratus 16 site, check bottom bathymetry, check currents, run test deployment track
May 13, 2017	0600-1800 local	deploy Stratus 16
	1800-2000 local	anchor survey
May 14, 2017		Ship vs buoy comparisons at Stratus 15
May 15, 2017		Ship buoy comparison at Stratus 16, two CTDs

		at Stratus 16
May 16, 2017	0600-1800 local	recover Stratus 15
	1800 local	standby Stratus 16, ship versus buoy comparison
May 17, 2017	0400 local	depart for Arica, 840 nm transit
		deploying Argo floats, drifters
May 18, 2017		transit t Arica
May 19, 2017		transit to Arica
	0400 local	reach EEZ2, underway sampling stops
		Argo float and drifter deployments complete
May 20, 2017	0600 local	off Arica
May 22, 2017		Destage in Arica
July 7, 2017		Unload in Key West

Argo Float Drop Locations (see Figure 3)

1.	Argo 1	10° S	83° 36' 22.66" W
2.	Argo 2	12° S	83° 49' 48.05" W
3.	Argo 3	14° S	84° 05' 57.02" W
4.	Argo 4	16° S	84° 19' 59.73" W
5.	Argo 5	18° S	84° 34' 40.50" W
6.	Argo 6	19° 56' 49.35" S	84° W
7.	Argo 7	19° 50' 06.62" S	82° W
8.	Argo 8	19° 29' 47.24" S	80° W

Figure 3. Drop locations for Argo profiling floats.

NOAA Surface Drifter Drop Locations (see Figure 4)

1.	Drifter 1	10° S	83° 36' 25.81" W

2.	Drifter 2	11° S	83° 43' 54.96" W
3.	Drifters 3, 4	12° S	83° 50' 42.72" W
4.	Drifter 5	13° S	83° 58' 22.24" W
5.	Drifter 6	14° S	84° 06'32.89" W
6.	Drifters 7, 8	15° S	84° 12' 08.69" W
7.	Drifter 9	16° S	84° 20' 15.26" W
8.	Drifter 10	17° S	84° 29' 10.61" W
9.	Drifters 11, 12	18° S	84° 35' 32.76" W
10.	Drifter 13	19° S	84° 42' 56.47" W
11.	Drifter 14	19° 57 39.52" S	84° W
12.	Drifters 15, 16	19° 52' 31.31" S	83° W
13.	Drifter 17	19° 48' 12.65" S	82° W
14.	Drifter 18	19° 43' 16.20" S	81° W
15.	Drifters 19, 20	19° 38' 02.49" S	80° W
16.	Drifter 21	19° 32' 39.64" S	79° W
17.	Drifter 22	19° 26' 36.39" S	78° W
18.	Drifter 23	19° 20' 19.89" S	77° W
19.	Drifter 24	19° 13' 56.78" S	76° W

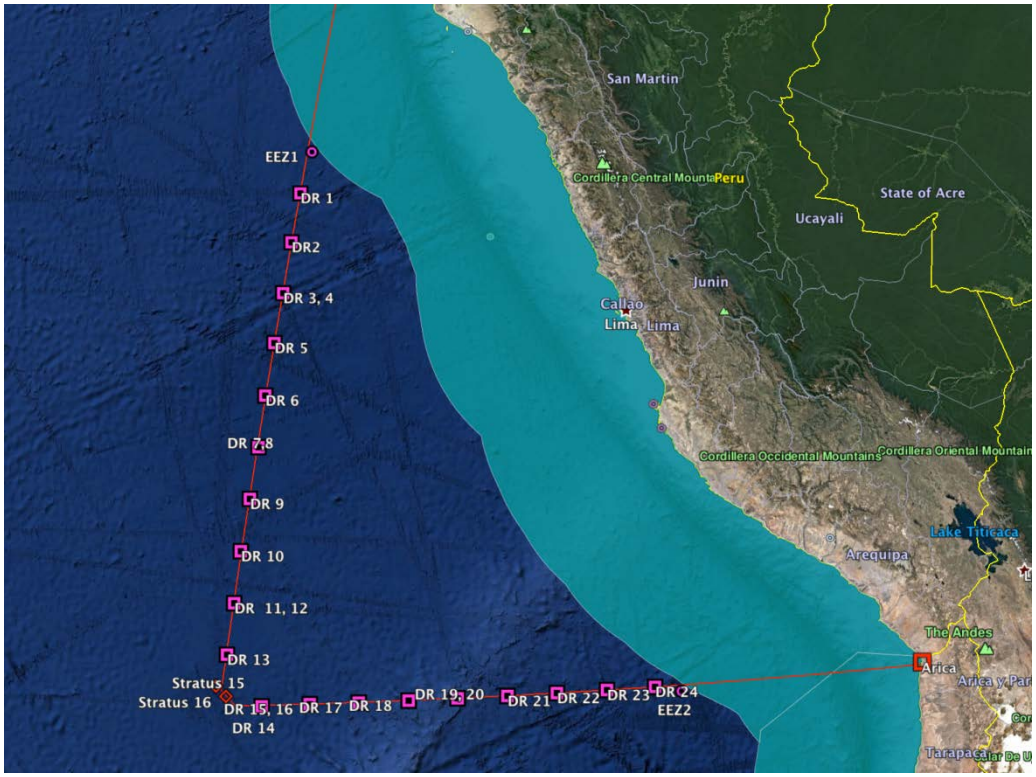


Figure 4. Drop locations for NOAA Surface drifters.

B. Staging and Destaging:

The scientific equipment for this cruise will be loaded in Charleston. WHOI and ESRL personnel will complete preparations on board the *RH Brown* in Charleston. Under discussion now is the extent to which WHOI and ESRL gear is to be unloaded in Arica, Chile. Also under discussion is the extent to which gear needed for the TAO legs after Stratus can be loaded in Charleston. Copies of equipment lists, including serial numbers and country of origin, will be requested by the Executive Officer (XO) and Chief Scientist as needed for foreign clearance purposes. The project, in coordination with the OPS officer, will make arrangements for a shore-side crane as needed for loading and unloading.

Load summaries:

Weller/WHOI: In Chalreston, load van with glass balls, load mooring reels, anchors (2 x 9,300 lbs), load instruments and lab gear. The buoy will be built up on the dock and tested prior to loading on the ship. Weights: Open top van – 12,000 lbs. Anchors = 2x9300 lbs. Tip plate – 600lbs. Tension cart – 500 lbs. Winding cart – 500 lbs. Hardware boxes 2x1500 lbs. Large air tugger – 600 lbs. Buoy – 4,000 lbs. Wire/line – 6 reels total 4500 lbs. 6 baskets of line – 7800 lbs. Fairlead plate – 200 lbs. H-bit – 400 lbs. Wire basket misc – 600 lbs. Mooring winch (TSE) – 7000 lbs. Lashing gear – 200 lbs. Dragging gear – 3000 lbs. Deck gear – 700 lbs. 2 UCTD – 400 lb. Lab gear – 1500 lb. 20 surface drifters – 20x 30 lbs. 8 Argo floats – 8 x 100 lbs.

NOAA AOML: Surface drifters (24) were shipped to Charleston and will be loaded with the WHOI gear.

Argo floats: Eight Argo floats were included in the WHOI shipment to Charleston and loaded there.

ESRL: ESRL gear will be loaded in Charleston. Appendix G provides detail.

Potential Impacts of the Ship:

A drawing of the proposed deck layout, along with a list giving the weights of the major deck items, is provided in Appendix A. Also in Appendix A is a list of the major items of scientific equipment to be brought onboard.

Unloading:

WHOI: As needed to accommodate TAO legs, WHOI gear will be unloaded in Arica for shipment back to WHOI. If possible, WHOI gear to be stored on board and unloaded at Key West.

ESRL: To stay on board through TAO legs.

C. Operations to be Conducted:

1. Station Operations

Release Tests

At a convenient time during the transit to the Stratus 15 site *Ronald H. Brown* will stop and hold station to allow the science party to perform release tests. The CTD will be tested at the same time, with the acoustic releases deployed below the CTD. We will use the ship's in the hull 12 KHz transducer in preference to the WHOI over the side transducer.

Close Approach to Buoys

If the schedule allows, during daylight hours *Ronald H. Brown* will make a close approach to the Stratus 15 (in the water now, to be recovered), and Stratus 16 (to be deployed) to allow visual inspection of buoy and sensor condition, determination of the water line, and photographs. A typical scheme includes an initial, upwind pass with the buoy along the starboard rail followed by a slow circle around the buoy.

Stratus 16 Mooring Deployment

The mooring is an inverse catenary design utilizing wire rope, chain, nylon and polypropylene line and a scope of 1.25 (Scope = slack length/water depth). The surface buoy is a 2.7-meter diameter buoy, with a two-part aluminum tower. A mooring drawing, specifying the mooring components and location of the attached instrumentation, is provided in Appendix C.

The first step of the deployment procedure is the lowering of the upper 40 meters of the mooring over the port side of the ship. This allows for controlled lowering of closely spaced instruments along the upper part of the mooring line. Also, the suspended instrumentation acts as a sea anchor to stabilize the buoy during the deployment. All instruments and chain shots from 40 meters to the surface are deployed off the port side using the crane to lift them into the water. Stopper lines are used to transfer the load as instruments and mooring components are added to the array. The WHOI TSE winch drum is pre-wound with a combination of wire and synthetic mooring components to facilitate payout of the mooring. Prior to deployment a 50-meter length of 3/8" diameter hauling wire is paid out, and its bitter end passed through the center of the A-frame, around the aft port quarter, and forward along the port rail to the instrument lowering area. The bottom of the 40-meter instrument is attached to the hauling wire prior to deployment. Wire handlers on the rail tend the hauling wire as instruments are lowered into the water. After 40 meters of instruments and components have been lowered into the water, the top shot of chain is stopped off using a slip line on a cleat, leaving enough loose chain to allow attachment to the buoy's bridle.

The next phase of the operation is the launching of the buoy. Slip lines are rigged on the buoy to maintain constant swing control during the lift. With all three slip lines in place the crane is positioned over the buoy and attached to the quick release hook. The straps binding the buoy to the deck are removed, and 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 and swung outboard as the slip lines keep the hull in check. The bridle slip line is removed first, followed by the tower bail slip line. The slip line to the buoy deck bail is cleared just as the buoy begins to settle into the water. Once the discus 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 discus 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 without capsizing or hitting the ship. The remainder of the mooring is deployed over the stern.

Once the buoy is behind the ship, speed is increased to about .5 knot and the hauling wire is pulled up on the winch. A traveling block is rigged to the A-frame using the large air tugger to adjust to block height. Stopper lines on cleats are used when disconnecting the mooring to attach instruments, chain and wire. Instruments and mooring components are added to the 40 meters previously deployed. The mooring winch is used to take up tension on the mooring and ease instruments and mooring components over the stern. The long lengths of wire and nylon are then paid out. The mooring wire and nylon on the winch drum is paid out approximately 10% slower than the ship's speed through the water.

An H-bit cleat, positioned in front of the winch is used to slip the 3000-meter shot of nylon/polypropylene line stowed in two wire baskets. This saves the time of loading the winch drum two more times. While the nylon/polypropylene line is being paid out, the port side crane lifts the 96 glass balls out of the rag top container. Balls are staged fore and aft in segments.

The deployment of the glass balls is accomplished using the mooring winch and two 3/4" Sampson stopper lines fitted with 2 ton snap hooks. Two four-meter strings are shackled into the mooring at the stern, and the winch leader is shackled into the loose and of the glass ball string. Tension is taken up on the winch, and the stopper lines are removed. The winch pays out until the seven glass balls are over the stern. The stopper lines are used to stop off the mooring while more glass balls are inserted into the mooring.

The acoustic release and trawler chain segments are deployed using an air tugger hauling line reeved through a block hung in the a-frame, and the winch. The 20 meter 1" Samson anchor pennant is shackled to the winch tag line and pre-wound onto the winch drum.

The tugger line is hauled in, lifting the release off the deck. The a-frame is shifted out board with the winch slowly paying out its line. Once the release has cleared the deck, the winch is stopped and the tugger line removed. The 5 meter 1/2" chain is then stopped off with a stopper line and the anchor pennant removed.

The chain shackled to the anchor is lead out over the stern and back onto the deck. The free end of the 1/2" chain is shackled to the stopped off end link. The winch tag line is eased off and removed. The crane is positioned so the whip hangs over and slightly aft of the anchor. The whip hook is secured to the tip plate chain bridle. The chain lashings are removed from the anchor. Tension is transferred to the anchor. The crane is whip raised to lift the forward side of the tip plate, causing the anchor to slide over board.

Anchor Tracking

Ronald H. Brown will hold station approximately 0.25 nm away from the Stratus 16 mooring anchor drop point immediately following release of the anchor from the fantail. The science party will perform repeated acoustic ranging on the release (located 30 m above the mooring anchor) in order to track the anchor during its descent. It is expected to take about 40 min for the anchor to reach the bottom. Issues relating to use of WHOI's over-the-rail transceiver vs. *Ronald H. Brown's* 12 kHz hull transducer are the same as described for the Release Tests above.

Anchor Survey

Ronald H. Brown 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. Issues relating to use of WHOI's over-the-rail transceiver vs. *Ronald H. Brown's* 12 kHz hull transducer are the same as described for the Release Tests above.

Sensor Inter-comparison (Stratus 15 and 16 Buoys)

Ronald H. Brown will establish and hold a position, with bow into the wind, approximately 0.5 nm downwind of the Stratus 15 buoy. This station will be held while the science party confirms data reception from Argos uplink receivers that will acquire, decode, and record the meteorological data transmitted by the buoy. *Ronald H. Brown* will continue to hold station for approximately 24h while the data stream from the buoy is recorded. During the intercomparison period, *Ronald H. Brown's* IMET meteorology will be continuously recorded and the science party will make periodic observations with hand-held meteorological sensors. The intercomparison period will last approximately 24 hour. During the work at the Stratus area, two CTD casts to 4,000 m will be made with the WHOI CTD at each mooring. These will be 4000 m casts and will not require bottle sampling. The Chief Scientist in consultation with the OPS officer will set a CTD operator schedule for the science party to assist and cover CTD operations as needed relative to the STs workload.

Stratus 15 Mooring recovery

WHOI has developed a technique for handling large surface moorings in deep water. The following is an abbreviated version of the steps taken during the recovery and deployment process.

Recovery is achieved using what we call the reverse haul technique. It allows heavily instrumented surface moorings to be recovered in a safe and orderly fashion that optimizes available deck space.

The acoustic release will be fired and the ship will move to recover the glass balls first. Once the glass balls are secure on deck, the winch tag line is transferred to the mooring line and recovery of line begins. The ship will steam ahead at approximately .5 knots to keep the catenary from becoming too great and fouling the mooring. As the winch hauls in the mooring, personnel on deck untangle and remove shackles from the cluster of glass balls. The balls are moved to an area for stowage later.

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.

Once the 40 – 50 m deep location on the mooring is reached, the mooring will be broken, allowing the surface buoy and gear underneath to drift free. The weight under the buoy keeps it from tipping over. Then the ship maneuvers to recover the buoy. In most cases, a section of the bulwark is removed to ease recovery, and a small boat is deployed to attach a lifting pennant to the buoy lifting eye. With minimal weight and drag under the hull, the buoy is easily lifted over the side of the ship using the crane. 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. The entire recovery operation requires about nine hours.

Drifter deployments

Surface drifters will be deployed for NOAA AOML. The drifters can be deployed at full speed and will not require the ship to slow or turn from its course. There will be 24 drifters, and drop sites are listed above in the cruise itinerary.

Argo float deployments

Eight Argo floats have been provided from the WHOI group involved in the Argo float program. The floats will be deployed at slow speed, requiring the ship to drop to 1-2 kts. Argo floats to be dropped nominally at the locations listed in the cruise itinerary.

2. Underway Operations

ADCP: The ship-mounted ADCP system will be used to continuously measure the currents in the upper ocean along the track line while in international waters and in waters where foreign clearance has been obtained. Operations will follow UHDAS procedures.

SST and SSS: Sea surface temperature and salinity will be recorded continuously, using the installed SEABIRD SBE-38 and SBE-45. Data from the TSG will be recorded to SCS and translated to ASCII. The ST is responsible for checking the logging status, ensuring the instrument is functioning properly, and producing data plots as requested. It is the vessel's responsibility to ensure that the thermosalinograph is calibrated, at a minimum, annually.

EM 122 Survey: Upon arrival at the Stratus 16 site, a bottom survey will be performed using the EM 122 to map an area centered near 19° 48.9713'S, 84° 44.3744'W. Cruising speed, leg length, and leg spacing will be adjusted as needed to ensure adequate data overlap and good system performance. The multibeam will be run during the Stratus 16 deployment to verify selection of an anchor site of correct depth.

3. Small Boat Operations

The ship's small boat (RHIB) will be required during Stratus 15 mooring recovery operations. Expected duration of small boat use is about 60 minutes. Small boat operations would be within 0.5 nm of the ship. Additionally, a close visual inspection of the Stratus 16 mooring after its deployment will be required.

D. Dive Plan

Dives are not planned for this project

E. Applicable Restrictions

Conditions which preclude normal operations:

Deployment and recovery of surface moorings requires suitable conditions. The Chief Scientists will work with the officers of the *Ronald H. Brown* to watch marine forecasts. The winds are typically not strong in the operations area, and it is the swell that may be of concern. Swell coming from weather systems in the South Pacific and Southern Ocean are of concern if they are large in size, introducing some challenge to mooring

deployment and recovery. Deployment and recovery dates/times will be adjusted if needed to avoid days of high swells.

Similarly, swell and sea state may preclude small boat operations. All operations in mooring recovery/deployment can be accomplished if need be without the small boat.

III. Equipment

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

Communications, including VSAT internet link for data, facsimile, and e-mail messages.

GPS Navigation
In the event of SCS failure, the bridge will record hourly GPS positions in the hourly weather log. GPS position and time-base will be made available in real-time to the science workstations over the ship computer network.

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. SCS data will be logged and archived once the ship reaches international waters, and as permitted by research clearances in foreign jurisdictional waters. The SCS data display nodes will provide scientists with the capability of monitoring sensor acquisition via text and graphic displays.

At regular intervals, not to exceed every five days, the ship's STs will archive data files to a secondary system to reduce the chances of data loss. Data will be archived to an external hard and provided to the Chief Scientist at the end of the cruise. Additional recording of processed data may be requested of the ship's SCS manager. These requirements will be identified at the beginning of the cruise.

The ship's SCS Manager will ensure data quality through the administration of standard SCS protocols for data monitoring. If requested by the Chief Scientist, standard SCS daily quality assurance summaries will be prepared for review. During the cruise, the scientific party may require the assistance of the ship's SCS Manager to determine if all sensors are functioning properly and to monitor some of the collected data in real time to make sampling strategy decisions.

Thermosalinograph and uncontaminated seawater

Thermosalinograph data required.

Laboratory/work space
Space will be required in the main lab, hydro lab, wet lab, bio lab, plot room, and computer room, primarily for instrument data systems whose sensors are positioned

outside. One unit of computer space is defined as countertop space 2 feet wide, 30 inches deep, and three feet high. Needs include:

Sensor/van	Sensor Location	Best Lab	Units Needed
Flux system	Jack Staff/ Bow Tower	Main	3
WHOI buoy	Fantail	Main	8
Mooring work area		Wet	2
WHOI workstations		Main	20
Float, drifter staging		Port, Hydro	

Two thirds of main lab allocated to WHOI for instrument staging, preparation, data downloading, data analysis, remaining space in main lab allocated to ESRL. Main bench in hydro lab (aft, port) for drifter, float staging. Benches in wet lab (starboard, aft) for staging deck work and WHOI CTD.

Power:
Only the following power outputs are available from the ship, all at 60 Hz: 1) 440 VAC, 3 phase, 2) 220 VAC, 1 or 3 phase, and 3) 120 VAC, 1 or 3 phase. Three-phase power is configured as "delta" (no ground), not as "Y" (with central ground). Transformers or motor-generators for other power requirements will not be provided by the ship and must be provided by the participants. The ship will provide only U.S. standard power plugs and jacks.

Power needs include:

Weller/WHOI: Mooring winch*;* winding cart. Mooring winch (480 VAC, 3 phase, 40 amps. The ESRL flux tower to be run off ship's power during transit (120V, single phase).

SCS Data Streams:
Data streams output from SCS in RS-232 format will be made available as requested at the beginning of the cruise. At regular intervals, not to exceed 5 days, the ship's STs will archive data from disk external hard drivefor delivery to Chief Scientist at the end of the cruise.

WHOI requests real time access to IMET and Navigation data in the Science lab.

The ship's IMET suite data will be provided to the science party via the ship's SCS system and computer network.

Specific deck equipment for mooring work, including two air-tuggers and a power washer, are requested for use by the science party.

12 KHz depth sounder is requested in case dragging operations are required for the recovery of mooring equipment.

Network connections

The science party requests the following connections to the ship's computer network:

Network requirements by Stratus 15 science party.

Group	Space	Usage
WHOI	Main Lab	16 laptop PCs/Macs
WHOI	Hydro Lab	3 Mac/PC(laptop)
ESRL	Main Lab	3 PC (laptop)

IT Security: Any computer that will be hooked into the ship's network must comply with the *NMAO Fleet IT Security Policy* 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 these requirements prior to boarding the ship is preferable.

Non-NOAA personnel using the ship's computers or connecting their own computers to the ship's network must complete NOAA's IT Security Awareness Course within 3 days of embarking.

Storage Requirements:

The following storage space will be required for shipping containers:

Group Space Usage

WHOI	Indoors	20 shipping cases

Freezer Usage

Freezer not required.

Refrigerator Usage

Not required.

CTD winch, cable and Rosette

WHOI self-contained CTD will be deployed using the ship's CTD winch and wire. Also to be used to lower acoustic releases to 1,500 m for testing.

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

All 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) and scientific equipment for the main lab (computers, RF and acoustic receivers, hand-held meteorological sensors, consumable supplies) will be provided by the program except as noted above. Science party personnel will be familiar with mooring deployment and recovery and will be capable of directing operations in cooperation with the ships crew during all phases of mooring operations. Additional science personnel will assist with mooring operations, met watches, and other observation and data collection activities. WHOI will provide a SeaBird self-contained CTD that records internally and can be deployed from either hydro wire or CTD wire; this will be a backup to the ship's CTD.

IV. Hazardous Materials

HAZMAT info (See Appendix E for summary listings)

WHOI: Lithium batteries for instruments; see Appendix E.

NOAA PMEL PCO2 system: 1 cylinder compressed air.

ESRL: Requested

A. Policy and Compliance

WHOI: No significant amounts of HAZMAT will be used for buoy recovery and deployment operations. The usual lab supplies: alcohol, contact cleaner, contact cement,

WD-40, etc. will be on hand for use as needed. We will also be using a limited amount of anti fouling coatings on the instruments and cages.

An inventory of these items (and any NDBC Hazmat) 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 OPS Officer before loading commences.

All HAZMAT, except small amounts for ready use, will be stored in the HAZMAT Locker. If science party requirements exceed ship's storage capacity, excess HAZMAT will be stored in dedicated lockers meeting OSHA/NFPA standards to be provided by the science party.

Ronald H. Brown will operate in full compliance with all environmental compliance requirements imposed by NOAA. All hazardous materials and substances needed to carry out the objectives of the embarked science mission, including ancillary tasks, are the direct responsibility of the embarked designated Chief Scientist, whether or not that Chief Scientist is using them directly. The ship's Environmental Compliance Officer (ECO) will work with the Chief Scientist to ensure that this management policy is properly executed, and that any problems are brought promptly to the attention of the Commanding Officer.

All hazardous materials require a Material Safety Data Sheet (MSDS). Copies of all MSDSs shall be forwarded to the ship at least two weeks prior to sailing. The Chief Scientist shall have copies of each MSDS available when the hazardous materials are loaded aboard. Hazardous material for which the MSDS is not provided will not be loaded aboard.

The Chief Scientist will provide the Commanding Officer with an inventory indicating the amount, concentrations, and intended storage area of each hazardous material brought onboard, and for which the Chief Scientist is responsible. This inventory shall be verified at time of departure from port, and again upon completion of the cruise, accounting for the amount of material being removed, the amount consumed in science operations, and the amount being removed in the form of waste.

The scientific party, under supervision of the Chief Scientist, shall be prepared to respond fully to emergencies involving spills of any mission HAZMAT. This includes providing properly trained personnel for response, as well as the necessary neutralizing chemicals and clean-up materials. Ship's personnel are not first responders and will act in a support role only in the event of a spill.

The Chief Scientist is directly responsible for the handling, both administrative and physical, of all scientific party hazardous wastes. No liquid wastes shall be introduced

into the ship's drainage system. No solid waste material shall be placed in the ship's garbage.

The Chief Scientist is responsible for complying with MOCDOC 15, Fleet Environmental Compliance #07, Hazardous Material and Hazardous Waste Management Requirements for Visiting Scientists, released July 2002. Documentation regarding those requirements will be provided by the Chief of Operations, Marine Operations Center Atlantic, upon request and can be reached at ChiefOps.MOA@noaa.gov or 757-441-6842.

C. Chemical safety and spill response procedures

A: ACID

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

M: Mercury

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

F: Formalin/Formaldehyde

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

Inventory of Spill Kit supplies

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

(OR See attached Appendix #

D. Radioactive Materials

No Radioactive Isotopes are planned for this project.

V. Additional Projects

A. Supplementary ("Piggyback") Projects

NOAA AOML Surface Drifters
As discussed above the science party of the Stratus 16 cruise will deploy 24 surface drifters from NOAA AOML.

Argo Floats
As discussed above the science party of the Stratus 16 cruise will deploy 8 Argo floats for the international Argo float program.

Underway Measurements in support of Global Carbon Cycle Research (GCC)

Request: As part of the ongoing research to quantify the CO2 uptake by the world's oceans we have installed underway systems on *Ronald H. Brown*. After initial start-up, which requires about one hour of monitoring, the system needs checking twice a day requiring a total of about 20-minutes. We would also request weekly data downloads and transmission such that we can perform on shore near-real-time quality control to assess if the instrument is operating satisfactorily. All costs of the email transmissions and survey technician overtime would be covered by AOML. In the event of system malfunction that cannot be easily repaired, we will ask the Survey Technician to shut the system down.

Principal investigators:
Dr Rik Wanninkhof, AOML 305-361-4379 wanninkhof@aoml.noaa.gov
Dr Richard Feely, PMEL 206-526-6214 feely@pmel.noaa.gov
Robert Castle, AOML 305-361-4418 castle@aoml.noaa.gov

Introduction: The underway sensors on *Ronald H. Brown* will be used in support of the objectives of the Global Carbon Cycle Research (GCC) to quantify the uptake of carbon by the world's ocean and to understand the bio-geochemical mechanisms responsible for variations of partial pressure of CO2 in surface water (pCO2). This work is a collaborative effort between the CO2 groups at AOML and PMEL.

Rationale: Current estimates of anthropogenic CO2 uptake by the oceans range from 1 to 2.8 Gigatons per year. The CO2 fluxes between air and water are poorly constrained because of lack of seasonal and geographic coverage of delta pCO2 (the air-water disequilibrium) values and incomplete understanding of factors controlling the air-sea exchange of carbon dioxide. Seasonal and temporal coverage can be increased dramatically by deploying pCO2 analyzers on ships. The effort on *Ronald H. Brown* is expanded beyond the historical scope of the underway programs by incorporating additional sensors to improve our understanding of the factors controlling pCO2 levels.

Sensors and installation: The semi-automated instruments are installed on a permanent basis in the hydrolab of *Ronald H. Brown*. All work is performed on a not-to-interfere basis and does not introduce any added ship logistic requirements other than the continuous operation of the bow water pump and thermosalinograph. The instrumentation is comprised of an underway system to measure pCO2, a SOMMA (single operator multi-parameter metabolic analyzer) -coulometer system to measure total Dissolved Inorganic Carbon (DIC), - a Turner Designs fluorometer, and an YSI oxygen probe. All the instruments are set up along the port side bulkhead and aft bench in the hydrolab.

a. Underway pCO2 system. This system consists of a large (40-liter) air-water equilibrator requiring an unobstructed drain at floor level for the 15 L/min outflow, an infrared analyzer with valves and flow meters, and a computer controlling the operating sequence and which also logs the data. The underway pCO2 system is an integrated package for measurement of pCO2 in air and water and support sensors necessary to reduce the data (such as equilibrator temperature, location, salinity, sea surface temperature and barometric pressure). This system is an upgrade from the initial systems and requires routine checks at 6-12 hour intervals, including logging of mercury thermometers in the equilibrator.

b. Turner Designs Fluorometer. This instrument requires a water throughput of about 5 L/min. Periodic cleaning of the flow through cell (2-14 days) is required. The signal of the fluorometer is logged on the shipboard SCS system or on the computer logging the underway pCO2 data. Aliquots of seawater are extracted twice per day and analyzed for chlorophyll and phaopigments on a separate fluorometer following routine procedures to calibrate the fluorometer signal. This information will be particularly useful to

extrapolate the observations from the NASA SEAWIFS satellite to in situ pigment concentrations.

Ship Infrastructure Requirements:

1. Continuous seawater supply: 20 lpm minimum, 40 lpm maximum for instruments, and 75 lpm throughput to assure short residence time of water in line and minimal heating.

2. Access to TSG and SCS data: Temperature at intake, salinity from TSG, fluorometer signal, wind speed (true and relative), wind direction (true and relative), time, latitude, longitude, and ship speed.

3. Bench space, hydrolab space, access to bow water line and drains.

Associated HAZMATS: This project has the following associated HAZMAT for which the chief scientist must assume responsibility. Compressed gas cylinders in hydro lab listed in Appendix E. MSDS sheets are on file with the ship.

B. NOAA Fleet Ancillary Projects

Ancillary tasks will be accomplished in accordance with the NOAA Fleet Standing Ancillary Instructions.

Synoptic weather reports will be handled in accordance with NC Instruction 3142D, SEAS Data Collection and Transmission Procedures.

VI. Disposition of Data and Reports

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

A. Data Classifications:

Data to be collected, including details of station operations, underway operations, and small boat operations, are summarized above. The cruise plan is summarized above. Staging and de-staging are described above.

Collection of scientific data will be limited to international waters, and those foreign jurisdictional waters (within 200 nm) for which a research clearance permitting such activities has been granted and presented to the ship.

Another sampling goal is to conduct in the field comparisons between the ship and the buoys. The sampling undertaken will include: underway surface temperature and salinity, underway shipboard ADCP (velocity), as well as CTD measurements on station. Data collection while steaming will be carried out between the periods of work at the two moorings. Atmospheric measurement undertaken will be with the ships IMET system and a bow mast mounted turbulence flux package. On station sampling at the two moorings seeks to capture at least several daily or diurnal cycles in the evolution of the atmosphere and ocean at two contrasting locations.

Data to be collected

- Underway physical oceanographic sampling (thermosalinograph, fluorometer, ADCP)
- CTD profiles
- Underway atmospheric sampling (shipboard mean meteorology and turbulent flux)
- Multibeam bathymetry

WHOI mooring: the WHOI surface mooring is heavily instrumented to collect surface meteorology and ocean temperature, salinity, oxygen, chlorophyll, and velocity data.

B. Responsibilities: *Under Development*

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.

Data Requirements

The following data products will be included in the cruise data package:

1) CTD digital recordings and log sheets
2) ADCP digital recordings
3) Marine weather observation logs
4) Calibration information for ship's salinometer and thermosalinograph
7) SCS data on external hard drive

Marine Observation Log:

A Marine Operations Abstract (MOA) form will be recorded in SCS during the cruise. The critical information to record at each station is:

1) GMT date and time
2) Position
3) Station number
4) Bottom depth

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

VIII. Miscellaneous

A. Meals and Berthing

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

Berthing requirements, including number and gender of the scientific party, will be provided to the ship by the Chief Scientist. The Chief Scientist and Commanding Officer will work together on a detailed berthing plan to accommodate the gender mix of the scientific party taking into consideration the current make-up of the ship's complement. The Chief Scientist is responsible for ensuring the scientific berthing spaces are left in the condition in which they were received;

for stripping bedding and linen return; and for the return of any room keys which were issued. The Chief Scientist is also responsible for the cleanliness of the laboratory spaces and the storage areas utilized by the scientific party, both during the project and at its conclusion prior to departing the ship.

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

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

B. Medical Forms and Emergency Contacts

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

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

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

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

The only secure email process approved by NOAA is Accellion Secure File Transfer which requires the sender to setup an account. Accellion's Web Users Guide is a valuable aid in using this service, however to reduce cost the DOC contract doesn't provide for automatically issuing full functioning accounts. To receive access to a "Send Tab", after your Accellion account has

been established send an email from the associated email account to accellionAlerts@doc.gov requesting access to the "Send Tab" function. They will notify you via email usually within 1 business day of your approval. The 'Send Tab" function will be accessible for 30 days.

Contact information:

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

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

C. Shipboard Safety

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

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

D. Communications

A progress report on operations prepared by the Chief Scientist may be relayed to the program office. Sometimes it is necessary for the Chief Scientist to communicate with another vessel, aircraft, or shore facility. Through various means of communications, the ship can usually accommodate the Chief Scientist. Special radio voice communications requirements should be listed in the project instructions. The ship's primary means of communication with the Marine Operations Center is via email and the Very Small Aperture Terminal (VSAT) link. Standard VSAT bandwidth at 128kbs is shared by all vessels staff and the science team at no charge. Increased bandwidth in 30 day increments is available on the VSAT systems at increased cost to the scientific party. If increased bandwidth is being considered, program accounting is required and it must be arranged through the ship's Commanding Officer at least 30 days in advance.

E. IT Security

Any computer that will be hooked into the ship's network must comply with the *OMAO Fleet IT Security Policy* 1.1 (November 4, 2005) prior to establishing a direct connection to the NOAA WAN. Requirements include, but are not limited to:

(1) Installation of the latest virus definition (.DAT) file on all systems and performance of a virus scan on each system.
(2) Installation of the latest critical operating system security patches.
(3) No external public Internet Service Provider (ISP) connections.

Completion of the above requirements prior to boarding the ship is required.

Non-NOAA personnel using the ship's computers or connecting their own computers to the ship's network must complete NOAA's IT Security Awareness Course within 3 days of embarking.

F. Foreign National Guests Access to OMAO Facilities and Platforms

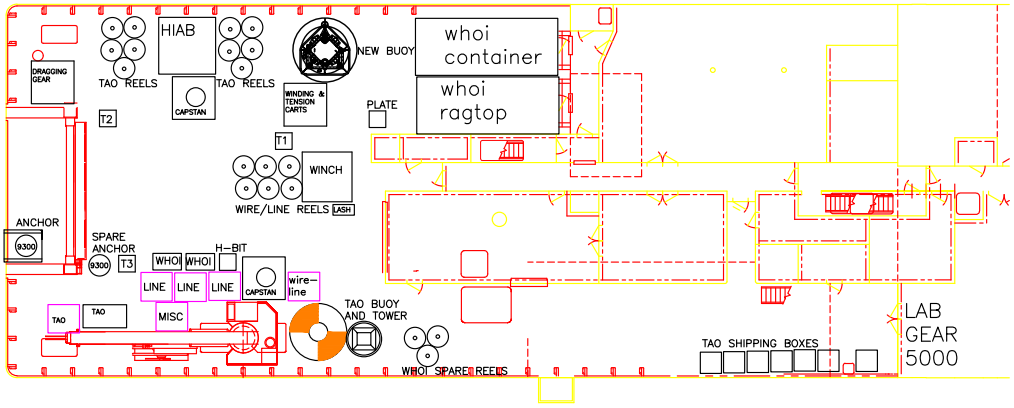
Foreign National access to the NOAA ship or Federal Facilities is not required for this project.

VIII. Appendices

Appendix A: Equipment Inventory

Proposed deck layouts and locations of vans and weights for equipment are provided below. The actual plan is to be determined in consultation with the OPS and the bosun

R/V RONALD H. BROWN
PRELIMINARY DECK PLAN
STRATUS 2017 PLUS TAO



DECK LOAD

2 ANCHORS – 9300 EA.
BUOY – 5000
WINCH – 7000
4 BOX LINE – 1100 EA.
HARDWARE BOX – 2000
DECK GEAR – 800
BLOCKS – 200
WINDING CART – 600
20 FOOT RAGTOP –15000
LARGE TUGGER – 600
5 REELS WIRE – 500 EA
5 REELS LINE – 400 EA
TIP PLATE – 800
H– BIT – 400
FAIRLEAD PLATE – 200
LASHING GEAR – 200
DRAGGING GEAR – 3000
BASKET MISC – 600
TENSION CART – 600
20 FT. HARD TOP– 7000
(3) ACOUTIC RELEASE 350
LAB GEAR – 5000

WHOI Vans:

2 WHOI vans will be loaded in Charleston. WHOI 20' rag top (removable fabric top) will go on the main deck, fantail, port, inboard van slot; WHOI 20' lab equipment and deck gear shipping and storage van to go outboard. No power or communications links are needed for these vans.

Van	**Name**	**Deck**	**Location**	**Weights (lbs)**
1	WHOI	main deck	port, outboard	14,000
2	WHOI	main deck	port, inboard	14,000

The containers are each 5,000 lbs. The glass balls, spare wire rope and other mooring material will remain in the ragtop 20' van, so its weight remains 14,000 lbs. The 9,000 lb of lab gear packed into the 20' hardtop will be moved into the lab for the cruise. Gear that will be spotted on deck will include the following weights:

WHOI Deck loads:

DESCRIPTION	WEIGHT
2.7 Meter Buoy	4,000
Anchor	9,300
Anchor	9,300
Mooring Winch	7,000
Tension Cart	600
Winding Cart	500
Hardware Box # 1	1500
Hardware Box # 2	1800
Launch and Recovery Box	800
Large Air Tugger	600

Proposed deck layout.

Anchor Tip Platter	700
6 – Wire Baskets Line	7,500
H-Bit	350
Fairlead Plate	200
Dragging Gear	3,000
5 Reels wire rope	2,500
2 Reels nylon/wire	800
7 - Empty Reels	700
WHOI Flux sensors Jackstaff	300
TOTAL DECK LOAD - WHOI	**51,450**

Appendix B: Waypoints and Time Line

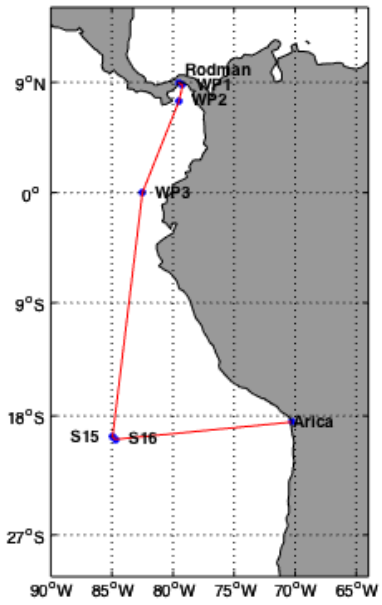


Figure B1. Planned cruise track for 2017 Stratus ORS and cruise.

Feb. 23, 2017 rev 2.0

Key Locations and Waypoints

Rodman, Panama	8° 57’ 18” N	79° 34’ 30” W
Waypoint 1	8° 45’ N	79° 28’ W
Waypoint 2	7° 30’ N	79° 30’W
Waypoint 3	0°	82° 30’ W
EEZ1	9° 8' 57.33"S	83° 23' 51.02" W
Stratus area	20° S	85° W
Stratus 15 anchor	19° 37.5734’S	84° 56.818’W
Stratus 16 target	19° 48.9713’S	84° 44.3744’W
EEZ2	19° 17' 26.46'S	75° 27' 18.38"W
Arica, Chile	18.4783° S	70.3126° W

Note: Waypoints 1, 2, and 3 are nominal and used to plan distances and time; ship will develop detailed cruise track for transit from Rodman to Stratus mooring site. Use 11.0 kts for transits.

Note: EEZ1 is estimated location to enter international waters outbound from Rodman to Stratus site. EEZ2 is estimated location to leave international waters when heading to Arica from the Stratus site.

Note: Drop points for NOAA surface drifters and Argo floats are given along the draft track line. Drop sites do not have to be precise, but should be along track near desired latitude outbound from Rodman and then near desired longitude inbound to Arica.

Transit Distances

Rodman – WP 1	25.5 nm
WP1 – WP2	76 nm
WP2 – WP 3	482.6 nm
WP3 - EEZ1	548.9 nm
WP3 – Stratus area	1203.6 nm
Stratus 15 – Stratus 16	16.3 nm
Stratus area - EEZ2	526 nm
Stratus area – Arica	840 nm

Draft Plan (see Figure B1 for track line)

April 24-25, 2017		Load in Charleston
April 26, 2017		Depart Charleston
May 4, 2017		Embark science party in Rodman
May 5, 2017	1000 local	leave Rodman arrive WP1 1300
	2000 local	arrive WP2, 44 hour run to WP
May 6, 2017		transit to WP3
May 7, 2017		transit to WP3
	1600 local	arrive WP3, 110 hour transit to Stratus
May 8, 2017		underway to Stratus
May 9, 2017		underway to Stratus
May 10, 2017		underway to Stratus
	1100 local	reach EEZ1, begin deploying Argo floats, drifters start underway sampling (ADCP, TSG); stop to do test CTD, test acoustic releases, 6 hours on station
May 11, 2017		underway to Stratus
May 12, 2017	1200 local	arrive Stratus 15, visual check, two CTDs at Stratus 15
	2000 local	move to Stratus 16 site, check bottom bathymetry, check currents, run test deployment track
May 13, 2017	0600-1800 local	deploy Stratus 16
	1800-2000 local	anchor survey
May 14, 2017		Ship vs buoy comparisons at Stratus 15
May 15, 2017		Ship buoy comparison at Stratus 16, two CTDs at Stratus 16
May 16, 2017	0600-1800 local	recover Stratus 15

	1800 local on	standby Stratus 16, ship versus buoy
May 17, 2017	0400 local	depart for Arica, 840 nm transit
		deploying Argo floats, drifters
May 18, 2017		transit t Arica
May 19, 2017		transit to Arica
	0400 local	reach EEZ2, underway sampling stops
		Argo float and drifter deployments complete
May 20, 2017	0600 local	off Arica
May 22, 2017		Destage in Arica
July 7, 2017		Unload in Key West

Argo Float Drop Locations

1.	Argo 1	10° S	83° 36' 22.66" W
2.	Argo 2	12° S	83° 49' 48.05" W
3.	Argo 3	14° S	84° 05' 57.02" W
4.	Argo 4	16° S	84° 19' 59.73" W
5.	Argo 5	18° S	84° 34' 40.50" W
6.	Argo 6	19° 56' 49.35" S	84° W
7.	Argo 7	19° 50' 06.62" S	82° W
8.	Argo 8	19° 29' 47.24" S	80° W

NOAA Surface Drifter Drop Locations

1.	Drifter 1	10° S	83° 36' 25.81" W
2.	Drifter 2	11° S	83° 43' 54.96" W
3.	Drifters 3, 4	12° S	83° 50' 42.72" W
4.	Drifter 5	13° S	83° 58' 22.24" W
5.	Drifter 6	14° S	84° 06'32.89" W
6.	Drifters 7, 8	15° S	84° 12' 08.69" W
7.	Drifter 9	16° S	84° 20' 15.26" W
8.	Drifter 10	17° S	84° 29' 10.61" W
9.	Drifters 11, 12	18° S	84° 35' 32.76" W
10.	Drifter 13	19° S	84° 42' 56.47" W
11.	Drifter 14	19° 57 39.52" S	84° W
12.	Drifters 15, 16	19° 52' 31.31" S	83° W
13.	Drifter 17	19° 48' 12.65" S	82° W
14.	Drifter 18	19° 43' 16.20" S	81° W
15.	Drifters 19, 20	19° 38' 02.49" S	80° W
16.	Drifter 21	19° 32' 39.64" S	79° W
17.	Drifter 22	19° 26' 36.39" S	78° W
18.	Drifter 23	19° 20' 19.89" S	77° W
19.	Drifter 24	19° 13' 56.78" S	76° W

Appendix C: WHOI Mooring Drawings

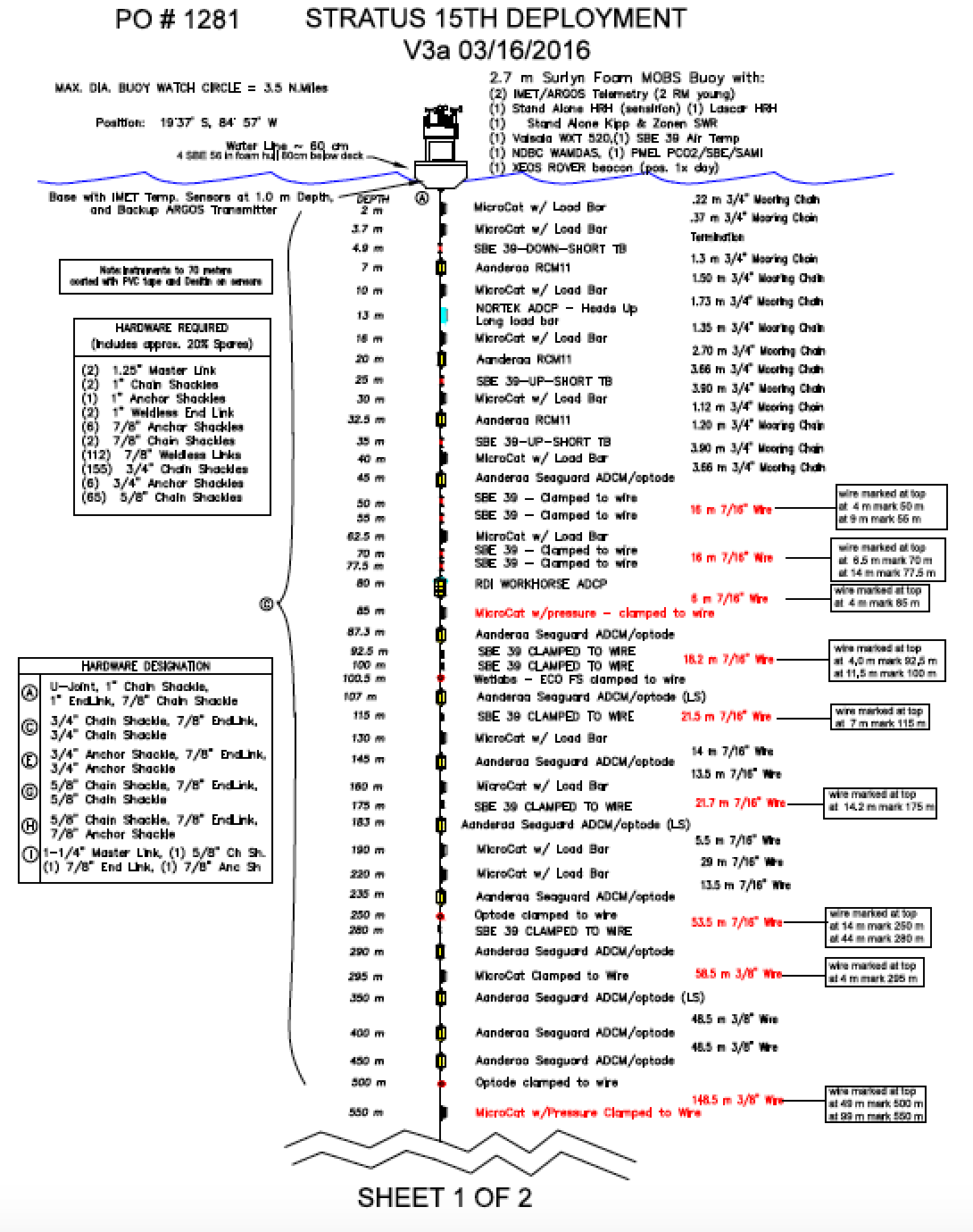


Figure C1. Page 1, diagram WHOI mooring to be recovered, Stratus 15.

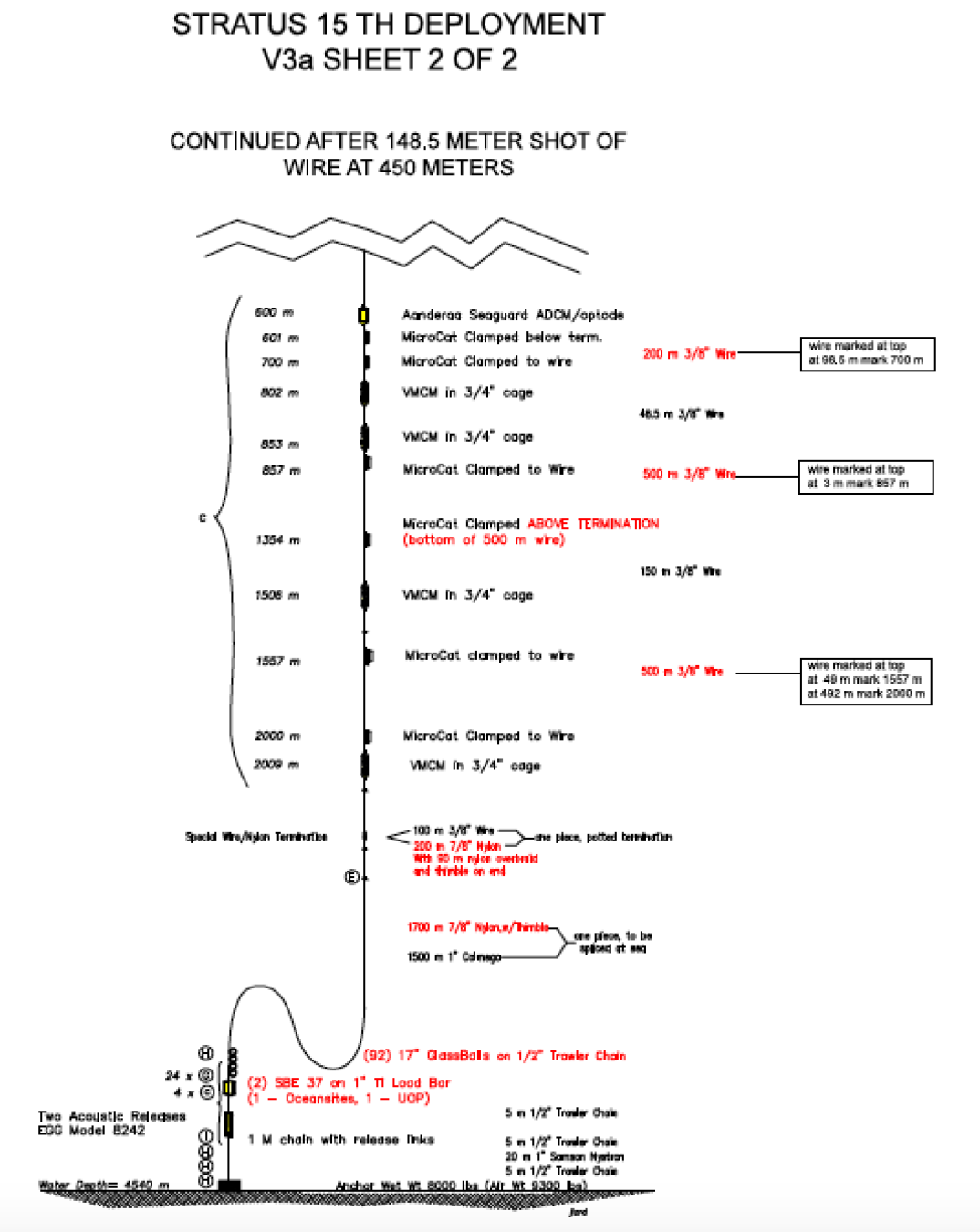


Figure C.2 Page 2, diagram of Stratus 15 mooring.

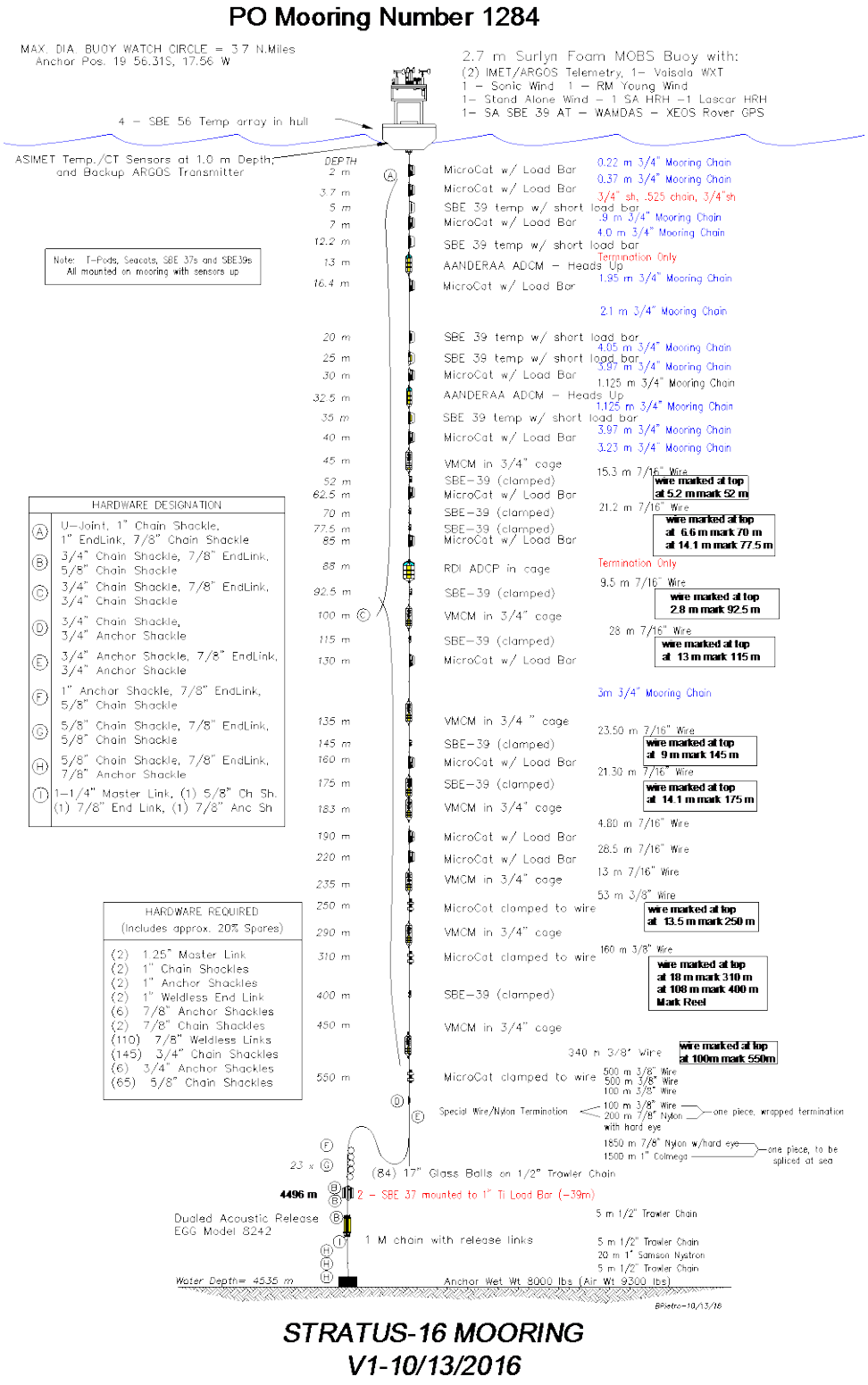


Figure C3. Diagram of Stratus 16, to be deployed.

Appendix D: Cruise Participants

Stratus Cruise 2017
Participants

1. Robert Weller	**Chief Scientist**	**WHOI**	**rweller@whoi.edu**
2. Sebastien Bigorre	**Scientist**	**WHOI**	**sbigorre@whoi.edu**
3. Ben Pietro	**Mooring lead**	**WHOI**	**bpietro@whoi.edu**
4. Emerson Hasbrouck	**Ocean Tech**	**WHOI**	**ehasbrouck@whoi.edu**
5. Raymond Graham	**Ocean Tech**	**WHOI**	**rgraham@whoi.edu**
6. ESRL TBD			
7. ESRL TBD			

Appendix E: HAZMAT Lists

WHOI

Description	*MSDS file*	*Battery pack construction*	*Packaging*	*Total*	*Qty containers*	*Type*	*Wt per container*	*Total weight*
Aanderaa current meter – Lithium batteries in equipment	*BCX_85_MSDS.pdf* *3B4000Datashett_1.pdf*	*6 D cells – 5 grams per cell*	*1 pack per instrument, 1 instrument per box*	*14 boxes – 30 grams lithium per box*	*2*	*Plastic/wood*	*70*	*140*
RDI current meter – Lithium batteries in instrument	*MSDS BPWL1600* *BPAL350* *BPLSG400_1.pdf*	*26 cells – 5 grams lithium per cell*	*1 pack per instrument* *1 instrument per box*	*1 box – 130 grams lithium*	*1*	*Plastic*	*100*	*100*
WHOI Argo floats *Lithium batteries in instruments*	*PUMP_CSC_PMX_MSDS* *CPU_BCX_85_MSDS*			*4 boxes – 131.6 grams lithium per box*	*8*	*Cardboard*	*70*	*560*
PMEL PCO2 system in WHOI buoy –compressed gas, air	*CompressedGas.pdf* *(HAZDEC)*		*1*		*1*			

Appendix F. Lab space assignments and layouts

1. Bioanalytical Lab (1-27-2)
   TAO gear storage

2. Hydro lab
   a. WHOI
   b. Floats, drifters
   c. WHOI mooring techs

3. Science Office
   a. Dive gear
   b. Phones/PCs for public usage

4. Main lab
   a. WHOI moored instrumentation
   b. Underway data processing/Bigorre
   c. Bench – Weller
   d. WHOI moored instrument prep, download
   e. Laptop – WHOI
   f. Laptop – WHOI
   g. ESRL flux
   h. ESRL flux

5. Computer Lab
   a. Laptops – transient

6. Wet Lab
   a. WHOI CTD staging

7. Staging bay
   a. Mooring group tools etc

Appendix G: The ESRL/PSD Turbulent Flux System

The PSD Turbulent Flux Measurement System consists of six components (Table 1) plus an extra combined sensor:

1. A turbulent wind measurement system with motion correction mounted on the top of the foremast, mounted to an aluminum extension plate.
2. Solar and infrared radiation sensors. Radiometers are mounted on the highest and unobstructed sky-see location of vessel.
3. Bulk Meteorology sensors (air temperature, relative humidity, sea surface temperature and precipitation). These instruments are mounted on the foremast also.
4. A CO2/H2O gas analyzer - mounted on the foremast.
5. Two differential GPS units measuring heading, pitch and roll information. These instruments are usually installed on top of a sea container or a railing.
6. A sea surface temperature measurement made with a floating thermistor deployed off a port or starboard side with an outrigger.
7. A Vaisala WXT550 wind/temperature/pressure/humidity sensor

Table G1. PSD sensor heights and sampling rates.

1 Sensor	Sampling rate	Height (m)
2 Bow sonic	10 Hz	17.75
3 Motion Pack	10 Hz	16.95
4 Riegl Laser wave ht sensor	10 Hz	17.0
5 ORG	0.1Hz, averaged to 1 sample/min	16.5
6 T/RH	0.1Hz, averaged to 1 sample/min	15.6
7 Licor7500 (CO2&H2O)	10 Hz	17.2
8 Radiometers	0.1Hz, averaged to 1 sample/min	10.6
9 Barometer	0.1Hz, averaged to 1 sample/min	10.6
10 SST	0.1Hz, averaged to 1 sample/min	-0.05 to -0.10
11 Vaisala WXT550	10 Hz	17.5
12 Laser Ceilometer	0.1Hz, averaged to 1 sample/min	10.6

We are also bringing a lidar ceilometer to measure cloud base height. These systems 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 through 7 from Table G1 on the RHB foremast (Fig. G-1). The tower has an aluminum extension plate. The radiometers, GPS (Table G1, item 8) and various electronics packages will be mounted on the O2 deck forward (Fig. G-2). ESRL will also mount an outrigger to deploy the "sea snake", a water temperature sensor (Table A1, item 10) that drags near the surface. A laser ceilometer (Fig. G-3) will be deployed to measure cloud base height.

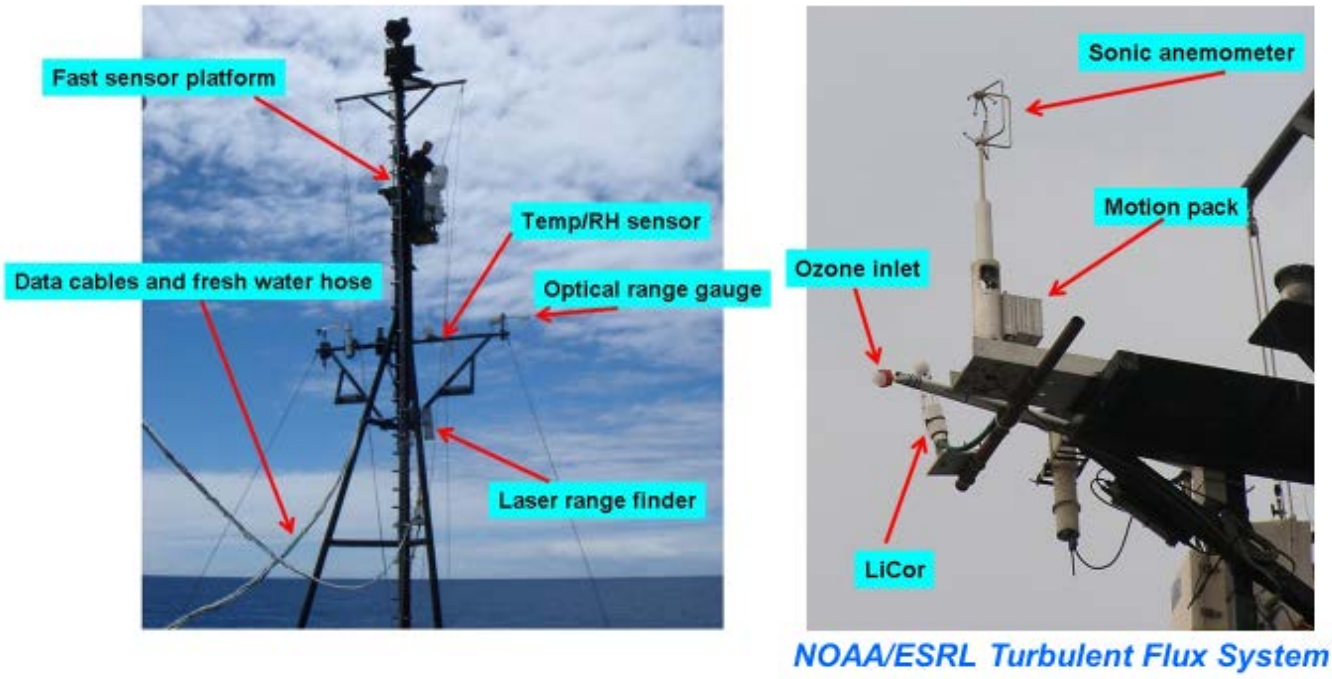


Figure G-1. NOAA PSD seagoing flux system on the *RHB* jackstaff. The aluminum C-channel plate is visible in the right panel.

Figure G-2. ESRL/PSD radiometers mounted on the 02 deck.

The ESRL flux team will also operate a Vaisala CL31K cloud ceilometer to record cloud base height at 15s intervals. The ceilometer is mounted to the deck in a location that provides an unobstructed view of the sky (Fig. A-3). It will be operated continuously and the data logged and archived for later distribution.

Figure G-3. ESRL/PSD ceilometer mounted on the 03 deck.