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 Joseph Pica, NOAA
Commanding Officer, NOAA Ship *Ronald H. Brown*

FROM: Captain Anne K. Lynch, NOAA Nancy Hann, CDR/NOAA
Commanding Officer, NOAA Marine Operations Center-Atlantic

SUBJECT: Project Instruction for RB-14-01
Thirteenth Setting of the Stratus Ocean Reference Station

Attached is the final Project Instruction for RB-14-01, Thirteenth Setting of the Stratus Ocean Reference Station, which is scheduled aboard NOAA Ship *Ronald H. Brown* during the period of 25 February – 14 March, 2014. Of the 18 DAS scheduled for this project, 0 DAS are funded by an OMAO allocation and 18 DAS are funded by 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.

Attachment

cc:
MOA1

Project Instructions

Date Submitted:	6 February 2014
Platform:	NOAA Ship *Ronald H. Brown*
Cruise Number:	RB-14-01 Stratus 13
Project Title:	Thirteenth Setting of the Stratus Ocean Reference Station
Cruise Dates:	25 February – 14 March, 2014

Prepared by: ______________________ Dated: 6 February 2014_____
Robert A. Weller
Chief Scientist
Woods Hole Oceanographic Institution

Approved by: Don Anderson __Dated: __10 February 2014___
Dr. Don Anderson
Director
Cooperative Institute for the North Atlantic Region (CINAR)

Approved by: Nancy Hann, CDR NOAA Dated: 14 Feb 14
Captain Anne K. Lynch, NOAA
Commanding Officer
Marine Operations Center - Atlantic

Stratus 13
Cruise RB-14-01
NOAA Ship *Ronald H. Brown*
Valparaiso - Arica, February 25 – March 14, 2014
Chief Scientist: Robert A. Weller

I. OVERVIEW

A. Cruise RB-14-01 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) deployment for up to several days of a near-surface temperature and velocity sampling array next to the Stratus 13 buoy, 3) servicing the NOAA NDBC DART 32412 (17°58'30" S 86°23'30" W), including recovering and redeploying a Bottom Pressure Recorder (BPR) and deploying a new surface mooring, 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. Because the existing Stratus surface mooring parted on January 25, 2014, the first activity will be for the *R H Brown* to steam to intercept the buoy and recover it. The cruise plan has been developed based on the Stratus 12 buoy continuing to drift to the west-northwest at 1.6 knots. The ship will then steam to the southeast to the DART site and do the DART servicing. After DART, the ship will return to the Stratus mooring area. A new surface buoy and mooring, Stratus 13, will be deployed. The bottom part of the Stratus 12 mooring, in the water since May 2012, will be recovered. As time permits, a near-surface sampling array will be deployed near the Stratus 13 buoy. In addition, intercomparisons of shipboard and moored sensors will be carried out as well as various shipboard oceanographic and atmospheric sampling. After the work at the WHOI Stratus mooring site, *R H Brown* will head east to Arica, Chile. The cruise originates in Valparaiso, Chile where equipment will be loaded and the science party will join. The cruise will end in Arica, Chile; and equipment will be shipped back from there. The planned cruise track is shown in Figure 1.

B. Days at Sea (DAS)

Of the 18 DAS scheduled for this project, 0 DAS are funded by an OMAO allocation, 18 DAS are funded by a Line Office Allocation, 0 DAS are Program Funded, and 0DAS 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 Valparaiso, Chile, to the northwest to work at the Stratus ORS site at ~20°S, 85°W off northern Chile, transit to the DART site (17°58'30" S 86°23'30" W), then transit east ending in Arica, Chile.

A speed of 11.5 knots has been used in planning for the initial part of the cruise, when the ship is steaming to intercept the drifting Stratus 12 buoy. After the recovery of the Stratus 12 surface buoy, a speed of 11.0 kts has been used. Before deploying the Stratus 13 surface mooring there will be one stop to lower acoustic releases to ~1,500 m to test them before using them in the Stratus 13 deployment. This will be done with the WHOI self-contained, Seabird CTD on the wire to also t

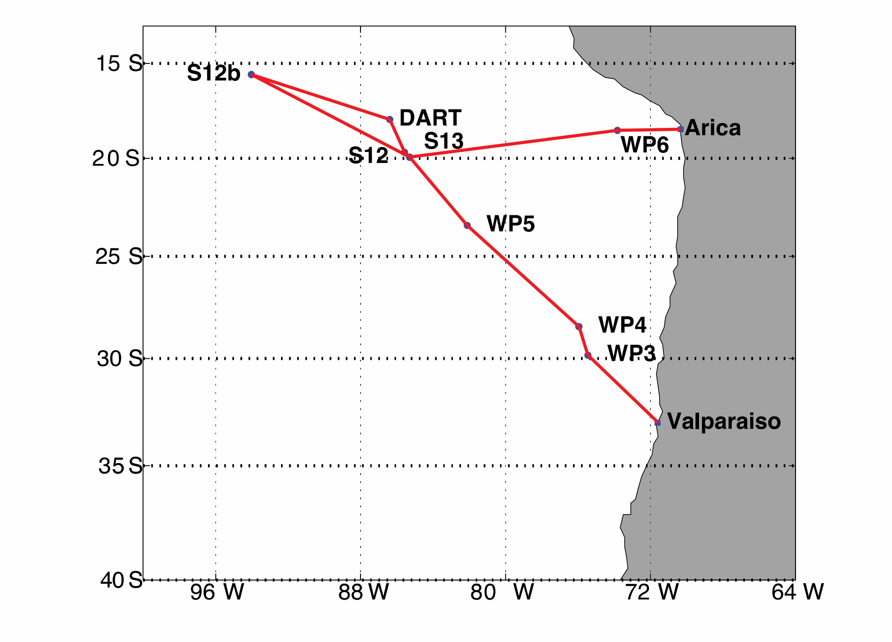


Figure 1. Cruise track (red) for RB-14-01. Waypoints (WP3, WP4, WP5, and WP6 mark points where the track cross the boundary of Chilean water. S12 and S13 indicate the present and planned anchor locations of the Stratus moorings. DART marks the location of the NDBC DART installation. S12b is the point where it is estimated that the ship will recover the drifting Stratus 12 surface buoy.

CTD profiles to 5,000 m will be collected at the Stratus 12 and 13 moorings using the WHOI self-contained Seabird CTD. If the *RH Brown* CTD is available with an oxygen sensor, a cat to 1,500m would be done near the Stratus 13 mooring.

D. Summary of Objectives

1) the recovery and redeployment of the Stratus Ocean Reference Station (ORS) at ~20°S, 85°W,
2) deployment for up to several days of a near-surface sampling array next to the Stratus 13 buoy,
3) servicing the NOAA NDBC DART 32412 (17°58'30" S 86°23'30" W,
4) collection of meteorological and oceanographic data while underway and on station,
5) deployment of surface drifting buoys for NOAA AOML, and
6) deployment of profiling Argo floats for the international Argo program.

E. Participating Institutions:

Woods Hole Oceanographic Institution (WHOI)
NOAA National Data Buoy Center (NDBC)
NOAA Atlantic Oceanographic and Meteorological Laboratory (AOML)
University of Concepcion, Concepcion, Chile (UdeC)

The science party will be eleven. WHOI will provide five; NDBC will send two; and two students from the University of Concepcion (UdeC) will participate. AOML will provide surface drifters to be deployed by the science party. WHOI will provide Argo floats to be deployed by the science party.

F. Personnel
The Chief Scientist is Dr. Robert Weller, who is affiliated with the Woods Hole Oceanographic Institution. Science personnel participating in RB-14-01 are listed below.

NOAA Ship Ronald H. Brown – Valparaiso, Chile (February 25, 2014) – Arica, Chile (March 14, 2014)

	Name	Title	Date aboard	Date disembark	Gender	Affiliation	Nationality
1	R. Weller	Chief Scientist	2/25	3/14	M	WHOI	USA
2	S. Bigorre	Res. Assoc.	2/25	3/14	M	WHOI	USA
3	N. Galbraith	Comp. Sci	2/25	3/14	F	WHOI	USA
4	S. Whelan	Ocean tech	2/25	3/14	M	WHOI	USA
5	J. Lord	Group Ops Lead	2/25	3/14	M	WHOI	USA
6	J. Coleman	DART tech.	2/25	3/14	M	NDBC	USA
7	D. Parrett	DART tech.	2/25	3/14	M	NDBC	USA
8	C. Aguilera Bravo	Student	2/25	3/14	M	U de C	Chile
9	M. Contreras Contreras	Student	2/25	3/14	f	U dec C	Chile

Notes:
WHOI=Woods Hole Oceanographic Institution
NDBC=National Data Buoy Center
U de C=Universidad de Concepcion, Concepcion, Chile
WHOI personnel will be in Valparaiso starting 2/15 to assist in loading gear, and will assist in Arica through 3/15

G. Administrative
1. Points of Contact: 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. Jeff Lord (jlord@whoi.edu) will coordinate logistics for the WHOI work as well as for the

DART work, liaising with Jeff Jenner (jeff.jenner@noaa.gov) and Brian Lake (Brian.Lake@noaa.gov). WHOI is working with Broom as a port agent (Mario Montero, Operations Manager, Broom Group, mmontero@broomgroup.com, 56 32 2268209)

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. Laura Gibson
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	
Cellular:	843-693-2082 (OOD: 843-297-1835)	
CO:	CAPT Joe Pica	co.ronald.brown@noaa.gov
XO:	LCDR Jason Appler	xo.ronald.brown@noaa.gov
Ops Officer:	LT Paul Chamberlain	ops.ronald.brown@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. Clearances:
Foreign clearance is requested from Chile to do underway sampling. These clearances have been applied for in coordination with NMAO. The Chief Scientist is responsible for ensuring all stipulations of the approved research clearances are met. The cruise plan assumes that clearances to work in the EEZ of these countries will be obtained.

3. Licenses and Permits:
Not applicable.

II OPERATIONS

A. Project Itinerary

The cruise starts in Valparaiso, Chile, departing February 25, 2014 and ends in Arica, Chile on March 14, 2014. An itinerary has been developed based on 11.5 kt transit speeds until the drifting Stratus 12 buoy is recovered and then 11.0 kts later:

Key Locations and Transit Distances
Port of origin: Valparaiso, Chile 33° 0.0’S, 71° 34’ 59.88”W (-33.0, -71.5833)

WHOI Stratus 12 site: 19° 56.332’S, 85° 17.594’W (-19.9389, -85.29323)

WHOI Stratus 12 buoy: estimated intercept of drifting buoy 15°36.094’S, 94° 01.817’W (-15.6015, -94.0302)

WHOI Stratus 13 site: 19° 41.4783’S, 85° 34.0093’W (-19.6913, -85.5668)

DART 32412 site: 17° 58’ 30”S, 86° 23’ 30”W (-17.975, -86.392)

Port for end of cruise: Arica, Chile 18° 32.0’ S, 70° 20.0’W (-18.4833, -70.3333)

Way points:

Valparaiso (WP1), northwest to Stratus ORS (WP2, WP3, WP4, WP5), Stratus 13, Stratus 12, DART, WP6, Arica

WP1 = Valparaiso

WP2	32° 57.844’S, 71° 38.665’W;	
WP3	29° 50’ 31”S, 75° 27’ 5.64”W	Depart Chilean waters
WP4	28° 28’ 9.84”S, 75° 56’ 57.27”W	Enter Chilean waters
WP5	23° 26’ 37.75”S, 82° 07’ 9.26”W	Depart Chilean waters
Stratus 13		
Stratus 12		
Stratus 12 buoy intercept		
DART 32412		
WP6	18° 32’ 31.46”S, 73° 49’ 37.91”W	Enter Chilean waters

Arica

Transit distances:

Valparaiso (WP1) to WP2:	11.6 nm	sum
WP2 to WP3:	271.7 nm	283.3 nm
WP3 to WP4:	86.0 nm	369.3 nm
WP4 to WP5:	450.4 nm	819.7 nm
WP5 to S12:	275.7 nm	1095.4 nm
S12 to S12buoy	564.4 nm	1659.8 nm
S12buoy to DART:	133.0 nm	1792.8 nm
DART to S13	129.8 nm	1922.6 nm
S13 to S12	77.2 nm	1999.8 nm
S12 to WP6:	718.6 nm	2718.4 nm
WP6 to Arica:	199.2 nm	2917.6 nm

Cruise Plan (Draft)

Day -8 Feb 17, ship arrives Valparaiso, Chile

Day -7, -6 Feb 18-19, in port, loading Stratus

Day -5 to -1 Feb 20-24, in port, preparing Stratus 13 on board *R. H. Brown*

Day 0 Feb 25, 0800 l, depart Valparaiso, Chile

Day 1 Feb 26, northwest toward Stratus 12b, transit at 11.5 kts
~0900 l arrive WP3, depart Chilean waters, Argo floats and drifters
per Tables 1 and 2, underway oceanography and meteorological obs
~1700 l arrive WP4, enter Chilean waters

Day 2 Feb 27, heading northwest to Stratus 12b
while underway Argo floats and drifters
per Tables 1 and 2, underway oceanography and meteorological obs

Day 3 Feb 28, heading northwest to Stratus 12b, Argo floats and drifters
per Tables 1 and 2, underway oceanography and meteorological obs,
while underway Argo floats and drifters per Tables 1 and 2

Day 4 March 1, heading northwest to Stratus 12b
while underway Argo floats and drifters per Tables 1 and 2,
~0800 l, WP5, depart Chilean waters,

Day 5 March 2, heading northwest to Stratus 12b
while underway Argo floats and drifters per Tables 1 and 2,
~0800l, pass over S12 anchor site

Day 6	March 3, heading northwest to Stratus 12b while underway Argo floats and drifters per Tables 1 and 2
Day 7	March 4, ~0800 l intercept S12buoy, recover; ~1600 l, underway to DART
Day 8	March 5, ~0400 l, talk to DART release; ~0800 l recover BPR, deploy BPR, deploy surface mooring; verify DART operations; ~2200 l depart for Stratus 13 anchor site
Day 9	March 6, ~0800 l, at target Stratus 13 anchor site, test releases, verify Bottom depth; deploy Stratus 13, anchor survey, verify operation, two deep CTDS
Day 10	March 7, recover Stratus 12 bottom part starting after breakfast
Day 11	March 8, stand by Stratus 13, ship-buoy comparisons, Near-surface array deployed
Days 12	March 9, stand by Stratus 13, ship-buoy comparisons, Near-surface array deployed
Day 13	March 10, finish Stratus operations, confirm function ~2120 l, depart, headed east to Arica at 11 kts, Argo floats and drifters per Tables 1 and 2, underway oceanography and meteorological obs
Day 14	March 11, heading east to Arica, Argo floats and drifters per Tables 1 and 2, underway oceanography and meteorological obs
Day 15	March 12, east to Arica, Argo floats and drifters per Tables 1 and 2, underway oceanography and meteorological obs
Day 16	March 13, ~1400 l, WP6, enter Chilean waters, heading east to Arica, Chile
Day 17	March 14, ~0800 l, enter Arica, Chile, unload WHOI and DART gear; All sampling stops 3 nm offshore
Day 18	March 15, all gear off

Table 1: Argo float deployments

Argo floats to be dropped nominally at these locations; deploy when these longitudes reached.

Argo float	Latitude	Longitude
1	29.0°S	73.3W
2	27.7°S	74.9°W
3	26.0°S	77.2°W
4	24.0°S	79.8°W
5	22.0°S	82.4°
6	20.0°S	85.0°W
7	19.3°S	78.66°W
8	18.7°S	73.22°W

An additional 7 floats to be deployed in eddies on transit from DART to Arica; positions to be determined from satellite data when there.

Table 2: Surface drifter deployments

Deploy 18 drifters during this leg; 9 to be deployed next leg. 1-13 along track at latitudes in table; 14-18, along track at longitudes in table.

Drifter	Latitude	Longitude
1	32°S	
2	31°S	
3	30°S	
4	29°S	
5	28°S	
6	27°S	
7	26°S	
8	25°S	
9	24°S	
10	23°S	
11	22°S	
12	21°S	
13	20°S	
14		84°W
15		81°W
16		78°W
17		75°W
18		72°W

B.   Staging and Destaging

The scientific equipment for this cruise will be loaded in Valparaiso, Chile immediately after the gear from the previous leg is unloaded. WHOI and NDBC personnel will complete preparations on board the *RH Brown.* 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.

Load summaries:

Weller/WHOI: In Valparaiso, 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. 15 surface drifters – 15x 30 lbs.

NOAA AOML: Surface drifters (27) were shipped to WHOI and will be loaded with the WHOI gear.

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

DART/NDBC: NDBC gear will be loaded in Valparaiso and stay on board, with no unload in Arica. To be loaded in Valparaiso gear including: 3,000 lb anchor, chain, nylon line, surface buoy, bottom pressure recorder (BPR), cables and electronics, acoustic release, deck gear, reel handling gear, tools, and miscellaneous supplies.

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: All WHOI gear will be unloaded in Arica for shipment back toWHOI. In Arica, we will offload: 1 WHOI 20 foot container with lab gear (12,000 lb); 1 WHOI 20 foot container with glass balls and mooring components (13,000 lb.)

We will remove the rest of the gear from the decks, including buoy, TSE winch, spare mooring components anchor, winching carts, etc. These items will be stuffed into two 40 foot containers that the agent will provide in Arica. Another 30,000 pounds.

DART/NDBC:
NDBC gear will be loaded in Valparaiso and stay on board, with no unload in Arica.

C. Operations to be Conducted

1. Station Operations

Release Tests
At a convenient time during the transit to the Stratus 13 site *Ronald H. Brown* will stop and hold station to allow the science party to perform release tests. If possible 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 12 (in the water now, to be recovered), and Stratus 13 (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 13 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 13 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 13 Buoy)
Ronald H. Brown will establish and hold a position, with bow into the wind, approximately 0.5 nm downwind of the Stratus 13 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. Prior to the inter-comparison period, two CTD casts to 4,000 m will be made with the WHOI CTD. 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 CST's workload. Also, during work around the surface buoys, floats with temperature sensors will be deployed near to or tethered to the surface buoys to validate the sea temperature measurements made by the buoys.

Near-surface Array Deployment
A small surface float will be used to support a string of thermistors chains with two small Acoustic Doppler Current Profilers (ADCPs) attached. This floating array will be deployed from the small boat and tied off to the Stratus 13 surface buoy for one to several days while the *Ronald H. Brown* is conducting ship vs buoy comparisons at Stratus 13. Should the *RH Brown* CTD be available with oxygen sensor, we would make two CTD casts with this instrument to 1,500 m at Stratus 13.

Stratus 12 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.

On this cruise we will go first for the drifting surface 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.
Later in the cruise, when we return to the Stratus 12 anchor site, the ship is positioned downwind of the surface mooring (in this case it will be the lower part of the mooring that has fallen to the sea floor) while the acoustic release is fired. When the glass ball floatation surfaces, the ship approaches the balls. If weather conditions permit, the small boat is launched to attach a recovery line to the balls. Otherwise, they are grabbed using a hook or grapnel. A strong hook and pennant is used to secure the floatation cluster to the mooring winch line. Once secure, the ship steams beyond 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. At this stage, the mooring line above the floats is stopped off and secured. The acoustic release, on the other end of the cluster, is pulled up the transom and removed from the mooring.

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.

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 18 drifters. Deployment points to be set by AOML and the Chief Scientist. Deploy 18 drifters during this

leg; 9 to be deployed next leg. 1-13 along track at latitudes in table; 14-18, along track at longitudes in table.

Drifter	Latitude	Longitude
1	32°S	
2	31°S	
3	30°S	
4	29°S	
5	28°S	
6	27°S	
7	26°S	
8	25°S	
9	24°S	
10	23°S	
11	22°S	
12	21°S	
13	20°S	
14		84°W
15		81°W
16		78°W
17		75°W
18		72°W

Argo float deployments

Eight Argo floats have been provided from the WHOI group involved in the Argo float program. The floats will be deployed while the ship is underway. Argo floats to be dropped nominally at these locations; deploy when these longitudes reached. The Argo science team is looking at our revised cruise track and considering altering these locations to take advantage of the extension of the track to the northwest to catch the drifting Stratus 12 buoy.

Argo float	Latitude	Longitude
1	29.0°S	73.3W
2	27.7°S	74.9°W
3	26.0°S	77.2°W
4	24.0°S	79.8°W
5	22.0°S	82.4°
6	20.0°S	85.0°W
7	19.3°S	78.66°W
8	18.7°S	73.22°W

An additional 7 Argo floats with oxygen sensors have been provided by Dr. Lothar Stramma of GEOMAR, Kiel, Germany. These are to be deployed in eddies to be found in the vicinity of the Stratus moorings. Stramma will be looking at satellite data as the ship approaches the region and provide guidance on where to deploy these floats.

Operations at the NOAA NDBC DART buoy

This procedure serves as a consolidated location for both deployment and recovery procedures. Each section title is prefixed with either “Deployment-“ or “Recovery-“ to indicate which operation the steps apply to.

NDBC is responsible for the establishment and maintenance of the DART network and for accurate and timely metadata collection. This instruction details how to deploy DART II buoys and BPRs and can be used for multiple deployments on a single cruise. Note that for deployment and recovery operations a standard data sheet will be supplied with the FSP (Field Service Plan).

The recovery steps in this procedure are organized into three sections dealing with recovering the buoy, recovering the BPR and recovering the BPR data. These steps do not necessarily have to occur in order, but should be completed at the first opportunity. The BPR must be recovered before recovering BPR data. All times in this procedure require a time and date in GMT. The date can often change during an operation and needs to be considered. Use a GPS enabled device to get the time. An alternate method is to verify the time by calling the automated Time-of-Day Service provided by NIST. The numbers are **(303) 499-7111** (Colorado), or **(808) 335-4363** (Hawaii).

Depth Corrections

Echo soundings measure ocean depth by sending an audible ping and measuring the return time of the ping echo. A depth is calculated based on this return time and often by assuming a constant 1500 meters/second for the speed of sound. However, the speed of sound is not constant due to pressure, temperature and salinity variations in the water column. Typically, for shallow depths, these variations are minor and can be ignored. However for the deep ocean, these variations will cause a significant error if a constant speed of sound is assumed. Therefore, echo sounding depths must be converted to corrected depths using Echo-Sounding Correction Tables (aka Carter tables). These depth corrections are required for proper calculation of mooring length.

Carter Tables include a series of maps that divide the world’s oceans into a series of defined areas. Each area is assigned an area number and has a unique correction table associated with it. To obtain a corrected depth for an observed depth, the first step is to determine which area the observed depth was measured. Next, the corresponding area’s correction table is used to find the corrected true depth. Software called “CARTERGO” is used to automatically convert uncorrected water depth at a given latitude and longitude to a corrected water depth.

Deployment- Site Preparation Prerequisites

Prior to arriving on site for deployment, the leading NDBC ET (Electronics Technician), shall record the buoy hull number and all items with control numbers for both the buoy and BPR. Complete the Buoy Data section. Indicate the section type, fishbite type and buoy paint color. Complete the BPR Data section. Indicate the Firmware version, C34 Capacitors, O-rings, Battery diodes and BPR cable status.

While in transit, a call shall be placed to the MCC (Mission Control Center) to report which buoy, BPR, and electronics will be deployed at a particular station. During this call, an estimated time for deployment shall also be reported. The leading ET is responsible for ensuring that the buoy and BPR are powered on, programmed, and ready for deployment. The leading ET will also ensure, via the MCC, that the buoy and BPR are in Test Mode.

Finally, the deployment team including the appropriate ship's crew shall meet to discuss a plan of action for the upcoming deployment. At this time, a deck lead will be determined, which is typically the leading DART MT.

Deployment- Buoy Start Up Procedure

This must be performed for both the primary and secondary buoy payloads. The buoy must be powered up by connecting power sources to equipment in a certain sequence. First connect the Iridium power. Next connect the AM power. Finally connect the Buoy Payload (CPU) power. Configure the Buoy Payload. Power up BPR and configure.

Deployment-Buoy Deployment Preparation

Upon arriving at the designated area for deployment, a survey of the ocean floor will be conducted. This will be done to determine the depth and the layout of the bottom. Following the bottom survey, a mooring calculation will be performed by the leading MT. The water depth used in the calculation shall be the smallest of the survey depth, chart depth or BPR depth. These calculations are done to determine the total length of mooring nylon line that will be used.

Note that water depth from surveys and charts in these calculations should be the corrected water depth using Echo-Sounding Correction Tables (aka Carter Tables). Use the CARTERGO software to convert the observed uncorrected depth to the corrected depth. If using BPR depth, Carter Tables should not be used.

Position and secure the buoy directly beneath the block on the A-frame (or other lifting equipment that will be used to deploy the buoy) with the buoy bridle facing the stern of the vessel. Attach the upper mooring chain to the buoy. If necessary, set up a reel stand to the side of the ship's capstan creating approximately a 90º angle of the reel stand, capstan and ship's A-frame. Wrap the fishbite rope around the capstan and fake out excess line on deck for buoy deployment. Attach the fishbite rope to the upper mooring chain with shackle and lead through an open block mounted to the ship in line with the capstan and A-frame block.

Secure one end of a 2-ton capacity (minimum) lifting sling in the fixed upper shackle of the quick –release, feed it through the teacup handle on the buoy's mast and secure the other end in the quick-release mechanism. If a sling is not available, a 3/4" eye-spliced piece of nylon may be attached to the teacup handle on the buoy's mast for deployment.

Attach at least two tag lines to the buoy mast, one on each side of the lift point and rigged to allow easy removal when buoy is set in the water. The handling end of the tag lines should have at least one turn around a rigid deck fitting.

Deployment-Buoy Deployment Operations

NOTE: The deck lead will give all commands during buoy operations. He must be listened to at all times.

NOTE: If the vessel has Dynamic Positioning (DP) do not engage it during buoy deployment

If speed and direction of oceans currents are known, position the vessel at two times (or more) the desired buoy anchor drop point water depth in the down-current direction. (example: if water depth 3800m then position vessel at 7600m or more up-current). Turn vessel heading back to the desired buoy anchor drop point. If speed and direction are NOT known, position the vessel at two times (or more) the desired buoy anchor drop point water depth in any direction from the desired buoy anchor drop point (example: if water depth is 3800m then position the vessel at 7600m or more away in any direction). Turn vessel heading back toward the desired buoy anchor drop point.

The deck lead directs the lifting equipment operator to take a strain on the buoy and to take the slack out of tag lines. The deck lead directs removal of the buoy tie-downs. The deck lead directs the lifting equipment operator to begin slowly lifting the buoy over

Once the buoy has been lowered into the water, remove all tag lines. Trip the quick-release to free the buoy. The ship will begin to move away from the buoy and transit at 1KT speed toward the drop point while deploying line in a systematic and consistent manner. If the vessel cannot go as slow as 1KT then go as slow as possible and pay out line at faster rate. When the buoy is in a position behind the ship, begin paying out line using the capstan to feed the line. The ship shall slowly steam ahead at an appropriate speed and direction.

After the fishbite rope is almost completely deployed, secure it by wrapping it around the capstan several times and stopping the capstan. Attach the upper mooring nylon rope to the fishbite rope using a 7/8" shackle connected to the fisfishbite end and a 1" safety anchor shackle connected to the upper nylon line. Begin feeding out the upper mooring nylon line. Keep mooring line taut and off the deck. Monitor

Begin feeding out the upper mooring nylon line. Keep mooring line taut and off the deck. Monitor line measurement points to ensure that anchor drop point is not reached before all mooring line is fully paid out. Following the upper mooring nylon line are the 3/4" NEV spools. These spools are connected using 5/8" safety anchor shackles. The number of these spools used depends upon the water depth and the number to be spooled will have been determined before the deployment.

Following the deployment of the NEV spools, will be the EV spool. The length of line needed, which was previously determined, will be cut and an eye splice performed. Overshoot beyond the selected drop coordinates by 10-15% of the water depth (ex: for 3800m depth => 380-570m) for anchor drop location. Remove the mooring line from the open or fair lead of the ship. Secure the mooring line off to the ship for towing buoy. Attach the pear link on the anchor chain to the crane. Attach tag lines to each anchor for handling. Use the crane and tag lines to move anchor into position for deployment. This will most likely be done off the stern of the ship. Remove the anchor from the crane. Attach the release mechanism to the pear link on the anchor chain.

Attach the A-Frame wire rope hook (or other lifting equipment that will be used to deploy the anchor) to the release mechanism.

Once the ship has arrived at the determined drop location, obtain slack in the mooring line and attach EV eye splice to anchor chain using a 5/8” safety anchor shackle. Lower the anchor into the water using the A-frame. As the anchors are being lowered, the rope on the release mechanism shall be tied off to a cleat on the deck of the ship. Upon further lowering, the weight of the anchors will trip the release mechanism. Allow one hour for the mooring to settle. After the buoy has settled, annotate Att. A with the deployment time, position and water depth used.

Deployment- Bottom Pressure Recorder (BPR) Deployment Preparation

NOTE: If the vessel has Dynamic Positioning (DP) do not engage it during BPR deployment

Move the platform into position for deployment underneath the block of the A-frame (or other lifting equipment that will be used to deploy the BPR). Remove the mooring floats from their cage and place them in a line on the deck of the ship with the top float closest to the stern. Attach the top float to the second float using the 10 meter piece of yalex rope and .” safety anchor shackles. Attach all remaining floats using the 3/4” diameter, 3 meter long pieces of nylon rope. Paired floats will have 1/2”, 1 meter long pieces of chain attached with u-bolts.

Complete assembly of the BPR mooring in accordance with the mooring diagram supplied in the FSP. Attach the A-Frame (or other lifting equipment that will be used to deploy the BPR) hook to the release mechanism. The tag lines shall still be attached to the BPR anchor and rigged for easy removal after the BPR is outboard of the ship. The lead technician and the ship’s captain shall predetermine the desired coordinates.

The goal is to place the BPR unit as close to the buoy anchors as possible. Begin evolution at 500m away from the BPR drop point heading. Start at 500m down-current heading up-current if current is known. Start at any location 500m away from drop point if current is unknown. Begin dropping BPR floats at the 500m point and carefully pay them out. If current direction is known, then overshoot the drop point by 100m for BPR drop point. If current direction is not known, then BPR platform drop point will be exactly on BPR coordinates.

Deployment- Bottom Pressure Recorder Deployment Operations

When the ship is in position for the drop, the deck lead will give the A-Frame (or other lifting equipment that will be used to deploy the BPR) operator the command to begin lifting the unit. Once the unit is lifted approximately 5” off the deck, the lead will give the operator the command to move the BPR outboard of the ship. Once the unit is a safe distance away from the ship, the lead will give the operator the command to begin lowering the unit. As the unit is being lowered, the release mechanism rope shall be tied off to a cleat on the deck of the ship. The weight of the unit will trip the release. After the BPR is released, annotate forms with the time, position, depth for this BPR deployment.

Deployment- Post-Deployment Operations (Field Technicians, DART Supervisor, MCC and IT(Information Technology))

Immediately after the release of the BPR, the lead Field Technician shall contact the MCC at Stennis Space Center to inform them of the deployment. (011-228-688-3593 or 011-228-688-3716) Once the BPR touches bottom, note with the amount of time needed to reach the bottom. The DART Supervisor, Field Technician, or MCC will monitor the "deployment mode" data being received from the station. In addition, the output of the BPR Tilt Sensor will be monitored to determine BPR orientation on the ocean floor. If either the horizontal X or Y angles with the ocean floor exceed 10 degrees, the BPR shall be recovered and redeployed, if feasible. The DART Supervisor or MCC can release the deployment team from site following the first transmitted block of six hour data. The hourly data block is the second test to ensure functionality. Hourly data can also be verified prior to a six hour transmit through the "Standard Message" command.

After receiving the first six hours of the hourly data block, a "get engineering data" command shall be issued by the MCC. This command can be given any time after the deployment. This is thefirst test to ensure functionality of the system. After a 36-48 hour monitoring period by the DART Supervisor and the MCC, following the unit settling back into normal data logging mode, the system can be taken out of Test Mode and be released to the NDBC website as operational.

Upon return to NDBC, the Chief Scientist or Lead Technician for the deployment will review the completed forms for accuracy, make corrections, and will forward any corrected copies to and notify the MCC of any changes or that the entries are accurate. Upon receipt of the notification of the Chief Scientist's accuracy of the documentation, the SDAC (Science and Data Assembly Center) Manager will certify that all entries have been accurately entered into the appropriate databases.

Recovery- Buoy Recovery Operations

Move the ship to the last know position of the buoy.

The recovery team including the appropriate ship's crew shall meet to discuss a plan of action for the recovery. A deck lead shall be determined at this time, which is typically the leading DART MT.

Locate the buoy and move the ship into position for recovery, usually along side.

Attach a lifting line to the teacup handle of the buoy. A buoy hooker may be use to pass a small messenger line through the handle. The messenger line may be used to pull a 2-ton capacity lifting sling or .'' piece of nylon through the handle. Depending upon sea conditions, the deck lead may decided to perform this operation from a small boat.

Attach two tag lines to the buoy mast on each side of the lift point to guide it safely onboard. Lift the buoy and place it on deck and secure both mooing chain and buoy. Place the buoy with the bridle facing stern leaving enough work room between bridle and the end of the deck. Detach the upper mooring chain from the buoy. The upper mooring components should be inspected if the mooring is to be used for the next deployment.

Recovery- Buoy Post Recovery

After the buoy is brought on board, check for damage to the buoy hull or other buoy structure. Note condition of buoy and annotate Att. A. Photograph any damaged components. If this system has failed at sea, keep all part (cables, LRUs, etc.) from the failed system together for a "postmortem" forensic analysis. Tag and label the equipment with the word “Postmortem”. Gas test the buoy according to any applicable procedure. Open buoy and inspect for water intrusion or other damage. Measure the battery voltages of the Iridium, CPU and Acoustic Modem battery packs.

Recovery- BPR Recovery Operations

Move the ship to the last known position of the BPR. The recovery team including the appropriated ship’s crew shall meet to discuss a plan of action for the recovery. A deck lead shall be determined at this time, which is typically the leading DART MT. Notify the MCC at least one hour prior to beginning the BPR recovery. Using the Acoustic Release Deck Set with transducer extended below sea surface, signal the BPR’s acoustic release. Use the ranging capabilities of the deck set to position the ship directly over the BPR.

Send the release code and note that the confirmation tones are returned. Continue to monitor the BPR ascent by ranging on the release. The MCC may also monitor and confirm the ascent if an active buoy is deployed on location. The ship should continue to hold position while the BPR ascends. Estimate the time expected for the floats to reach the surface and alert the ship’s crew for lookout.

Locate the BPR floats and move the ship into position for recovery. Normally the upper two of the five pairs of glass floats will be visible on the surface. Use a grapple hook to attach the float mooring to the A-Frame (or other lifting equipment). During recovery, keep the lifting equipment extended over the water to prevent the BPR mooring from chafing along the back of the ship. Beginning with the upper floats, lift each float onto the deck and secure that section of mooring until the BPR can be lifted on deck. Failure to keep the mooring secure until the BPR is on deck can result in the loss of the BPR. When the BPR is at the surface and can be lifted above deck, attach two tag lines to the mooring to guide the BPR safely onboard.

Recovery- BPR Post Recovery

After the BPR is brought on board, check for damage. Note condition and annotate Att. A. Photograph any damaged components. If this system has failed at sea, keep all part (cables, LRUs, etc.) from the failed system together for a "postmortem" forensic analysis. Tag and label the equipment with the word “Postmortem”.

Briefly remove the plugs on the battery canisters to release any built up gas. Then replace plugs. Connect to BPR CPU with a PC and check the time against GMT time. Also, measure the ambient temperature and pressure while taking this measurement. Measure the battery voltages of BPR battery packs. Disconnect from the BPR and complete the remainder of the recover log as information becomes available.

Recovery- BPR Data Recovery

The BPR CPU canister contains valuable data on an internal flash card. To protect the data and to ensure it will be properly recovered, recommended procedures should be followed.

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. For calibration purposes it is essential that bottom tracking be activated at the start and end of a cruise when in water depths shallower then 500m. The ship's Electronics Technician will be in charge of data storage (hard drive to disks and/or CD's as necessary). The ADCP will be interfaced to the ship's GPS receiver and will receive data at one-second intervals. The clock on the ADCP IBM computer will NOT be reset while underway.

Ship's ET will select proper GPS codes to enable ADCP navigation data collection. The ADCP will be interfaced with the ship's gyro so that accurate heading information is available to the ADCP. The Chief Survey Technician (CST) will log a manual comparison of the ADCP heading/gyro reading while the ship is dockside at the beginning of a cruise. For calibration purposes, "Bottom Tracking" should be activated whenever the ship is transiting water shallower than 500m.

SST and SSS: Sea surface temperature and salinity will be recorded continuously, using the installed SEABIRD SBE-21. Data from the TSG will be recorded to SCS and translated to ASCII. The CST 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 13 site, a bottom survey will be performed using SeaBeam to map an area centered near 19° 41.4783'S, 85° 34.0093'W (-19.6913, -85.5668). Cruising speed, leg length, and leg spacing will be adjusted as needed to ensure adequate data overlap and good system performance.

3. Small Boat Operations

The ship's small boat (RHIB) will be required during Stratus 12 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 13 mooring after its deployment will be required. In addition the small boat will be used to deploy and recover the near-surface array to be tethered to the Stratus 13 buoy for one to several days.

D. Dive Plan

All dives are to be conducted in accordance with the requirements and regulations of the NOAA Diving Program (http://www.ndc.noaa.gov/dr.html) and require the approval of the ship's Commanding Officer.

No diving planned.

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.

The plan to deploy and recover the near surface array may need to be adjusted, giving up on the plan to tether to the surface buoy should swell and sea state preclude small boat operations.

III. Equipment

A. Equipment and Capabilities provided by the ship

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

GPS Navigation

Navigation information will be recorded in the Marine Operations Abstract (MOA - OSC Worksheet 001). All entry will be recorded as significant operations occur, at the time the ship changes course or speed while underway in open water, and at least once every 4-hour watch. 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.

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 SCS manager will archive data files to a secondary system to reduce the chances of data loss. Data will be archived to CD's 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

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
NDBC work area		Hydro	2
WHOI workstations		Main	20

Two thirds of main lab allocated to WHOI for instrument staging, preparation, data downloading, data analysis, remaining space in main lab allocated to a Chilean Observer if appointed by Chile and the Universidad de Concepcion students. Main bench in hydro lab (aft, port) for NDBC. 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), <u>not</u> 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 PMEL flux buoy 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 CST will archive data from disk to tape (or CD) for 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 13 science party.		
Group	Space	Usage
WHOI	Main Lab	16 laptop PCs/Macs
Chilean Navy Hydrographic and Oceanographic Service	Science Lab	1 PC(laptop)
Universidad de Concepcion	Science Lab	3 PC (laptop)
NDBC	Hydro Lab	2 PC (laptop)

<u>IT Security</u>: 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:

<u>Group</u>	<u>Space</u>	<u>Usage</u>
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.

If the ship's CTD is available with an oxygen sensor, a cast will be done by each of the moorings to calibrate oxygen sensors.

B. Equipment and Capabilities provided by participants

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 ?? for summary listings)
WHOI: Miscellaneous lab supplies, paints, batteries for instruments; see Appendix ??.

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.

B. RADIOACTIVE ISOTOPES

None.

V. ADDITIONAL PROJECTS

Any additional work will be subordinate to the primary project and will be accomplished only with the concurrence of the Commanding Officer and the Chief Scientist, on a not-to-interfere basis with the programs described in these instructions.

A. Supplementary ("Piggyback") projects:

NOAA AOML Surface Drifters

As discussed above the science party of the Stratus 13 cruise will deploy 18 surface drifters fro NOAA AOML.

Argo Floats
As discussed above the science party of the Stratus 13 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 CO_2 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 Chief 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 CO_2 in surface water (pCO_2). This work is a collaborative effort between the CO_2 groups at AOML and PMEL.

Rationale: Current estimates of anthropogenic CO_2 uptake by the oceans range from 1 to 2.8 Gigatons per year. The CO_2 fluxes between air and water are poorly constrained because of lack of seasonal and geographic coverage of delta pCO_2 (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 pCO_2 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 pCO_2 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 pCO_2, 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. 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

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)

NDBC DART *mooring:* the DART mooring is primarily a tsunami warning or DART buoy. It measures bottom pressure and alerts for the passage of tsunamis. The bottom package communicates acoustically to the surface mooring, which in turns uses satellite telemetry to pass on the alert.

WHOI mooring: the WHOI surface mooring is heavily instrumented to collect surface meteorology and ocean temperature, salinity, oxygen, clorophyll, 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) Marine Operations Abstracts
2) CTD digital tape recordings and log sheets
3) ADCP digital recordings
4) Marine weather observation logs
5) Calibration information for ship's salinometer and thermosalinograph
6) SCS data on CD-ROM

Marine Observation Log:
A Marine Operations Abstract (MOA) form will be maintained by the bridge watch 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

At present, a paper form (hard copy) MOA is the most secure method for ensuring that these data are recorded and preserved. However, a secure electronic version could be used to replace the paper MOA.

VII. Meetings, Vessel Familiarization, and Project Evaluations

A. Pre-Project Meetings:
Prior to departure, the Chief Scientist will conduct a meeting of the scientific party to train them in sample collection and inform them of procedures and policies, required equipment, planned operations, concerns, and establish mitigation strategies for all concerns. The ship's Operations Officer will assist the Chief Scientist in arranging this meeting.

B. Vessel Familiarization Meeting:
Some vessel protocols, e.g., meals, watches, etiquette, etc. will be presented by the ship's Operations Officer within 24 hours of the project's start

C. Post-Project Meeting:
Upon completion of the project, a meeting will normally be held at 0830 (unless prior alternate arrangements are made) and attended by the ship's officers, the Chief Scientist and members of the scientific party to review the project. Concerns regarding safety, efficiency, and suggestions for improvements for future projects should be discussed. Minutes of the post-project meeting will be distributed to all participants by email, and to the Commanding Officer and Chief of Operations, Marine Operations Center.

D. Project Evaluation Report:
Within seven days of the completion of the cruise, a Ship Operation Evaluation form is to be completed by the Chief Scientist. The preferred method of transmittal of this form is via email to OMAO.Customer.Satisfation@noaa.gov . If email is not an option, a hard copy may be forwarded to:

Director, NOAA Marine and Aviation Operations
NOAA Office of Marine and Aviation Operations
8403 Colesville Road, Suite 500
Silver Spring, MD 20910

Foreign Research Clearance Reports
A request to conduct Marine Scientific Research in foreign waters (Colombia, Ecuador, Peru and Chile) has been submitted by the Marine Operations Center Norfolk to the U.S. Department of State on behalf of the Chief Scientist. Copies of clearances received will be provided to the CO before departure. The Chief Scientist is responsible for satisfying the post-cruise obligations associated with diplomatic clearances to conduct research operations in foreign waters. These obligations consist of (1) submitting a "Preliminary Cruise Report" within 30 days following the completion of the cruise, (2) ultimately meeting the commitments to submit data copies of the primary project to the host foreign country, and (3) satisfying any additional reporting requirements stipulated in the final research clearance. All obligations should be submitted via Wendy Bradfield-Smith at Marine Operations Center, Atlantic, for forwarding to the Department of State (telephone 757.441.6172 or e-mail Wendy.Bradfield-Smith@noaa.gov).

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 survey.

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 7, 1999 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, Revised: 02 JAN 2012) 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. The completed form should be sent to the Regional Director of Health Services at Marine Operations Center. The participant can mail, fax, or scan the form into an email using the contact information below. The NHSQ should reach the Health Services Office no later than 4 weeks prior to the project to allow time for the participant to obtain and submit additional information that health services might require before clearance to sail can be granted. Please contact MOC Health Services with any questions regarding eligibility or completion of the NHSQ. Be sure to include proof of tuberculosis (TB) testing, sign and date the 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.

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
E-mail 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

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. Steel-toed shoes are required to participate in any work dealing with suspended loads, including CTD deployments and recovery. The ship does not provide steel-toed boots. Hard hats are also 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.

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 e-mail 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 it must be arranged at least 30 days in advance.

E. IT Security

Any computer that will be hooked into the ship's network must comply with the *NMAO 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 these 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

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 (FRNS) 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 NMFS Deemed Exports 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, it must also be sought and approved for the dates of any DOC facilities (marine centers or port offices) that foreign nationals might have to traverse to 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 e-mail generated by the FRNS granting approval for the foreign national guest's visit. This e-mail 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 Regional Security Officer.
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:

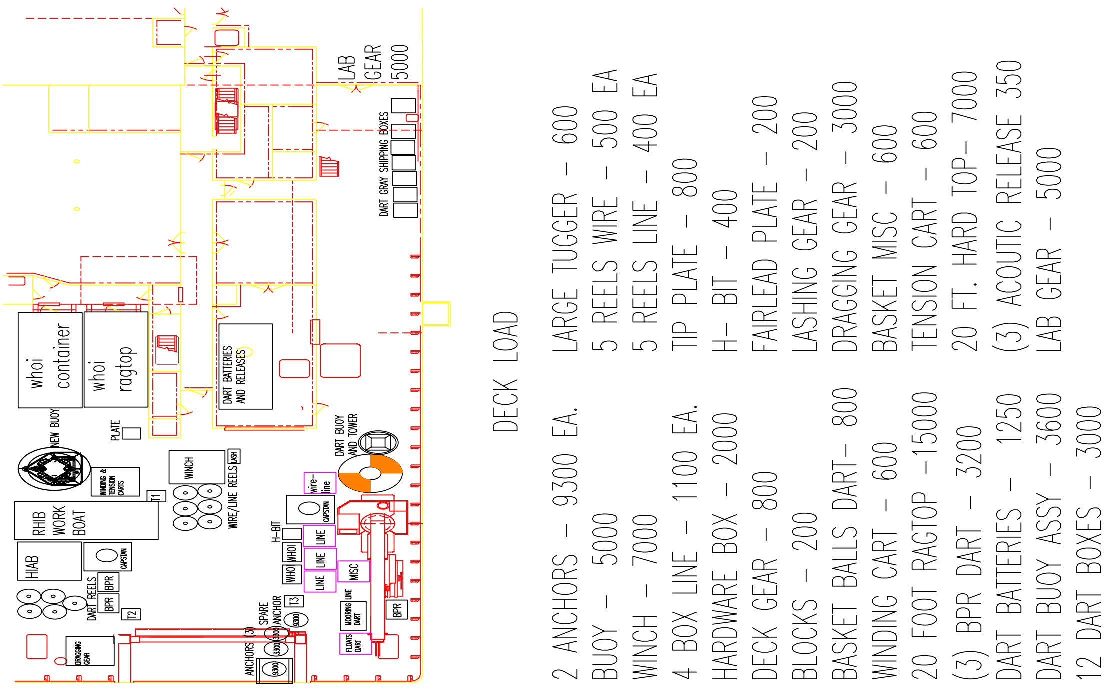
1. Ensure only those foreign nationals with DOC/OSY clearance are granted access.
2. Deny access to OMAO platforms and facilities by foreign nationals from countries controlled for anti-terrorism (AT) reasons and individuals from Cuba or Iran without written NMAO approval and compliance with export and 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 FRNS e-mail 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 Regional Security Officer.

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, 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

9.0 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. Total (WHOI plus NDBC) deck load is estimated at 88,700 lbs.. (Proposed deck layout shown below.)



WHOI Vans:

2 WHOI vans will be loaded in Valparaiso 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:

Proposed deck layout.

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
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

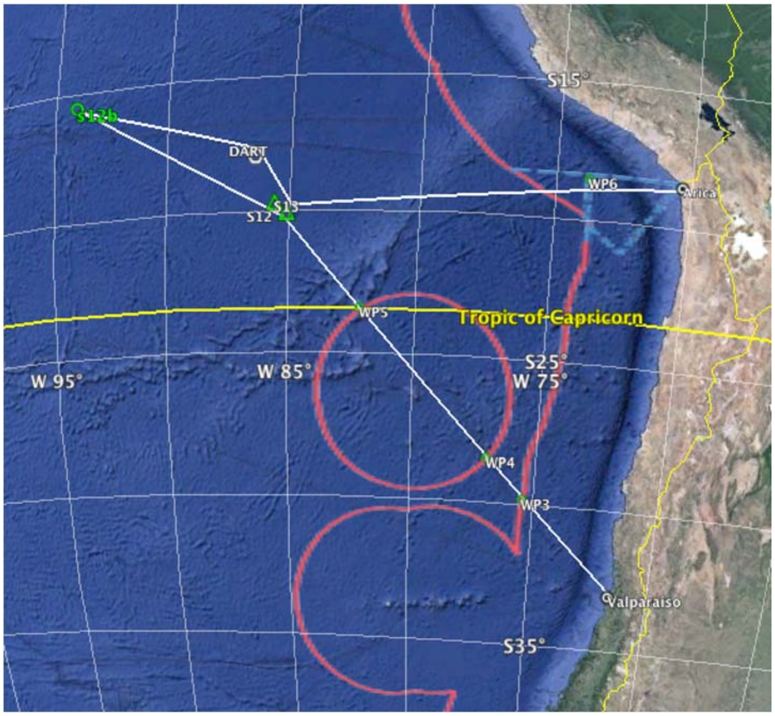


Figure B1. Planned cruise track for 2013 Stratus ORS and DART cruise. The white line is the cruise track while the red lines are EEZ boundaries.

Key Locations and Transit Distances

Port of origin: Valparaiso, Chile 33° 0.0'S, 71° 34' 59.88"W (-33.0, -71.5833)

WHOI Stratus 12 site: 19° 56.332'S, 85° 17.594'W (-19.9389, -85.29323)

WHOI Stratus 12 buoy: estimated intercept of drifting buoy 15°36.094'S, 94° 01.817'W (-15.6015, -94.0302)

WHOI Stratus 13 site: 19° 41.4783'S, 85° 34.0093'W (-19.6913, -85.5668)

DART 32412 site: 17° 58' 30"S, 86° 23' 30"W (-17.975, -86.392)

Port for end of cruise: Arica, Chile 18° 32.0' S, 70° 20.0'W (-18.4833, -70.3333)

Way points:

Valparaiso (WP1), northwest to Stratus ORS (WP2, WP3, WP4, WP5), Stratus 13, Stratus 12, DART, WP6, Arica

WP1 = Valparaiso
WP2   32° 57.844'S, 71° 38.665'W;
WP3   29° 50' 31"S, 75° 27' 5.64"W   Depart Chilean waters
WP4   28° 28' 9.84"S, 75° 56' 57.27"W   Enter Chilean waters
WP5   23° 26' 37.75"S, 82° 07' 9.26"W   Depart Chilean waters
Stratus 13

Stratus 12
Stratus 12 buoy intercept
DART 32412
WP6 18° 32' 31.46"S, 73° 49' 37.91"W Enter Chilean waters
Arica

Transit distances:

Valparaiso (WP1) to WP2:	11.6 nm	sum
WP2 to WP3:	271.7 nm	283.3 nm
WP3 to WP4:	86.0 nm	369.3 nm
WP4 to WP5:	450.4 nm	819.7 nm
WP5 to S12:	275.7 nm	1095.4 nm
S12 to S12buoy	564.4 nm	1659.8 nm
S12buoy to DART:	133.0 nm	1792.8 nm
DART to S13	129.8 nm	1922.6 nm
S13 to S12	77.2 nm	1999.8 nm
S12 to WP6:	718.6 nm	2718.4 nm
WP6 to Arica:	199.2 nm	2917.6 nm

Cruise Plan (Draft)

Day -8 Feb 17, ship arrives Valparaiso, Chile

Day -7, -6 Feb 18-19, in port, loading Stratus

Day -5 to -1 Feb 20-24, in port, preparing Stratus 13 on board *R. H. Brown*

Day 0 Feb 25, 0800 l, depart Valparaiso, Chile

Day 1 Feb 26, northwest toward Stratus 12b, transit at 11.5 kts
~0900 l arrive WP3, depart Chilean waters, Argo floats and drifters
per Tables 1 and 2, underway oceanography and meteorological obs
~1700 l arrive WP4, enter Chilean waters

Day 2 Feb 27, heading northwest to Stratus 12b
while underway Argo floats and drifters
per Tables 1 and 2, underway oceanography and meteorological obs

Day 3 Feb 28, heading northwest to Stratus 12b, Argo floats and drifters
per Tables 1 and 2, underway oceanography and meteorological obs,
while underway Argo floats and drifters per Tables 1 and 2

Day 4 March 1, heading northwest to Stratus 12b
while underway Argo floats and drifters per Tables 1 and 2,
~0800 l, WP5, depart Chilean waters,

Day 5	March 2, heading northwest to Stratus 12b while underway Argo floats and drifters per Tables 1 and 2, ~0800l, pass over S12 anchor site
Day 6	March 3, heading northwest to Stratus 12b while underway Argo floats and drifters per Tables 1 and 2
Day 7	March 4, ~0800 l intercept S12buoy, recover; ~1600 l, underway to DART
Day 8	March 5, ~0400 l, talk to DART release; ~0800 l recover BPR, deploy BPR, deploy surface mooring; verify DART operations; ~2200 l depart for Stratus 13 anchor site
Day 9	March 6, ~0800 l, at target Stratus 13 anchor site, test releases, verify Bottom depth; deploy Stratus 13, anchor survey, verify operation, two deep CTDS
Day 10	March 7, recover Stratus 12 bottom part starting after breakfast
Day 11	March 8, stand by Stratus 13, ship-buoy comparisons, Near-surface array deployed
Days 12	March 9, stand by Stratus 13, ship-buoy comparisons, Near-surface array deployed
Day 13	March 10, finish Stratus operations, confirm function ~2120 l, depart, headed east to Arica at 11 kts, Argo floats and drifters per Tables 1 and 2, underway oceanography and meteorological obs
Day 14	March 11, heading east to Arica, Argo floats and drifters per Tables 1 and 2, underway oceanography and meteorological obs
Day 15	March 12, east to Arica, Argo floats and drifters per Tables 1 and 2, underway oceanography and meteorological obs
Day 16	March 13, ~1400 l, WP6, enter Chilean waters, heading east to Arica, Chile
Day 17	March 14, ~0800 l, enter Arica, Chile, unload WHOI and DART gear; All sampling stops 3 nm offshore
Day 18	March 15, all gear off

Appendix C: WHOI Mooring Drawings

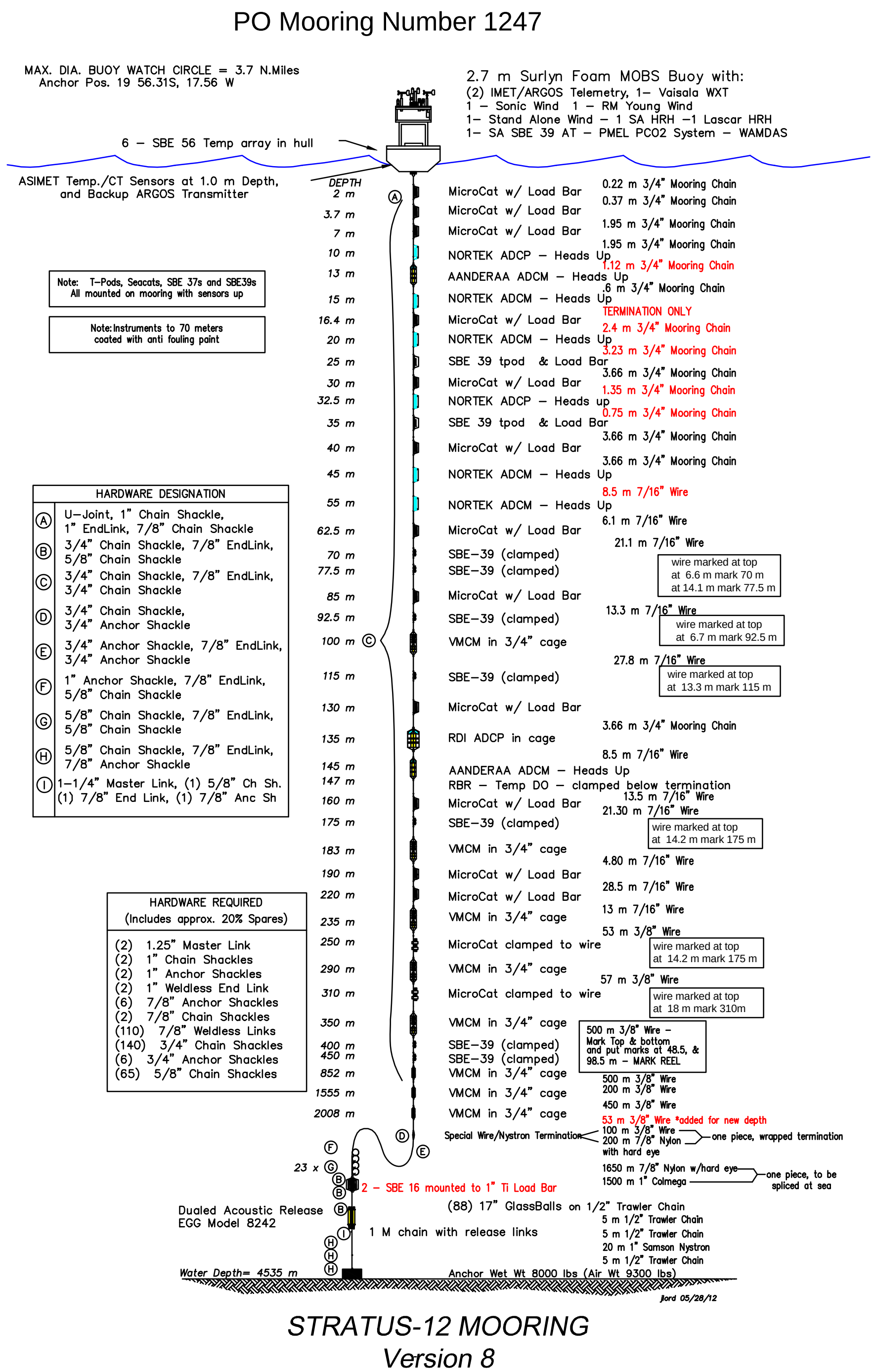


Figure C1. Diagram WHOI mooring to be recovered.

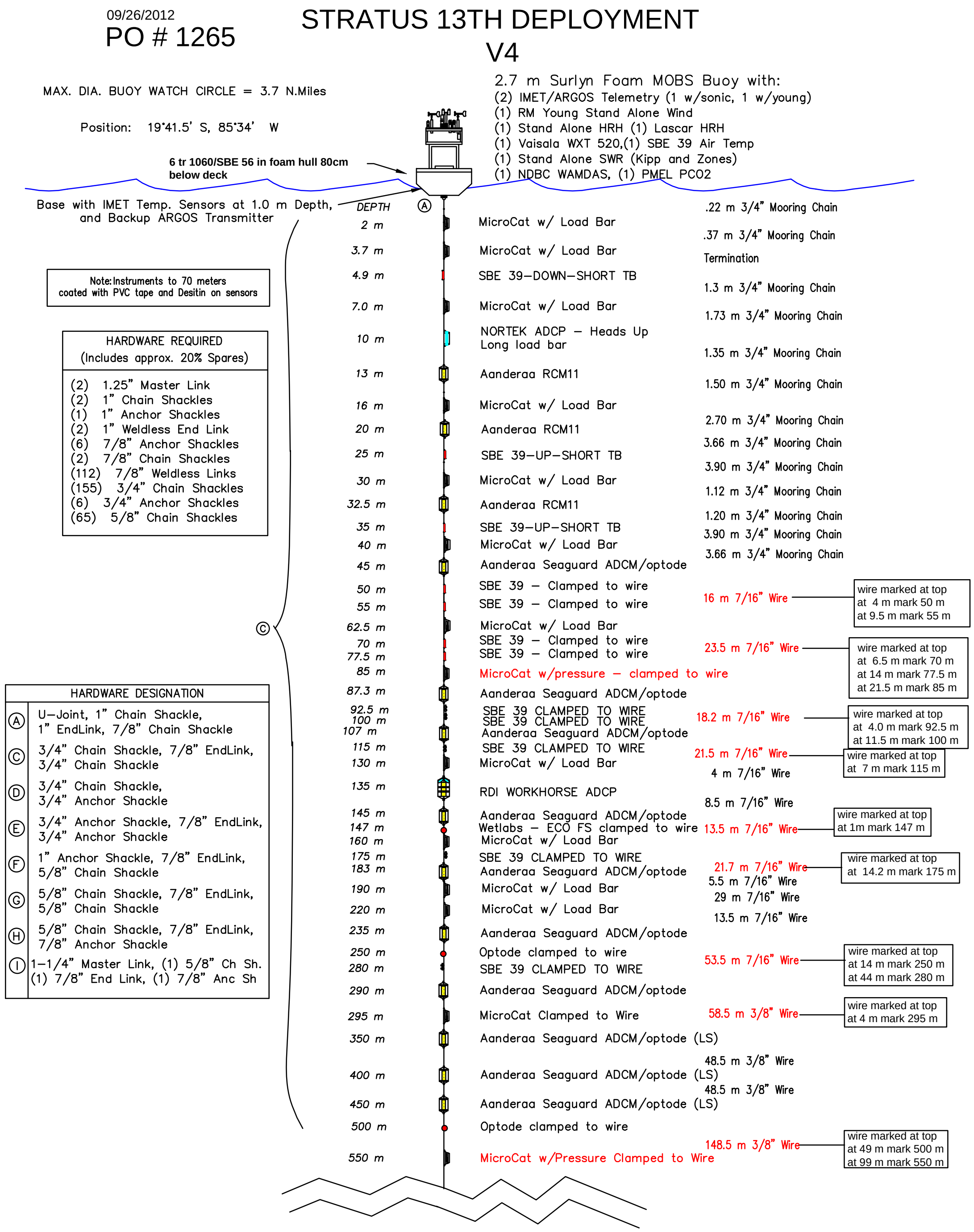


Figure C2. Page 1, diagram of Stratus 13, to be deployed.

STRATUS 13TH DEPLOYMENT
V4
SHEET 2 OF 2

CONTINUED AFTER 148.5 METER SHOT OF
WIRE AT 450 METERS

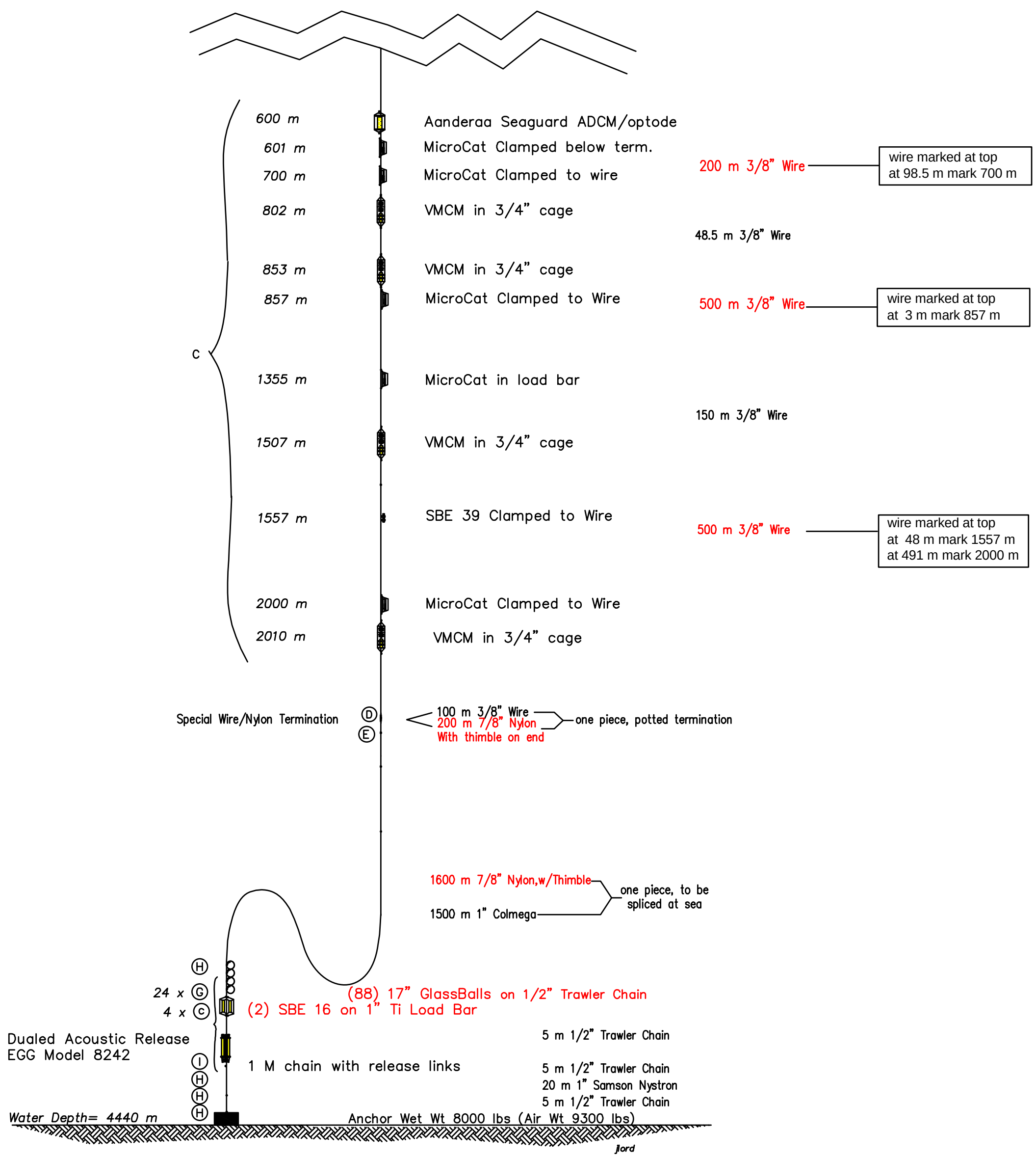


Figure C3. Page 2 of WHOI mooring to be deployed.

Appendix D: NDBC DART Mooring Diagram

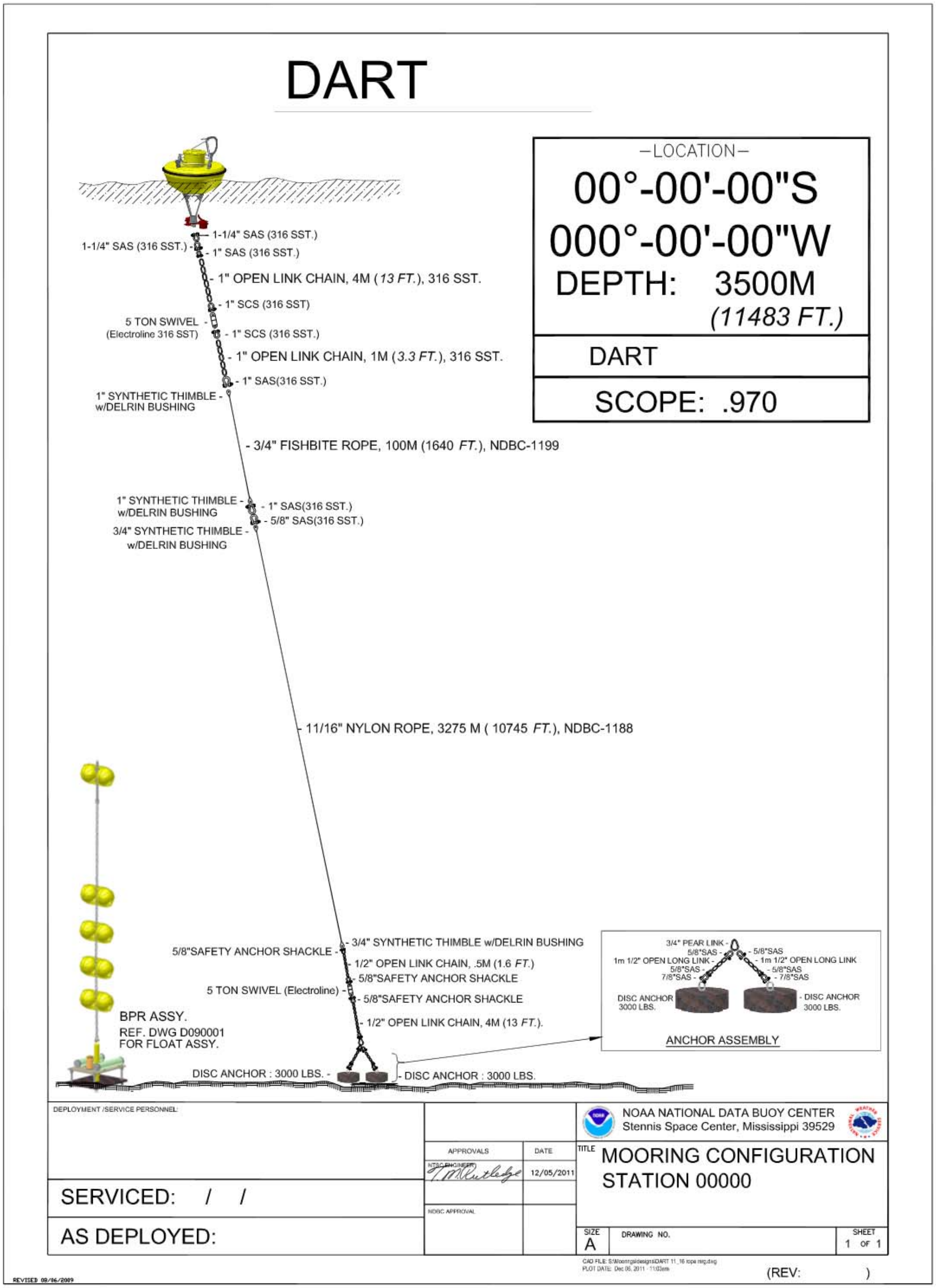


Figure D1. Diagram of the DART mooring. To be recovered, serviced, and redeployed.

Appendix E: Cruise Participants

Stratus Cruise 2014
Participants

1. **Robert Weller**	**Chief Scientist**	**WHOI**	rweller@whoi.edu
2. **Jeff Lord**	**Group Ops Leader**	**WHOI**	jlord@whoi.edu
3. **Sebastien Bigorre**	**Scientist**	**WHOI**	sbigorre@whoi.edu
4. **Nan Galbraith**	**Computer tech**	**WHOI**	ngalbraith@whoi.edu
5. **Sean Whelan**	**Technician**	**WHOI**	swhelan@whoi.edu
6. **James Coleman**	**NDBC tech**	**NDBC**	james.coleman@noaa.gov
7. **David Parrett**	**NDBC tech**	**NDBC**	david.parrett@noaa.gov
8. Cristobal Andrés Aguilera Bravo	**student**	**U. Concepcion**	caguilerab@udec.cl
9. **Marcela Paz Contreras Contreras**	**student**	**U. Concepcion**	**marcecontreras@udec.cl**

Appendix F: HAZMAT Lists

WHOI

ITEM	DESCRIPTION	QTY.	UNIT	APPLICATION	COMMENTS
1	DENATURED ALCOHOL(ethyl)	1	qt.	lab use, cleaning agent	flammable liquid class 1B
2	ANTI-FOULING PAINT (EPAINT -sunwave)	1	GAL.	MOORING COMPONENT ANTI FOULANT	water based
3	ANTI-FOULING PAINT (EPAINT - ZO)	1	GAL.	MOORING COMPONENT ANTI FOULANT	USED ON BUOY AND CAGES
4	ANTI FOULANT DEVICE (Sea-Bird)	16	7.14 g	installed on Sea Bird Conductivity Cells	Handle with gloves
5	SILICROIL	3	12 oz CAN	TOOL LUBRICANT/PENETRANT (aerosol)	
6	CONTACT CLEANER	2	20 ozCAN	ELECTRICAL CLEANING SOLVENT (aerosol)	CONSUMER COMMODITY ORM-D
7	MARINE CLEANER	1	20 ozCAN	HARDWARE CLEANING (aerosol)	CONSUMER COMMODITY ORM-D
8	BIO-GREASE	1	pt	ADCP HEADS	
9	SILICONE SPRAY	2	12 oz can	LUBRICATION	CONSUMER COMMODITY ORM-D
10	6-56 MULTI PURPOSE LUBRICANT	1	12 oz can	TOOL LUBRICANT/PENETRANT	CONSUMER COMMODITY ORM-D
11	LITHUIM BATTERIES -5 SEACAT, 5 D-CELL, 14 MICROCAT CELLS, 4 - 9 V CELLS,	41	EA.	USED IN INSTRUMENTS	INSTALLED IN INSTRUMENTS - ALL VERY SMALL CELLS AND PACKS - not DOT regulated
12	SCOTCH COTE ELECTRICAL COATING	1	CAN	WATER TIGHT SPLICES	

Appendix G. Lab space assignments and layouts

1. Bioanalytical Lab (1-27-2)
   Open at present

2. Hydro lab
   a. NDBC
   b.
3. Science Office
   a. ESRL flux
   b. Phones/PCs for public usage
   c.
4. Main lab
   a. WHOI moored instrumentation
   b. Underway data processing/Galbraith
   c. Bench – Weller
   d. WHOI moored instrument prep, download
   e. Laptop – Chilean observer if appointed
   f. Laptop – U de C student
   g. Laptop – U de C student
   h. Laptops – U de C student
   i.
5. Computer Lab
   a. Laptops – transient
   b.
6. Wet Lab
   a. WHOI CTD staging
   b.
7. Staging bay
   a. Mooring group tools etc

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