



Cruise Plan
Coastal Pioneer 3 Deployment
Leg 1: R/V *Knorr* Cruise KN-222
3-11 October 2014

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Author: A. Plueddemann

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Coastal and Global Scale Nodes
Ocean Observatories Initiative
Woods Hole Oceanographic Institution
Oregon State University
Scripps Institution of Oceanography



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1.0 Introduction

1.1. Overview

This cruise represents the third major infrastructure deployment for the Pioneer Array of the National Science Foundation's Ocean Observatories Initiative (OOI; <http://www.oceanobservatories.org>). The Pioneer Array includes a network of moorings and autonomous robotic vehicles to monitor waters of the continental shelf and slope south of New England and, in particular, the shelfbreak front where nutrients and other properties are exchanged between the coast and the deep ocean. Data from the Pioneer Array will provide new insights into coastal ocean processes such as shelf/slope nutrient exchange, air-sea property exchange, carbon cycling, and ocean acidification that are important to the New England shelf and to continental shelf ecosystems around the world.

The Pioneer 3 Leg 1 deployment cruise (Pioneer-3a) has 13 primary objectives (see Sec. 2.3) that include the recovery and deployment of Profiler Moorings, the deployment of gliders, and CTD casts with water sampling at the mooring sites. The Pioneer-3a cruise also has additional objectives, including multi-beam bathymetry surveys of the Pioneer region and CTD/ADCP surveys in the vicinity of the Pioneer moored array.

1.2. Operating Area

The Pioneer operating area is the southern New England continental shelf and slope within a region bounded by approximately 39.0°- 40.7° N and 69.9° - 71.5° W (Fig. 1-1). Pioneer-2 operations will be focused on the Pioneer Moored Array centered near 40.15°N, 70.83°W (Fig. 1-2) and the glider lines (Fig. 1-3). Mooring site locations and water depths are provided in Appendix A.

2.0 Cruise Plan

2.1. Background

The Pioneer Array will be deployed in three phases, as described in the Pioneer Array Deployment Plan (CGSN 3101-00091: ECR 1303-01166). The deployment plan, and the instrument configurations on each platform, assume that Coastal Surface Moorings will be deployed for ~1 year and Coastal Profiler Moorings for ~6 months. The Pioneer Central Surface Mooring (CNSM) and the Upstream Inshore and Upstream Offshore Profiler Moorings (PMUI, PMUO) were deployed on the Pioneer-1 cruise. The surface mooring and two profiler moorings were recovered, and five profiler moorings were deployed (PMUI, PMUI, PMCI, PMCO and OSPM), on the Pioneer 2 cruise. Three gliders were deployed on Pioneer 2, occupying the EB, FZ and SS-1 lines. These gliders have since been recovered; no Pioneer gliders are currently deployed. The Pioneer 2 cruise also provided an opportunity to repeat the multibeam bathymetry surveys that were only partially successful on Pioneer-1 (see Pioneer-1 Cruise Report, 3204-00022).

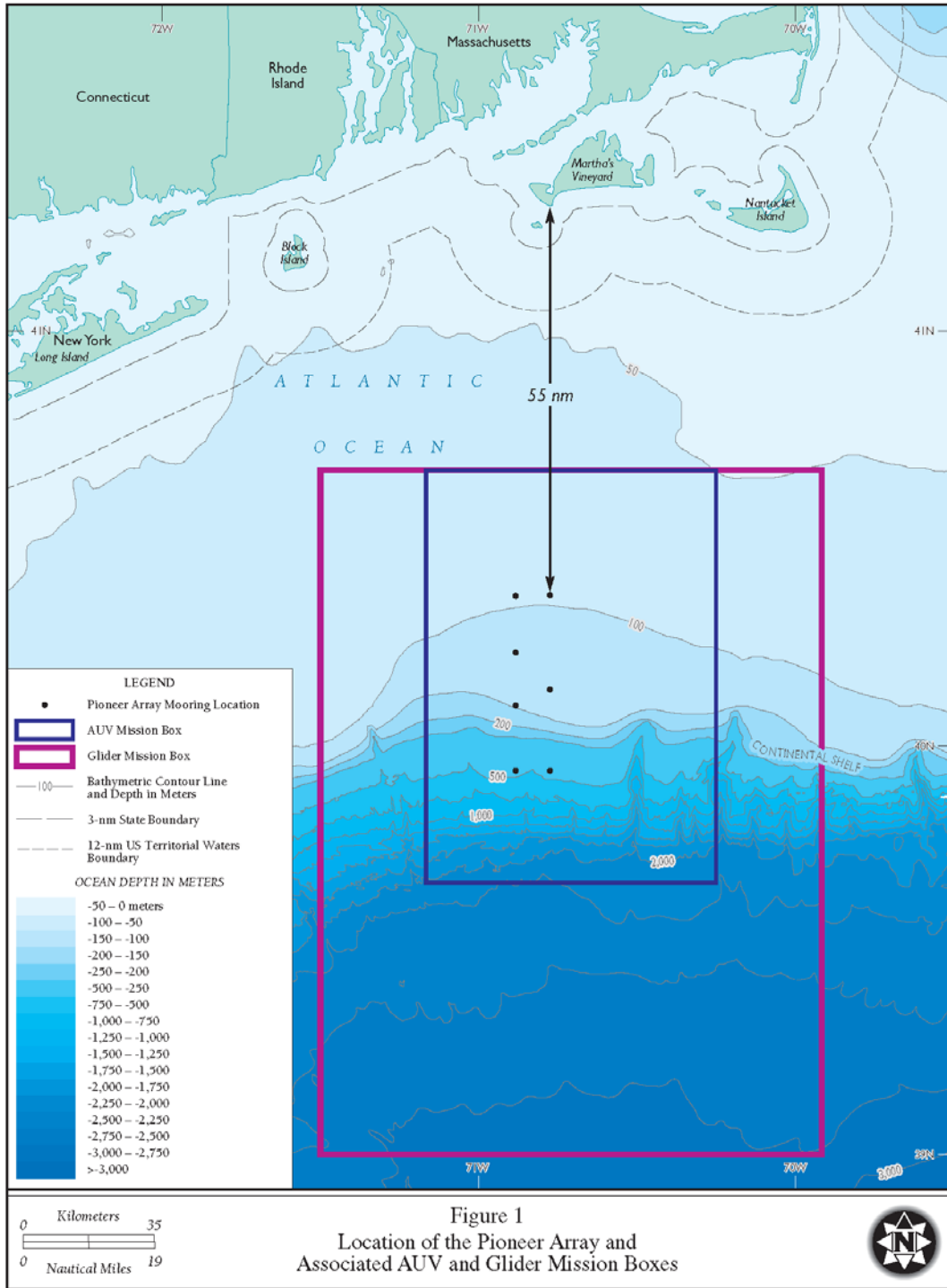


Figure 2-1 Map of the Pioneer Array region over the southern New England continental shelf and slope. The seven sites of the moored array, the AUV operating region and the glider operating region are shown along with bathymetric contours.

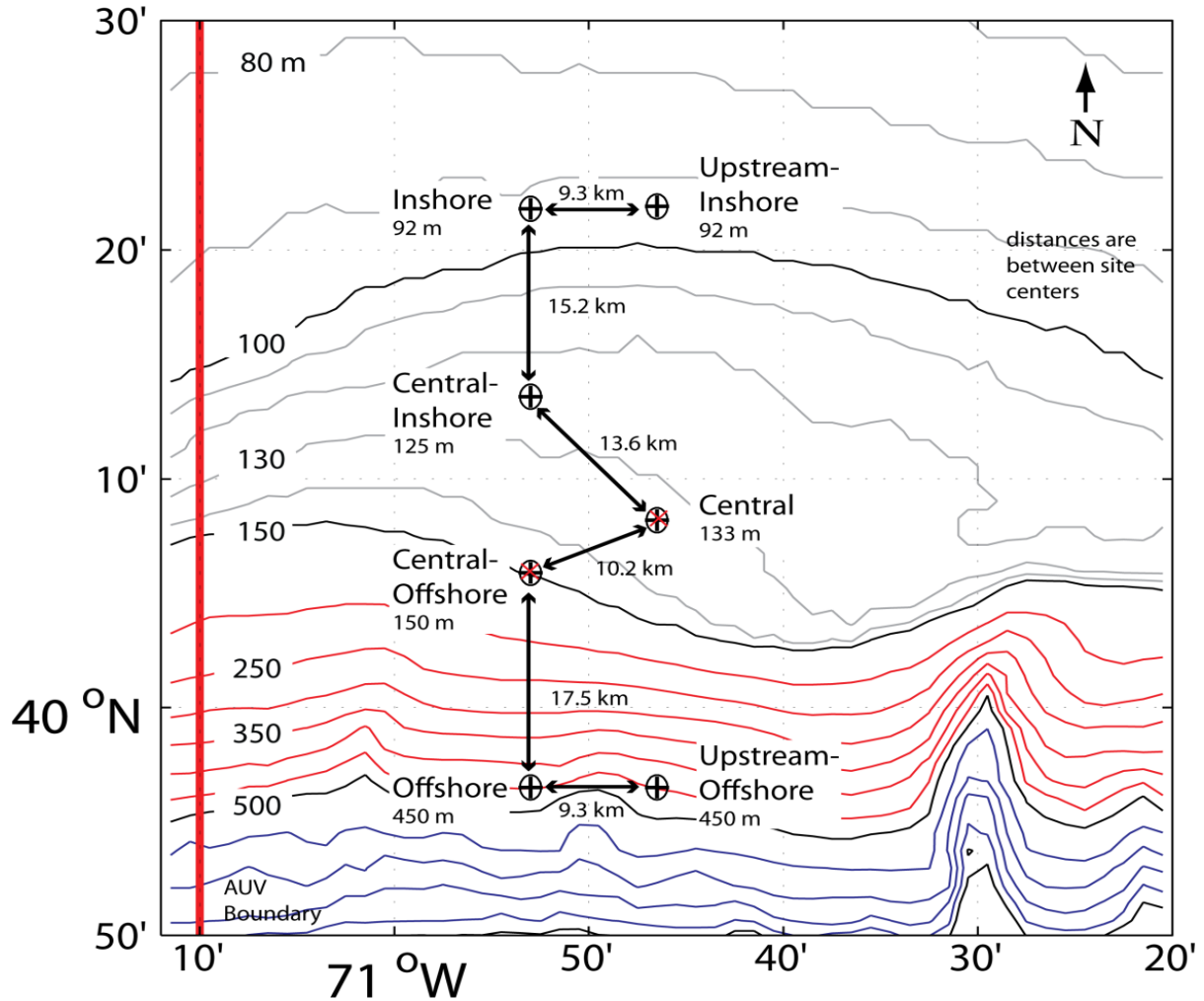


Figure 2-2 Pioneer Array mooring site locations and separations. Site centers are marked by black "+" and encircled by approximate 0.5 nm radius buffer zones. Distances between buffer zones are indicated. Red "x" denote locations of known "hangs" avoided by mobile-gear fishermen. Bathymetry is shown at 10 m (gray), 50 m (red) and 100 m (blue) intervals, respectively. Black contours are at 100 m, 150 m, 500 m and 1000 m.

2.2. Staging and De-Staging

Staging and loading will be done at the Woods Hole Oceanographic Institution (WHOI) dock during 1-2 October 2014. The ship's crane will be suitable for loading all science gear. At the discretion of the R/V *Knorr*, partial loading and access to the ship may be possible before October 1st. As part of the staging operation, it will be necessary to mount several antennas and run cables from these antennas to the main lab. Antenna mount locations and cable runs will be determined by consultation with the ship. A list of major equipment to be loaded and a deck plan showing the location of major deck components are provided in Appendix A.

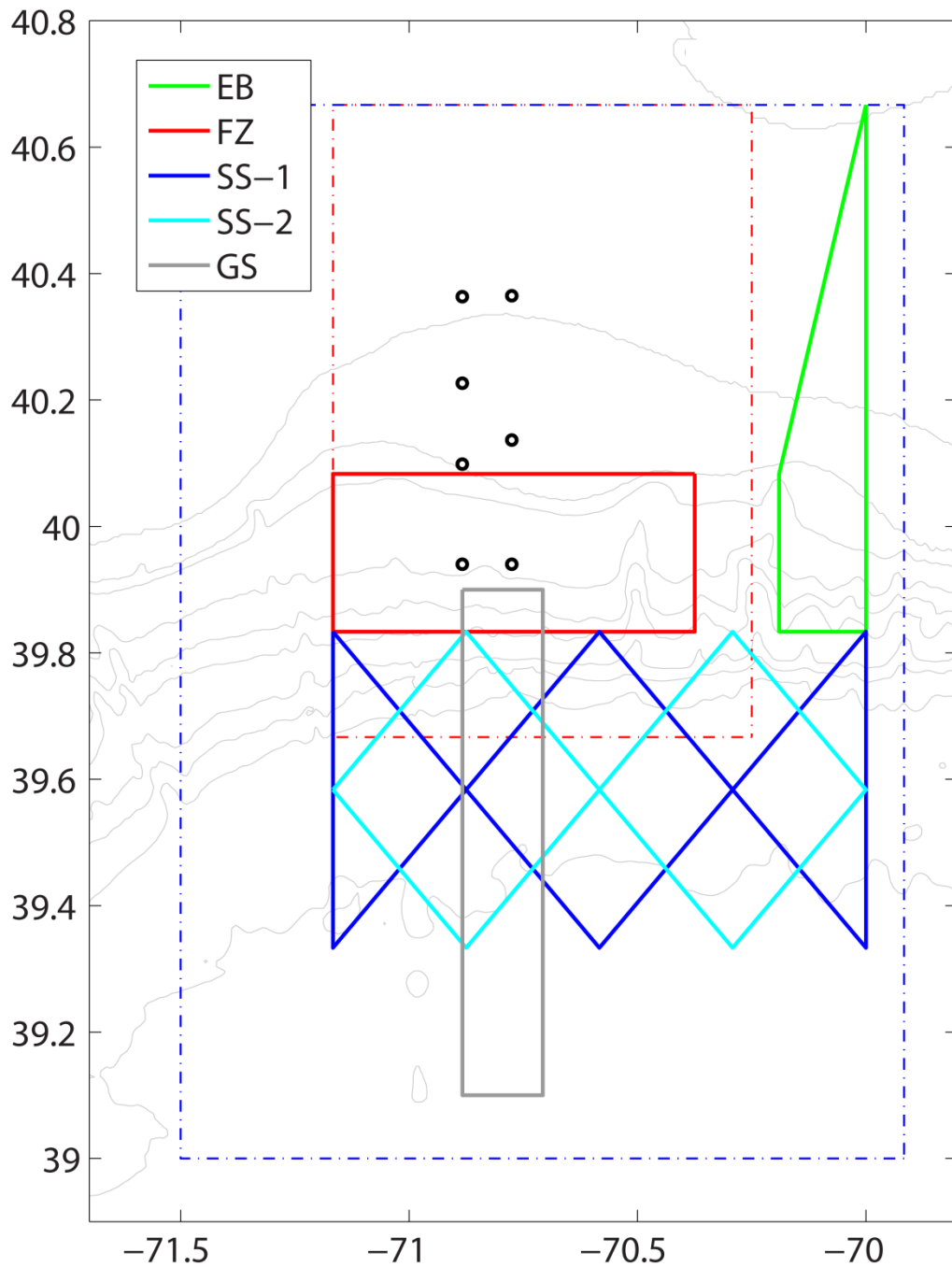


Figure 2-3 Pioneer Array glider lines. The Eastern Boundary (EB, green), Frontal Zone (FZ, red), Slope Sea (SS-1, blue; SS-2, cyan) and Gulf Stream (GS, gray) tracks are shown along with the Pioneer Array moorings (circles) and the glider and AUV operating areas (blue and red dashed lines, respectively).

Destaging and offloading of scientific equipment will be initiated at WHOI upon termination of the cruise on 11 October and will continue on 12 October if necessary. The ship's crane will be suitable for offloading all science gear.

2.3. Cruise Operations and Objectives

The R/V *Knorr* will depart from Woods Hole and transit to the Pioneer Offshore site where operations will commence. Successive days will include either two mooring operations (deployment and recovery) or one mooring deployment and one glider deployment. CTDs with bottle samples will be done in conjunction with the mooring turns. Glider deployments will be interspersed with mooring operations at times and locations chosen for efficiency. Multibeam surveys and ADCP surveys will be conducted in late evening after mooring and glider operations are completed. A detailed timeline is provided in Appendix A.

The primary Objectives (O1-O13) are listed below. Nominal times for these activities are given in the cruise timeline (Appendix A). Site locations are listed in Appendix B.

- O1. Recover the Upstream-Inshore Profiler Mooring (CP02PMUI-00002).
- O2. Deploy the Upstream-Inshore Profiler Mooring (CP02PMUI-00003).
- O3. Recover the Upstream-Offshore Profiler Mooring (CP02PMUO-00003).
- O4. Deploy the Upstream-Offshore Profiler Mooring (CP02PMUO-00004).
- O5. Recover the Central Inshore Profiler Mooring (CP02PMCI-00001).
- O6. Deploy the Central Inshore Profiler Mooring (CP02PMCI-00002).
- O7. Recover the Central Offshore Profiler Mooring (CP02PMCO-00001).
- O8. Deploy the Central Offshore Profiler Mooring (CP02PMCO-00002).
- O9. Recover the Offshore Profiler Mooring (CP04OSPM-00001).
- O10. Deploy the Offshore Profiler Mooring (CP04OSPM-00002).
- O11. Deploy two shallow (200 m engine) coastal gliders (EB, FZ-2).
- O12. Deploy three deep (1000 m engine) coastal gliders (FZ-1, SS-1, SS-2).
- O13. Conduct CTD casts with water sampling at the mooring sites.

There are also Additional objectives (A1-A5) that would be desirable to accomplish on the cruise. The Additional objectives are listed in rough priority order, and will be completed as time and conditions permit.

- A1. Conduct multibeam bathymetry surveys in the Pioneer region.
- A2. Conduct a CTD surveys (no bottle samples) in the vicinity of the moored array.
- A3. Conduct shipboard ADCP surveys in the vicinity of the moored array.

The Chief Scientist (CS) will execute the cruise according to the direction of the Program Manager (PM) in order to accomplish, to the extent practicable, programmatic and scientific objectives as described above. The ship's Master and the CS have discretion to alter the order of operations as well as determine that some operations cannot be accomplished safely or effectively, based on conditions encountered at sea. The CS and PM have discussed tasks and responsibilities for the cruise, have reviewed likely at-sea failure modes and actions, have reviewed guiding principles for at-sea decision making, and have established communication pathways for both routine reporting (e.g. email) and emergency contact (e.g. satellite telephone).

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

2.3.1. Release Tests

At a convenient time prior to deployment of the moorings, the science party will perform release tests. The release tests involve lowering multiple acoustic releases, to one or more depths between 500 m and the surface and held there while being interrogated acoustically. The science party will bring an acoustic transceiver that can be lowered over the rail with a cable run to the main lab and connected to a transceiver controller. Alternatively, the controller can be connected directly to a 12 kHz hull transducer on the R/V *Knorr*.

2.3.2. Mooring Operations

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

2.3.3. Glider Operations

Glider deployments (and recoveries if necessary) will typically be done using air tuggers and handling equipment supplied by the science party. It is also possible to use the A-frame and ship's crane. Science party personnel will be familiar with glider deployment and recovery, and will be capable of directing operations in cooperation with the ship's crew during all phases of glider operations.

2.3.4. Anchor Surveys

Once the anchor has settled on the bottom, R/V *Knorr* will occupy three stations 0.3 to 0.5 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.

2.3.5. CTD casts

CTD casts will be conducted using the ship's 9-11 CTD sensors, 24 bottle rosette frame, and deck box. Sensors requested in addition to C,T,D are dissolved oxygen, chlorophyll fluorometer, transmissometer, and PAR. CTD operations will be supervised by shipboard SSSG technicians – the science

party will supply line handlers and a lab operator. Water sampling and analysis will be handled by the science party.

2.3.6. Sensor Performance Evaluation

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

2.3.7. Shipboard Underway Data

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

2.3.8. Shipboard Multi-beam Bathymetry

Bathymetric surveys will be conducted within the Pioneer Array region (e.g. within the AUV Mission Box of Fig. 1-1). Nominal waypoints for each survey will be provided to the bridge and discussed with survey technicians. Cruising speed, leg length, and leg spacing can be adjusted as needed to ensure adequate data optimal system performance. The results of the bathymetry survey should be displayed immediately after completion for evaluation by the Chief Scientist.

2.3.9. Small Boat Operations

The use of a work boat may be requested, at the discretion of the ship, for glider recovery or attending to unforeseen problems that would require physical access to a buoy tower. Expected duration of use is approximately 0.5 to 1.5 hr. Work boat operations would be within 0.5-1.0 nm of the ship.

2.4. Potential Restrictions

Small boat activities may be restricted by weather. In the case of a recovery operation, the ship will maneuver to the item to be retrieved and grappling lines and/or pick up poles will be used. Mooring activities may be restricted by severe weather or equipment failure. Severe weather would result in postponement until conditions eased. Failure of a given piece of Project equipment (e.g. winch, air tugger) can typically be compensated by use of an alternative approach. Failure of ship's equipment (e.g. electrical or hydraulic system) would result in postponement of operations until the failure was addressed. Deployment and recovery activities may be restricted by the presence of multiple fixed objects (e.g. fishing gear) in the deployment area or along the deployment/recovery track. If possible,

operations will be delayed until conditions are more favorable (e.g. change in prevailing wind direction allowing deployment approach along a different, unobstructed course).

3.0 Appendices

Appendix A – Cruise Timeline

Appendix B – Selected Waypoints and Maps

Appendix C – Equipment Inventory and Deck Plan

Appendix D – Science Party

Appendix E – Mooring Drawings

Appendix A – Cruise Timeline

01 – 02 Oct	Mobilization, LOSOS and WHOI pier
03 – 12 Oct	Cruise dates, Leg-1 (10 DAS)
12 – 13 Oct	Demob, WHOI pier and LOSOS

Timeline

03 Oct	<p>Depart WHOI</p> <p>13:00 Depart Woods Hole, steam to Offshore site (~10 h)</p>
04 Oct	<p>Offshore site</p> <p>07:00 – 08:00: Deck prep, ck weather, determine approach, steam line</p> <p>08:00 – 09:00: Release tests, OSPM</p> <p>09:00 – 12:00: Deploy OSPM-002</p> <p>12:00 – 13:00: CTD with samples, OSPM profile zero</p> <p>13:00 – 18:00: Recover OSPM-001</p> <p>18:00 – 19:00: Anchor survey, OSPM</p> <p>19:00 – 20:00: Steam to glider deployment site</p> <p>20:00 – 22:00: Deploy glider SS-2</p> <p>22:00 – 23:00: CTD with samples, glider dive zero</p> <p>Overnight</p> <p>Multibeam bathymetry lines, end up at Upstream Offshore site</p>
05 Oct	<p>Upstream-Offshore Site</p> <p>07:00 – 08:00: Deck prep, ck weather, determine approach, steam line</p> <p>08:00 – 09:00: Release tests, PMUO</p> <p>09:00 – 12:00: Deploy PMUO-004</p> <p>12:00 – 13:00: CTD with samples and PMUO profile zero</p> <p>13:00 – 18:00: Recover PMUO-003</p> <p>18:00 – 19:00: Anchor survey, PMUO</p> <p>19:00 – 22:00: Deploy glider SS-2 (second chance)</p> <p>Overnight</p> <p>Multibeam bathymetry lines, end up at SS-1/FZ-2 glider deployment site</p>

- 06 Oct Glider deployment site: SS-1/FZ-2
 08:00 – 11:00: Deploy gliders SS-1, FZ-2
 11:00 – 12:00: CTD with samples, glider dive zero
 12:00 – 14:00: Steam to EB Waypoint 4
 Glider deployment site: EB
 14:00 – 17:00: Deploy glider EB
 17:00 – 18:00: CTD with samples, glider dive zero
 18:00 – 20:00: Releases tests, TBD activities
 Overnight
 Multibeam bathymetry lines, end up at Upstream Inshore site
- 07 Oct Upstream Inshore site
 07:00 – 08:00: Deck prep, ck weather, determine approach, steam line
 08:00 – 09:00: Release tests, PMUI
 09:00 – 12:00: Deploy PMUI-003
 12:00 – 13:00: CTD with samples and PMUI profile zero
 13:00 – 18:00: Recover PMUI-002
 18:00 – 19:00: Anchor survey, PMUI
 19:00 – 22:00: Releases tests, TBD activities
 Overnight
 Multibeam bathymetry lines, end up at Central Inshore site
- 08 Oct Central-Inshore site
 07:00 – 08:00: Deck prep, ck weather, determine approach, steam line
 08:00 – 09:00: Release tests, PMCI
 09:00 – 12:00: Deploy PMCI-002
 12:00 – 13:00: CTD with samples, PMCO profile zero
 13:00 – 18:00: Recover PMCI-001
 18:00 – 19:00: Anchor survey, PMCI
 19:00 – 21:00: Deploy glider FZ-1
 21:00 – 22:00: CTD with samples, glider dive zero
 Overnight
 Multibeam bathymetry lines, end up at Central Offshore site

- 09 Oct Central-Offshore site
- 07:00 – 08:00: Deck prep, ck weather, determine approach, steam line
 - 08:00 – 09:00: Release tests, PMCO
 - 09:00 – 12:00: Deploy PMCO-002
 - 12:00 – 13:00: CTD with samples, PMCO profile zero
 - 13:00 – 18:00: Recover PMCO-001
 - 18:00 – 19:00: Anchor survey, PMCO
 - 19:00 – 21:00: Deploy glider FZ-1 (second chance)
- Overnight
- Multibeam bathymetry lines, end up at Upstream Offshore site
- 10 Oct Cross-Shelf CTD survey and/or Additional Activities*
- 08:00 – 09:30: CTD cast at Upstream Offshore site, 30 min transit
 - 09:30 – 11:00: CTD cast at CS-4 site, 30 min transit
 - 11:00 – 12:30: CTD cast at CS-3 site, 30 min transit
 - 12:30 – 14:00: CTD cast at Central site, 30 min transit
 - 14:00 – 15:30: CTD cast at CS-2 site, 30 min transit
 - 15:30 – 17:00: CTD cast at CS-1 site, 30 min transit
 - 17:00 – 18:00: CTD cast at Upstream Inshore site
- Overnight
- Transit to WHOI
- 11 Oct Arrive WHOI

* Additional activities may include:

- Address problems detected by shore station
- Complete unfinished anchor surveys
- Cross-Shelf CTD survey, UI to UO (~8 h)
- Steam cross-shelf AUV box (8 h @ 10 kt)
- Steam mooring box (6 h @ 10 kt)

Appendix B – Selected Waypoints and Maps

Station List: Pioneer 3, R/V Knorr October 2014					
See timeline for order of occupation; some sites are occupied more than once					
Name	Code	Lat	Lon	water depth	comments
Upstream-Inshore	UI	40 21.9	70 46.5	91.5 m	profiler mooring recovery and deployment, CTD
Inshore	IS	40 21.8	70 53.0	91.5 m	no activities planned
Central-Inshore	CI	40 13.6	70 53.0	125 m	profiler mooring recovery and deployment, CTD
Central	CN	40 08.2	70 46.5	133 m	no activities planned
Central-Offshore	CO	40 05.9	70 53.0	150 m	profiler mooring recovery and deployment, CTD
Offshore	OS	39 56.4	70 53.0	450 m	profiler mooring recovery and deployment, CTD
Upstream-Offshore	UO	39 56.4	70 46.5	450 m	profiler mooring recovery and deployment, CTD
Glider EB	EB	40 05.0	70 11.4	~150 m	glider deployment, CTD
Glider FZ	FZ	40 05.0	70 53.0	~150 m	glider deployment, CTD
Glider SS-1	SS-1	39 50.0	70 35.0	~1000 m	glider deployment, CTD
Glider SS-2	SS-2	39 50.0	70 53.0	~1000 m	glider deployment, CTD

Table B-1: Pioneer 3 station list

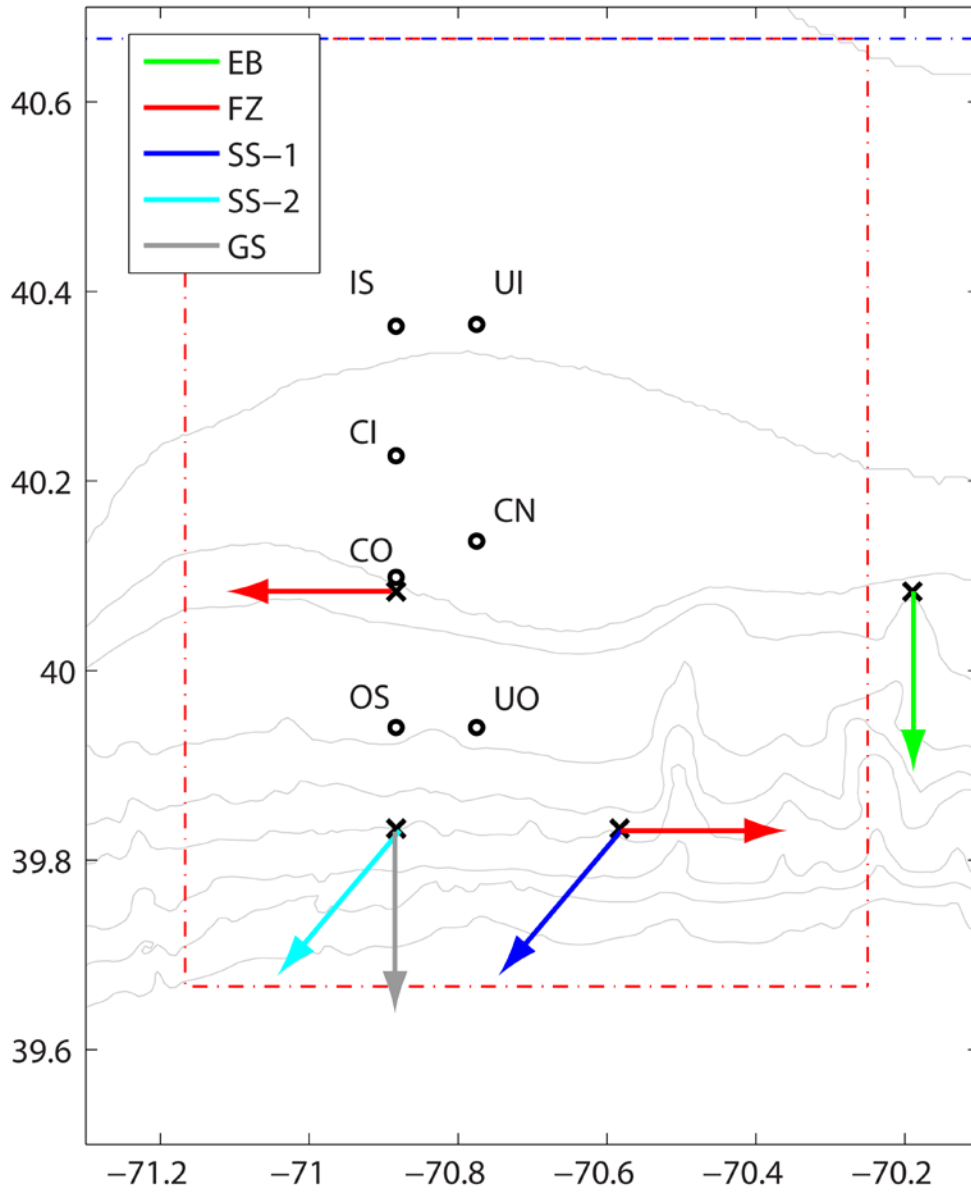


Figure B-2: Station map for Pioneer-3. The seven Pioneer Array mooring sites (circles) are shown along with three proposed glider deployment sites (crosses). Moorings will be recovered from and deployed at UI, UO, CI, CO and OS sites. No mooring activities are to be conducted at IS and CN sites.

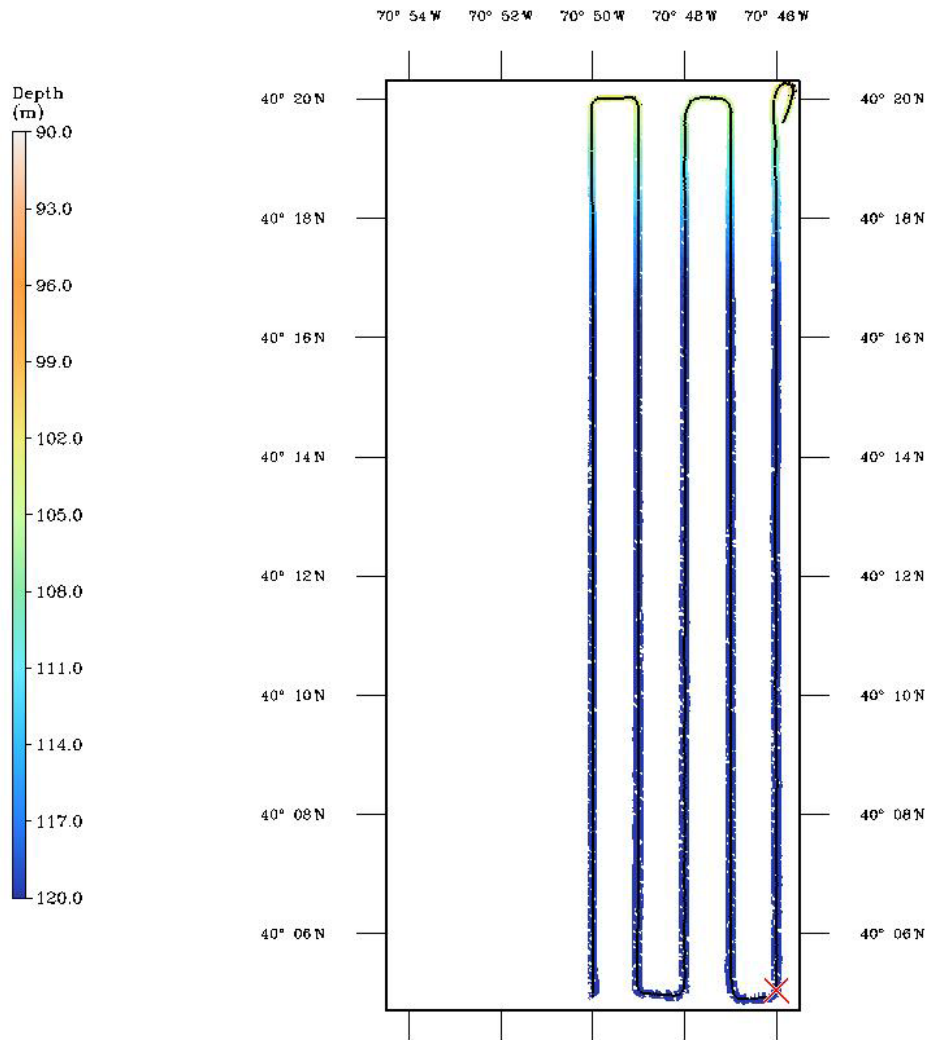


Figure B-3: Example of multibeam bathymetry survey conducted in the Pioneer Array region during the Pioneer 2 cruise, covering about 7 x 15 nm. The desired survey area is approximately 10 x 28 nm. The spacing between lines would be about 0.8 nm – it is recognized that successive tracks will not overlap. The total track distance for the desired survey is ~360 nm, which would take about 46 h to complete at 8 kt. Such a survey could be completed over multiple 8 h overnight periods (e.g. two track lines per night).

Appendix C – Equipment Inventory and Deck Plan

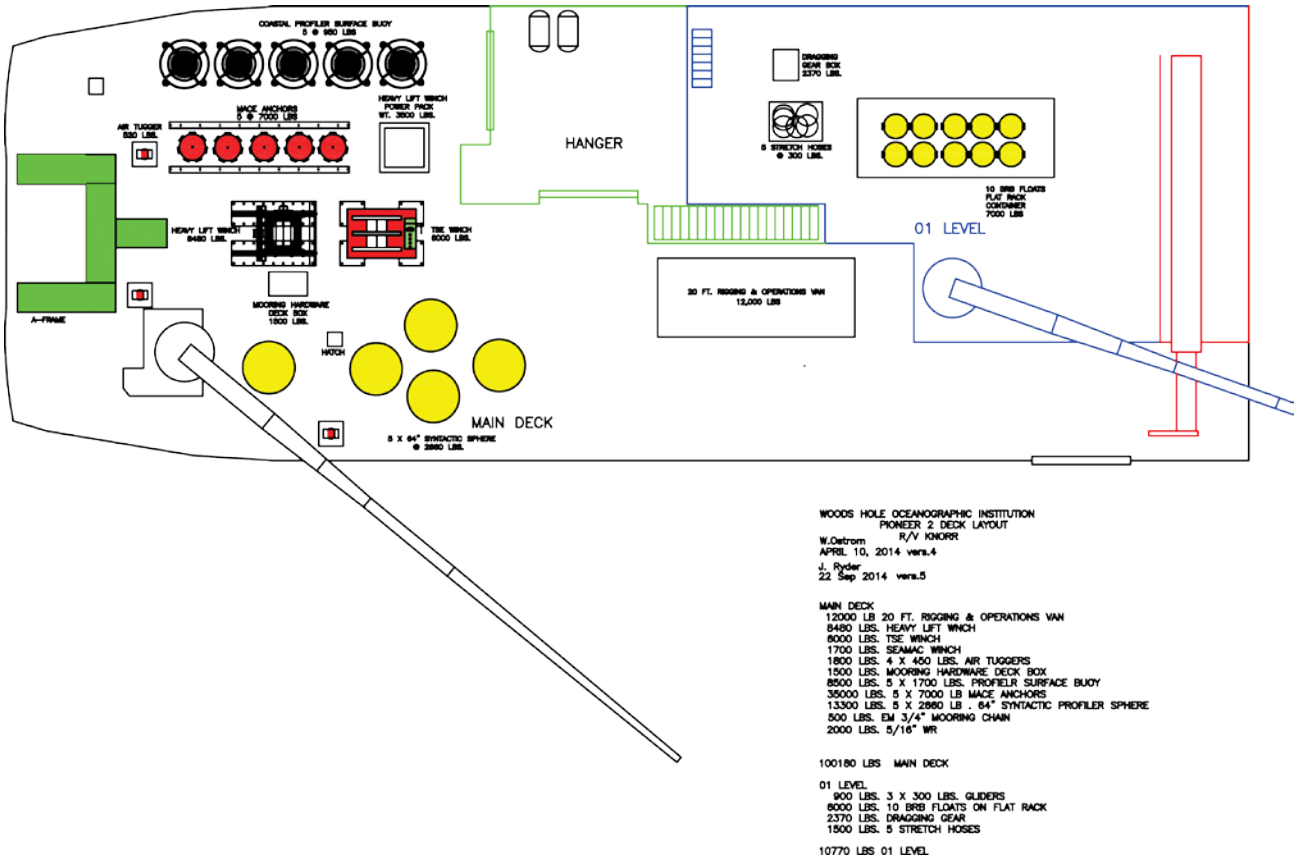


Figure C-1: Nominal deck layout for the major components associated with Pioneer-2 operations. Proposed locations of major deck elements are shown. Estimates weights of major deck components are also documented in a table.

Table C-1: Estimated Deckload

Piece No.	Description of Items	Unit Dimensions L" x W" X H"	Weight in Lbs.
Support Equipment			
1	20 Foot Rigging and Operations Container	240 x 96 x 96	13000
2	TSE Mooring Winch	108 x 98 x 72	7000
3	Heavy Lift Anchor Winch	48 x 48 x 30	8400
4	HLW Power Pack	72 x 48 x 50	3000
5	Air Tugger Winch on Stand	28 x 28 x 57	520
6	Air Tugger Winch on Stand	28 x 28 x 57	520
7	Air Tugger Winch on Stand	28 x 28 x 57	520
8	Air Tugger Winch on Stand	28 x 28 x 57	520
9	Galvanized Anchor Track (1 set)	151 x 8 x 9	500
10	Hydraulic Tensioning Cart	67 x 48 x 51	690
11	Fairlead Plate	28 x 28 x 7	170
Surface Mooring with Profiler - CP02PMUO			
12	Pressure Hardened Surface Buoy on stand	96 x 48 x 48	800
13	64" Syntatctic Sphere on Stand	48 x 48 x 60	2580
14	Wooden Reel with 5/16" Mooring Cable	32 x 32 x 30	380
15	Backup Recovery Module (BRB)	56 x 44 x 44	490
16	Backup Recovery Module (BRB)	57 x 44 x 44	490
17	Cast Iron Mooring Anchor	33 x 32 x 40	7000
Surface Mooring with Profiler - CP04OSPM			
18	Pressure Hardened Surface Buoy on stand	96 x 48 x 48	800
19	64" Syntatctic Sphere on Stand	48 x 48 x 60	2580
20	Wooden Reel with 5/16" Mooring Cable	32 x 32 x 30	380
21	Backup Recovery Module (BRB)	56 x 44 x 44	490
22	Backup Recovery Module (BRB)	57 x 44 x 44	490
23	Cast Iron Mooring Anchor	33 x 32 x 40	7000
Surface Mooring with Profiler - CP02PMCO			
24	Pressure Hardened Surface Buoy on stand	96 x 48 x 48	800
25	64" Syntatctic Sphere on Stand	48 x 48 x 60	2580
26	Wooden Reel with 5/16" Mooring Cable	32 x 32 x 30	380
27	Backup Recovery Module (BRB)	56 x 44 x 44	490
28	Backup Recovery Module (BRB)	57 x 44 x 44	490
29	Cast Iron Mooring Anchor	33 x 32 x 40	7000
Surface Mooring with Profiler - CP02PMCI			
30	Pressure Hardened Surface Buoy on stand	96 x 48 x 48	800
31	64" Syntatctic Sphere on Stand	48 x 48 x 60	2580
32	Wooden Reel with 5/16" Mooring Cable	32 x 32 x 30	380
33	Backup Recovery Module (BRB)	56 x 44 x 44	490
34	Backup Recovery Module (BRB)	57 x 44 x 44	490
35	Cast Iron Mooring Anchor	33 x 32 x 40	7000
Surface Mooring with Profiler - CP02PMUI			
36	Pressure Hardened Surface Buoy on stand	96 x 48 x 48	800
37	64" Syntatctic Sphere on Stand	48 x 48 x 60	2580
38	Wooden Reel with 5/16" Mooring Cable	32 x 32 x 30	380
39	Backup Recovery Module (BRB)	56 x 44 x 44	490
40	Backup Recovery Module (BRB)	57 x 44 x 44	490
41	Cast Iron Mooring Anchor	33 x 32 x 40	7000
Total Weight (Lbs.)			93540
Total Weight (Tons)			46.77

Appendix D - Science Party

There will be 11 participants in the science party, all affiliated with the Woods Hole Oceanographic Institution (WHOI). The Chief Scientist is Dr. Albert J. Plueddemann (WHOI). WHOI Shipboard Scientific Services Group (SSSG) participants will be Allison Heater and Tina Thomas. An alphabetical list is given in the table below.

Participating Scientists

<u>Name</u>	<u>Gender</u>	<u>Nationality</u>	<u>Affiliation</u>
1. Alai, Aidan	M	USA	WHOI
2. Heater, Allison	F	USA	WHOI/SSSG
3. Lumping, Chris	M	USA	WHOI
4. Lund, John	M	USA	WHOI
5. Murphy, Steven	M	USA	WHOI
6. Pietro, Jeff	M	USA	WHOI
7. Plueddemann, Al	M	USA	WHOI/Chief Sci
8. Ryder, Jim	M	USA	WHOI
9. Thomas, Tina	F	USA	WHOI/SSSG
10. Wellwood, Dave	M	USA	WHOI
11. White, Sheri	F	USA	WHOI

Roles and responsibilities will be delegated among individuals and groups per the following major categories. These assignments are representative, and not intended to be limiting – all participants will assist with multiple aspects of the cruise effort as warranted.

- Overall cruise coordination and execution
 - Al Plueddemann, Jim Ryder
- Cruise documentation, deployment records, platform and instrument metadata
 - Sheri White, John Lund (profilers), Aidan Alai (gliders)
- Logistics, deck operations, mooring hardware, mooring operations
 - Jim Ryder, Steve Murphy, Jeff Pietro, Chris Lumping
- Mooring control, power and telemetry systems
 - John Lund (profilers),
- Instrument configuration, preparation and pre-deployment checks
 - John Lund (profilers), Aidan Alai (gliders)
- Platform configuration and mission plan
 - John Lund (profilers), Aidan Alai (gliders)
- Hydrographic sampling, including physical sample preparation
 - Dave Wellwood, Sheri White, Aidan Alai
- Shipboard Scientific Services (CTD, ADCP, multibeam)
 - Allison Heater, Tina Thomas

Appendix E - Mooring Drawings

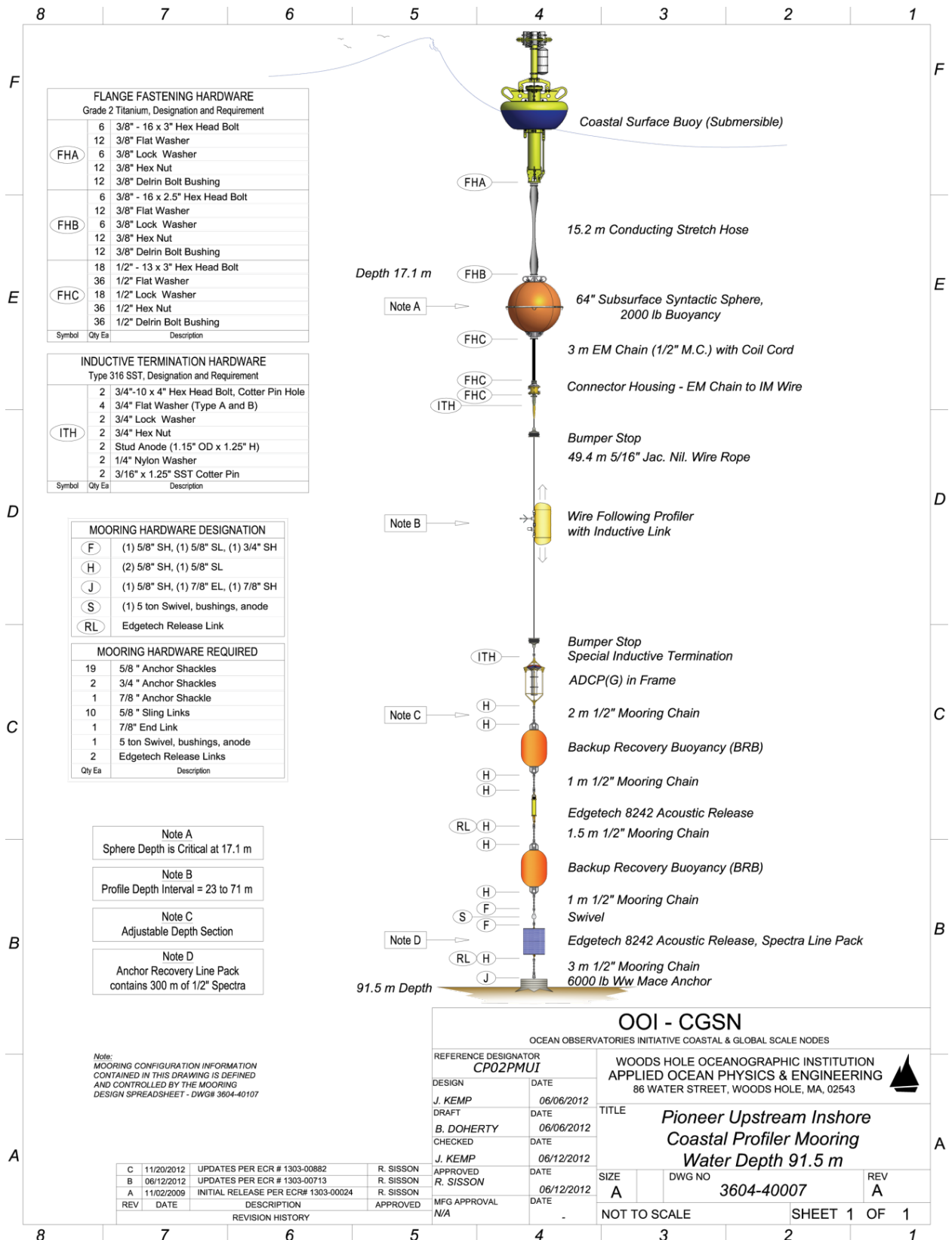


Figure E-1. Pioneer Upstream Inshore Profiler Mooring (PMUI).

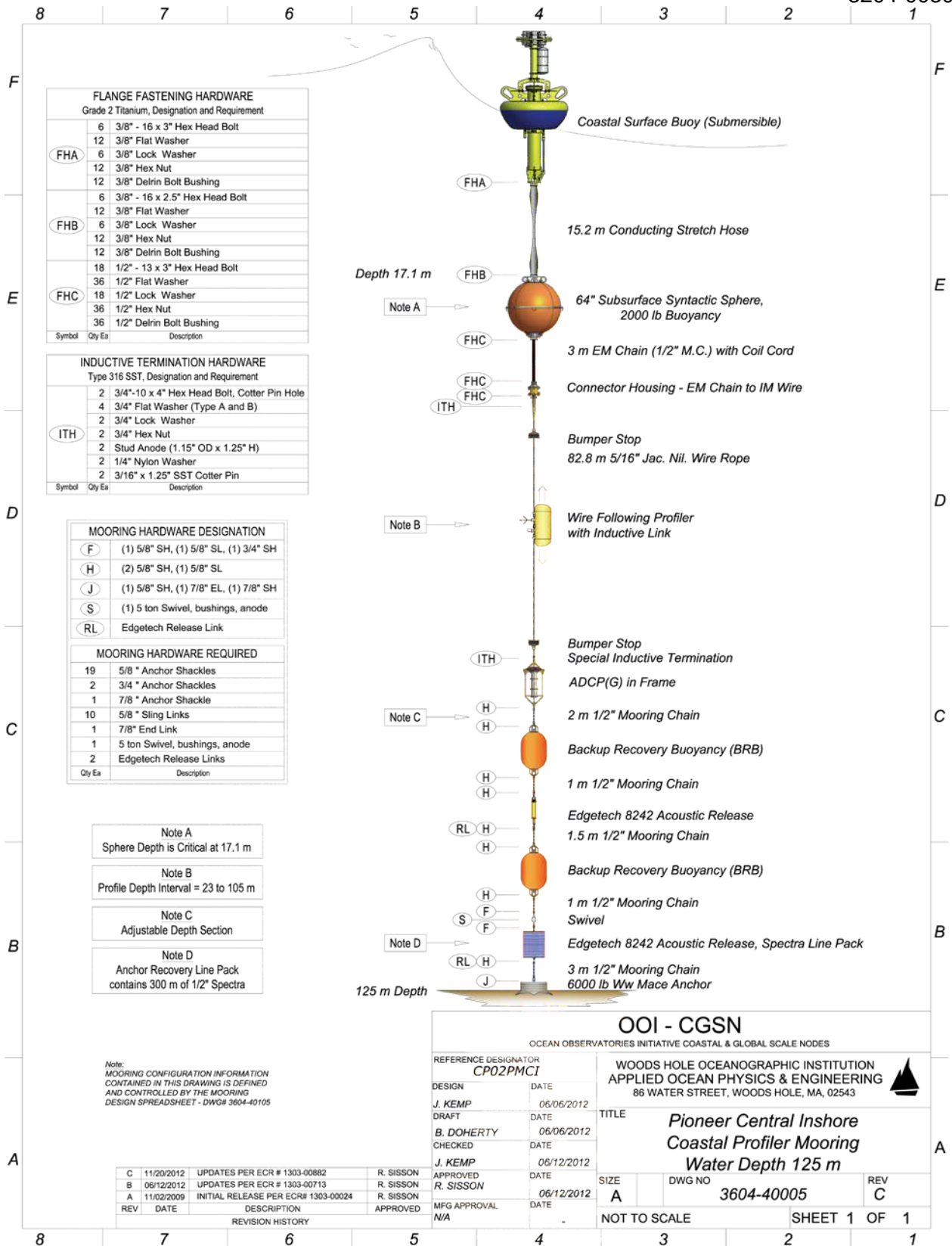


Figure E-2. Pioneer Central Inshore Profiler Mooring (PMCI).

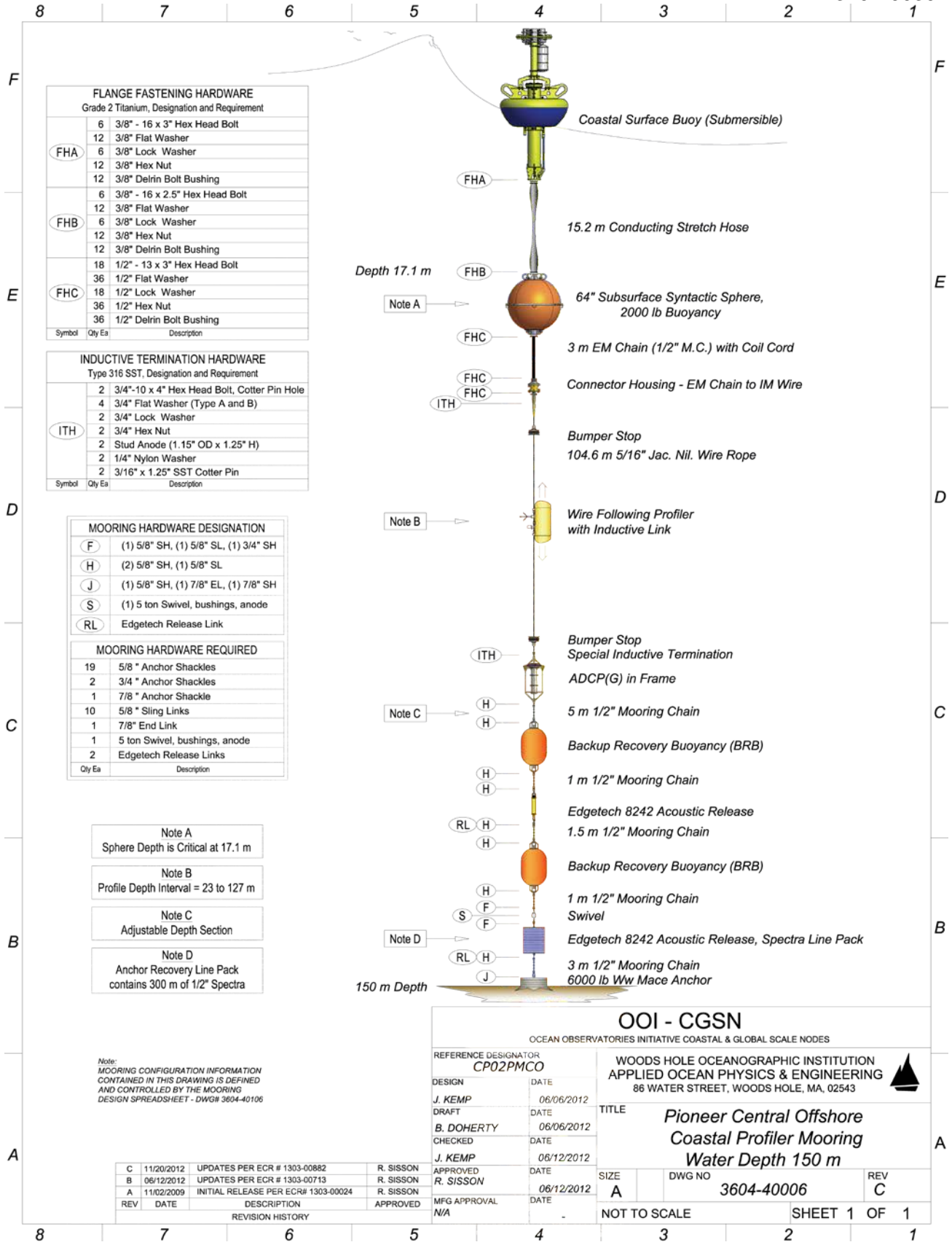


Figure E-3. Pioneer Central Offshore Profiler Mooring (PMCO).

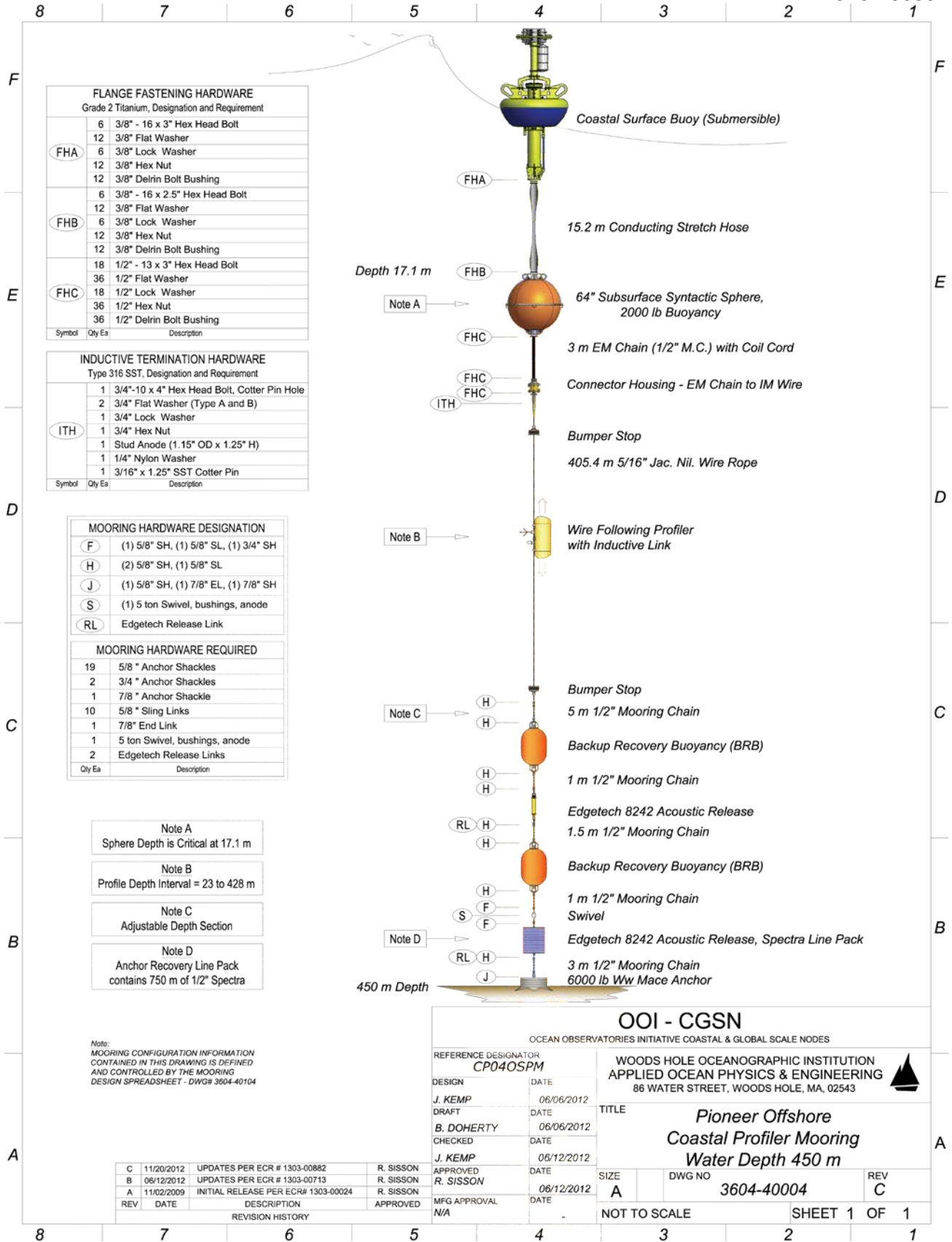


Figure E-4. Pioneer Offshore Profiler Mooring (OSPM).

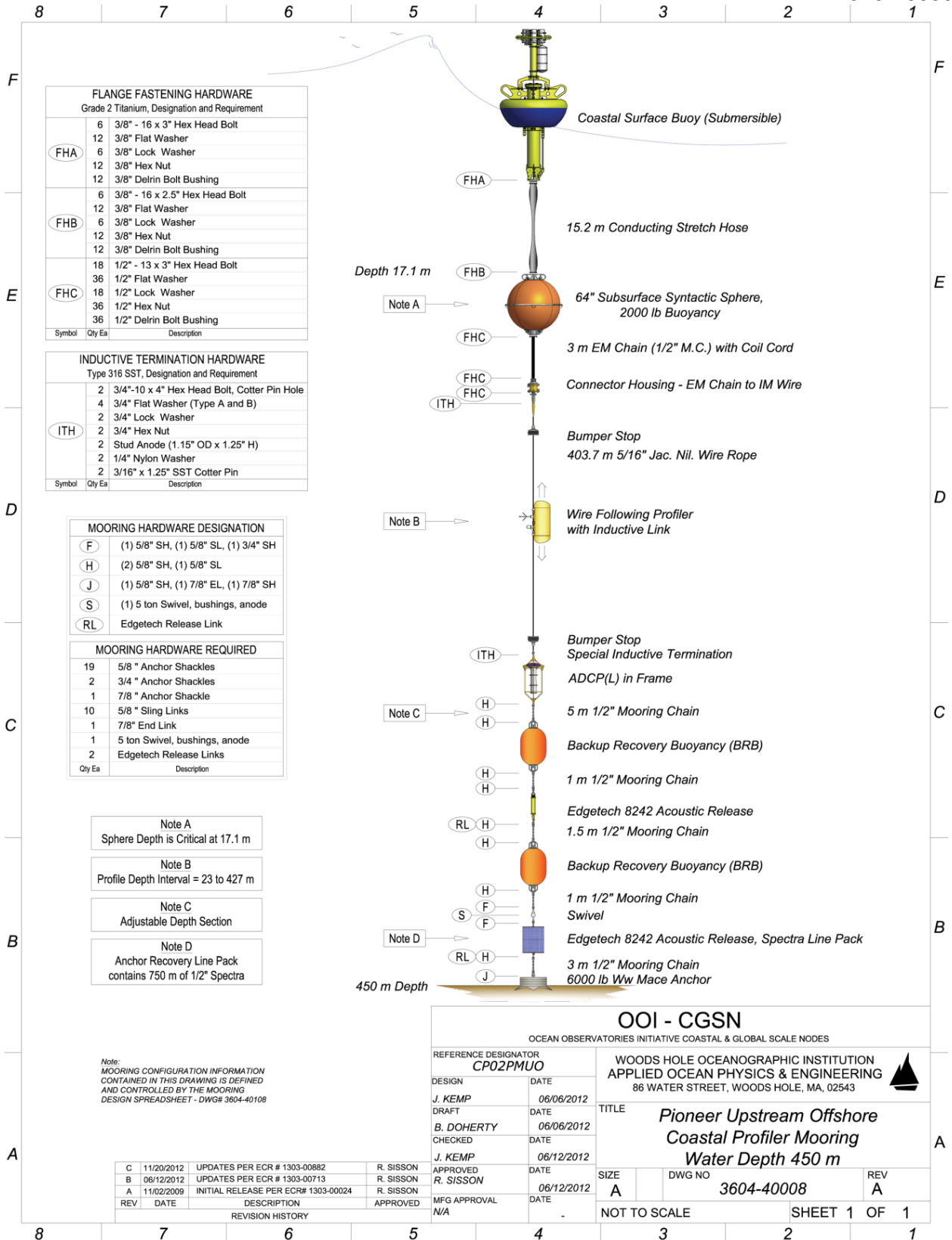


Figure E-5. Pioneer Upstream Offshore Profiler Mooring (PMU).