KN221-03 Cruise Report

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Cruise Summary

Vessel: R/V Knorr
Cruise ID: KN221-03
Chief Scientist: Robert Pickart

Ports: Reykjavik, Iceland to Reykjavik, Iceland
Dates: Aug 05, 2014 – Sep 02, 2014

The Overturning in the Subpolar North Atlantic Program (OSNAP) is an effort to determine the strength of the meridional overturning circulation and associated heat and freshwater fluxes in the subpolar North Atlantic. It is a collaborative program with scientists from the U.S., U.K., Netherlands, Germany, France, Canada and China. Together, moorings were deployed across the boundaries of the Labrador Sea, Irminger Sea, Iceland Basin, and Rockall Trough (Fig. 1), and a RAFOS float program was established in the western part of the domain to study deep water pathways. This report summarizes the operations carried out aboard R/V *Knorr* during cruise 221 leg 3 (KN221-03) in late summer 2014. The study area of KN221-03 was the southwestern Irminger Sea and southern Labrador Sea (Fig. 2). The participating institutions on the cruise were the Woods Hole Oceanographic Institution, USA (WHOI); the National Oceanography Centre, UK (NOC); the Helmholtz Centre for Ocean Research, Germany (GEOMAR); and Ocean University of China (OUC). The science party consisted of 21 personnel from four different nations (US, UK, China, Russia).

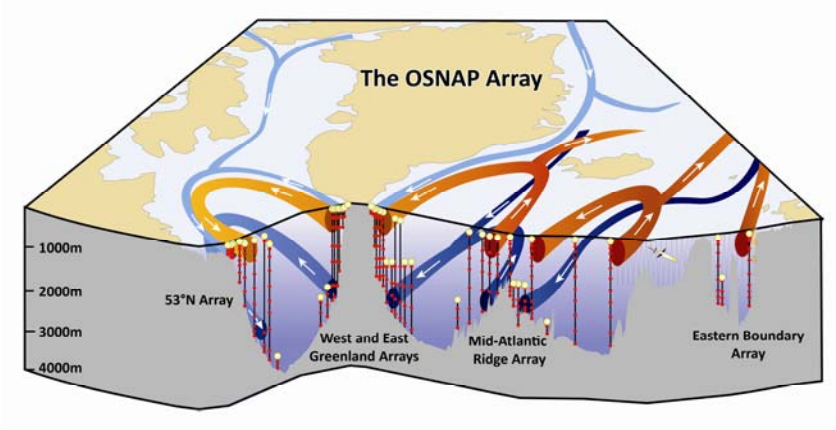


Figure 1. Schematic of the OSNAP measurement system in relation to the Atlantic meridional overturning circulation.

Scientific Objectives

The primary objectives of the cruise were as follows:

1. To deploy 22 hydrographic/velocity moorings comprising two arrays near Cape Farewell, Greenland: one extending across the east Greenland shelf and slope (the OSNAP East Irminger array), and one extending across the west Greenland shelf and slope (the OSNAP West eastern Labrador array).

2. To deploy 3 sound source moorings for the OSNAP RAFOS float program in the Labrador and Irminger Seas.

3. To carry out a shipboard hydrographic/velocity survey of the region near Cape Farewell, Greenland, including transects along the two mooring array lines.

4. To launch acoustically tracked RAFOS floats at a number of sites near the mooring array lines.

All of the above objectives were successfully met. A total of 25 moorings were deployed, 196 conductivity-temperature-depth (CTD) stations were occupied, most of them with a lowered acoustic Doppler current profiler (ADCP), and 18 RAFOS floats were launched. In addition, the vessel-mounted ADCP was operational throughout the cruise and returned a full data set.

Cruise Synopsis

Knorr departed Reykjavik, Iceland on 5 August 2014 and mooring operations began roughly two days later. The eastern mooring array was deployed first, working offshore to inshore. Most of the moorings on this line were deployed at pre-determined positions and/or bottom depths, but a bathymetric survey was necessary to determine the location of two of the WHOI moorings on the upper continental slope. In general, mooring operations were conducted during daylight hours, while hydrographic operations were done overnight. CTD/lowered-ADCP stations were carried out at each of the mooring sites for calibration purposes, as well as in between the sites to obtain better horizontal resolution along the mooring lines. Additional CTD/velocity transects were done in the vicinity of Greenland as time permitted. The mooring diagrams for all of the moorings deployed during KN221-03 are contained in the Appendix.

After the completing operations in the Irminger Sea, including launching a number of RAFOS floats, *Knorr* steamed through Prins Christian Sund and we began deploying the

moorings in the Labrador Sea, again working offshore to inshore. Prior to the first mooring deployment a bathymetric transect was carried out to determine the precise positions/bottom depths for the WHOI and GEOMAR moorings. Expendable bathythermographs (XBTs) were used along the transect for sound speed correction and to assess the hydrographic conditions along the line. Notably, this transect is a bit south of the planned mooring line due to a region of ill-behaved bathymetry along the original line. As before, the mooring work was done during the day and hydrographic measurements carried out mainly at night. After finishing the WHOI and GEOMAR mooring deployments, *Knorr* steamed southwest to the base of the Labrador continental slope to deploy the final RAFOS sound source mooring and to launch a RAFOS float. We then returned to the vicinity of Cape Farewell, Greenland and carried out three final CTD/velocity transects before steaming back to Reykjavik, arriving on 2 September 2014.

We now give specific information on the each of the components of the cruise.

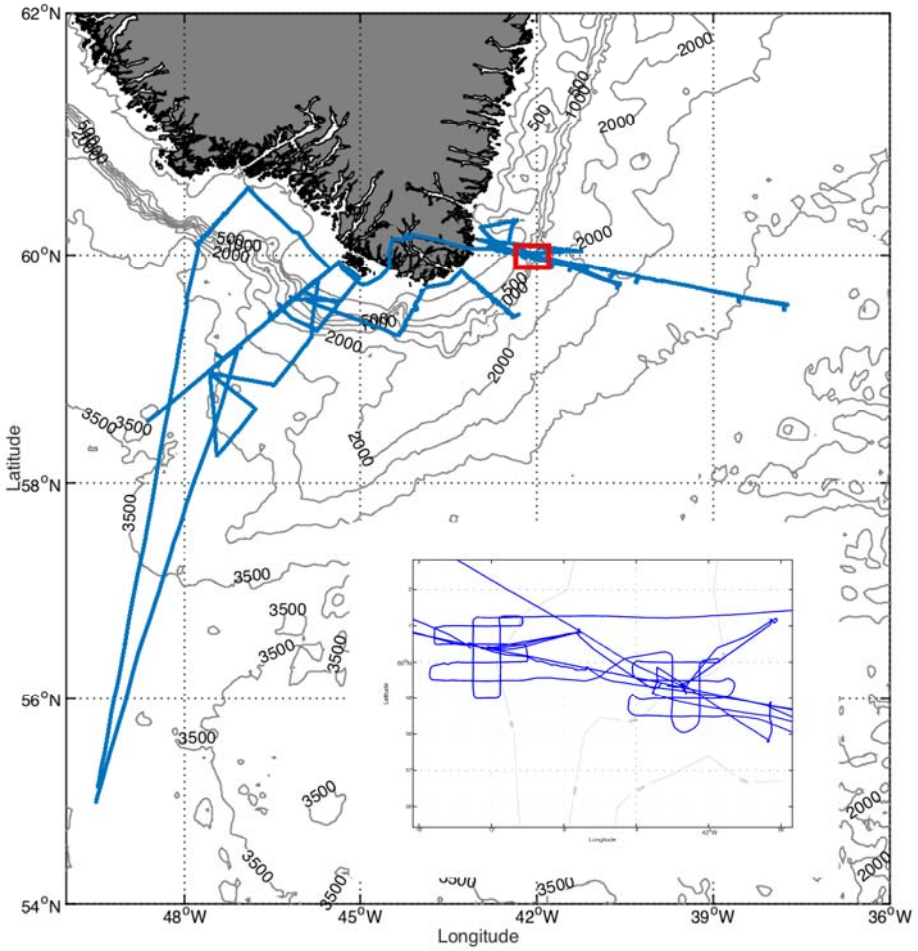


Figure 2. Cruise track of KN211-3, along which bathymetry and ADCP data were collected. The inset shows the bathymetric surveys done for two of the east Greenland slope moorings.

Moorings

A total of 25 moorings were deployed during the cruise: 10 tall moorings (WHOI and NOC), 6 short moorings (NOC and GOEMAR), 6 shelf tripods (WHOI), and 3 sound source moorings (WHOI). The locations of the oceanographic moorings are shown in plan view in Fig. 3 and in the vertical plane in Fig. 4 (the OSNAP East Irminger array) and Fig. 5 (the OSNAP West eastern Labrador array). Table 1 lists the pertinent information for each of the moorings.

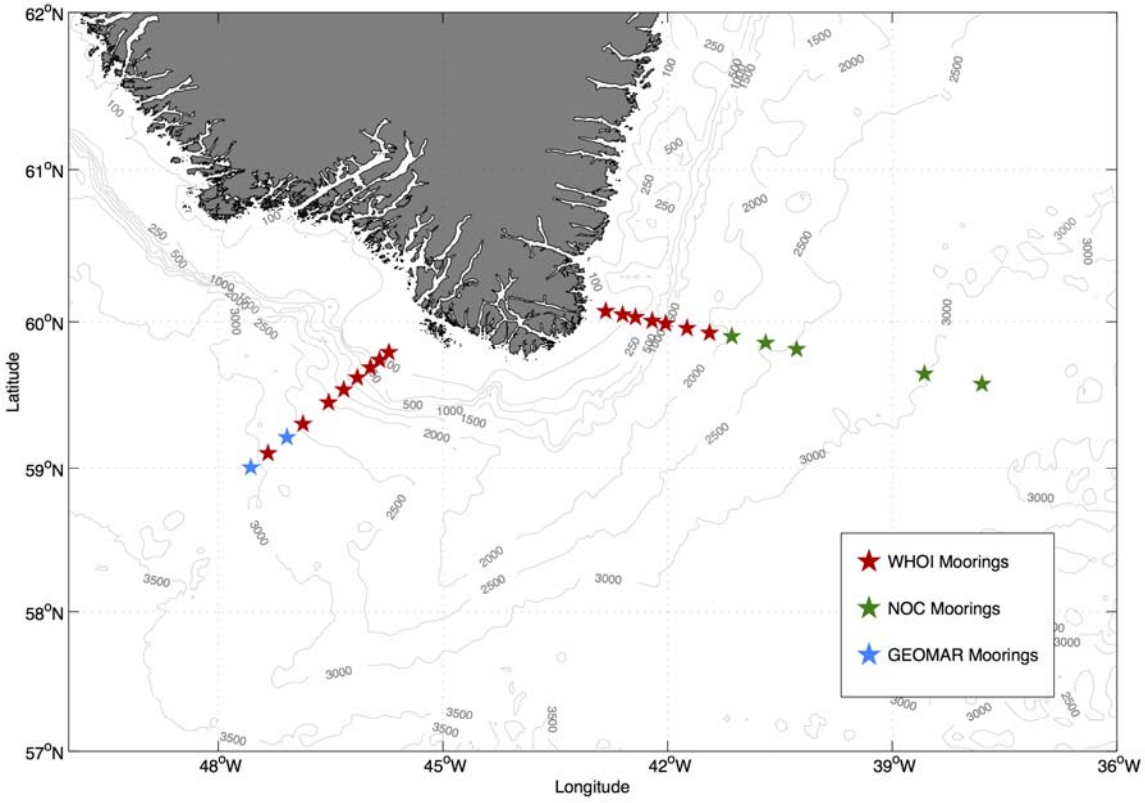


Figure 3. Positions of the 22 oceanographic moorings deployed during the cruise.

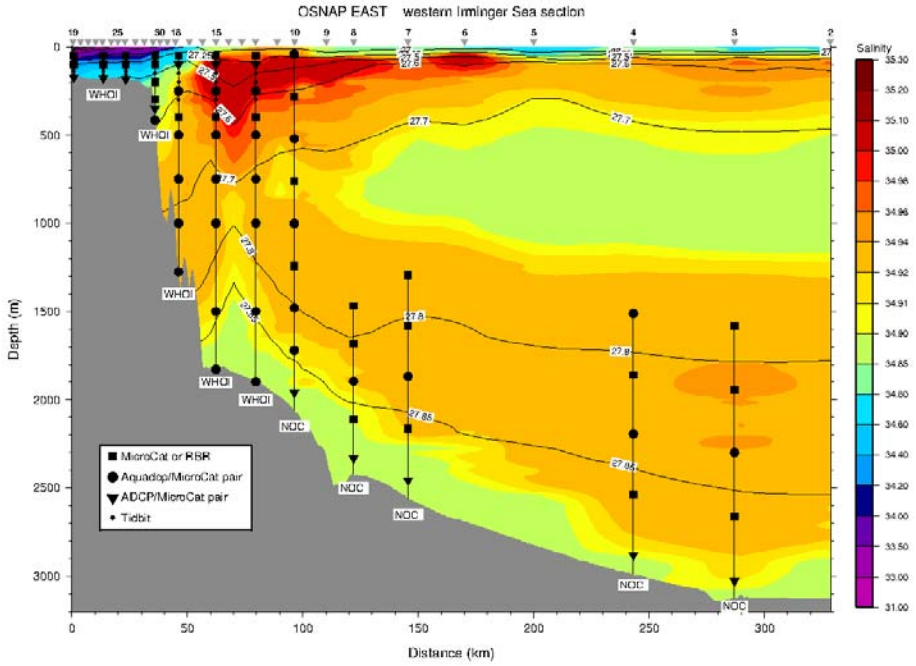


Figure 4. Locations of the OSNAP East Irminger Sea moorings and the instrumentation used (see the key) overlaid on the CTD salinity section (color) and potential density (contours, kg/m^3).

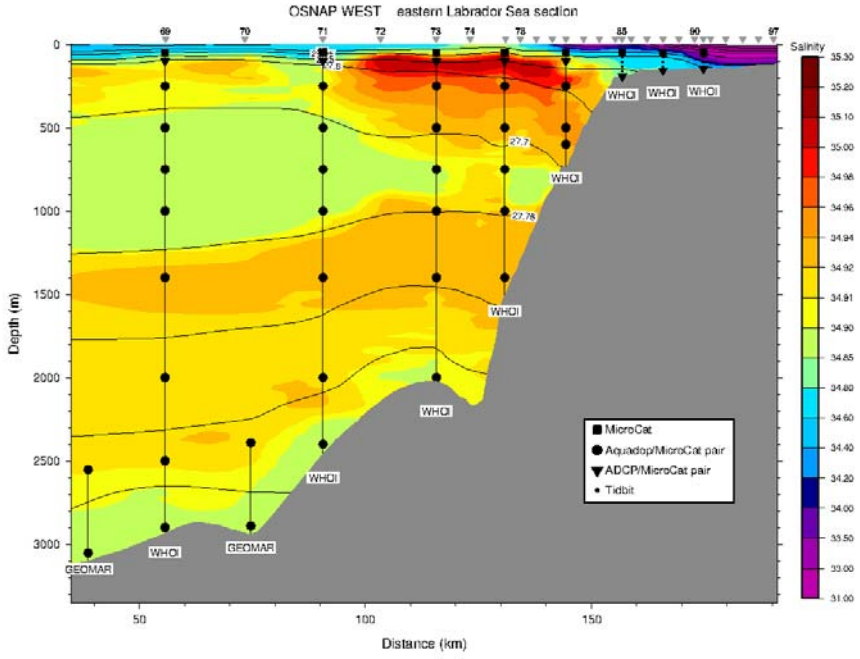


Figure 5. Locations of the OSNAP West Labrador Sea moorings and the instrumentation used (see the key) overlaid on the CTD salinity section (color) and potential density (contours, kg/m^3).

Table 1. Mooring Deployment information.

Mooring Name	Latitude (N)	Longitude (W)	Depth (m)	Note
M5	59 34.74	37 47.90	3134	NOC
M4	59 38.87	38 34.04	2987	NOC
M3	59 48.86	40 16.53	2593	NOC
M2	59 51.56	40 41.33	2547	NOC
M1	59 54.64	41 08.20	2062	NOC
SS4	59 45.60	40 37.80	2656	WHOI sound source
SS3	58 56.80	47 27.68	3082	WHOI sound source
CF7	59 55.74	41 26.28	1900	WHOI
CF6	59 57.60	41 44.40	1830	WHOI
CF5	59 59.36	42 01.32	1275	WHOI
CF4	60 00.38	42 12.25	385	WHOI
CF3	60 01.84	42 25.71	183	WHOI tripod
CF2	60 02.87	42 36.05	178	WHOI tripod
CF1	60 04.25	42 49.96	173	WHOI tripod
LS8	59 06.32	47 20.16	2930	WHOI
LS7	59 18.46	46 52.07	2458	WHOI
LS6	59 27.17	46 31.68	2022	WHOI
LS5	59 32.41	46 19.30	1508	WHOI
LS4	59 37.31	46 08.62	737	WHOI
LS3	59 41.41	45 58.10	190	WHOI
LS2	59 44.53	45 50.73	157	WHOI tripod
LS1	59 47.65	45 43.38	146	WHOI tripod
GM2	59 00.43	47 33.87	3104	GEOMAR 2
GM1	59 12.93	47 04.91	2941	GEOMAR 1

CTD/LADCP Measurements

A WHOI-provided rosette mounted with twelve 10-liter bottles, a Sea-Bird model SBE911+ CTD profiler, and upward- and downward-facing RDI Workhorse 300kHz lowered ADCPs were used for hydrographic stations on the cruise. The CTD sensor suite included dual temperature (T) and conductivity (C) sensors, dissolved oxygen, transmissometer, chlorophyll-α and CDOM fluorometers, surface PAR sensor, and an altimeter. Analysis of the oxygen data towards the end of the cruise indicated a faulty sensor. The sensor was swapped out for a backup sensor but this one also exhibited problems. The primary oxygen sensor was sent back to Sea-Bird Electronics after the cruise to be recalibrated. Evaluation of primary versus secondary T/C sensors showed that the differences was negligible throughout the cruise, lending confidence to the accuracy of the measurements. A total of 196 CTD stations were occupied on the cruise comprising 8 sections (Fig. 6). The majority of these included lowered ADCP measurements. For each cast, water samples were collected at discrete intervals and analyzed for salinity for the purpose of calibrating the CTD conductivity sensors.

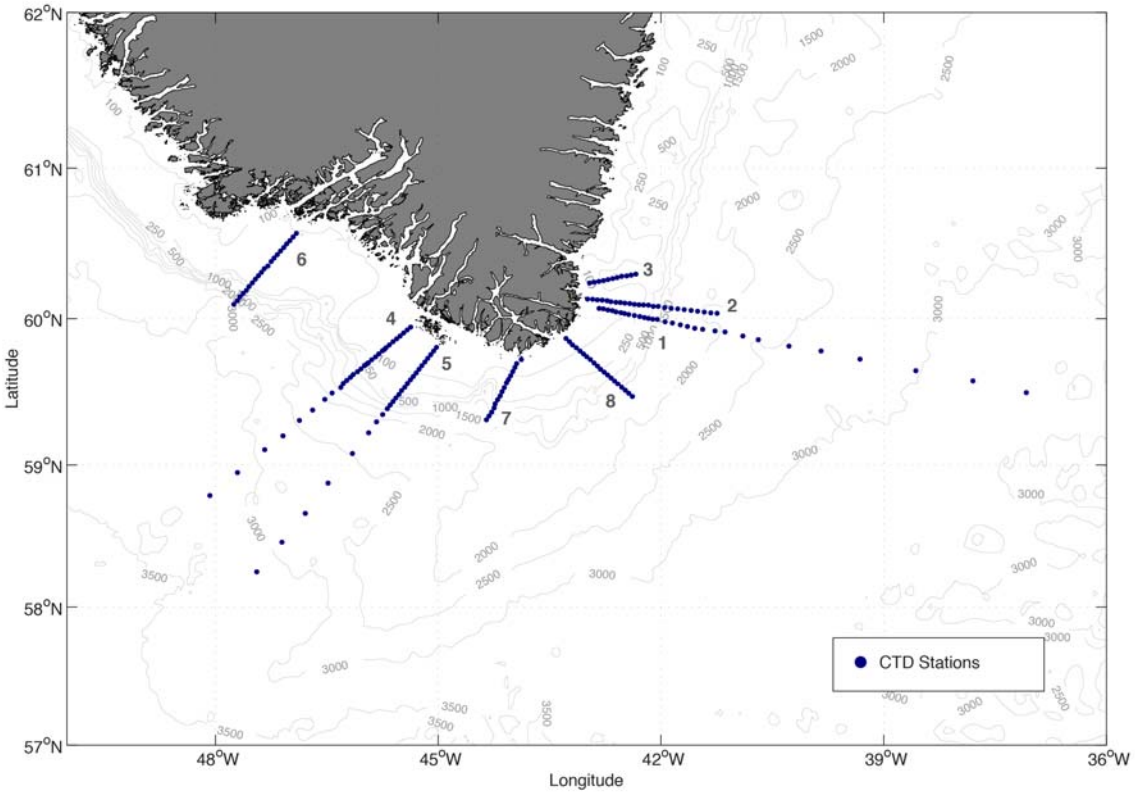


Figure 6. Positions of the 196 hydrographic stations occupied on KN221-3. A total of 8 transects were completed.

CTD Configuration

ROSETTE:
A custom built stainless-steel rosette and SBE32 pylon, with twelve 10-liter bottles, was used for the cruise.

CTD setup: (Note: specific details of serial number, channel assignment, and calibration data are in the configuration file for each station.)

SBE 911+ CTD Deck unit.
Dual SBE3 temperature sensors
Dual SBE4 conductivity sensors
SBE43 oxygen sensor on the primary pump.
Digiquartz TC Pressure sensor
Wetlabs ECO AFL Fluorometer
Wetlabs ECO NTU Turbidity Sensor
Wetlabs CStar Transmissometer
Benthos ESA916 Altimeter Sensor
Biospherical QSP2300 Surface PAR Sensor

Salinity Quality Control

The CTD data were processed using the recommended post-acquisition sequence of Sea-Bird routines for an SBE 9. This included removing out-of-water records, editing parameters to exclude outliers, filtering pressure, temperature, and conductivity, and deriving salinity and oxygen from the edited values. The result was a 1-decibar averaged downcast profile in Sea-Bird ascii format, with a lengthy header that contains the processing history for that file. Files were converted to a different ascii format with a simple three-line header for continued processing using WHOI Matlab scripts.

The output of the seabird routines was then quality controlled to assess conductivity and temperature sensor performance and to remove bad conductivity and/or temperature values as indicated by density inversions in the downcast portion of the profile. To accomplish this, plots of salinity, temperature, and density versus pressure were created for each CTD station and inspected for density inversions using a MATLAB graphical user interface (GUI). For inversions exceeding .005 kg/m^3, the bad parameter (temperature or conductivity) was removed, a new interpolated value calculated, and the derived salinity and density recomputed from the new values.

To assess the accuracy of the CTD salinity measurements, water sample values were used to calibrate the CTD's conductivity sensors. The water sample conductivity values were regressed against the CTD conductivity values, thus generating a correction slope and bias. The calibrated CTD values were then compared to the water samples as both a function of time and pressure, thus allowing any faulty bottles or sensors to be detected. The final accuracy of the salinity was estimated to be .002.

SeaBird Sensor Calibration

All Sea-bird sensors were calibrated by Sea-Bird Electronics within a year of the cruise start date. The sensors will be calibrated again after the field season is completed. It is expected that the accuracy of the temperature sensors will be .001^{o}C (but this remains to be verified).

ADCP Configuration

Lowered ADCP

A lowered ADCP (LADCP) system was used to measure full ocean depth profiles of velocity at each CTD station. The LADCP system consisted of a downward-facing 150 kHz ADCP and an upward-facing 300 kHz ADCP (both from Teledyne RD Instruments). The ADCPs were synchronized to ping out of phase with each other in order to minimize instrument interference. Each instrument was set to collect single pings in beam coordinates. Data from each ADCP were edited and combined with CTD and GPS data, and processed using software from Lamont-Doherty Earth Observatory resulting in a profile of absolute velocity at each station. The absolute velocity profiles were then corrected for magnetic variation using software from NOAA/NODC. Finally, the profiles were de-tided using a high-resolution (1/60th degree) tidal model developed at Oregon State University's College of Earth, Ocean, and Atmospheric Sciences.

Shipboard ADCP

Underway hull-mounted ADCP data were collected throughout the cruise using two independent systems. These were a 75 kHz Ocean Surveyor (OS75) and a 300 kHz Workhorse (WH300) ADCP (both from Teledyne RD Instruments). UHDAS data acquisition software from University of Hawaii was used to collect raw ADCP data from each instrument. The OS75 was set up to collect 128 8-meter bins of data every ping in narrowband mode. The WH300 was set up to collect 70 2-meter bins of data every ping in broadband mode. Raw single ping data were processed on board using the CODAS shipboard ADCP processing software developed at University of Hawaii's School of Earth Science and Technology. Single ping data were averaged and edited to remove ship motion from the measured velocity. Final processed data resulted in absolute velocity profiles at 5 minute sample intervals throughout the cruise. The data were then de-tided using the same tidal model used for the LADCP data.

Bathymetric Surveys

Bathymetric data were collected along most of the ship track with the Knudsen echo sounder. Unfortunately, *Knorr's* Seabeam system was not operational for the first half of the cruise, so the bathymetric surveys for the two WHOI east Greenland moorings on the upper slope were done using the single beam Knudsen (see inset of Fig. 2). Prior to the mooring work in the Labrador Sea, the Seabeam was partially fixed so we were able to use swath data from the transect across the west Greenland shelf/slope to choose our mooring locations for the Labrador Sea moorings. All of the Kundsen data collected along the mooring/CTD transects were processed during the cruise in order to produce a final sound speed corrected product, free of the noise inherent to the acquisition system.

RAFOS Floats

A total of 120 subsurface acoustically tracked RAFOS floats are planned to be released during 2014, 2015 and 2016 OSNAP cruises to directly observe the pathways of Overflow Waters (OW) throughout the subpolar North Atlantic. An array of 10 260-Hz sound sources will be used to track the floats until all the moored arrays are recovered in 2018. Figure 7 shows the approximate positions and pong times for the 10 sound sources. Six short-mission RAFOS floats and one profiling SOLO float with acoustic receiver were released in 2014 to confirm and monitor sound source performance.

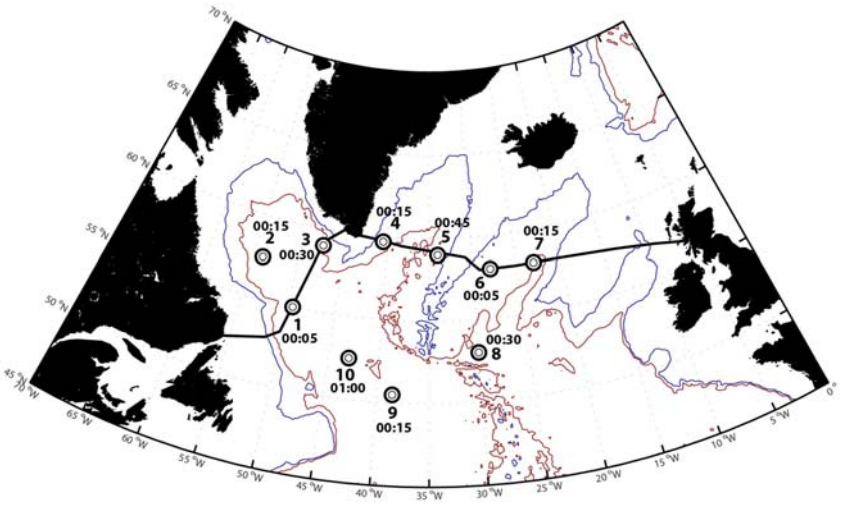


Figure 7. Sound source mooring positions and pong times (once daily) for the 10 sound sources deployed as part of the OSNAP program.

Deployments for 2014 were as follows:

- KN221-01: 10 RAFOS floats in the Charlie-Gibbs Fracture Zone (CGFZ); sound sources #8, 9 and 10; 2 monitoring RAFOS floats.
- KN221-02: 10 RAFOS floats on the eastern flank of the Reykjanes Ridge; sound sources #5, 6 and 7; 2 monitoring RAFOS floats in the Iceland Basin and 1 monitoring float in the Irminger Basin; 1 profiling SOLO float with acoustic receiver in the Irminger Basin.
- KN221-03: 19 RAFOS floats in the Overflow Water over the east Greenland slope; sound sources #1, 3 and 4; 1 monitoring RAFOS float in the Labrador Sea. (Note: one float was not deployed due to internal glass imperfections, therefore, only 18 of the 19 floats were deployed.)
- R/V Thalassa: sound source #2 (Johannes Karstenson, chief scientist; replacement cruise for R/V Merien).

Tables 2 and 3 below give the deployment information for float and sound source deployments on KN221-03. RAFOS floats that were released in the OW over the east Greenland slope were ballasted for 1800, 2000, 2200, 25000 and 2800m. The general deployment strategy was to release them 100-200 m above the sea floor.

Most of the RAFOS floats were released using the “holey tube” made out of PVC with a piston and starch ring that would dissolve and release the float when submerged off the fantail. On one occasion (RAFOS float s/n 1315), the bottom of the tube would not open. After more than a minute in the water an attempt to recover the tube and float was made. As the tube was slowly pulled up to check the release, the float slipped into the water while the bottom of the tube was just at the waterline. One float, S/N 1348, was not deployed due to internal glass imperfections.

Table 2. RAFOS float deployment information.

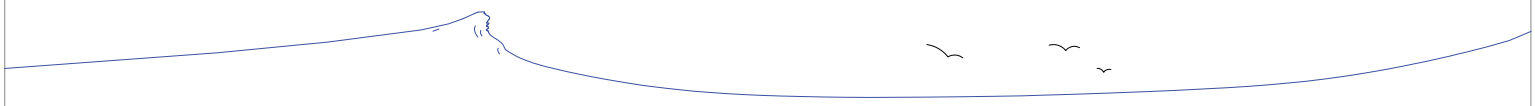
Closest CTD station	Instrument S/N	Deployment Date	Deployment Time GMT	Latitude (N)	Longitude (W)	RAFOS Windows	Corrected Water Depth Meters	Ballast/Target Depth Meters	Iridium ID
3, 4	1347	7-Aug-14	23:23	59.640	38.499	730	3000	2800	300234061828860
4	1346	8-Aug-14	02:51	59.664	38.764	730	2960	2800	300234061821880
4	1349	8-Aug-14	03:03	59.665	38.766	730	2949	2800	300234061828870
4,5	1345	8-Aug-14	03:53	59.694	39.020	180	2898	2800	300234061829860
6	1339	9-Aug-14	01:17	59.782	39.872	730	2688	2500	300234061823870
6	1340	9-Aug-14	01:27	59.783	39.872	730	2682	2500	300234061827870
6,7	1335	9-Aug-14	02:02	59.722	39.998	730	2656	2500	300234061821850
6,7	1336	9-Aug-14	02:09	59.789	39.998	730	2665	2500	300234061827860
9	1332	9-Aug-14	18:23	59.881	40.872	730	2424	2200	300234061827840
9	1331	9-Aug-14	18:39	59.884	40.833	730	2383	2200	300234061824840
9	1318	9-Aug-14	21:01	59.876	40.900	730	2291	2200	300234061825920
9	1328	9-Aug-14	21:14	59.875	40.876	730	2376	2200	300234061826890
9	1327	9-Aug-14	21:20	59.875	40.871	730	2383	2200	300234061826880
9	1317	9-Aug-14	21:56	59.894	40.997	730	2203	2000	300234061828880
9	1315	9-Aug-14	22:00	59.894	40.997	730	2203	2000	300234061821900
10,11	1309	10-Aug-14	01:18	59.909	41.219	730	2011	1800	300234061824930
10,11	1308	10-Aug-14	01:25	59.909	41.220	730	2001	1800	300234061826900
11	1307	10-Aug-14	04:01	59.919	41.311	730	1955	1800	300234061822890
n/a	1028	26-Aug-16	03:31	56.522	49.008	90	3533	1000	300234010552950

Table 3. Sound source deployment information.

CTD Station	Insturment S/N	Pong Time	Deployment Date	Deployment Time GMT	Latitude (N)	Longitude (W)	Site Number	Water Depth Meters	Ballast/Target Depth Meters
n/a	SS81	0:05	25-Aug-14	16:54	54.991	49.503	1	3617	1200
n/a	SS83	0:30	23-Aug-14	11:14	58.947	47.452	3	3081	1200
n/a	SS84	0:15	10-Aug-14	11:47	59.757	40.604	4	2657	1200

APPENDIX

KN221-03 MOORING DIAGRAMS



(2) 14" Panther Plast Floats (#714) on Tension Rod

P W2 Q

50 m Depth

MicroCAT

48.9 m 1/4" Spectra Line & MicroCAT — Note A

(1) Float 28 m up from lower end of Spectra

P W3 Q

44.2 m 1/4" Spectra Line — Note B

N

Ocean Research Benthic Instrument Tripod (ORBIT)
with MicroCAT, KILO,
(12) 17" Glassballs, Dual Release,
& Sentinel 300 kHz ADCP,
1000 lb Ww Anchor

Depth 146 m

Hardware Required (per mooring without spares)	
(2)	3/8" Anchor Shackle
(3)	1/2" Anchor Shackle
(1)	200 lb Weak Link
(1)	300 lb Weak Link

Hardware Designation	
P	(1) 1/2" SH
Q	(1) 3/8" SH
W2	200 lb Weak Link
W3	300 lb Weak Link

Note A

Tidbit mounted at 78 m

Note B

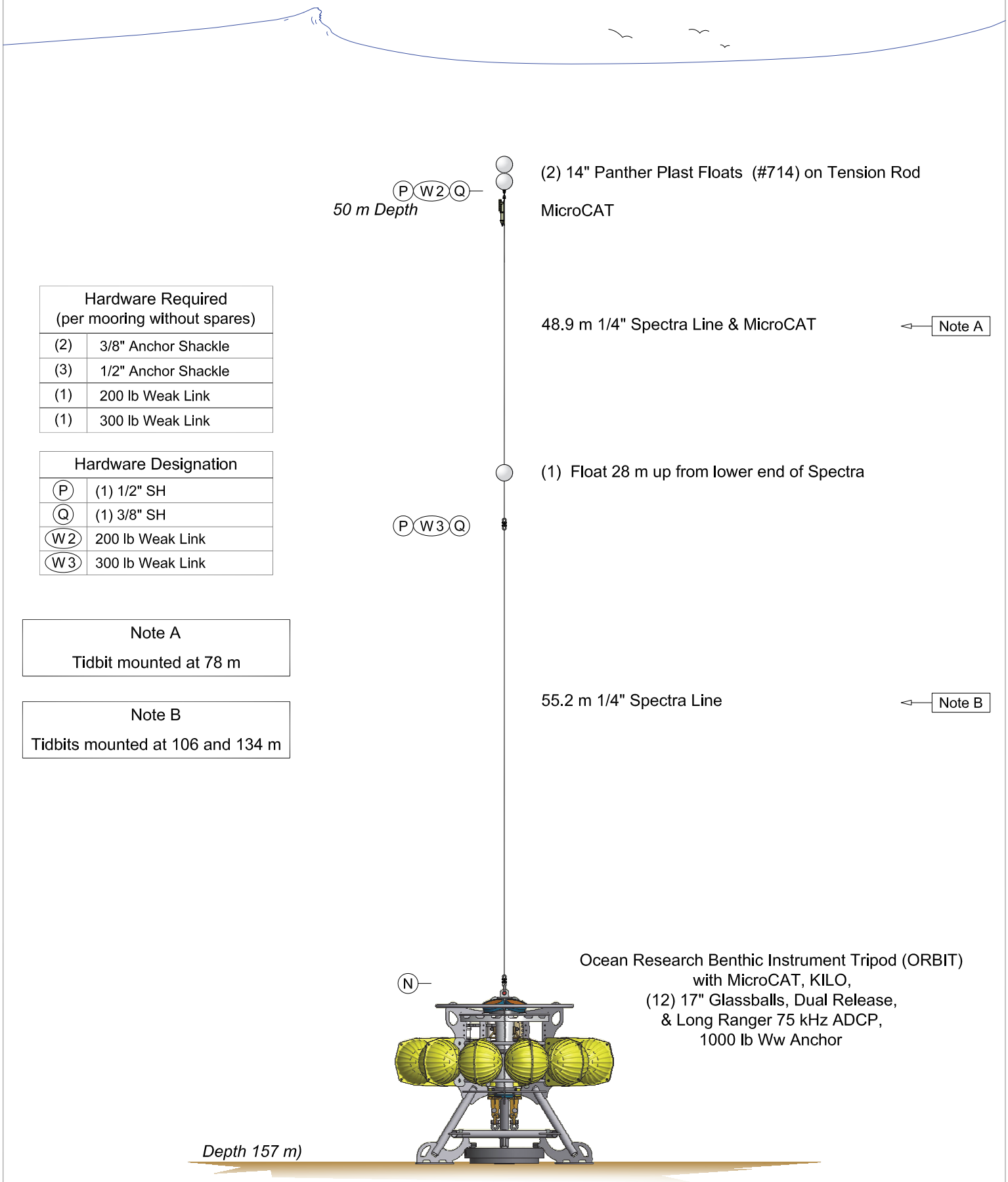
Tidbits mounted at 106 and 134 m

Pickart OSNAP Mooring LS-1

As Deployed

OSNAP-LS1

Woods Hole Oceanographic Institution	
designed by John Kemp, drawn by Betsey Doherty	
file: OSNAP Pickart	date: 12/02/2014



Hardware Required (per mooring without spares)	
(2)	3/8" Anchor Shackle
(3)	1/2" Anchor Shackle
(1)	200 lb Weak Link
(1)	300 lb Weak Link

Hardware Designation	
P	(1) 1/2" SH
Q	(1) 3/8" SH
W2	200 lb Weak Link
W3	300 lb Weak Link

Note A

Tidbit mounted at 78 m

Note B

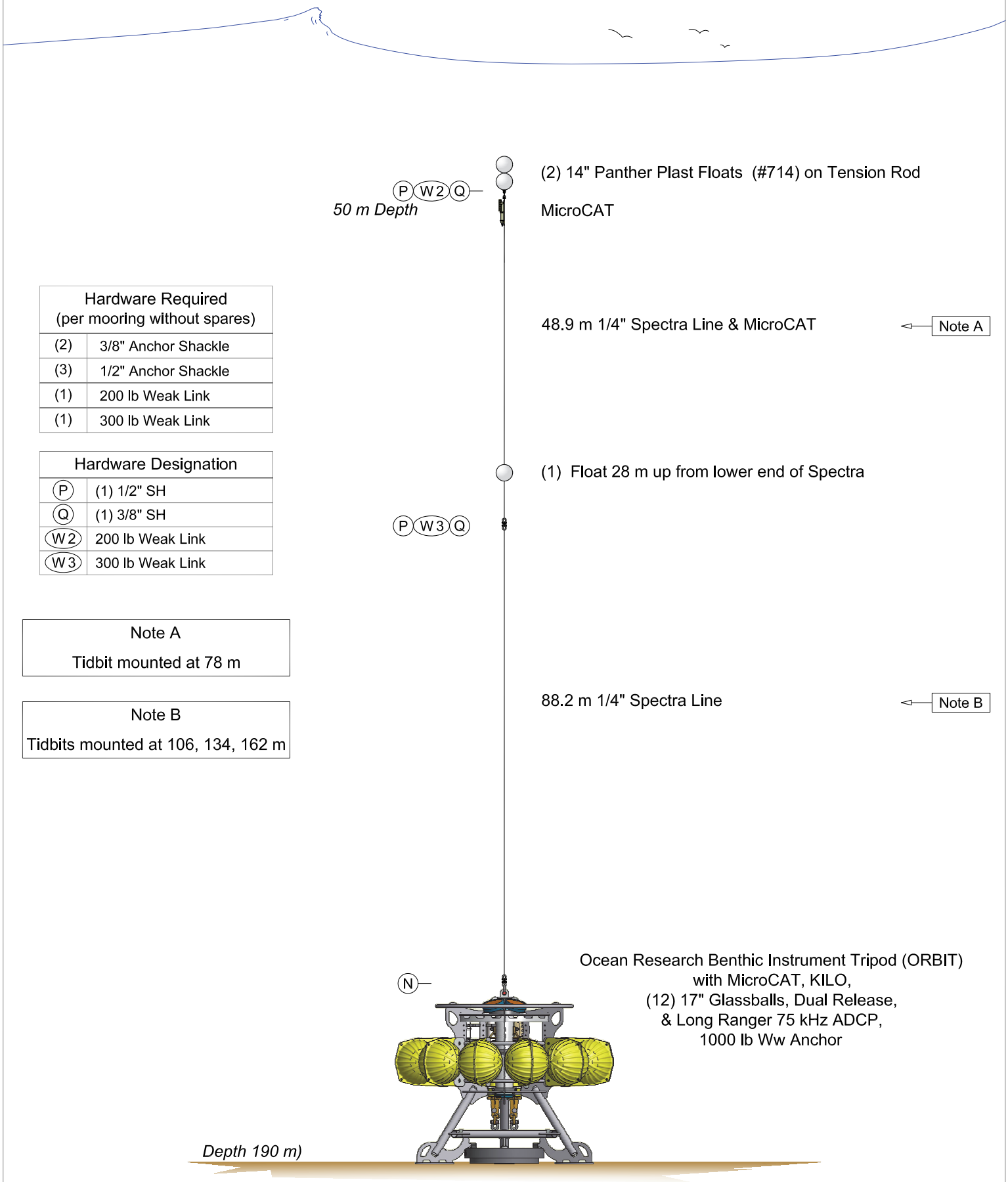
Tidbits mounted at 106 and 134 m

Pickart OSNAP Mooring LS-2

As Deployed

OSNAP-LS2

Woods Hole Oceanographic Institution	
designed by John Kemp, drawn by Betsey Doherty	
file: OSNAP Pickart	date: 12/02/2014



Hardware Required (per mooring without spares)	
(2)	3/8" Anchor Shackle
(3)	1/2" Anchor Shackle
(1)	200 lb Weak Link
(1)	300 lb Weak Link

Hardware Designation	
P	(1) 1/2" SH
Q	(1) 3/8" SH
W2	200 lb Weak Link
W3	300 lb Weak Link

Note A

Tidbit mounted at 78 m

Note B

Tidbits mounted at 106, 134, 162 m

Pickart OSNAP Mooring LS-3

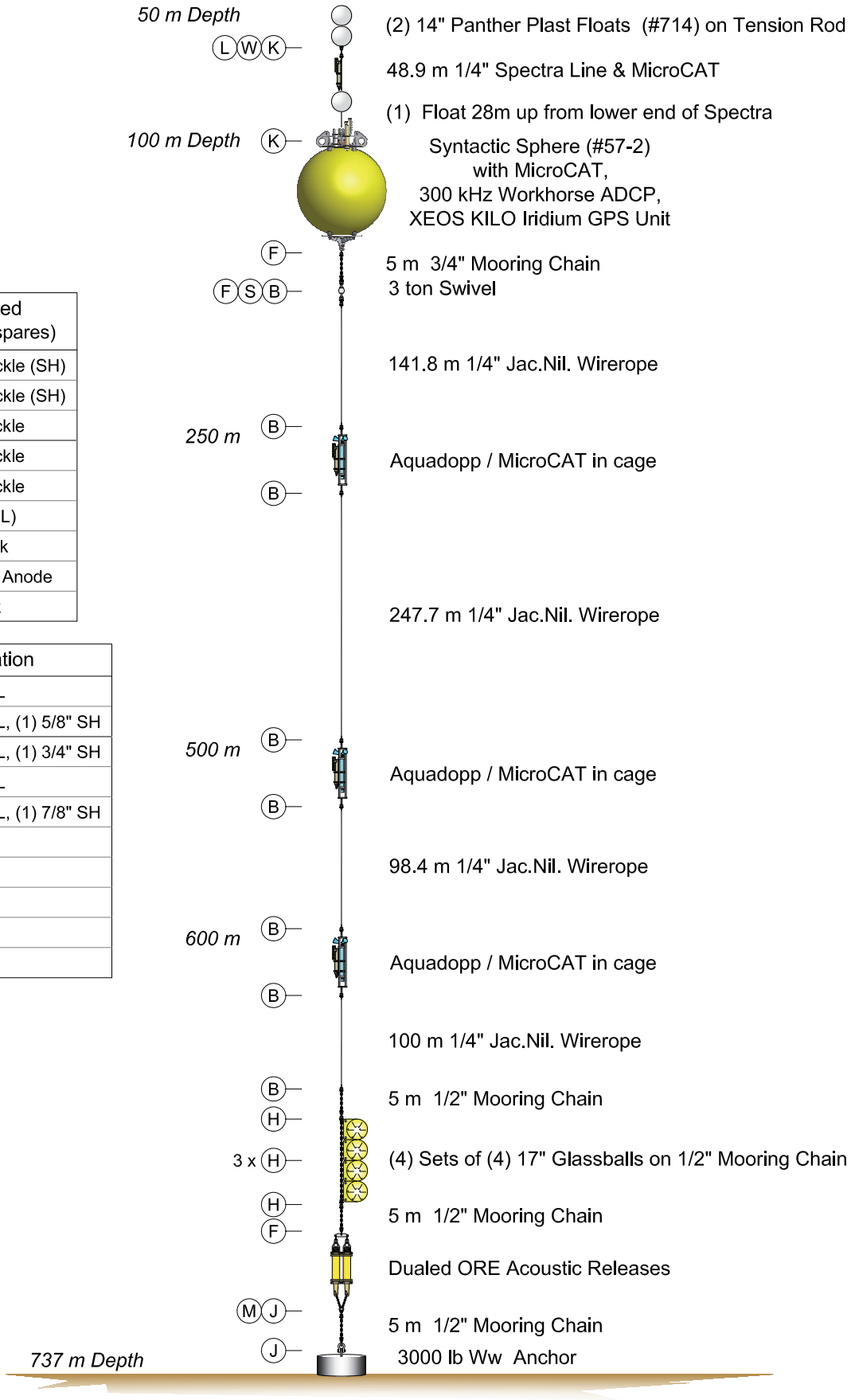
As Deployed

OSNAP-LS3

Woods Hole Oceanographic Institution

designed by John Kemp, drawn by Betsey Doherty

file: OSNAP Pickart | date: 12/02/2014



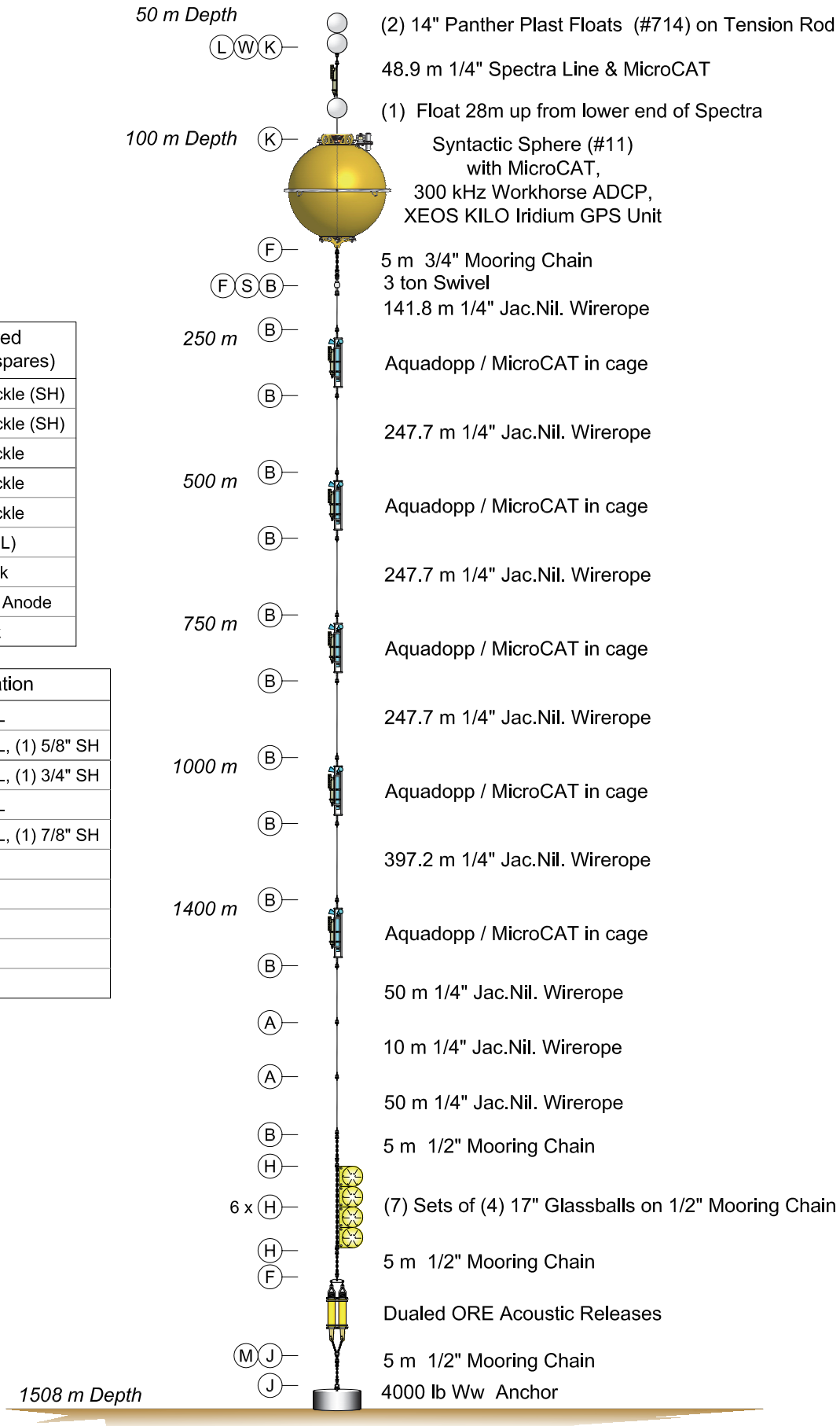
Hardware Required (per mooring without spares)	
(2)	3/8" Anchor Shackle (SH)
(11)	1/2" Anchor Shackle (SH)
(23)	5/8" Anchor Shackle
(3)	3/4" Anchor Shackle
(2)	7/8" Anchor Shackle
(19)	5/8" Sling Link (SL)
(1)	1-1/4" Master Link
(1)	3 ton Swivel with Anode
(1)	250 lb Weak Link

Hardware Designation	
A	(2) 1/2" SH, (1) 5/8" SL
B	(1) 1/2" SH, (1) 5/8" SL, (1) 5/8" SH
F	(1) 5/8" SH, (1) 5/8" SL, (1) 3/4" SH
H	(2) 5/8" SH, (1) 5/8" SL
J	(1) 5/8" SH, (1) 5/8" SL, (1) 7/8" SH
K	(1) 3/8" SH
L	(1) 1/2" SH
M	Master Link
S	Swivel
W	Weak Link

Pickart OSNAP Mooring LS-4
737 meter Depth, As Deployed

OSNAP-LS4

Woods Hole Oceanographic Institution	
designed by John Kemp, drawn by Betsey Doherty	
file: OSNAP Pickart	date: 12/02/2014



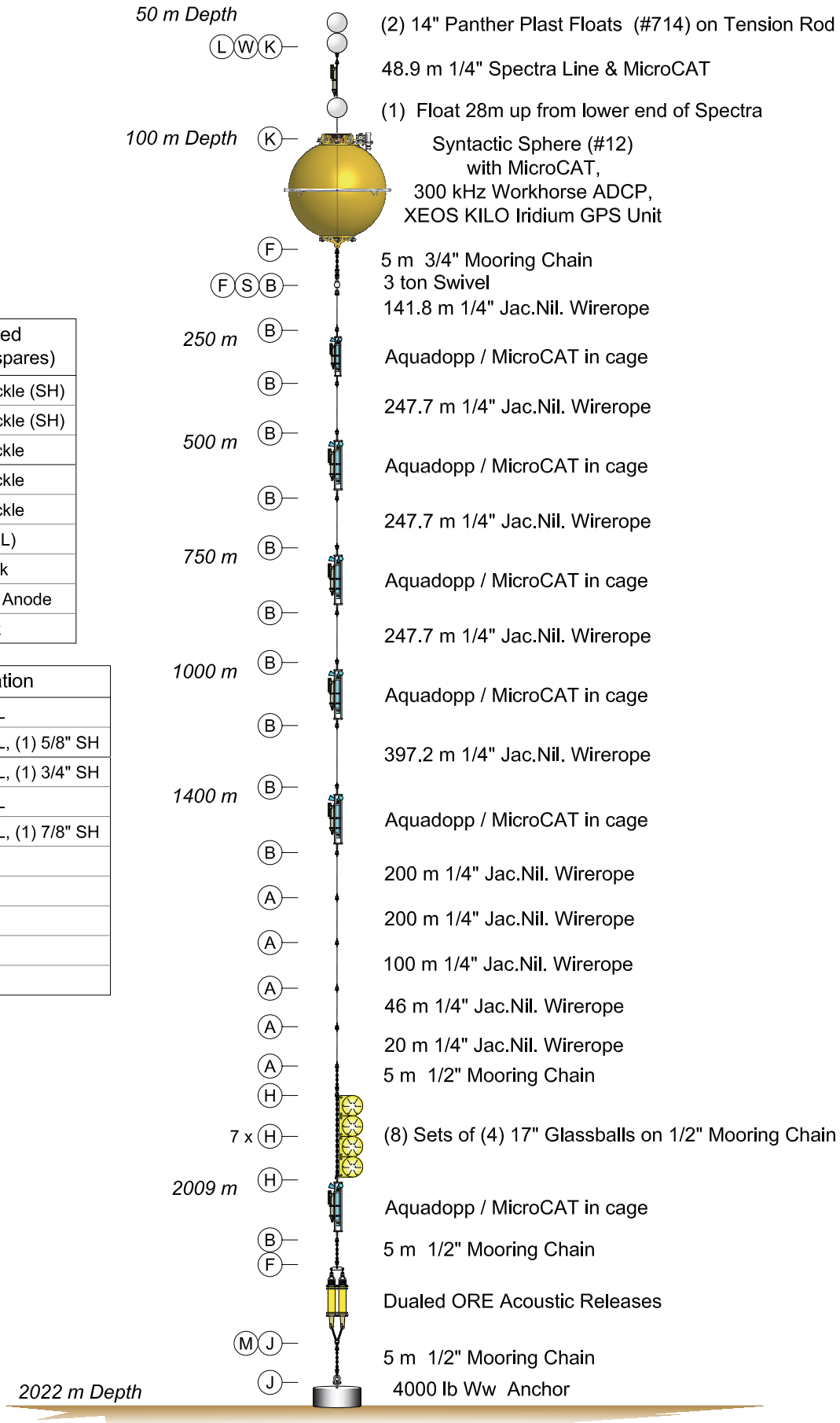
Hardware Required (per mooring without spares)	
(2)	3/8" Anchor Shackle (SH)
(19)	1/2" Anchor Shackle (SH)
(35)	5/8" Anchor Shackle
(3)	3/4" Anchor Shackle
(2)	7/8" Anchor Shackle
(29)	5/8" Sling Link (SL)
(1)	1-1/4" Master Link
(1)	3 ton Swivel with Anode
(1)	250 lb Weak Link

Hardware Designation	
(A)	(2) 1/2" SH, (1) 5/8" SL
(B)	(1) 1/2" SH, (1) 5/8" SL, (1) 5/8" SH
(F)	(1) 5/8" SH, (1) 5/8" SL, (1) 3/4" SH
(H)	(2) 5/8" SH, (1) 5/8" SL
(J)	(1) 5/8" SH, (1) 5/8" SL, (1) 7/8" SH
(K)	(1) 3/8" SH
(L)	(1) 1/2" SH
(M)	Master Link
(S)	Swivel
(W)	Weak Link

Pickart OSNAP Mooring LS-5
1508 meter Depth, As Deployed

OSNAP-LS5

Woods Hole Oceanographic Institution
designed by John Kemp, drawn by Betsey Doherty
file: OSNAP Pickart | date: 12/02/2014



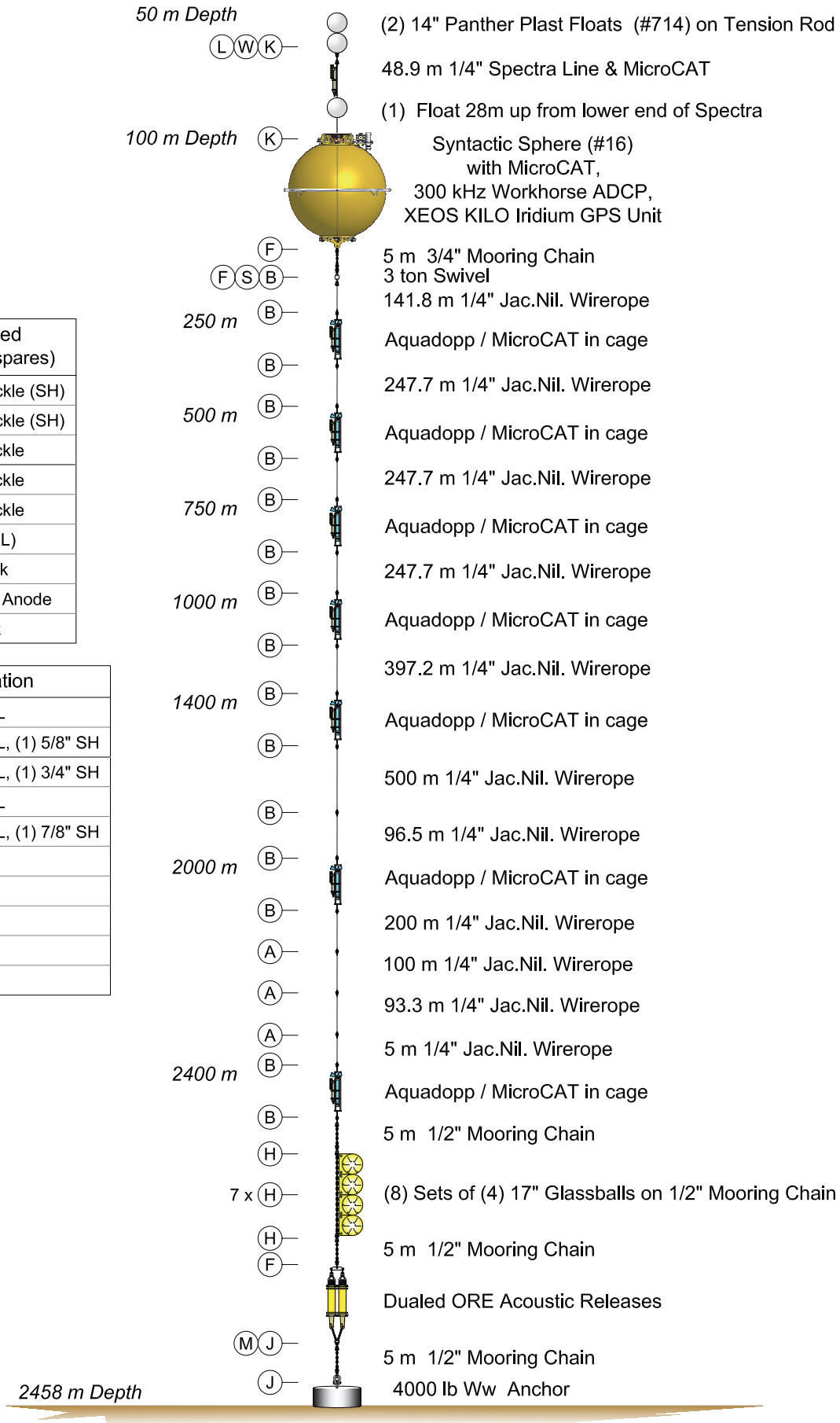
Hardware Required (per mooring without spares)	
(2)	3/8" Anchor Shackle (SH)
(20)	1/2" Anchor Shackle (SH)
(38)	5/8" Anchor Shackle
(3)	3/4" Anchor Shackle
(2)	7/8" Anchor Shackle
(31)	5/8" Sling Link (SL)
(1)	1-1/4" Master Link
(1)	3 ton Swivel with Anode
(1)	250 lb Weak Link

Hardware Designation	
A	(2) 1/2" SH, (1) 5/8" SL
B	(1) 1/2" SH, (1) 5/8" SL, (1) 5/8" SH
F	(1) 5/8" SH, (1) 5/8" SL, (1) 3/4" SH
H	(2) 5/8" SH, (1) 5/8" SL
J	(1) 5/8" SH, (1) 5/8" SL, (1) 7/8" SH
K	(1) 3/8" SH
L	(1) 1/2" SH
M	Master Link
S	Swivel
W	Weak Link

Pickart OSNAP Mooring LS-6
2022 meter Depth, As Deployed

OSNAP-LS6

Woods Hole Oceanographic Institution	
designed by John Kemp, drawn by Betsey Doherty	
file: OSNAP Pickart	date: 12/02/2014



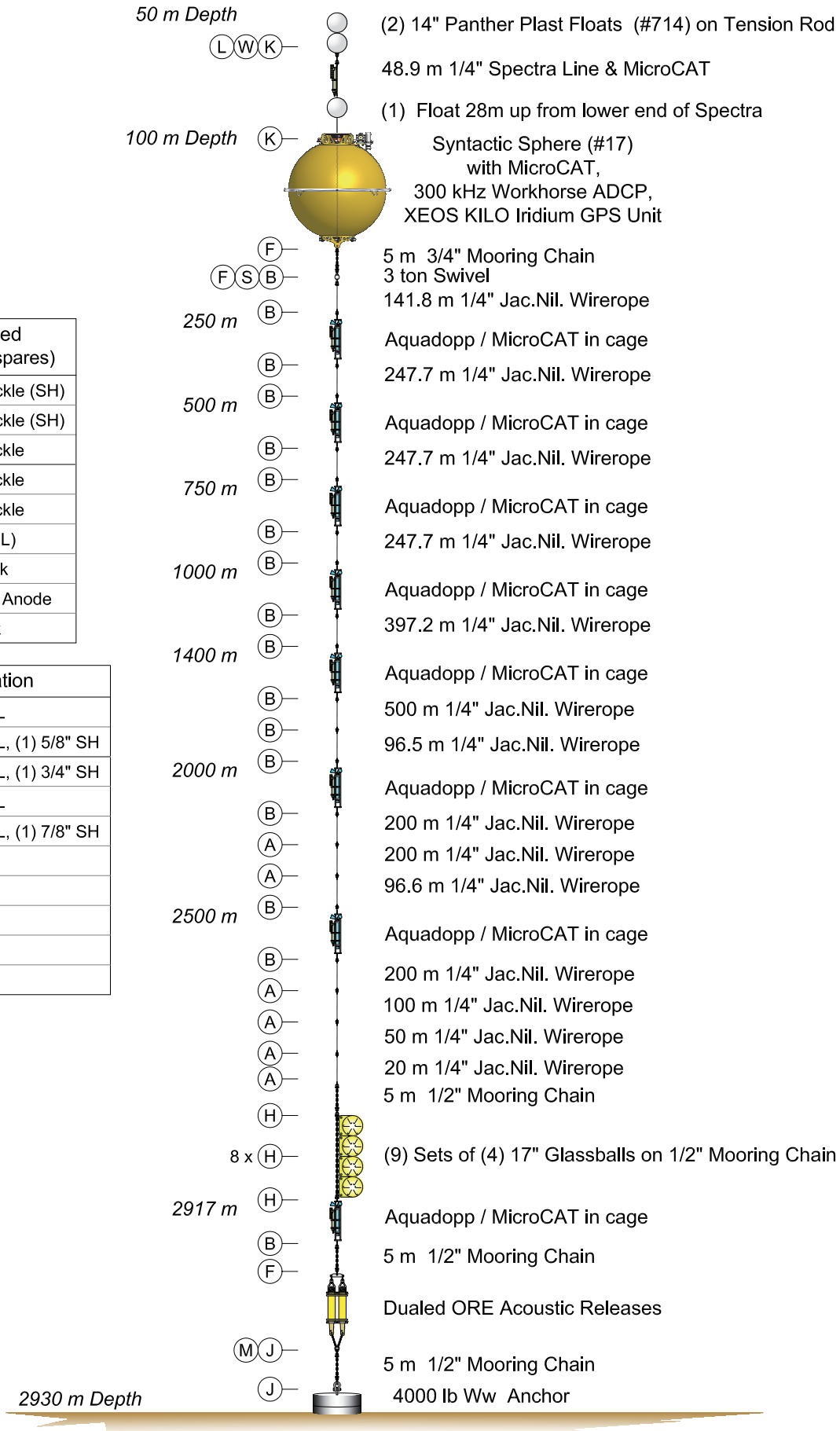
Hardware Required (per mooring without spares)	
(2)	3/8" Anchor Shackle (SH)
(20)	1/2" Anchor Shackle (SH)
(40)	5/8" Anchor Shackle
(3)	3/4" Anchor Shackle
(2)	7/8" Anchor Shackle
(32)	5/8" Sling Link (SL)
(1)	1-1/4" Master Link
(1)	3 ton Swivel with Anode
(1)	250 lb Weak Link

Hardware Designation	
A	(2) 1/2" SH, (1) 5/8" SL
B	(1) 1/2" SH, (1) 5/8" SL, (1) 5/8" SH
F	(1) 5/8" SH, (1) 5/8" SL, (1) 3/4" SH
H	(2) 5/8" SH, (1) 5/8" SL
J	(1) 5/8" SH, (1) 5/8" SL, (1) 7/8" SH
K	(1) 3/8" SH
L	(1) 1/2" SH
M	Master Link
S	Swivel
W	Weak Link

Pickart OSNAP Mooring LS-7
2458 meter Depth, As Deployed

OSNAP-LS7

Woods Hole Oceanographic Institution	
designed by John Kemp, drawn by Betsey Doherty	
file: OSNAP Pickart	date: 12/02/2014



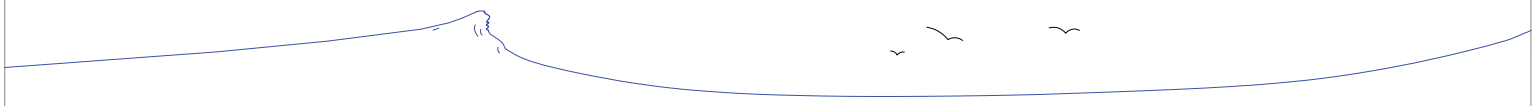
Hardware Required (per mooring without spares)	
(2)	3/8" Anchor Shackle (SH)
(22)	1/2" Anchor Shackle (SH)
(42)	5/8" Anchor Shackle
(3)	3/4" Anchor Shackle
(2)	7/8" Anchor Shackle
(34)	5/8" Sling Link (SL)
(1)	1-1/4" Master Link
(1)	3 ton Swivel with Anode
(1)	250 lb Weak Link

Hardware Designation	
A	(2) 1/2" SH, (1) 5/8" SL
B	(1) 1/2" SH, (1) 5/8" SL, (1) 5/8" SH
F	(1) 5/8" SH, (1) 5/8" SL, (1) 3/4" SH
H	(2) 5/8" SH, (1) 5/8" SL
J	(1) 5/8" SH, (1) 5/8" SL, (1) 7/8" SH
K	(1) 3/8" SH
L	(1) 1/2" SH
M	Master Link
S	Swivel
W	Weak Link

Pickart OSNAP Mooring LS-8
2930 meter Depth, As Deployed

OSNAP-LS8

Woods Hole Oceanographic Institution	
designed by John Kemp, drawn by Betsey Doherty	
file: OSNAP Pickart	date: 12/02/2014



50 m Depth

L W L

(2) 14" Panther Plast Floats (#714) on Tension Rod

MicroCAT

48.9 m 1/4" Spectra Line & MicroCAT ← Note A

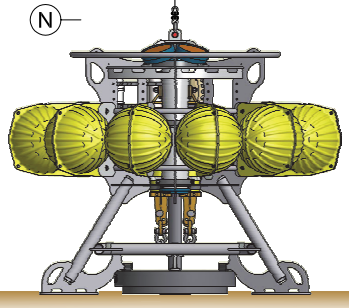
(1) Float 28 m up from lower end of Spectra

O

71.2 m 1/4" Spectra Line ← Note B

N

Ocean Research Benthic Instrument Tripod (ORBIT)
with:
Long Ranger 75 kHz ADCP,
MicroCAT,
XEOS KILO Unit,
Aquadopp Current Meter,
and Dual Release,
1000 lb Ww Anchor



Depth 173 m

Hardware Designation	
L	(1) 1/2" SH
N	(1) 1/2" SH, (1) 3/8" SH
O	(1) 3/8" SH, (1) 350 lb Weak Link, (1) 3/8" SH
W	(1) 250 lb Weak Link

Hardware Required (per mooring without spares)	
(3)	3/8" Anchor Shackle
(2)	1/2" Anchor Shackle
(1)	250 lb Weak Link
(1)	350 lb Weak Link

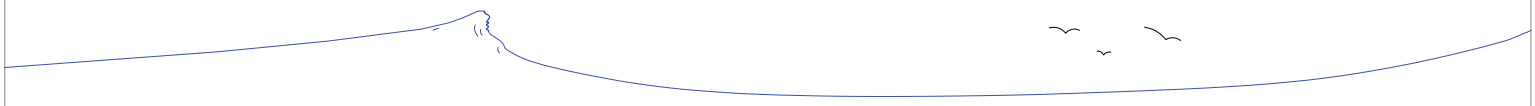
Note A Attach Instrument to Line	
Depth	Instrument
50 m	Plastic MicroCAT
60 m	Tidbit
70 m	Tidbit
80 m	Tidbit

Note B Attach Instrument to Line	
Depth	Instrument
100 m	MicroCAT (BH)
120 m	Tidbit
140 m	Tidbit
160 m	Tidbit

Straneo OSNAP Mooring CF1
As Deployed

CF1

Woods Hole Oceanographic Institution	
designed by John Kemp, drawn by Betsey Doherty	
file: OSNAP Straneo	date: 12/02/2014



50 m Depth

(L)(W)(L)

(2) 14" Panther Plast Floats (#714) on Tension Rod

MicroCAT

48.9 m 1/4" Spectra Line & MicroCAT ← Note A

Hardware Designation	
(L)	(1) 1/2" SH
(N)	(1) 1/2" SH, (1) 3/8" SH
(O)	(1) 3/8" SH, (1) 350 lb Weak Link, (1) 3/8" SH
(W)	(1) 250 lb Weak Link

Hardware Required (per mooring without spares)	
(3)	3/8" Anchor Shackle
(2)	1/2" Anchor Shackle
(1)	250 lb Weak Link
(1)	350 lb Weak Link

(1) Float 28 m up from lower end of Spectra

(O)

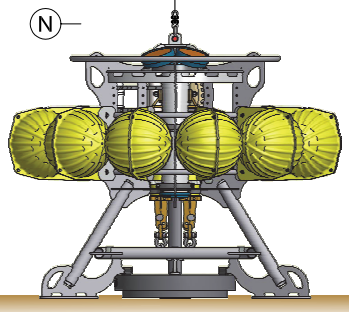
Note A Attach Instrument to Line	
Depth	Instrument
50 m	Plastic MicroCAT
60 m	Tidbit
70 m	Tidbit
80 m	Tidbit

76.2 m 1/4" Spectra Line ← Note B

Note B Attach Instrument to Line	
Depth	Instrument
100 m	MicroCAT (BH)
120 m	Tidbit
140 m	Tidbit
160 m	Tidbit

Ocean Research Benthic Instrument Tripod (ORBIT)
with:
Long Ranger 75 kHz ADCP,
MicroCAT,
XEOS KILO Unit,
Aquadopp Current Meter,
and Dual Release,
1000 lb Ww Anchor

(N)

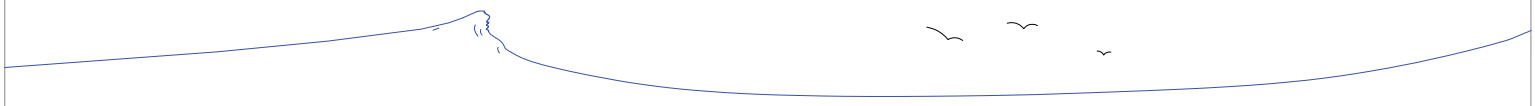


Depth 178 m

Straneo OSNAP Mooring CF2
As Deployed

CF2

Woods Hole Oceanographic Institution	
designed by John Kemp, drawn by Betsey Doherty	
file: OSNAP Straneo	date: 12/02/2014



50 m Depth

L W L

(2) 14" Panther Plast Floats (#714) on Tension Rod

MicroCAT

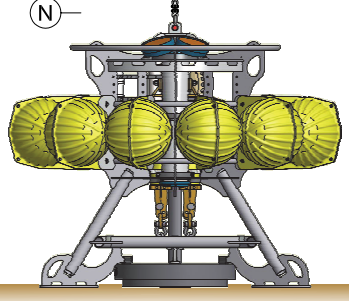
48.9 m 1/4" Spectra Line & MicroCAT ← Note A

(1) Float 28 m up from lower end of Spectra

O

81.2 m 1/4" Spectra Line ← Note B

N



Ocean Research Benthic Instrument Tripod (ORBIT)
with:
Long Ranger 75 kHz ADCP,
MicroCAT,
XEOS KILO Unit,
Aquadopp Current Meter,
and Dual Release,
1000 lb Ww Anchor

Depth 183 m

Hardware Designation	
L	(1) 1/2" SH
N	(1) 1/2" SH, (1) 3/8" SH
O	(1) 3/8" SH, (1) 350 lb Weak Link, (1) 3/8" SH
W	(1) 250 lb Weak Link

Hardware Required (per mooring without spares)	
(3)	3/8" Anchor Shackle
(2)	1/2" Anchor Shackle
(1)	250 lb Weak Link
(1)	350 lb Weak Link

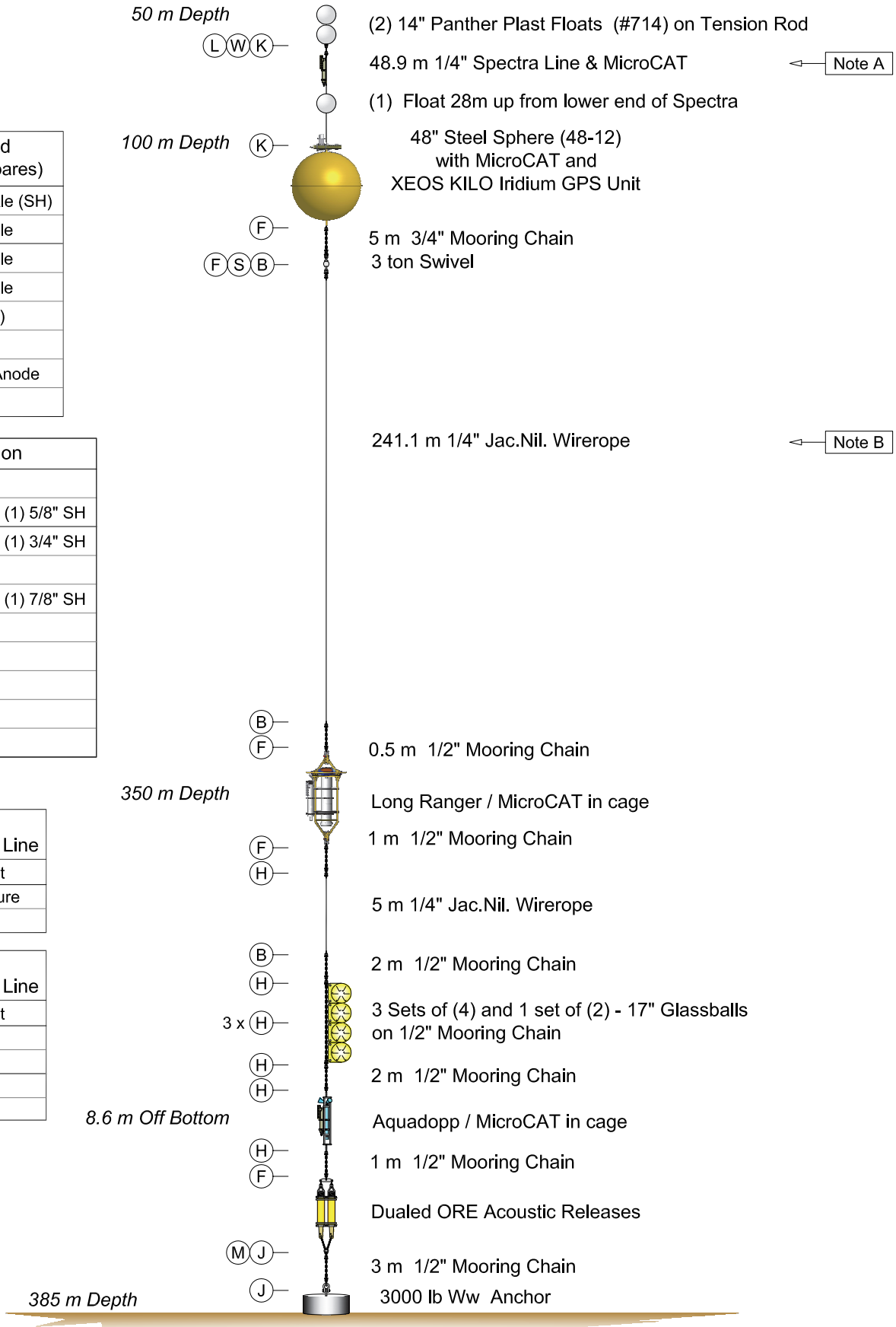
Note A Attach Instrument to Line	
Depth	Instrument
50 m	Plastic MicroCAT
60 m	Tidbit
70 m	Tidbit
80 m	Tidbit

Note B Attach Instrument to Line	
Depth	Instrument
100 m	MicroCAT (BH)
120 m	Tidbit
140 m	Tidbit
160 m	Tidbit
180 m	Tidbit

Straneo OSNAP Mooring CF3
As Deployed

CF3

Woods Hole Oceanographic Institution	
designed by John Kemp, drawn by Betsey Doherty	
file: OSNAP Straneo	date: 12/02/2014



Hardware Required (per mooring without spares)	
(8)	1/2" Anchor Shackle (SH)
(26)	5/8" Anchor Shackle
(5)	3/4" Anchor Shackle
(2)	7/8" Anchor Shackle
(19)	5/8" Sling Link (SL)
(1)	1-1/4" Master Link
(1)	3 ton Swivel with Anode
(1)	250 lb Weak Link

Hardware Designation	
A	(2) 1/2" SH, (1) 5/8" SL
B	(1) 1/2" SH, (1) 5/8" SL, (1) 5/8" SH
F	(1) 5/8" SH, (1) 5/8" SL, (1) 3/4" SH
H	(2) 5/8" SH, (1) 5/8" SL
J	(1) 5/8" SH, (1) 5/8" SL, (1) 7/8" SH
K	(1) 3/8" SH
L	(1) 1/2" SH
M	(1) 1-1/4" Master Link
S	(1) 3 ton Swivel
W	(1) 250 lb Weak Link

Note A Attach Instrument to Line	
Depth	Instrument
50 m	CTD / Pressure
75 m	Tidbit

Note B Attach Instrument to Line	
Depth	Instrument
100 m	MicroCAT
150 m	Tidbit
200 m	MicroCAT
300 m	RBR solo

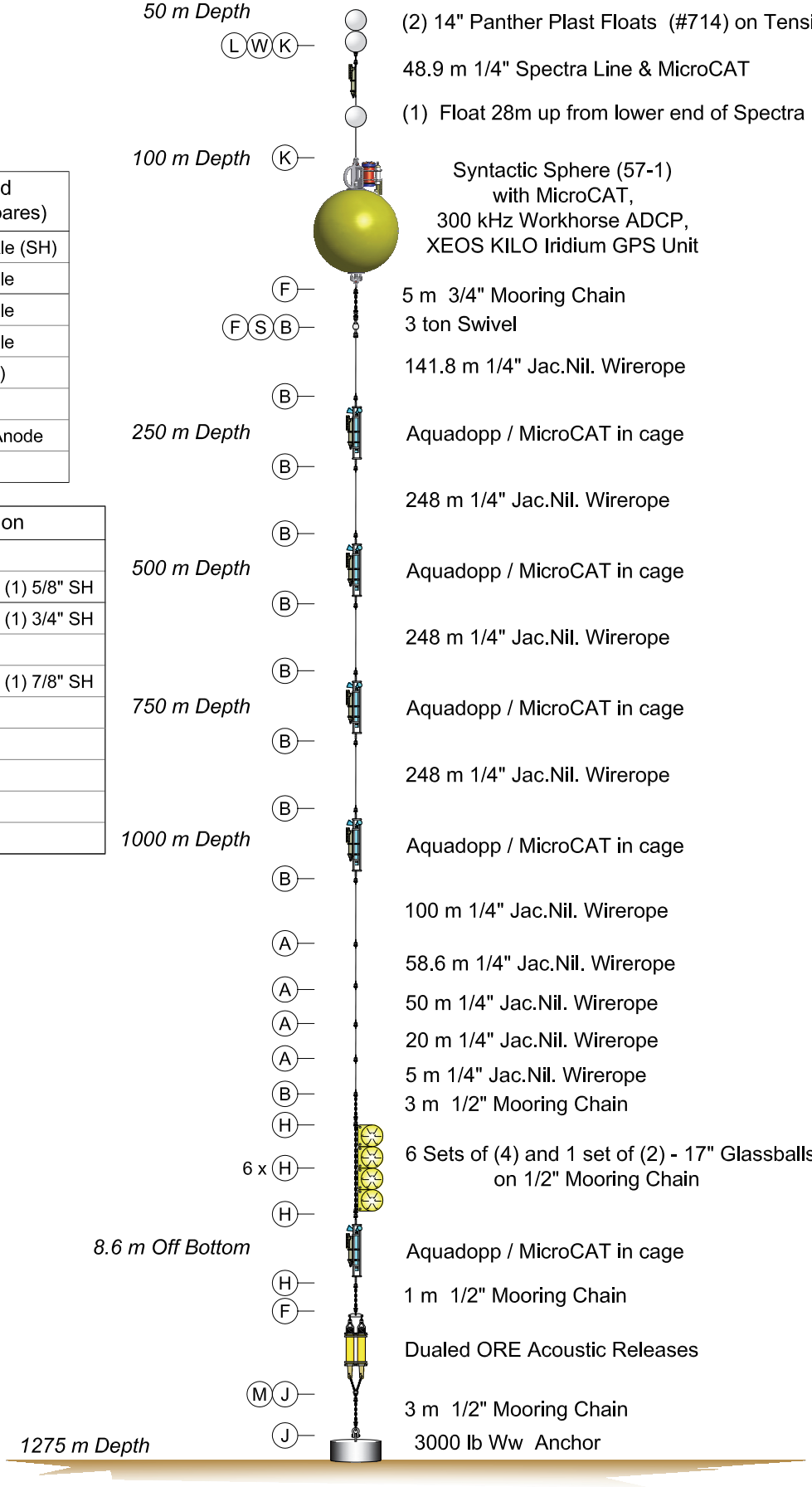
Straneo OSNAP Mooring CF4
385 m Depth, As Deployed

CF4

Woods Hole Oceanographic Institution	
designed by John Kemp, drawn by Betsey Doherty	
file: OSNAP Straneo	date: 12/02/2014

Hardware Required (per mooring without spares)	
(15)	1/2" Anchor Shackle (SH)
(33)	5/8" Anchor Shackle
(3)	3/4" Anchor Shackle
(2)	7/8" Anchor Shackle
(25)	5/8" Sling Link (SL)
(1)	1-1/4" Master Link
(1)	3 ton Swivel with Anode
(1)	250 lb Weak Link

Hardware Designation	
A	(2) 1/2" SH, (1) 5/8" SL
B	(1) 1/2" SH, (1) 5/8" SL, (1) 5/8" SH
F	(1) 5/8" SH, (1) 5/8" SL, (1) 3/4" SH
H	(2) 5/8" SH, (1) 5/8" SL
J	(1) 5/8" SH, (1) 5/8" SL, (1) 7/8" SH
K	(1) 3/8" SH
L	(1) 1/2" SH
M	(1) 1-1/4" Master Link
S	(1) 3 ton Swivel
W	(1) 250 lb Weak Link



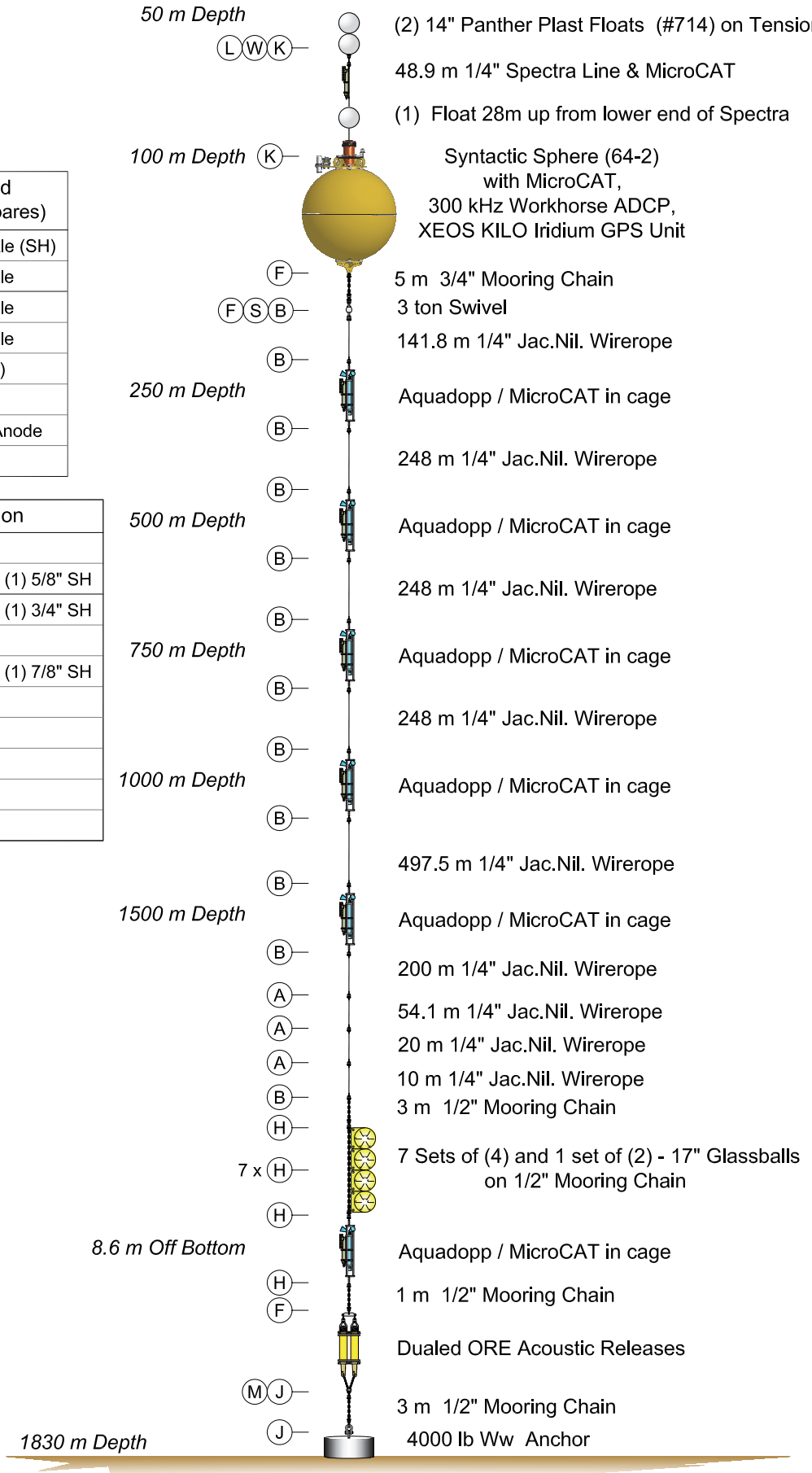
Straneo OSNAP Mooring CF5
1275 m Depth, As Deployed

CF5

Woods Hole Oceanographic Institution	
designed by John Kemp, drawn by Betsey Doherty	
file: OSNAP Straneo	date: 12/02/2014

Hardware Required (per mooring without spares)	
(17)	1/2" Anchor Shackle (SH)
(37)	5/8" Anchor Shackle
(3)	3/4" Anchor Shackle
(2)	7/8" Anchor Shackle
(28)	5/8" Sling Link (SL)
(1)	1-1/4" Master Link
(1)	3 ton Swivel with Anode
(1)	250 lb Weak Link

Hardware Designation	
A	(2) 1/2" SH, (1) 5/8" SL
B	(1) 1/2" SH, (1) 5/8" SL, (1) 5/8" SH
F	(1) 5/8" SH, (1) 5/8" SL, (1) 3/4" SH
H	(2) 5/8" SH, (1) 5/8" SL
J	(1) 5/8" SH, (1) 5/8" SL, (1) 7/8" SH
K	(1) 3/8" SH
L	(1) 1/2" SH
M	(1) 1-1/4" Master Link
S	(1) 3 ton Swivel
W	(1) 250 lb Weak Link



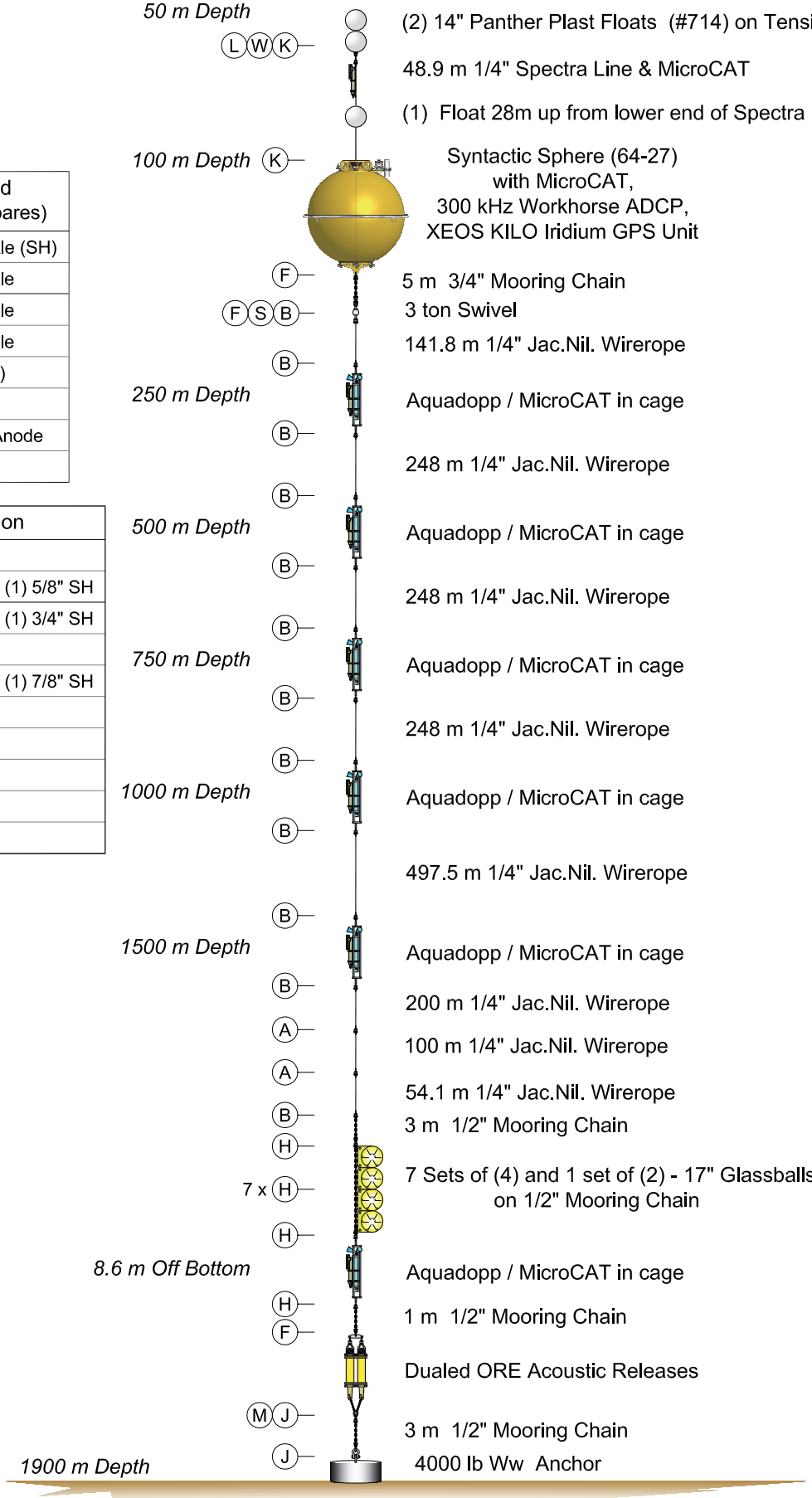
Straneo OSNAP Mooring CF6
1830 m Depth, As Deployed

CF6

Woods Hole Oceanographic Institution	
designed by John Kemp, drawn by Betsey Doherty	
file: OSNAP Straneo	date: 12/02/2014

Hardware Required (per mooring without spares)	
(19)	1/2" Anchor Shackle (SH)
(37)	5/8" Anchor Shackle
(3)	3/4" Anchor Shackle
(2)	7/8" Anchor Shackle
(29)	5/8" Sling Link (SL)
(1)	1-1/4" Master Link
(1)	3 ton Swivel with Anode
(1)	250 lb Weak Link

Hardware Designation	
A	(2) 1/2" SH, (1) 5/8" SL
B	(1) 1/2" SH, (1) 5/8" SL, (1) 5/8" SH
F	(1) 5/8" SH, (1) 5/8" SL, (1) 3/4" SH
H	(2) 5/8" SH, (1) 5/8" SL
J	(1) 5/8" SH, (1) 5/8" SL, (1) 7/8" SH
K	(1) 3/8" SH
L	(1) 1/2" SH
M	(1) 1-1/4" Master Link
S	(1) 3 ton Swivel
W	(1) 250 lb Weak Link



Straneo OSNAP Mooring CF7
1900 m Depth, As Deployed

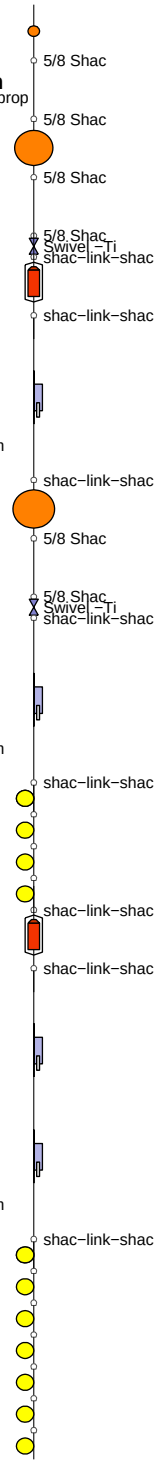
CF7

Woods Hole Oceanographic Institution	
designed by John Kemp, drawn by Betsey Doherty	
file: OSNAP Straneo	date: 12/02/2014

OSNAP M1 mooring v08 − 44" and 31" spheres

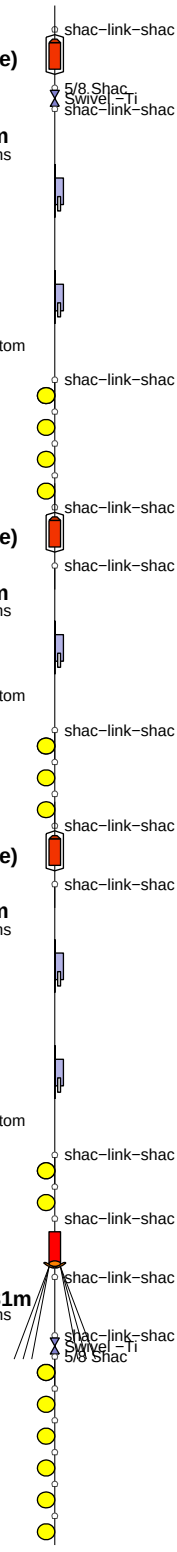
26−Jun−2014
12:07

depth (incl. stretch)	component	S/N	rope # & Length	Distance from lower rope end	in/out of water comment
33 m	McLane−12"				
			#1 **10m** 1/2" Polyprop	5/8 Shac	
43 m	31"synt 1500m			5/8 Shac	
			#2 **1m** chain−13	5/8 Shac	
				5/8 Shac Swivel −Ti shac−link−shac	
46 m	Nortek on load bar (estimate)	10			
			#3 top **235m** 3/16" ins	shac−link−shac	
52 m	SBE37 SMP	50			
			#3 bottom		
				shac−link−shac	
283 m	44"synt 1500m				
			#4 **1m** chain−13	5/8 Shac	
				5/8 Shac Swivel −Ti shac−link−shac	
			#5 top **235m** 3/16" ins		
290 m	SBE37 SMP	290			
			#5 bottom		
				shac−link−shac	
521 m	4x17" glass				
				shac−link−shac	
525 m	Nortek on load bar (estimate)	530			
			#6 top **472m** 3/16" ins	shac−link−shac	
531 m	SBE37 SMP	530			
766 m	SBE37 SMP	770			
			#6 bottom		
				shac−link−shac	
999 m	7x17" glass				

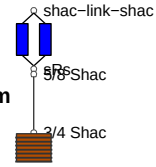


OSNAP M1 mooring v08 − 44" and 31" spheres

depth (incl. stretch)	component	S/N	rope # & Length	Distance from lower rope end	in/out of water comment
1006 m	Nortek on loadbar (estimate)	1018			
1012 m	SBE37 SMP	1010	#7 top 474m 1/4" ins		
1246 m	SBE37 SMP	1250	#7 bottom		
1482 m	4x17" glass				
1486 m	Nortek on loadbar (estimate)	1498	#8 top 235m 1/4" ins		
1492 m	SBE37 SMP	1490	#8 bottom		
1723 m	3x17" glass				
1726 m	Nortek on loadbar (estimate)	1738	#9 top 235m 1/4" ins		
1731 m	SBE37 SMP	1730	#9 bottom		
1957 m	SBE37 SMP				
1963 m	2x17" glass				
1965 m	ADCP−300−down	1970	#10 81m 1/4" ins		
2047 m	6x17" glass				



depth (incl. stretch)	component	S/N	rope # & Length	Distance from lower rope end	in/out of water comment
2053 m	AR−2				
			#11 chain−13	10m	
2064 m	Anchor	2200 kg (dry weight)			
	(Wet weight = 1914kg)				
	(Safe weight = 1927kg)				

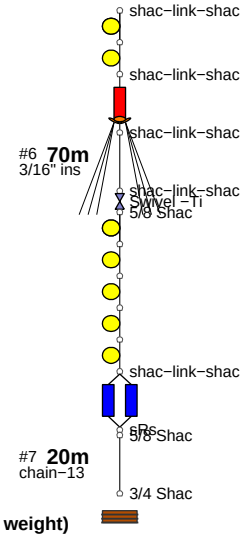


OSNAP M2 mooring v07

26−Jun−2014
11:57
Page # 1 / 3

depth (incl. stretch)	component	S/N	rope # & Length	Distance from lower rope end	in/out of water comment
1560 m	McLane−12"				
			#1 **15m** 1/2" Polyprop	s 3.2t	
				s 3.2t	
1576 m	Billings 3 sphere			s 3.2t	
			#2 **1m** chain−13		
1579 m	4x17" glass			shac−link−shac	
				5/8 Shac Swivel −Ti	
				shac−link−shac	
			#3 top **425m** 3/16" ins		
1587 m	SBE37 SMP	1500			
1802 m	SBE37 SMP	1715			
			#3 bottom		
2008 m	5x17" glass			shac−link−shac	
				shac−link−shac	
2013 m	Nortek on loadbar (estimate)	1930			
				shac−link−shac	
			#4 top **210m** 3/16" ins		
2018 m	SBE37 SMP	1930			
			#4 bottom		
2224 m	3x17" glass			shac−link−shac	
				shac−link−shac	
			#5 top **219m** 3/16" ins		
2232 m	SBE37 SMP	2145			
2441 m	SBE37 SMP				
			#5 bottom		

depth (incl. stretch)	component	S/N	rope # & Length	Distance from lower rope end	in/out of water comment
2446 m	**2x17" glass**				
2449 m	**ADCP−300−down**				
2520 m	**5x17" glass**				
2525 m	**AR−2**				
2546 m	**Anchor 900 kg (dry weight)** **(Wet weight = 783kg)** **(Safe weight = 670kg)**				

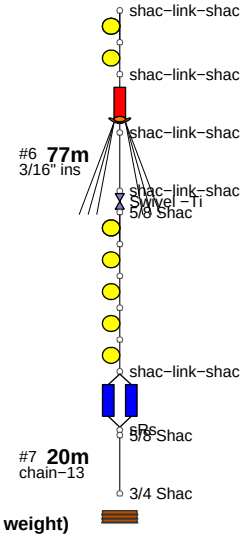


OSNAP M3 mooring v05

26−Jun−2014
12:53

depth (incl. stretch)	component	S/N	rope # & Length	Distance from lower rope end	in/out of water comment
1298 m	McLane−12"				
				s 3.2t	
			#1 **15m** 1/2" Polyprop		
				s 3.2t	
1315 m	Billings 3 sphere			s 3.2t	
			#2 **1m** chain−13		
				shac−link−shac	
1317 m	4x17" glass				
				5/8 Shac Swivel −Ti	
				shac−link−shac	
			#3 top **575m** 3/16" ins		
1326 m	SBE37 SMP	1500			
1616 m	SBE37 SMP	1790			
			#3 bottom		
				shac−link−shac	
1897 m	5x17" glass				
				shac−link−shac	
1901 m	Nortek on loadbar (estimate)	2080			
				shac−link−shac	
			#4 top **285m** 3/16" ins		
1907 m	SBE37 SMP	2080			
			#4 bottom		
				shac−link−shac	
2188 m	3x17" glass				
				shac−link−shac	
			#5 top **294m** 3/16" ins		
2195 m	SBE37 SMP	2370			
2480 m	SBE37 SMP				
			#5 bottom		

depth (incl. stretch)	component	S/N	rope # & Length	Distance from lower rope end	in/out of water comment
2485 m	**2x17" glass**				
2488 m	**ADCP−300−down**	**2661**			
2566 m	**5x17" glass**				
2571 m	**AR−2**				
2592 m	**Anchor 900 kg (dry weight)** **(Wet weight = 783kg)** **(Safe weight = 613kg)**				



OSNAP M4 mooring v05

27−Jun−2014
17:40
Page # 1 / 3

depth (incl. stretch)	component	S/N	rope # & Length	Distance from lower rope end	in/out of water comment
1489 m	McLane−12"				
			s 3.2t		
			#1 **15m** 1/2" Polyprop		
			s 3.2t		
1506 m	Billings 3 sphere				
			s 3.2t		
			#2 **1m** chain−13		
			shac−link−shac		
1508 m	6x17" glass				
			5/8 Shac		
			Swivel −Ti		
			5/8 Shac		
1514 m	Nortek on load bar (estimate)	1500			
			shac−link−shac		
			#3 top **675m** 3/16" ins		
1520 m	SBE37 SMP	1500			
1860 m	SBE37 SMP	1840			
			#3 bottom		
			shac−link−shac		
2191 m	5x17" glass				
			shac−link−shac		
2195 m	Nortek on load bar (estimate)	2180			
			shac−link−shac		
			#4 top **335m** 3/16" ins		
2201 m	SBE37 SMP	2180			
			#4 bottom		
			shac−link−shac		
2532 m	3x17" glass				
			shac−link−shac		
			#5 top **344m** 3/16" ins		
2539 m	SBE37 SMP	2520			

OSNAP M4 mooring v05

27−Jun−2014
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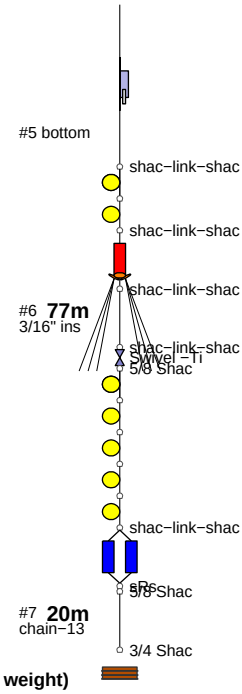
depth (incl. stretch)	component	S/N	rope # & Length	Distance from lower rope end	in/out of water comment
2874 m	SBE37 SMP	2520			
2879 m	2x17" glass				
2882 m	ADCP−300−d	2860			
2960 m	5x17" glass				
2965 m	AR−2				
2986 m	Anchor 900 kg (dry weight) (Wet weight = 783kg) (Safe weight = 610kg)				

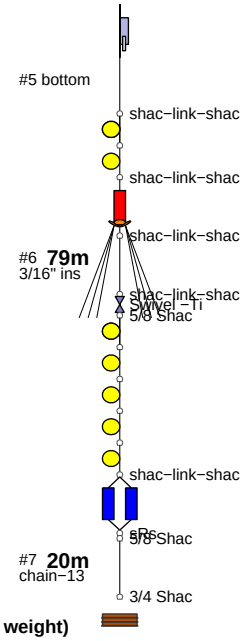


OSNAP M5 mooring v05

27−Jun−2014
17:46
Page # 1 / 3

depth (incl. stretch)	component	S/N	rope # & Length	Distance from lower rope end	in/out of water comment
1555 m	McLane−12"				
				s 3.2t	
			#1 **15m** 1/2" Polyprop		
				s 3.2t	
1571 m	Billings 3 sphere			s 3.2t	
			#2 **1m** chain−13		
				shac−link−shac	
1574 m	6x17" glass				
				5/8 Shac	
				Swivel −Ti	
				shac−link−shac	
			#3 top **715m** 3/16" ins		
1584 m	SBE37 SMP	1500			
1945 m	SBE37 SMP	1860			
			#3 bottom		
				shac−link−shac	
2296 m	5x17" glass				
				shac−link−shac	
2300 m	Nortek on loadbar (estimate)	12za			
				shac−link−shac	
			#4 top **355m** 3/16" ins		
2306 m	SBE37 SMP	2220			
			#4 bottom		
				shac−link−shac	
2657 m	3x17" glass				
				shac−link−shac	
			#5 top **364m** 3/16" ins		
2664 m	SBE37 SMP	2580			

depth (incl. stretch)	component	S/N	rope # & Length	Distance from lower rope end	in/out of water comment
3019 m	**SBE37 SMP**				
3024 m	**2x17" glass**				
3026 m	**ADCP−300−dual**	**2940**			
3107 m	**5x17" glass**				
3112 m	**AR−2**				
3133 m	**Anchor 900 kg (dry weight)** **(Wet weight = 783kg)** **(Safe weight = 574kg)**				



Mooring	**M1**	**Deployed**	**11:24Z**	**11th August 2014**
Latitude	**N59° 54.244'**		**Ship's heading**	**5°**
Longitude	**W041° 08.409'**			
Corrected Depth (m)	**2059**			
Release 1	**S/N 831 1668/49/55**			
Release 2	**S/N 1754 1A09/49/55**			
Iridium Beacons	**Upper IMEI 3002 3406 057 2000**			
	Lower IMEI 3002 3406 047 5730			

Instrument Number	Deploy Depth (m)	Instrument	s/n	Mount Type	I/W (GMT)
1	38	Light	B11-031	sphere mounted	08:40
2	38	Iridium Beacon	B11-050	sphere mounted	08:40
3	41	Nortek	8365	in-line frame	08:40
4	47	SBE37 SMP	10558	clamped to wire	08:40
5	278	Light	B11-040	sphere mounted	09:03
6	278	Iridium Beacon	B11-054	sphere mounted	09:03
7	285	SBE37 SMP	11326	clamped to wire	09:05
8	520	Nortek	9861	in-line frame	09:22
9	526	SBE37 SMP	11328	clamped to wire	09:24
10	761	SBE37 SMP	11329	clamped to wire	09:36
11	1001	Nortek	9868	in-line frame	09:48
12	1007	SBE37 SMP	11336	clamped to wire	09:50
13	1241	SBE37 SMP	11337	clamped to wire	10:00
14	1481	Nortek	9877	in-line frame	10:11
15	1487	SBE37 SMP	11339	clamped to wire	10:11
16	1721	Nortek	11035	in-line frame	10:28
17	1726	SBE37 SMP	11340	clamped to wire	10:28
18	1952	SBE37 SMP	8078	clamped to wire	10:40
19	1960	ADCP	20957	in-line frame	10:43
20	2048	A/R	831	in-line frame	10:52
21	2048	A/R	1754	in-line frame	10:52
	2059	Anchor			11:23

Mooring	M2	Deployed	17:12Z	9th August 2014

Latitude	**N59° 51.660'**	**Ship's heading**	**25°**
Longitude	**W040° 41.218'**		
Corrected Depth (m)	**2429**		
Release 1	**S/N 1270 08CB/49/55**		
Release 2	**S/N 1763 1A12/49/55**		
Iridium Beacon	**IMEI 3002 3406 057 0000**		

Instrument Number	Deploy Depth (m)	Instrument	s/n	Mount Type	I/W (GMT)
1	1459	Light	B11-029	pole	15:08
2	1470	Iridium Beacon	B11-055	pole	15:08
3	1470	SBE37SMP	8080	clamped to wire	15:13
4	1685	SBE37SMP	9374	clamped to wire	15:29
5	1896	Nortek	11048	in-line frame	15:46
6	1901	SBE37SMP	9378	clamped to wire	15:48
7	2115	SBE37SMP	10559	clamped to wire	16:02
8	2324	SBE37SMP	11341	clamped to wire	16:13
9	2332	ADCP	20959	in-line frame	16:15
10	2408	A/R	1270	in-line frame	16:23
11	2408	A/R	1763	in-line frame	16:23
12	2429	Anchor			17:10

Mooring	**M3**	**Deployed**	**10:58Z**	**9th August 2014**

Latitude	**N59° 48.947'**	**Ship's heading**	**31°**
Longitude	**W040° 16.413'**		
Corrected Depth (m)	**2560**		
Release 1	**S/N 1272 08CD/49/55**		
Release 2	**S/N 1757 1A0C/49/55**		
Iridium Beacon	**IMEI 3002 3406 057 1000**		

Instrument Number	Deploy Depth (m)	Instrument	s/n	Mount Type	I/W (GMT)
1	1283	Light	B11-030	pole	08:34
2	1283	Iridium Beacon	B11-049	pole	08:34
3	1294	SBE37SMP	8079	clamped to wire	08:40
4	1584	SBE37SMP	8081	clamped to wire	09:00
5	1869	Nortek	9867	in-line frame	09:17
6	1875	SBE37SMP	10561	clamped to wire	09:19
7	2163	SBE37SMP	11287	clamped to wire	09:38
8	2448	SBE37SMP	11330	clamped to wire	09:52
9	2456	ADCP	20961	in-line frame	09:55
10	2539	A/R	1272	in-line frame	10:07
11	2539	A/R	1757	in-line frame	10:07
12	2560	Anchor			10:58

Mooring	**M4**	**Deployed**	**16:18Z**	**8th August 2014**

Latitude	**N59° 38.8709'**	**Ship's heading**	**10.5°**
Longitude	**W038° 34.0344'**		
Corrected Depth (m)	**2985**		
Release 1	**S/N 1135 0823/49/55**		
Release 2	**S/N 1764 1A13/49/55**		
Iridium Beacon	**IMEI 3002 3406 047 6980**		

Instrument Number	Deploy Depth (m)	Instrument	s/n	Mount Type	I/W (GMT)
1	1505	Light	B11-026	pole	14:07
2	1505	Iridium Beacon	B11-045	pole	14:07
3	1513	Nortek	9854	in-line frame	14:09
4	1519	SBE37SMP	9371	clamped to wire	14:11
5	1859	SBE37SMP	9376	clamped to wire	14:32
6	2194	Nortek	9859	in-line frame	14:50
7	2200	SBE37SMP	10560	clamped to wire	14:59
8	2538	SBE37SMP	11338	clamped to wire	15:12
9	2873	SBE37SMP	11343	clamped to wire	15:30
10	2881	ADCP	20962	in-line frame	15:33
11	2964	A/R	1135	in-line frame	15:53
12	2964	A/R	1764	in-line frame	15:53
13	2985	Anchor			16:18

Mooring	M5	Deployed	10:54Z	8th August 2014

Latitude	**N59° 34.8463'**	**Ship's heading**
Longitude	**W037° 47.8957'**	
Corrected Depth (m)	**3122**	
Release 1	**S/N 1140 0828/49/55**	
Release 2	**S/N 1761 1A10/49/55**	
Iridium Beacon	**IMEI 3002 3406 097 5990**	

Instrument Number	Deploy Depth (m)	Instrument	s/n	Mount Type	I/W (GMT)
1	1571	Light	B11-027	pole	08:44
2	1571	Iridium Beacon	B11-046	pole	08:44
3	1584	SBE37SMP	9375	clamped to wire	08:48
4	1945	SBE37SMP	9377	clamped to wire	08:59
5	2300	Nortek	11046	in-line frame	09:31
6	2306	SBE37SMP	10562	clamped to wire	09:33
7	2664	SBE37SMP	11327	clamped to wire	09:52
8	3019	SBE37SMP	11342	clamped to wire	10:07
9	3026	ADCP	20958	in-line frame	10:10
10	3112	A/R	1140	in-line frame	10:29
11	3112	A/R	1761	in-line frame	10:29
12	3133	Anchor			10:54

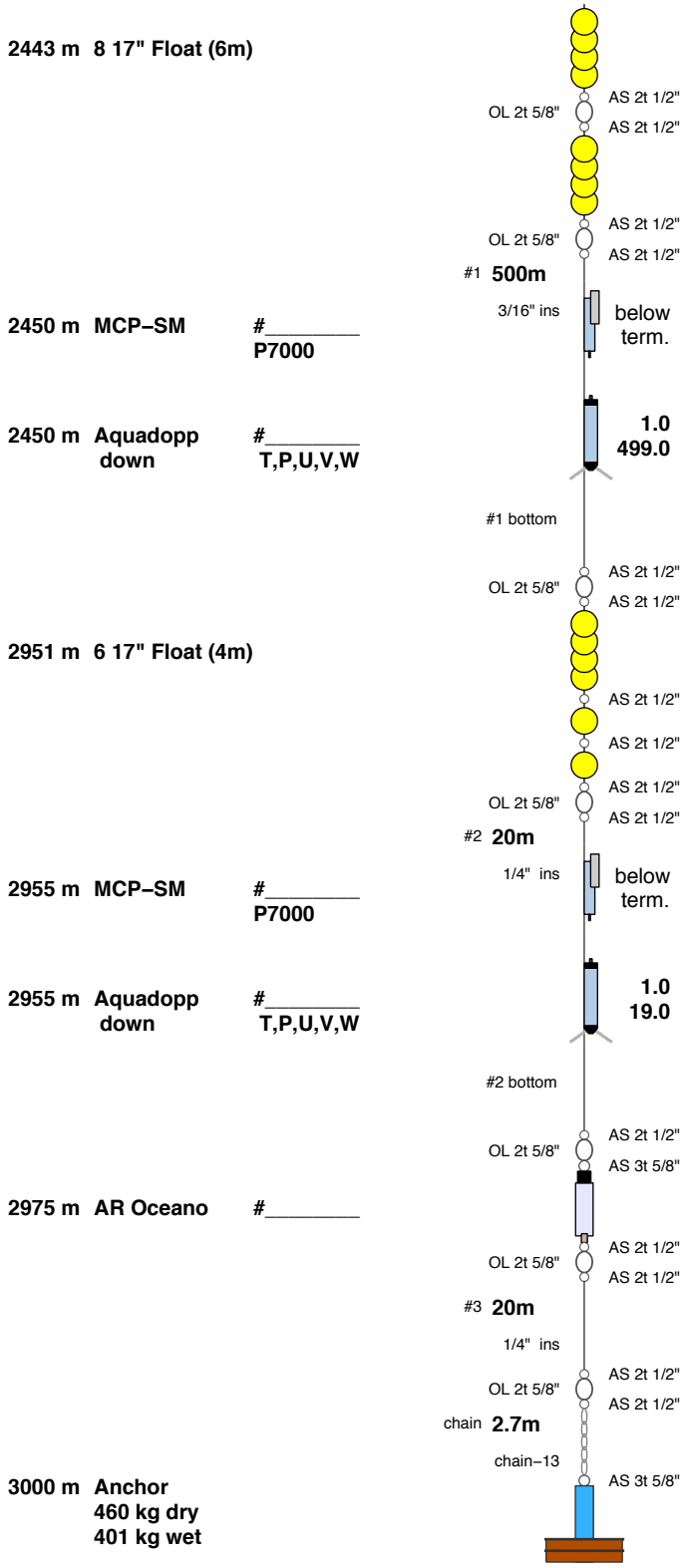
Short name: DSOW3 / KPO 1122

Deployment: RV Knoor – July/August 2014

Source: 09–Jul–2014 12:44:45, /ext/project/moorings/msm40/dsow/kpo1122_dsow3.cfg
Author: 09–Jul–2014 12:56:37, begler@kim(GLNX86)

depth (incl. stretch)	component description	S/N	rope # & Length	Distance from Upper / Lower rope end	in/out of water comment

!!! Check for Cotter Pins !!!



UTC

Lat: _____

Long: _____

Drop at Lat: **Long:**

Target at Lat: **Long:**

at bottom:

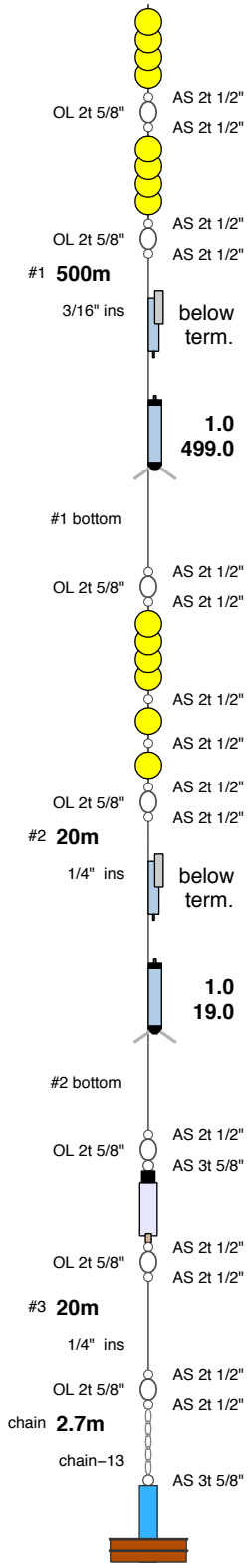
Short name: DSOW4 / KPO 1123

Deployment: RV Knoor – July/August 2014

Source: 09–Jul–2014 13:05:29, /ext/project/moorings/msm40/dsow/kpo1123_dsow4.cfg
Author: 09–Jul–2014 13:05:49, begler@kim(GLNX86)

depth (incl. stretch)	component description	S/N	rope # & Length	Distance from Upper / Lower rope end	in/out of water comment

!!! Check for Cotter Pins !!!



2043 m 8 17" Float (6m)

2050 m MCP–SM #_____ P7000

2050 m Aquadopp down #_____ T,P,U,V,W

2551 m 6 17" Float (4m)

2555 m MCP–SM #_____ P7000

2555 m Aquadopp down #_____ T,P,U,V,W

2575 m AR Oceano #_____

2600 m Anchor 460 kg dry 401 kg wet

UTC

Lat: _____

Long: _____

Mode _____

Enable _____

Release _____

Drop at Lat: **Long:**

Target at Lat: **Long:**

at bottom:

Short name: DSOW4 / KPO 1123

Deployment: RV Knoor – July/August 2014

Source: 09–Jul–2014 13:05:29, /ext/project/moorings/msm40/dsow/kpo1123_dsow4.cfg
Author: 09–Jul–2014 13:05:49, begler@kim(GLNX86)

Element List

Code	Count	Description	Label	Weight in air	/ water
Components					
31	15	1/2" BoltTypeAnchorShackle 2.0t	AS 2t 1/2"	6.1 kg	5.4 kg
32	2	5/8" BoltTypeAnchorShackle 3.2t	AS 3t 5/8"	1.5 kg	1.3 kg
42	7	5/8" oval link 1.9t	OL 2t 5/8"	4.6 kg	4.1 kg
291	2	1x17" Sphere serial, 0.7m chain	H17-1 serial	48.0 kg	-44.0 kg
294	3	4x17" Spheres serial, 2.7m chain	H17-4 serial	291.0 kg	-270.0 kg
334	2	MicroCAT SM37 pressure, clamp on	MCP-SM	7.6 kg	5.6 kg
347	2	Aquadopp DW clamp on	Aquadopp dow	19.0 kg	12.0 kg
471	1	Single IXSEA/Oceano AR	AR Oceano	35.0 kg	26.0 kg
			Components weight:	412.9 kg	-259.6 kg
Ropes					
101	500m	3/16" 3x19 NILSPIN insulated	3/16" ins	55.0 kg	38.6 kg
102	40m	1/4" 3x19 NILSPIN insulated	1/4" ins	7.7 kg	5.6 kg
151	3m	chain 13mm	chain-13	7.8 kg	6.8 kg
			Ropes weight:	70.5 kg	51.1 kg
Summary					
		Components		412.9 kg	-259.6 kg
		Ropes		70.5 kg	51.1 kg
520	1	Anchor variable	Anchor	460.0 kg	401.4 kg
			Mooring total weight:	943.4 kg	192.8 kg

Short name: DSOW4 / KPO 1123

Deployment: RV Knoor – July/August 2014

Source: 09–Jul–2014 13:05:29, /ext/project/moorings/msm40/dsow/kpo1123_dsow4.cfg
Author: 09–Jul–2014 13:05:49, begler@kim(GLNX86)

Rope List

#	Code	Length	Label	Weight in air	/ water
1	101	500m	3/16" 3x19 NILSPIN insulated	55.0 kg	38.6 kg
2	102	20m	1/4" 3x19 NILSPIN insulated	3.8 kg	2.8 kg
3	102	20m	1/4" 3x19 NILSPIN insulated	3.8 kg	2.8 kg
	151	3m	chain 13mm	7.8 kg	6.8 kg

Symmetric Marker: 4

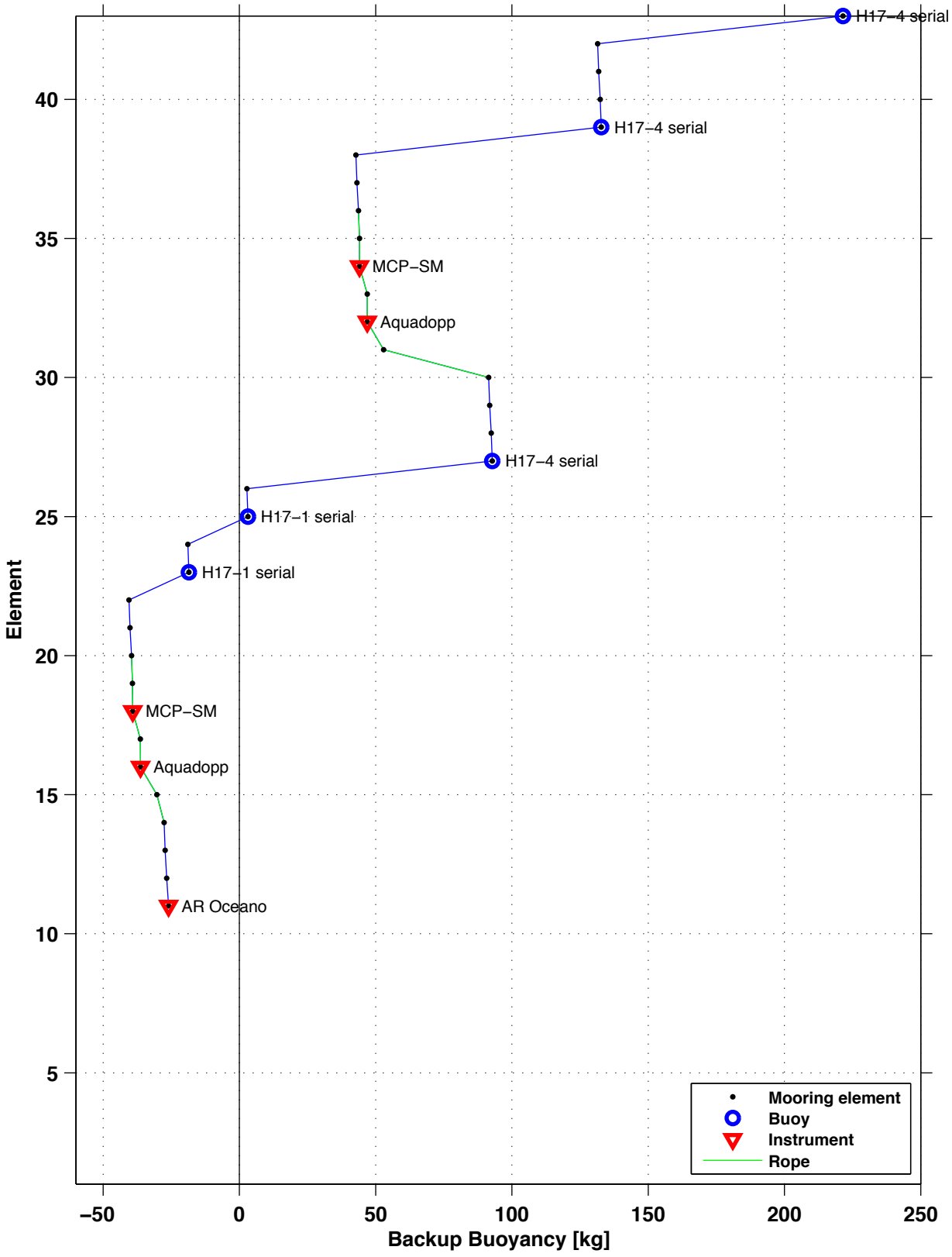
#	Length	Type	Position of Markers [m]
1	500m	3/16"	ins: 1, 499
2	20m	1/4"	ins: 1, 19

Short name: DSOW4 / KPO 1123

Deployment: RV Knoor – July/August 2014

Source: 09–Jul–2014 13:05:29, /ext/project/moorings/msm40/dsow/kpo1123_dsow4.cfg
Author: 09–Jul–2014 13:05:51, begler@kim(GLNX86)

Backup Buoyancy



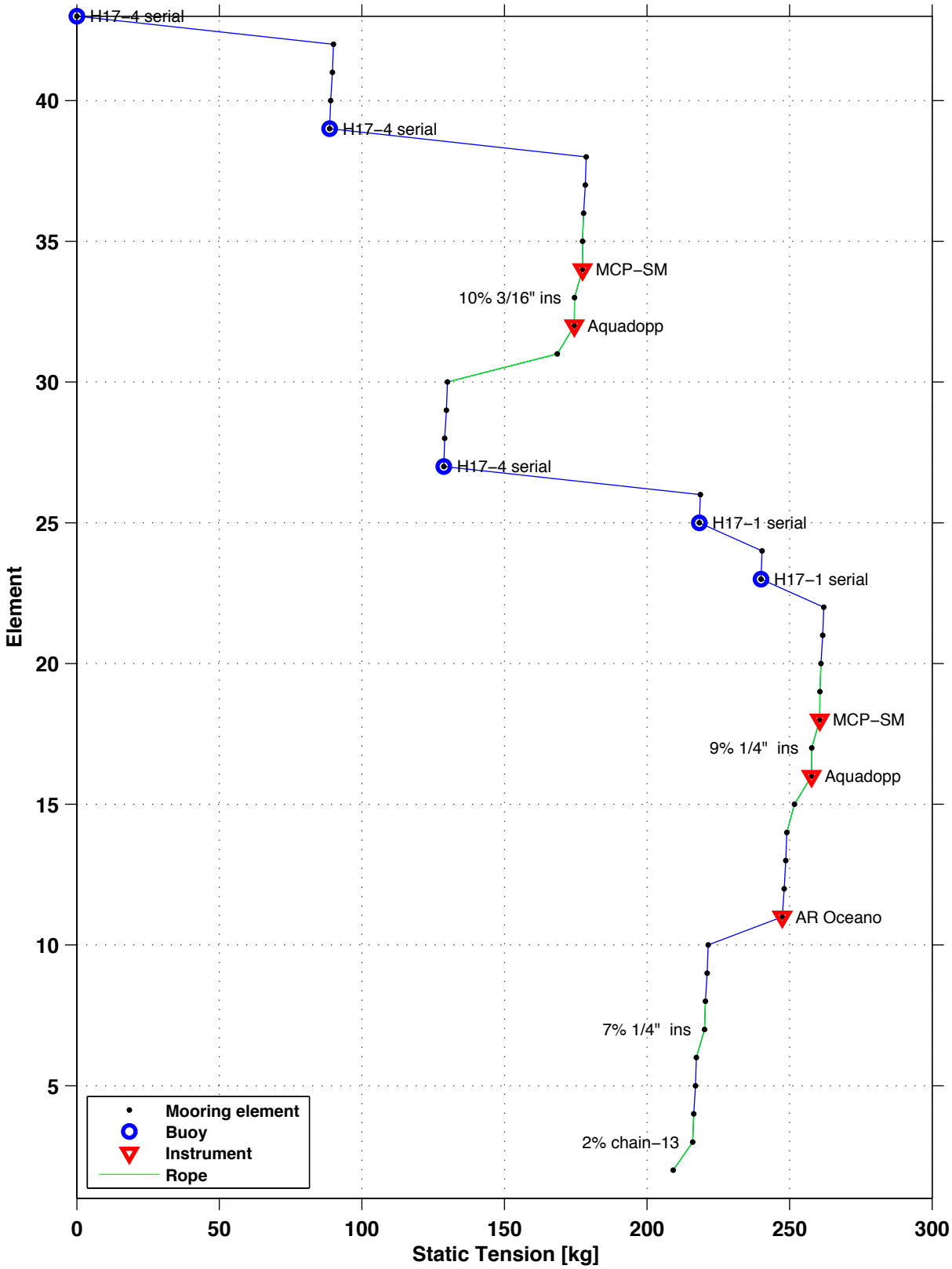
NO Current Vertical anchor load : 209 kg
Wet safe anchor weight : 313 kg (150%, max: 500 kg)
Wet / Dry Clump anchor weight : 401 kg / 460 kg

Short name: DSOW4 / KPO 1123

Deployment: RV Knoor – July/August 2014

Source: 09–Jul–2014 13:05:29, /ext/project/moorings/msm40/dsow/kpo1123_dsow4.cfg
Author: 09–Jul–2014 13:05:51, begler@kim(GLNX86)

No Current Static Tension



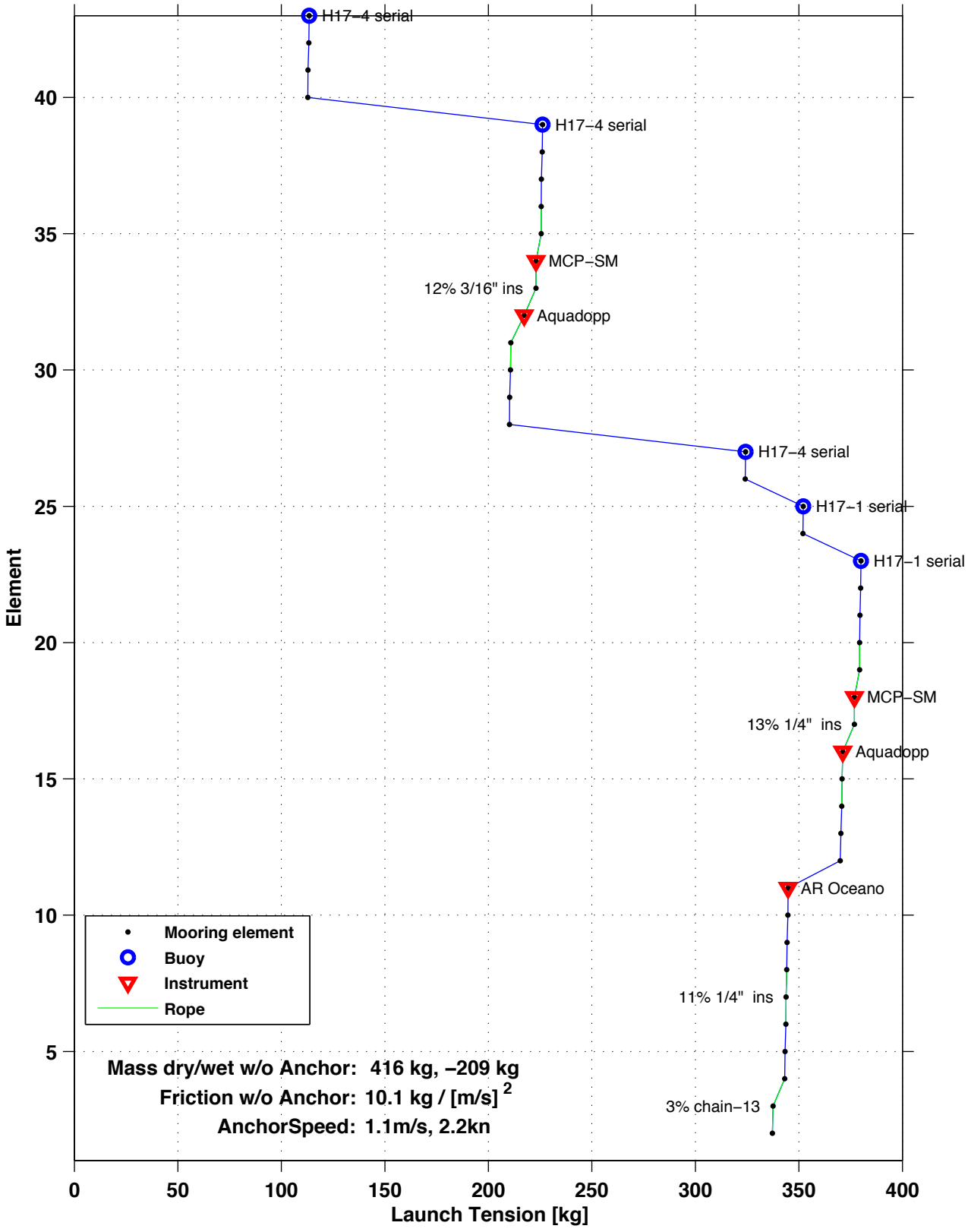
NO Current Vertical anchor load : 209 kg
Wet safe anchor weight : 313 kg (150%, max: 500 kg)
Wet / Dry Clump anchor weight : 401 kg / 460 kg

Short name: DSOW4 / KPO 1123

Deployment: RV Knoor – July/August 2014

Source: 09–Jul–2014 13:05:29, /ext/project/moorings/msm40/dsow/kpo1123_dsow4.cfg
Author: 09–Jul–2014 13:05:51, begler@kim(GLNX86)

Steady State Launch Tension



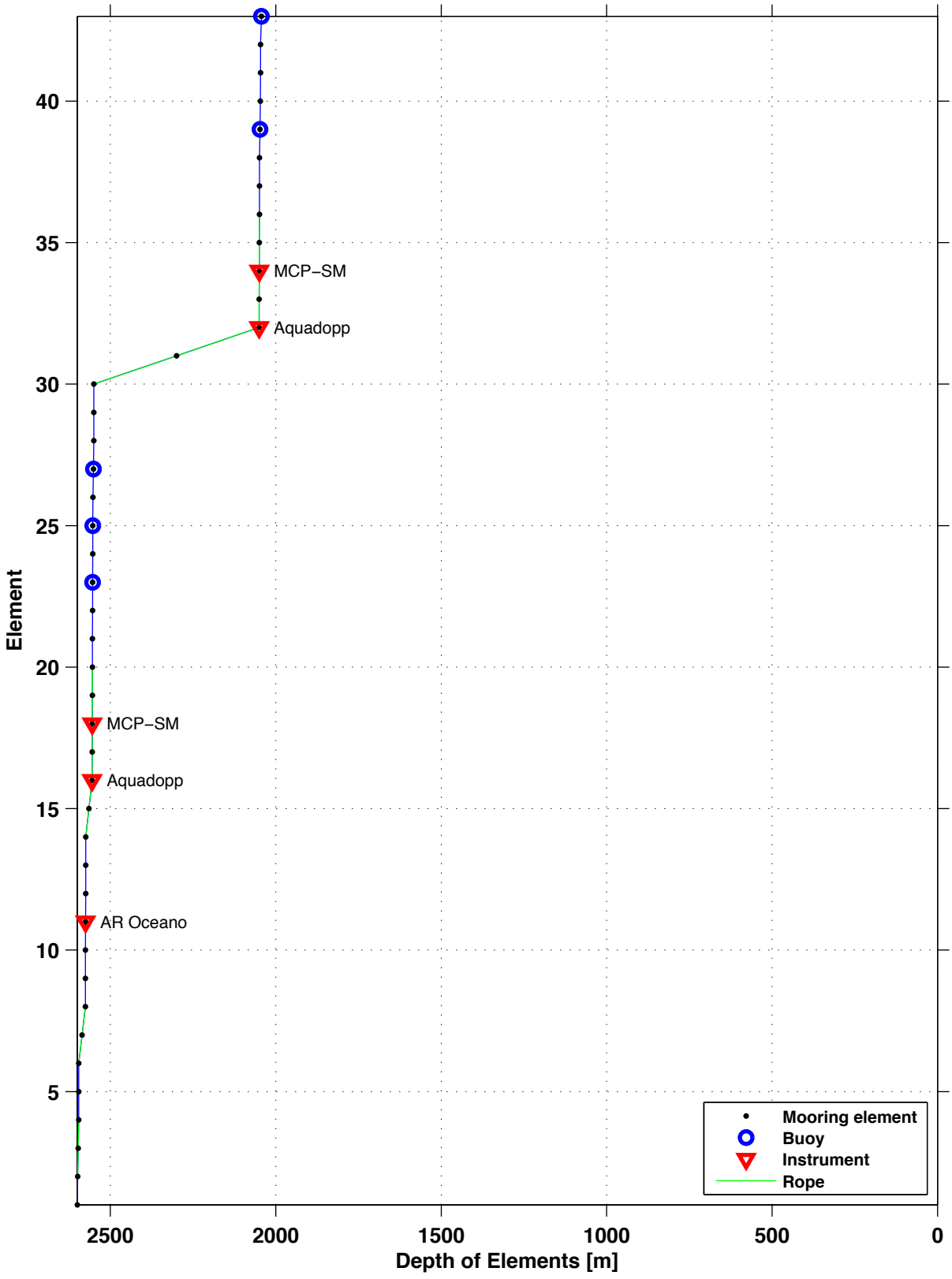
NO Current Vertical anchor load : 209 kg
Wet safe anchor weight : 313 kg (150%, max: 500 kg)
Wet / Dry Clump anchor weight : 401 kg / 460 kg

Short name: DSOW4 / KPO 1123

Deployment: RV Knoor – July/August 2014

Source: 09–Jul–2014 13:05:29, /ext/project/moorings/msm40/dsow/kpo1123_dsow4.cfg
Author: 09–Jul–2014 13:05:51, begler@kim(GLNX86)

Depth of Elements



NO Current Vertical anchor load : 209 kg
Wet safe anchor weight : 313 kg (150%, max: 500 kg)
Wet / Dry Clump anchor weight : 401 kg / 460 kg

Short name: DSOW4 / KPO 1123

Deployment: RV Knoor – July/August 2014

Source: 09–Jul–2014 13:05:29, /ext/project/moorings/msm40/dsow/kpo1123_dsow4.cfg
Author: 09–Jul–2014 13:05:51, begler@kim(GLNX86)

No Current Static Solution – Parameter

#	ID	Mooring Element	Length [m]	Buoy [kg]	Backup B.[kg]	Height [m]	Design Dpt [m]	Tension [kg]	[%]	Stretch [m]	[%]
43	294	H17-4 serial	2.7	90.0	221.5	556.6	2043.4	0.0	0.0	0.00	0.00
42	31	AS 2t 1/2"	0.0	-0.4	131.5	553.9	2046.2	90.0	1.1	0.00	0.00
41	42	OL 2t 5/8"	0.1	-0.6	131.8	553.8	2046.2	89.6	1.1	0.00	0.00
40	31	AS 2t 1/2"	0.0	-0.4	132.4	553.7	2046.3	89.1	1.1	0.00	0.00
39	294	H17-4 serial	2.7	90.0	132.8	553.7	2047.7	88.7	0.9	0.00	0.00
38	31	AS 2t 1/2"	0.0	-0.4	42.8	551.0	2049.1	178.7	2.2	0.00	0.00
37	42	OL 2t 5/8"	0.1	-0.6	43.1	550.9	2049.2	178.3	2.2	0.00	0.00
36	31	AS 2t 1/2"	0.0	-0.4	43.7	550.8	2049.2	177.8	2.2	0.00	0.00
35	101	3/16" ins	0.5	-0.0	44.1	550.7	2049.5	177.4	9.8	0.00	0.10
34	334	MCP-SM	0.0	-2.8	44.1	550.2	2049.8	177.4	1.8	0.00	0.00
33	101	3/16" ins	0.5	-0.0	46.9	550.2	2050.0	174.6	9.6	0.00	0.10
32	347	Aquadopp down	0.0	-6.0	46.9	549.7	2050.3	174.5	1.7	0.00	0.00
31	101	3/16" ins	499.4	-38.5	52.9	549.7	2300.0	168.5	9.3	0.41	0.08
30	31	AS 2t 1/2"	0.0	-0.4	91.5	50.3	2549.7	130.0	1.6	0.00	0.00
29	42	OL 2t 5/8"	0.1	-0.6	91.8	50.3	2549.8	129.6	1.6	0.00	0.00
28	31	AS 2t 1/2"	0.0	-0.4	92.4	50.2	2549.9	129.1	1.6	0.00	0.00
27	294	H17-4 serial	2.7	90.0	92.8	50.1	2551.2	128.7	1.3	0.00	0.00
26	31	AS 2t 1/2"	0.0	-0.4	2.8	47.4	2552.6	218.7	2.7	0.00	0.00
25	291	H17-1 serial	0.6	22.0	3.1	47.4	2552.9	218.3	2.2	0.00	0.00
24	31	AS 2t 1/2"	0.0	-0.4	-18.9	46.8	2553.2	240.3	3.0	0.00	0.00
23	291	H17-1 serial	0.6	22.0	-18.5	46.7	2553.5	240.0	2.4	0.00	0.00
22	31	AS 2t 1/2"	0.0	-0.4	-40.5	46.2	2553.9	262.0	3.3	0.00	0.00
21	42	OL 2t 5/8"	0.1	-0.6	-40.2	46.1	2553.9	261.6	3.3	0.00	0.00
20	31	AS 2t 1/2"	0.0	-0.4	-39.6	46.0	2554.0	261.0	3.3	0.00	0.00
19	102	1/4" ins	0.5	-0.1	-39.2	46.0	2554.3	260.7	8.6	0.00	0.09
18	334	MCP-SM	0.0	-2.8	-39.2	45.5	2554.5	260.6	2.6	0.00	0.00
17	102	1/4" ins	0.5	-0.1	-36.4	45.5	2554.8	257.8	8.5	0.00	0.09
16	347	Aquadopp down	0.0	-6.0	-36.3	45.0	2555.0	257.7	2.6	0.00	0.00
15	102	1/4" ins	19.0	-2.7	-30.3	45.0	2564.6	251.7	8.3	0.02	0.08
14	31	AS 2t 1/2"	0.1	-0.4	-27.6	25.9	2574.1	249.1	3.1	0.00	0.00
13	42	OL 2t 5/8"	0.1	-0.6	-27.2	25.9	2574.2	248.7	3.1	0.00	0.00
12	32	AS 3t 5/8"	0.1	-0.7	-26.7	25.8	2574.3	248.1	2.1	0.00	0.00
11	471	AR Oceano	1.0	-26.0	-26.0	25.7	2574.8	247.5	2.5	0.00	0.00
10	31	AS 2t 1/2"	0.1	-0.4	NaN	24.7	2575.3	221.5	2.8	0.00	0.00
9	42	OL 2t 5/8"	0.1	-0.6	NaN	24.7	2575.4	221.1	2.8	0.00	0.00
8	31	AS 2t 1/2"	0.1	-0.4	NaN	24.5	2575.5	220.5	2.8	0.00	0.00
7	102	1/4" ins	20.0	-2.8	NaN	24.5	2585.5	220.2	7.3	0.01	0.07
6	31	AS 2t 1/2"	0.0	-0.4	NaN	4.5	2595.5	217.3	2.7	0.00	0.00
5	42	OL 2t 5/8"	0.1	-0.6	NaN	4.4	2595.6	217.0	2.7	0.00	0.00
4	31	AS 2t 1/2"	0.0	-0.4	NaN	4.3	2595.7	216.4	2.7	0.00	0.00
3	151	chain-13	2.7	-6.8	NaN	4.3	2597.1	216.0	2.2	0.00	0.00
2	32	AS 3t 5/8"	0.1	-0.7	NaN	1.6	2598.5	209.2	1.7	0.00	0.00
1	520	Anchor	1.5	-401.4	NaN	1.5	2600.0	208.5	3.5	0.00	0.00
Max. 9.8% Static Tension at:											
35	101	3/16" ins	0.5	-0.0	44.1	550.7	2049.5	177.4	9.8	0.00	0.10

Vertical anchor load : 209 kg
Wet Clump Anchor weight : 401 kg
Safe Clump Anchor weight : 313 kg

Short name: DSOW4 / KPO 1123

Deployment: RV Knoor – July/August 2014

Source: 09–Jul–2014 13:05:29, /ext/project/moorings/msm40/dsow/kpo1123_dsow4.cfg
Author: 09–Jul–2014 13:05:51, begler@kim(GLNX86)

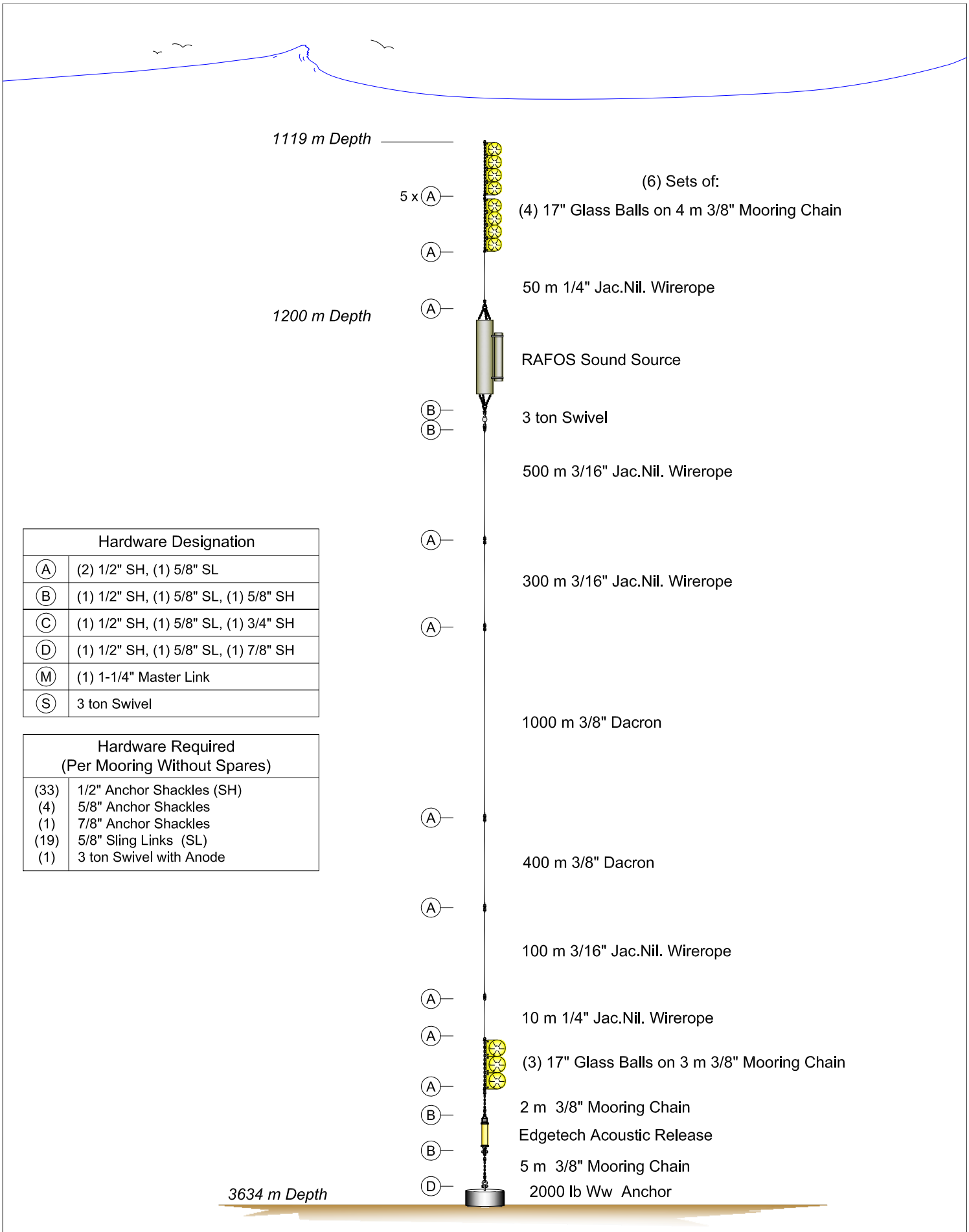
Steady State Launch Tension – Parameter: descent at 1.14 m/s, 2.2 kn

#	ID	Mooring Element	Length [m]	Buoy [kg]	Diameter [m]	Area [m^2]	Ct	Drag [kg]	LaunchTension [kg]	[%]
43	294	H17-4 serial	2.7	90.0	0.500	0.196	1.75	23.42	113.4	1.1
42	31	AS 2t 1/2"	0.0	-0.4	0.052	0.002	1.50	0.22	113.3	1.4
41	42	OL 2t 5/8"	0.1	-0.6	0.048	0.002	1.50	0.19	112.9	1.4
40	31	AS 2t 1/2"	0.0	-0.4	0.052	0.002	1.50	0.22	112.7	1.4
39	294	H17-4 serial	2.7	90.0	0.500	0.196	1.75	23.42	226.2	2.3
38	31	AS 2t 1/2"	0.0	-0.4	0.052	0.002	1.50	0.22	226.0	2.8
37	42	OL 2t 5/8"	0.1	-0.6	0.048	0.002	1.50	0.19	225.6	2.8
36	31	AS 2t 1/2"	0.0	-0.4	0.052	0.002	1.50	0.22	225.5	2.8
35	101	3/16" ins	0.5	-0.0	0.006	0.010	0.05	0.03	225.5	12.4
34	334	MCP-SM	0.0	-2.8	0.075	0.004	1.00	0.30	223.0	2.2
33	101	3/16" ins	0.5	-0.0	0.006	0.010	0.05	0.03	223.0	12.3
32	347	Aquadopp down	0.0	-6.0	0.084	0.006	0.90	0.34	217.3	2.2
31	101	3/16" ins	499.4	-38.5	0.006	9.959	0.05	32.04	210.8	11.6
30	31	AS 2t 1/2"	0.0	-0.4	0.052	0.002	1.50	0.22	210.7	2.6
29	42	OL 2t 5/8"	0.1	-0.6	0.048	0.002	1.50	0.19	210.3	2.6
28	31	AS 2t 1/2"	0.0	-0.4	0.052	0.002	1.50	0.22	210.2	2.6
27	294	H17-4 serial	2.7	90.0	0.500	0.196	1.80	24.09	324.2	3.2
26	31	AS 2t 1/2"	0.0	-0.4	0.052	0.002	1.50	0.22	324.1	4.1
25	291	H17-1 serial	0.6	22.0	0.500	0.196	0.45	6.02	352.1	3.5
24	31	AS 2t 1/2"	0.0	-0.4	0.052	0.002	1.50	0.22	352.0	4.4
23	291	H17-1 serial	0.6	22.0	0.500	0.196	0.45	6.02	380.0	3.8
22	31	AS 2t 1/2"	0.0	-0.4	0.052	0.002	1.50	0.22	379.9	4.7
21	42	OL 2t 5/8"	0.1	-0.6	0.048	0.002	1.50	0.19	379.5	4.7
20	31	AS 2t 1/2"	0.0	-0.4	0.052	0.002	1.50	0.22	379.3	4.7
19	102	1/4" ins	0.5	-0.1	0.008	0.012	0.07	0.06	379.3	12.6
18	334	MCP-SM	0.0	-2.8	0.075	0.004	1.00	0.30	376.8	3.8
17	102	1/4" ins	0.5	-0.1	0.008	0.012	0.07	0.06	376.8	12.5
16	347	Aquadopp down	0.0	-6.0	0.084	0.006	0.90	0.34	371.1	3.7
15	102	1/4" ins	19.0	-2.7	0.008	0.474	0.07	2.39	370.9	12.3
14	31	AS 2t 1/2"	0.1	-0.4	0.052	0.002	1.50	0.22	370.7	4.6
13	42	OL 2t 5/8"	0.1	-0.6	0.048	0.002	1.50	0.19	370.3	4.6
12	32	AS 3t 5/8"	0.1	-0.7	0.064	0.003	1.50	0.33	370.0	3.1
11	471	AR Oceano	1.0	-26.0	0.130	0.013	0.90	0.81	344.8	3.4
10	31	AS 2t 1/2"	0.1	-0.4	0.052	0.002	1.50	0.22	344.7	4.3
9	42	OL 2t 5/8"	0.1	-0.6	0.048	0.002	1.50	0.19	344.3	4.3
8	31	AS 2t 1/2"	0.1	-0.4	0.052	0.002	1.50	0.22	344.1	4.3
7	102	1/4" ins	20.0	-2.8	0.008	0.499	0.07	2.52	343.8	11.4
6	31	AS 2t 1/2"	0.0	-0.4	0.052	0.002	1.50	0.22	343.7	4.3
5	42	OL 2t 5/8"	0.1	-0.6	0.048	0.002	1.50	0.19	343.3	4.3
4	31	AS 2t 1/2"	0.0	-0.4	0.052	0.002	1.50	0.22	343.1	4.3
3	151	chain-13	2.7	-6.8	0.020	0.170	0.10	1.18	337.5	3.4
2	32	AS 3t 5/8"	0.1	-0.7	0.064	0.003	1.50	0.33	337.2	2.8
1	520	Anchor	1.5	-401.4	1.000	0.785	1.20	64.24	0.0	0.0

Max. 12.6% Launch Tension at:

19	102	1/4" ins	0.5	-0.1	0.008	0.012	0.07	0.06	379.3	12.6

Mass dry / wet w/o Anchor: 416 kg, -209 kg
Drag / Friction w/o Anchor: 128.6 kg, 98.9 kg/[m/s]^2
Dry/Wet Clump Anchor weight: 460 kg, 401 kg
Steady State AnchorSpeed : 1.14 m/s, 2.2 kn



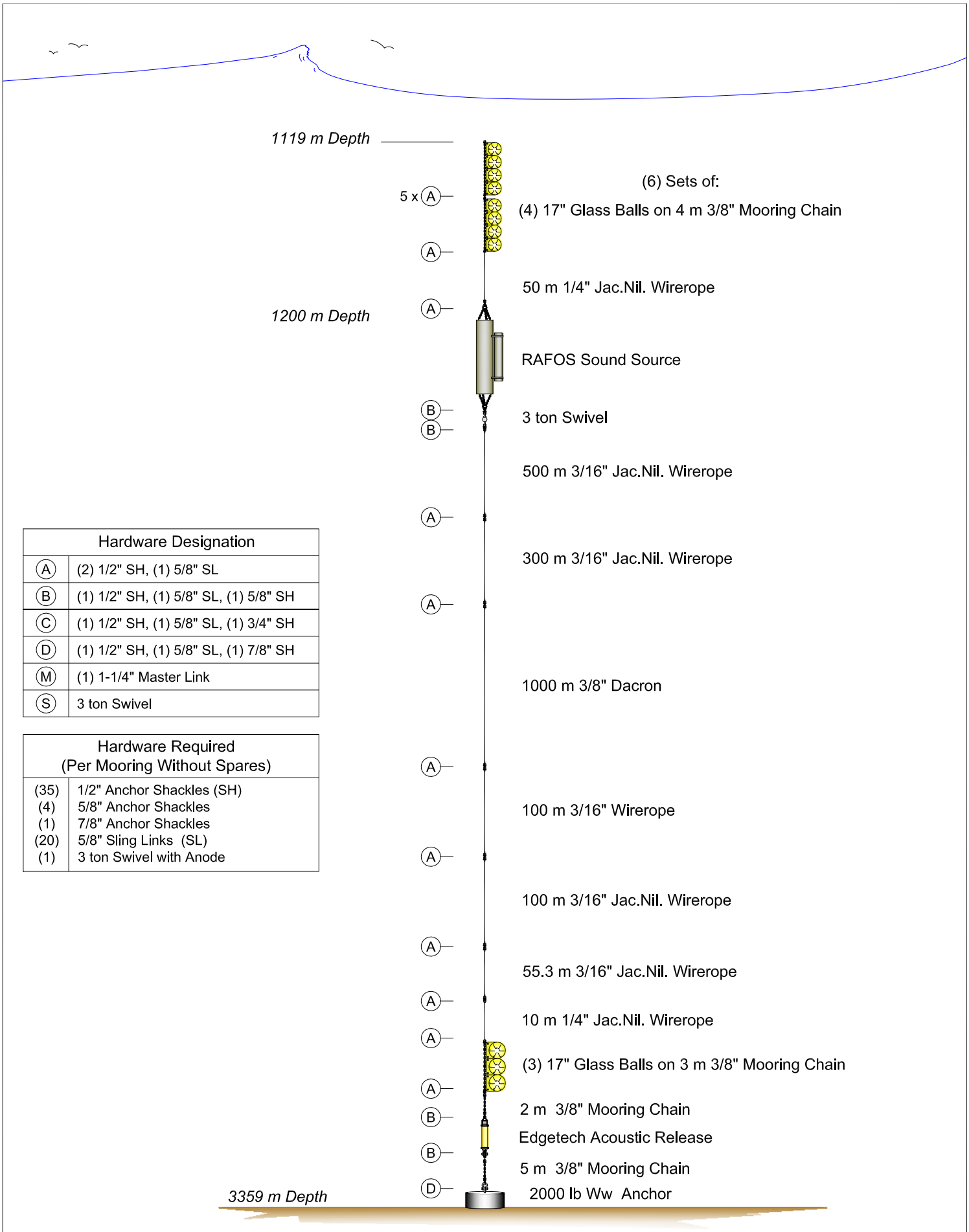
Hardware Designation	
A	(2) 1/2" SH, (1) 5/8" SL
B	(1) 1/2" SH, (1) 5/8" SL, (1) 5/8" SH
C	(1) 1/2" SH, (1) 5/8" SL, (1) 3/4" SH
D	(1) 1/2" SH, (1) 5/8" SL, (1) 7/8" SH
M	(1) 1-1/4" Master Link
S	3 ton Swivel

Hardware Required (Per Mooring Without Spares)	
(33)	1/2" Anchor Shackles (SH)
(4)	5/8" Anchor Shackles
(1)	7/8" Anchor Shackles
(19)	5/8" Sling Links (SL)
(1)	3 ton Swivel with Anode

Bower OSNAP Sound Source Mooring 1
3634 meter Depth

OSNAP-1

Woods Hole Oceanographic Institution
designed by John Kemp, drawn by Betsey Doherty
file: OSNAP | date: 05/01/2014



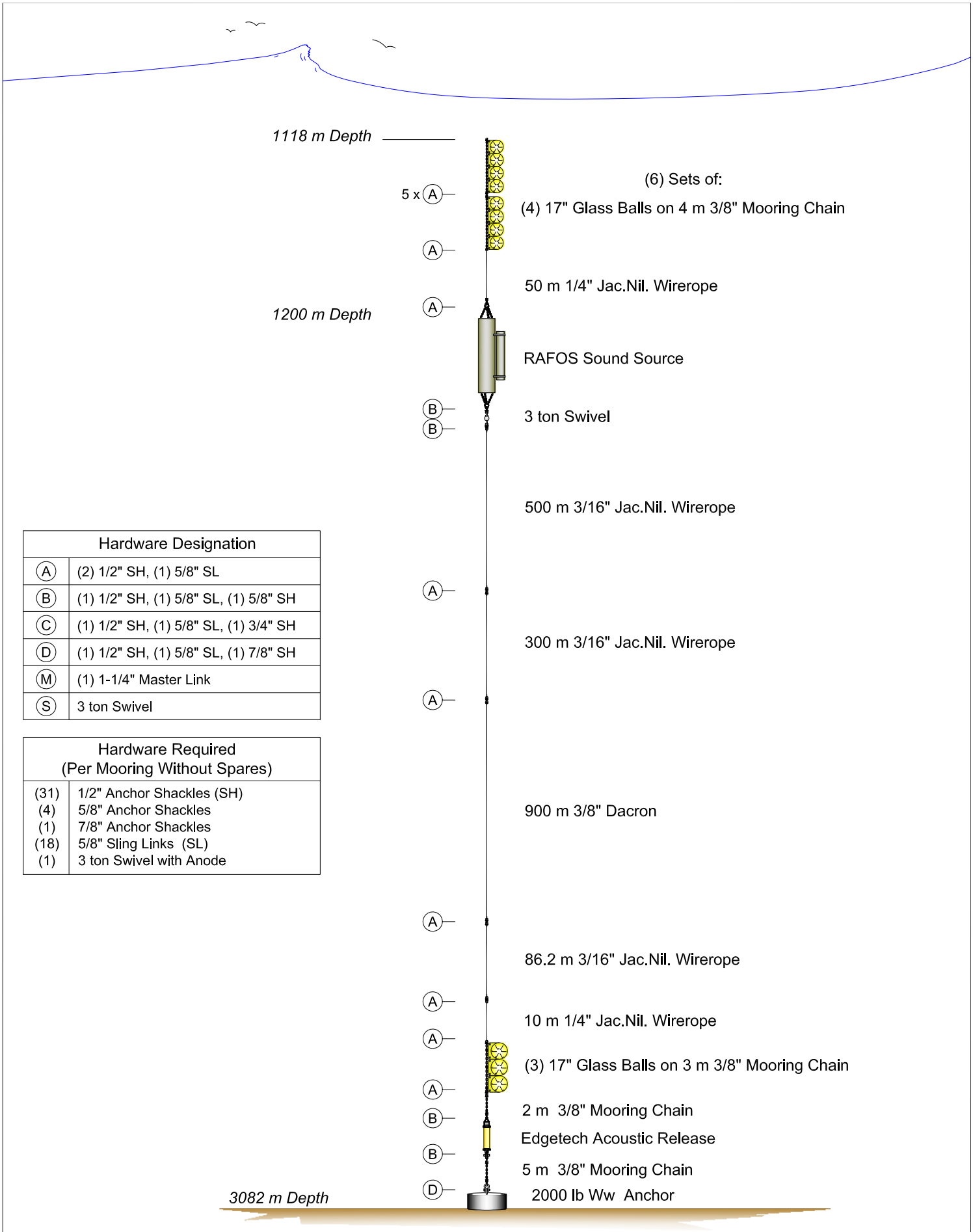
Hardware Designation	
A	(2) 1/2" SH, (1) 5/8" SL
B	(1) 1/2" SH, (1) 5/8" SL, (1) 5/8" SH
C	(1) 1/2" SH, (1) 5/8" SL, (1) 3/4" SH
D	(1) 1/2" SH, (1) 5/8" SL, (1) 7/8" SH
M	(1) 1-1/4" Master Link
S	3 ton Swivel

Hardware Required (Per Mooring Without Spares)	
(35)	1/2" Anchor Shackles (SH)
(4)	5/8" Anchor Shackles
(1)	7/8" Anchor Shackles
(20)	5/8" Sling Links (SL)
(1)	3 ton Swivel with Anode

Bower OSNAP Sound Source Mooring 2
3359 meter Depth

OSNAP-2

Woods Hole Oceanographic Institution
designed by John Kemp, drawn by Betsey Doherty
file: OSNAP date: 05/01/2014



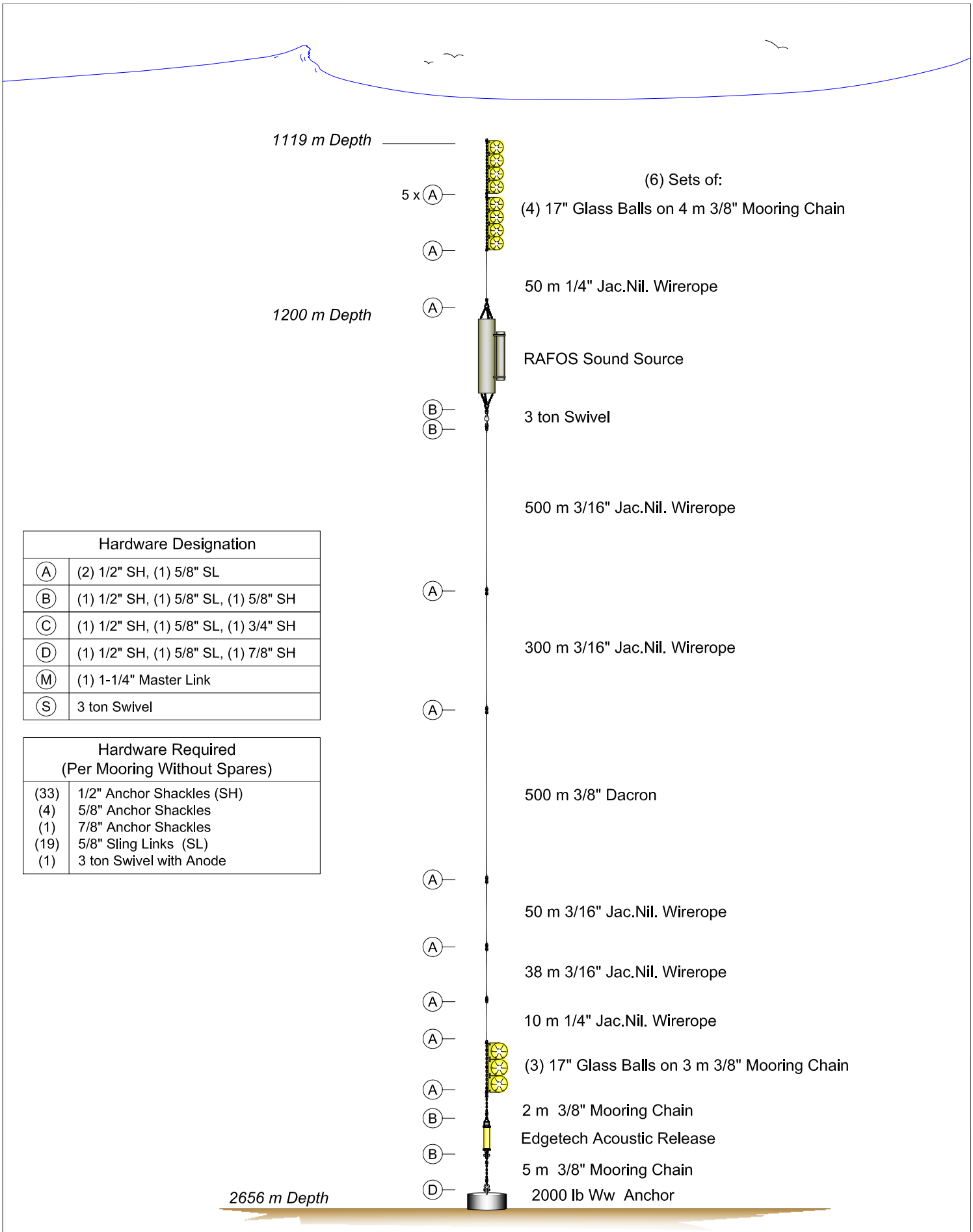
Hardware Designation	
A	(2) 1/2" SH, (1) 5/8" SL
B	(1) 1/2" SH, (1) 5/8" SL, (1) 5/8" SH
C	(1) 1/2" SH, (1) 5/8" SL, (1) 3/4" SH
D	(1) 1/2" SH, (1) 5/8" SL, (1) 7/8" SH
M	(1) 1-1/4" Master Link
S	3 ton Swivel

Hardware Required (Per Mooring Without Spares)	
(31)	1/2" Anchor Shackles (SH)
(4)	5/8" Anchor Shackles
(1)	7/8" Anchor Shackles
(18)	5/8" Sling Links (SL)
(1)	3 ton Swivel with Anode

Bower OSNAP Sound Source Mooring 3
3082 meter Depth

OSNAP-3

Woods Hole Oceanographic Institution
designed by John Kemp, drawn by Betsey Doherty
file: OSNAP date: 05/01/2014



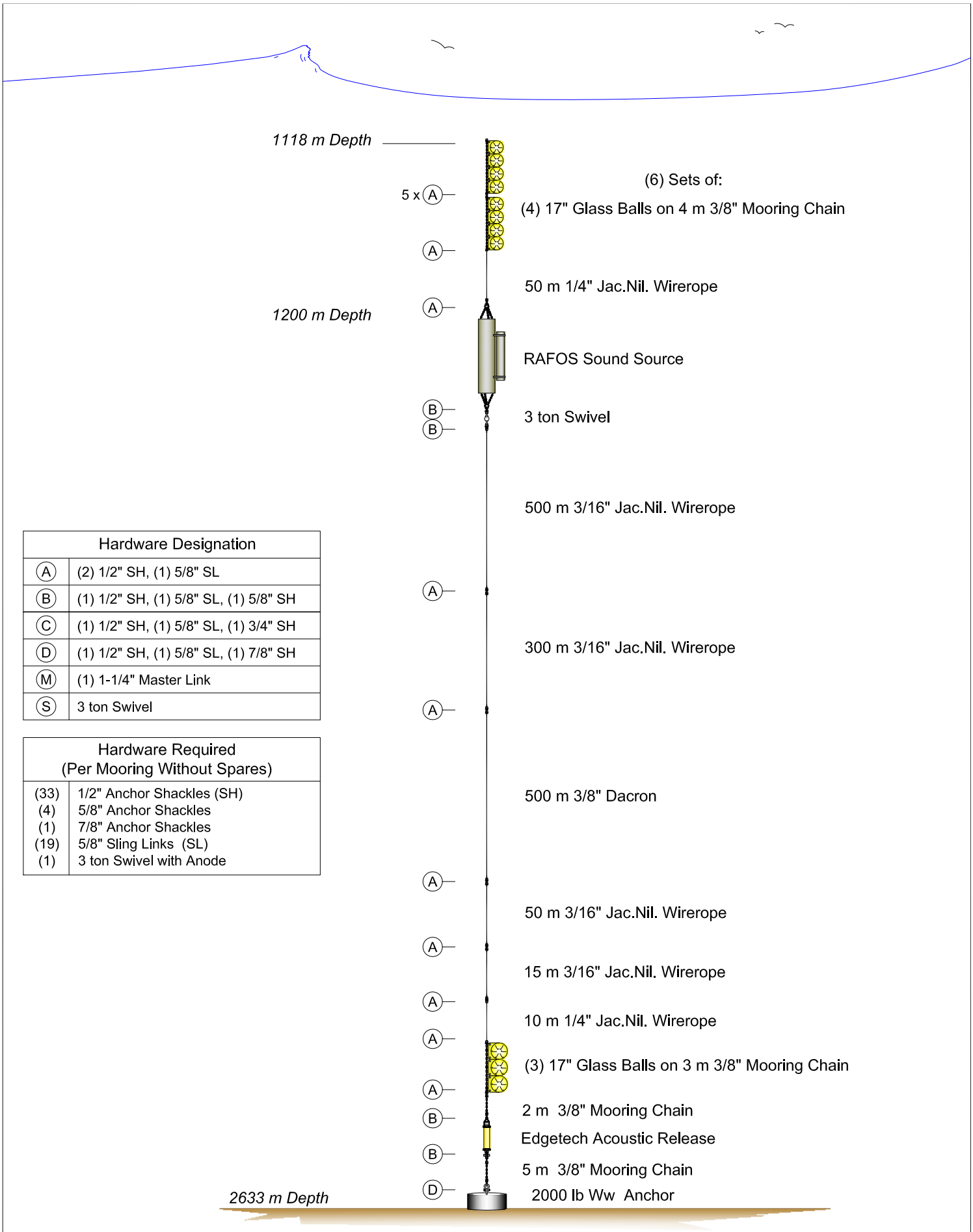
Hardware Designation	
A	(2) 1/2" SH, (1) 5/8" SL
B	(1) 1/2" SH, (1) 5/8" SL, (1) 5/8" SH
C	(1) 1/2" SH, (1) 5/8" SL, (1) 3/4" SH
D	(1) 1/2" SH, (1) 5/8" SL, (1) 7/8" SH
M	(1) 1-1/4" Master Link
S	3 ton Swivel

Hardware Required (Per Mooring Without Spares)	
(33)	1/2" Anchor Shackles (SH)
(4)	5/8" Anchor Shackles
(1)	7/8" Anchor Shackles
(19)	5/8" Sling Links (SL)
(1)	3 ton Swivel with Anode

Bower OSNAP Sound Source Mooring 4
2656 meter Depth

OSNAP-4

Woods Hole Oceanographic Institution
designed by John Kemp, drawn by Betsey Doherty
file: OSNAP date: 05/01/2014



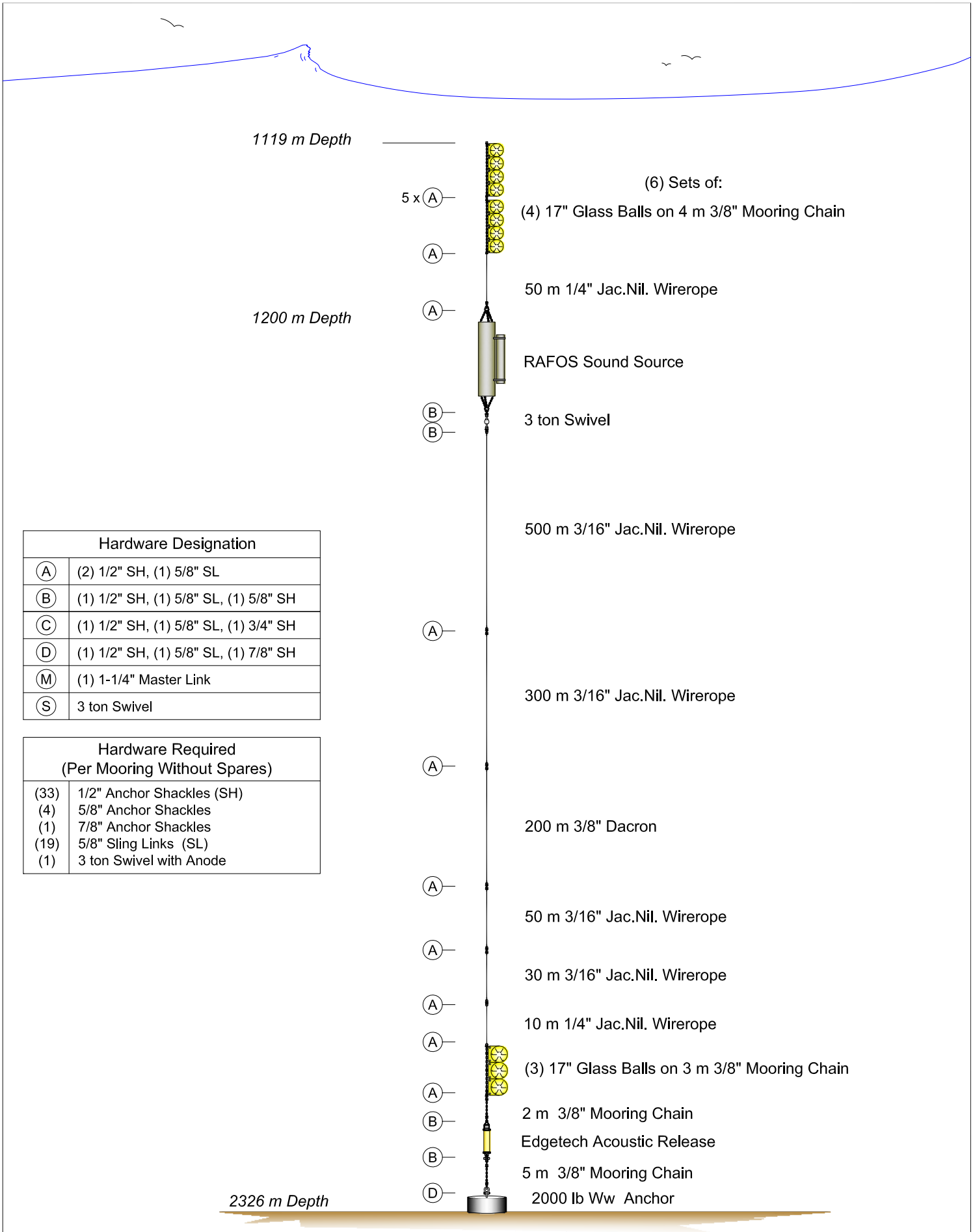
Hardware Designation	
A	(2) 1/2" SH, (1) 5/8" SL
B	(1) 1/2" SH, (1) 5/8" SL, (1) 5/8" SH
C	(1) 1/2" SH, (1) 5/8" SL, (1) 3/4" SH
D	(1) 1/2" SH, (1) 5/8" SL, (1) 7/8" SH
M	(1) 1-1/4" Master Link
S	3 ton Swivel

Hardware Required (Per Mooring Without Spares)	
(33)	1/2" Anchor Shackles (SH)
(4)	5/8" Anchor Shackles
(1)	7/8" Anchor Shackles
(19)	5/8" Sling Links (SL)
(1)	3 ton Swivel with Anode

Bower OSNAP Sound Source Mooring 5
2633 meter Depth

OSNAP-5

Woods Hole Oceanographic Institution
designed by John Kemp, drawn by Betsey Doherty
file: OSNAP date: 05/01/2014



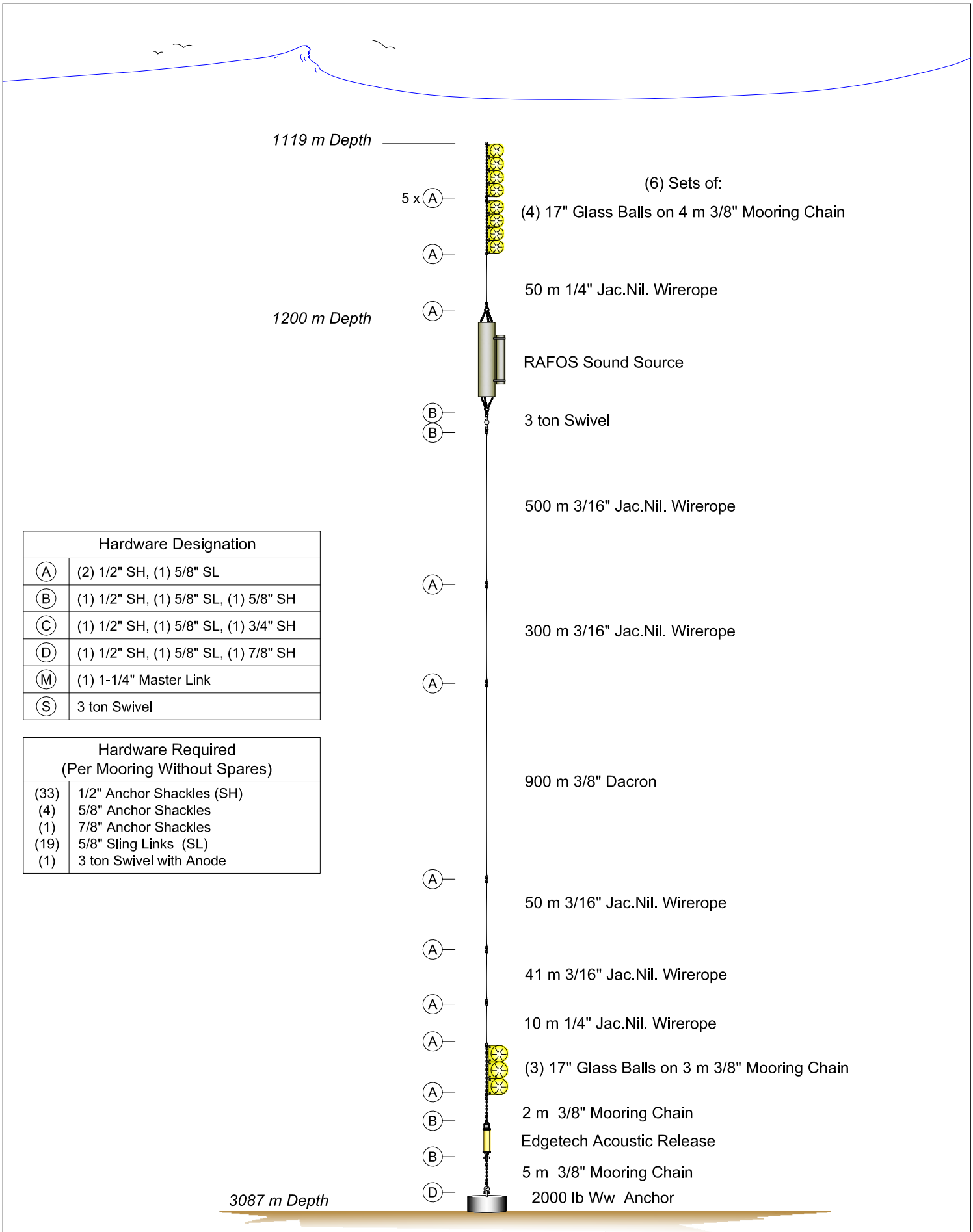
Hardware Designation	
A	(2) 1/2" SH, (1) 5/8" SL
B	(1) 1/2" SH, (1) 5/8" SL, (1) 5/8" SH
C	(1) 1/2" SH, (1) 5/8" SL, (1) 3/4" SH
D	(1) 1/2" SH, (1) 5/8" SL, (1) 7/8" SH
M	(1) 1-1/4" Master Link
S	3 ton Swivel

Hardware Required (Per Mooring Without Spares)	
(33)	1/2" Anchor Shackles (SH)
(4)	5/8" Anchor Shackles
(1)	7/8" Anchor Shackles
(19)	5/8" Sling Links (SL)
(1)	3 ton Swivel with Anode

Bower OSNAP Sound Source Mooring 6
2326 meter Depth

OSNAP-6

Woods Hole Oceanographic Institution
designed by John Kemp, drawn by Betsey Doherty
file: OSNAP date: 05/01/2014



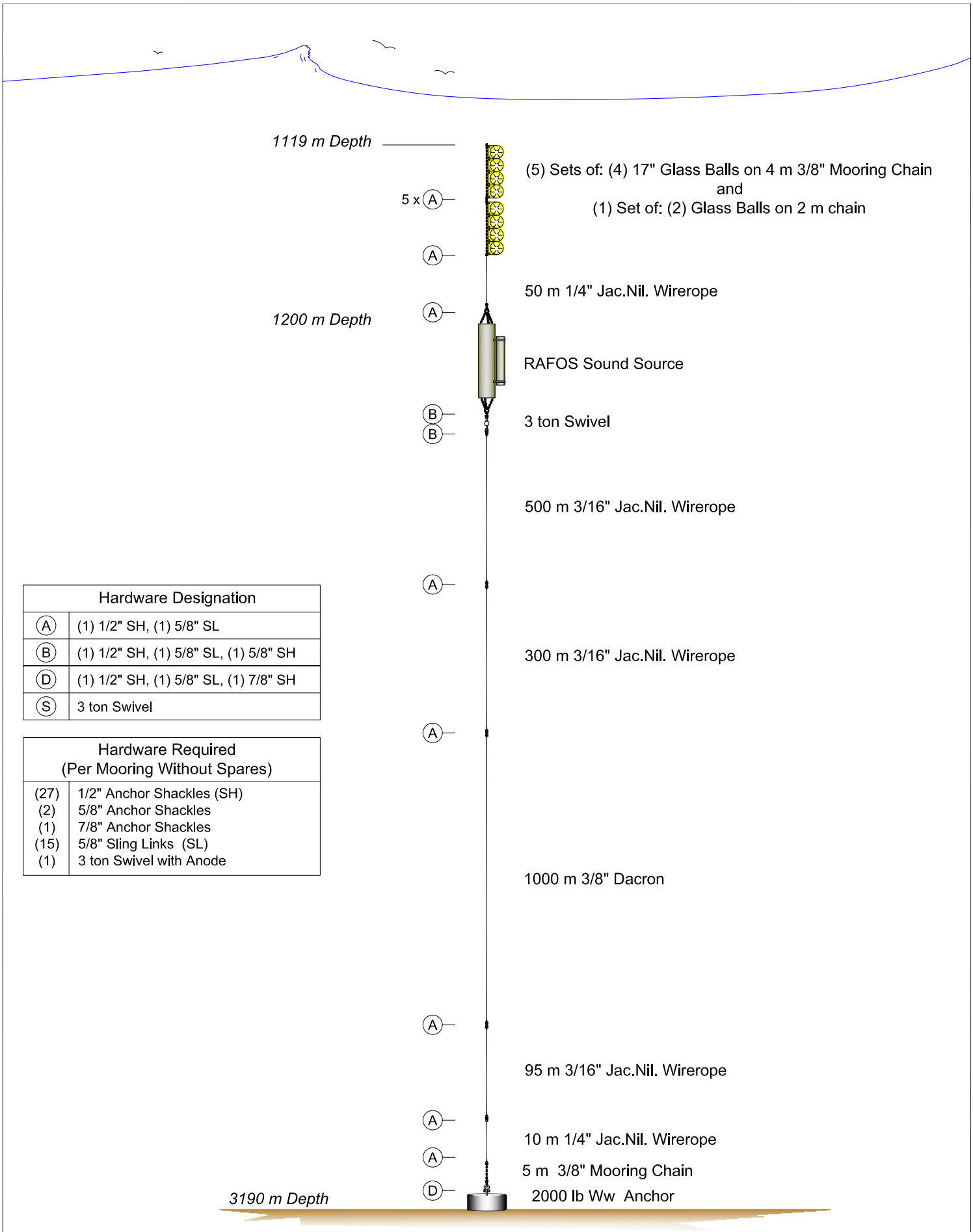
Hardware Designation	
A	(2) 1/2" SH, (1) 5/8" SL
B	(1) 1/2" SH, (1) 5/8" SL, (1) 5/8" SH
C	(1) 1/2" SH, (1) 5/8" SL, (1) 3/4" SH
D	(1) 1/2" SH, (1) 5/8" SL, (1) 7/8" SH
M	(1) 1-1/4" Master Link
S	3 ton Swivel

Hardware Required (Per Mooring Without Spares)	
(33)	1/2" Anchor Shackles (SH)
(4)	5/8" Anchor Shackles
(1)	7/8" Anchor Shackles
(19)	5/8" Sling Links (SL)
(1)	3 ton Swivel with Anode

Bower OSNAP Sound Source Mooring 7
3087 meter Depth

OSNAP-7

Woods Hole Oceanographic Institution
designed by John Kemp, drawn by Betsey Doherty
file: OSNAP date: 05/01/2014



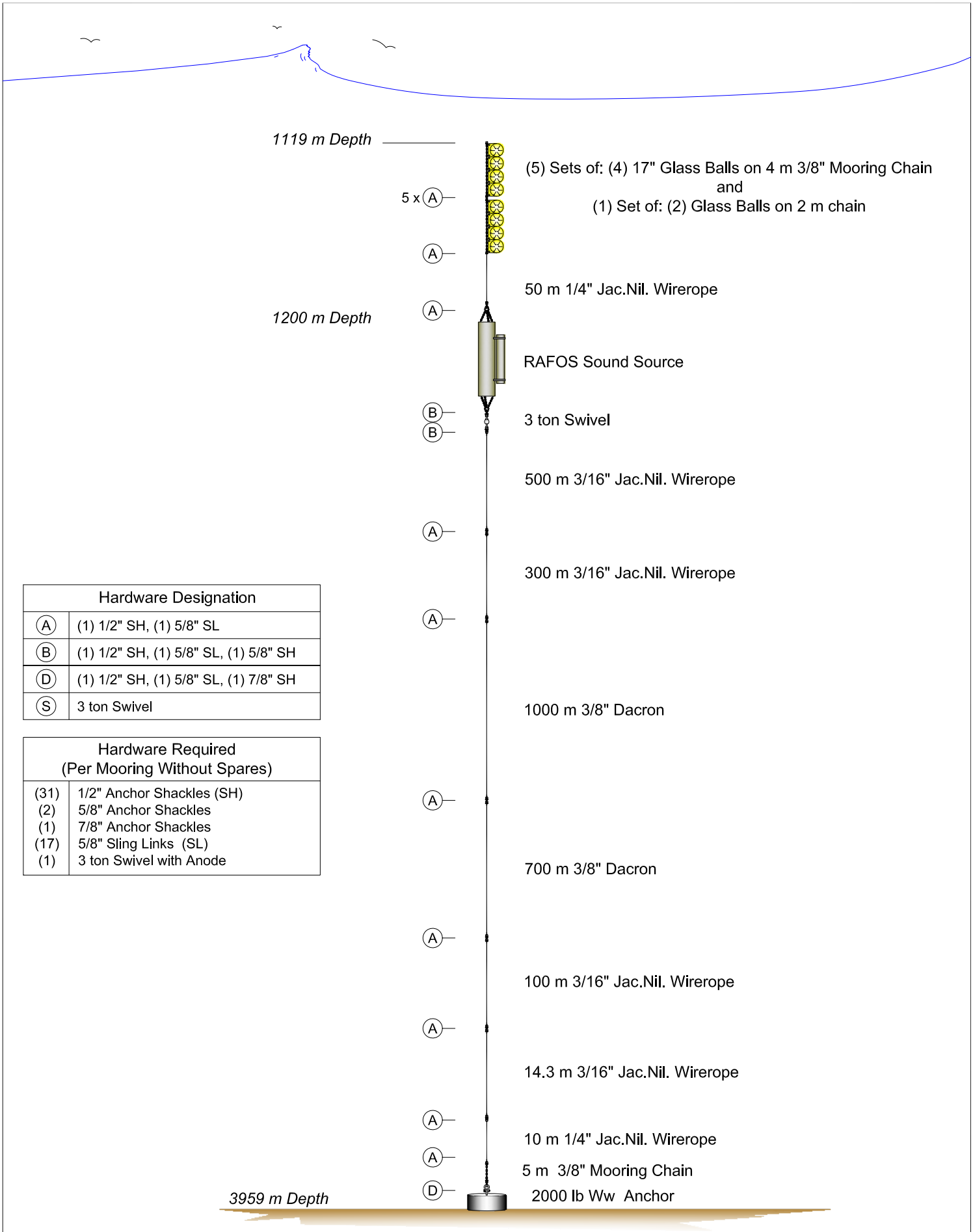
Hardware Designation	
A	(1) 1/2" SH, (1) 5/8" SL
B	(1) 1/2" SH, (1) 5/8" SL, (1) 5/8" SH
D	(1) 1/2" SH, (1) 5/8" SL, (1) 7/8" SH
S	3 ton Swivel

Hardware Required (Per Mooring Without Spares)	
(27)	1/2" Anchor Shackles (SH)
(2)	5/8" Anchor Shackles
(1)	7/8" Anchor Shackles
(15)	5/8" Sling Links (SL)
(1)	3 ton Swivel with Anode

Bower OSNAP Sound Source Mooring 8
3190 meter Depth

OSNAP-8

Woods Hole Oceanographic Institution
designed by John Kemp, drawn by Betsey Doherty
file: OSNAP date: 05/01/2014



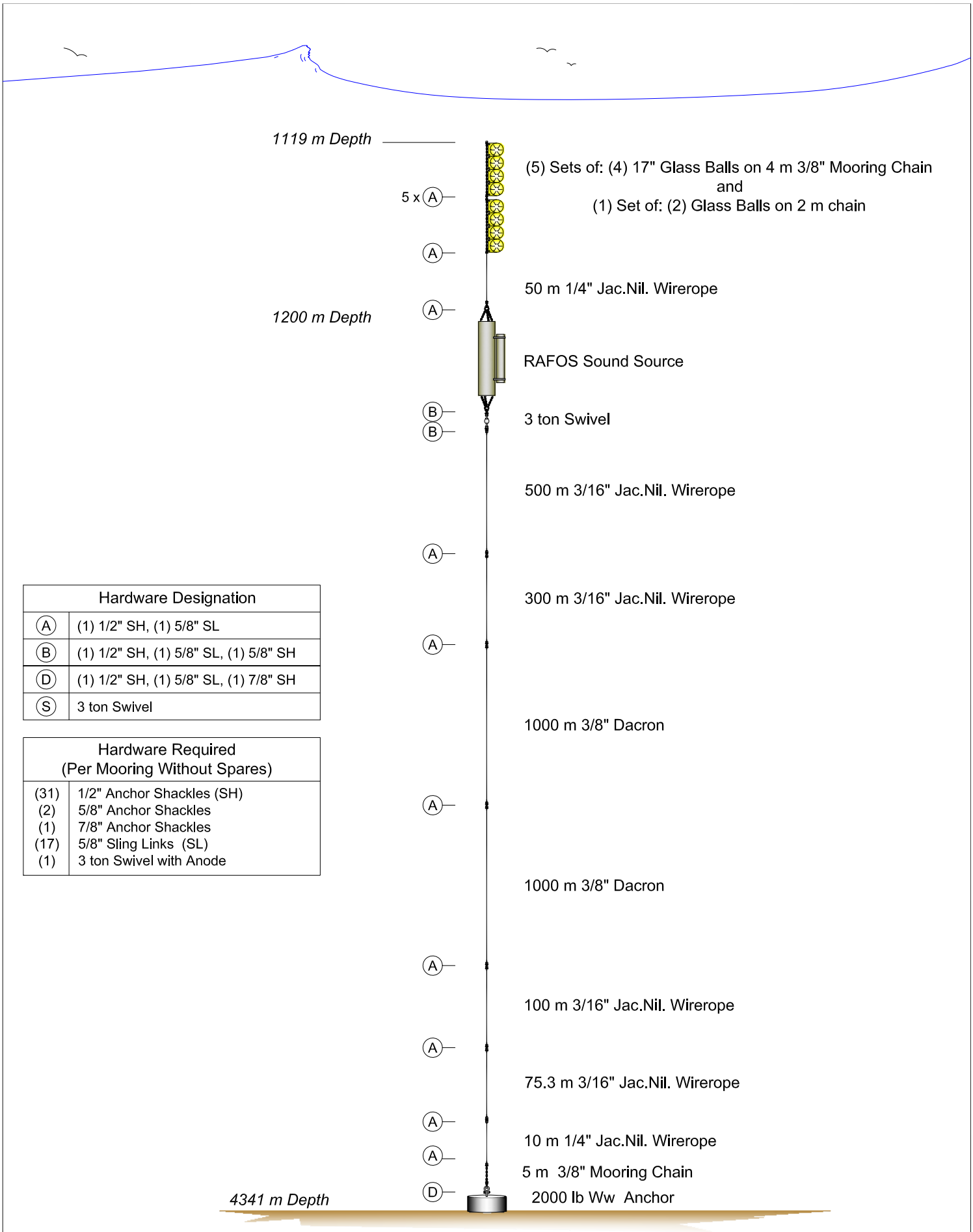
Hardware Designation	
A	(1) 1/2" SH, (1) 5/8" SL
B	(1) 1/2" SH, (1) 5/8" SL, (1) 5/8" SH
D	(1) 1/2" SH, (1) 5/8" SL, (1) 7/8" SH
S	3 ton Swivel

Hardware Required (Per Mooring Without Spares)	
(31)	1/2" Anchor Shackles (SH)
(2)	5/8" Anchor Shackles
(1)	7/8" Anchor Shackles
(17)	5/8" Sling Links (SL)
(1)	3 ton Swivel with Anode

Bower OSNAP Sound Source Mooring 9
3959 meter Depth

OSNAP-9

Woods Hole Oceanographic Institution
designed by John Kemp, drawn by Betsey Doherty
file: OSNAP date: 05/01/2014



(5) Sets of: (4) 17" Glass Balls on 4 m 3/8" Mooring Chain
and
(1) Set of: (2) Glass Balls on 2 m chain

Hardware Designation	
A	(1) 1/2" SH, (1) 5/8" SL
B	(1) 1/2" SH, (1) 5/8" SL, (1) 5/8" SH
D	(1) 1/2" SH, (1) 5/8" SL, (1) 7/8" SH
S	3 ton Swivel

Hardware Required (Per Mooring Without Spares)	
(31)	1/2" Anchor Shackles (SH)
(2)	5/8" Anchor Shackles
(1)	7/8" Anchor Shackles
(17)	5/8" Sling Links (SL)
(1)	3 ton Swivel with Anode

Bower OSNAP Sound Source Mooring 10
4341 meter Depth

OSNAP-10

Woods Hole Oceanographic Institution	
designed by John Kemp, drawn by Betsey Doherty	
file: OSNAP	date: 05/01/2014