

AR30-06 Cruise Report

Cruise Summary

Vessel: R/V Neil Armstrong

Cruise ID: AR30-06

Chief Scientist: Robert Pickart

Ports: Reykjavik, Iceland to Reykjavik, Iceland

Dates: Aug 27, 2018 – Oct 03, 2018

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. This report summarizes the operations carried out aboard R/V *Neil Armstrong* during cruise 30 leg 6 (AR30-06) in late-summer/early-fall 2018. The study area of AR30-06 was the southwestern Irminger Sea, southern Labrador Sea, and Denmark Strait. The science party consisted of 15 personnel from various institutions (Table 1).

Table 1: Science party members of AR30-6. WHOI = Woods Hole Oceanographic Institution; Scripps = Scripps Institution of Oceanography; MIT = Massachusetts Institute of Technology; UV = University of Venice.

Last Name	First Name	Institution	Position
Pickart	Robert	WHOI	Chief Scientist
Kemp	John	WHOI	Mooring Tech (lead)
Hogue	Brian	WHOI	Mooring Tech
Davies	Andrew	WHOI	Mooring Tech
Schettig	Mason	BIOS	Mooring Tech
Torres	Daniel	WHOI	Instruments/VMADCP/LADCP
Houghton	Leah	WHOI	Hydrography
McRaven	Leah	WHOI	CTD Operations (lead)

Le Bras	Isabela	Scripps	Chipods
Pacini	Astrid	WHOI	CTD Watchstander
Huang	Jie	WHOI	CTD Watchstander
Facchinetti	Federica	UV	CTD Watchstander
Sanchez	Robert	Scripps	CTD Watchstander
Williams	James	MIT	CTD Watchstander
Rainville	Edwin	WHOI	CTD Watchstander

Scientific Objectives

The primary objectives of the cruise were as follows:

1. To service 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 recover a sound source mooring for the OSNAP RAFOS float program in the Labrador Sea.
3. To carry out a shipboard hydrographic/velocity/chipod survey of the region near Cape Farewell, Greenland, including transects along the two mooring array lines, and collect additional shipboard measurements in Denmark Strait.

All of the above objectives were successfully met. The moorings were recovered and deployed, and a total of 296 conductivity-temperature-depth (CTD) stations were occupied, most of them with a lowered acoustic Doppler current profiler (ADCP). In addition, the vessel-mounted ADCP was operational throughout the cruise and returned a full data set.

Cruise Synopsis

Armstrong departed Reykjavik, Iceland on 27 August 2018. The entire cruise track is shown in Fig. 1. Mooring operations began roughly two days after leaving port, starting with the eastern mooring array. 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. All of the MicroCats being deployed, as well as those recovered, were further calibrated by attaching them to the CTD rosette on

designated comparison casts. Additional CTD/velocity transects were done in the vicinity of Greenland as time permitted. Mooring CF2, one of the tripods on the East Greenland shelf, did not come up (despite the fact that there were two releases on it). An initial attempt at dragging for the tripod was unsuccessful.

Following this, *Armstrong* steamed through Prins Christian Sund and we began servicing the moorings in the Labrador Sea. All 8 moorings in the original array were successfully recovered and re-deployed. In addition, we deployed two new tripods on the inshore end of the line, which was necessary to capture the full extent of the West Greenland Coastal Current.

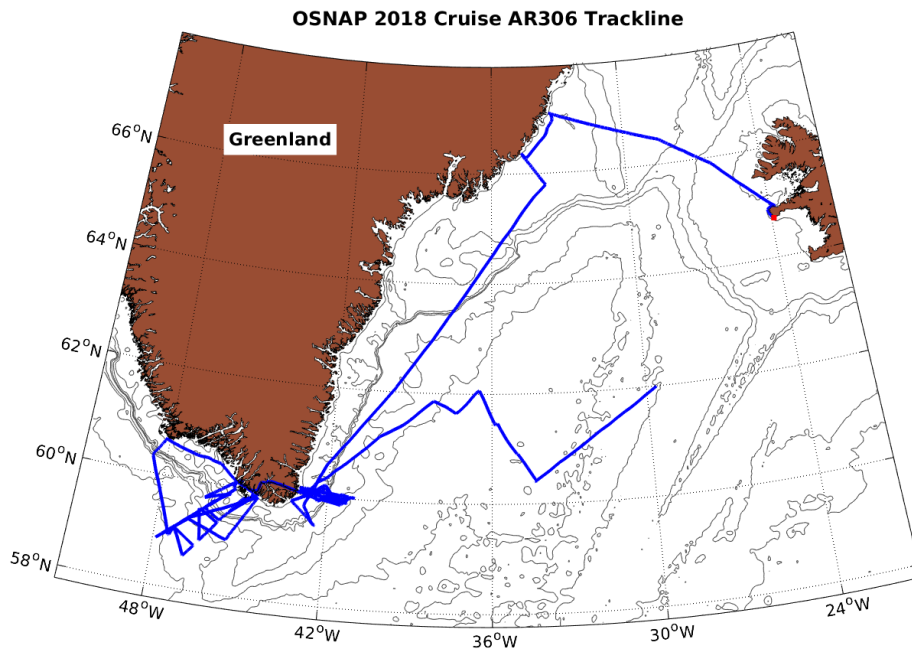
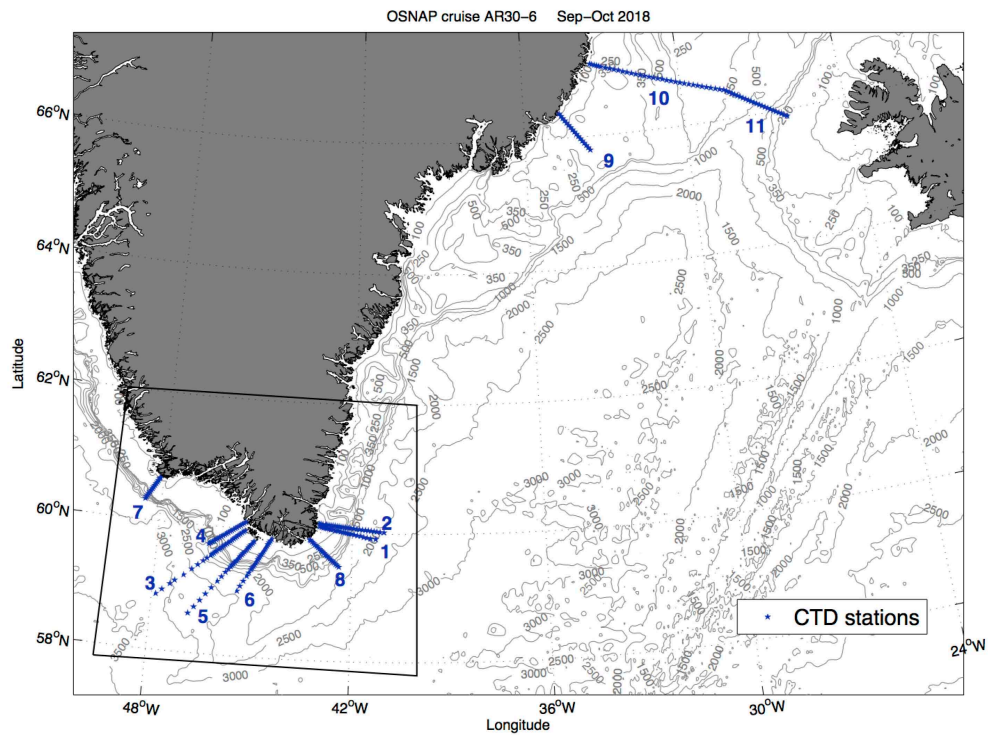


Figure 1: Cruise track for the OSNAP 2018 AR30-06 cruise.

After completing the Labrador Sea mooring work, it was our intention to conduct a shipboard survey of the West Greenland Coastal Current in order to better understand its evolution and fate as it progresses northward. However, due to a very unfavorable long-term weather forecast on the west side of Greenland, it was decided to head back through Prins Christian Sund to the Irminger Sea. At this point we successfully dragged for mooring CF2 and re-deployed it, then occupied another hydrographic section southeast of Cape Farewell. During the final phase of the cruise we steamed northward to Denmark Strait and carried out shipboard measurements. The goals here were to shed light on the origin of the East Greenland Coastal Current, and to re-occupy the Látrabjarg section across the strait which is a long-term timeseries line. On the way back to Reykjavik we stopped briefly in the coastal town of Rif in order to pick up a flotation buoy for the Ocean Observing Initiative which had washed up on the northwest Icelandic shore earlier in the summer.

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

a)



b)

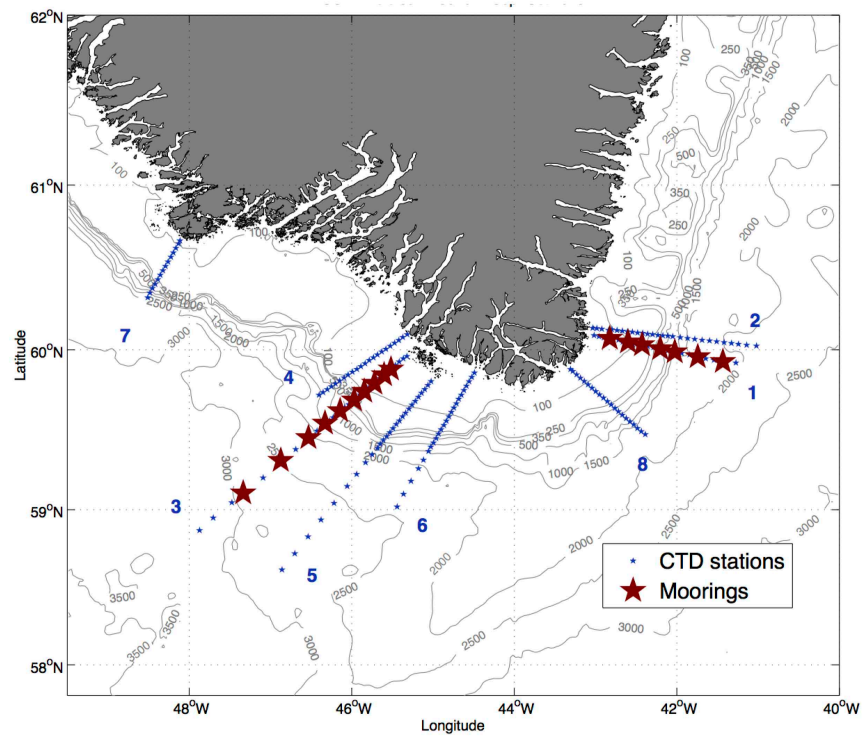


Figure 2: a) AR30-06 CTD station locations (small blue stars). The section numbers are labeled. The box delimits the enlarged area in (b) where the mooring arrays are located. b) Locations of the AR30-06 mooring deployments (red stars).

Moorings

The 7 Scripps moorings on the OSNAP East line were successfully turned-around, as were the 8 WHOI moorings on the OSNAP West line. Two additional shelf tripods were added to the inshore end of the OSNAP West line in order to bracket the West Greenland Coastal Current. Table 2 lists the pertinent information for the moorings deployed during AR30-6. The mooring diagrams for the full set of moorings are contained in Appendix B. The locations of the moorings are shown in plan view in Fig. 2 and in the vertical plane in Fig. 3 (for the OSNAP East array) and Fig. 4 (for the OSNAP West array). One of the new aspects of the arrays this year is that a STABLEMOOR top float was used at sites CF5 and LS6. These are the locations where energetic Denmark Strait Overflow Water cyclones tend to pass by the arrays causing major blowdowns. It is hoped that the more streamlined top floats will minimize these vertical excursions.

Table 2: Information on the moorings deployed during AR30-6.

OSNAP EAST						
Name	Latitude	Longitude	Bottom depth	Date	Anchor Drop Time	Position Method
CF7	59 55.647	41 26.029	1899	9/9/18	11:18	surveyed position
CF6	59 57.42	41 44.58	1831	9/8/18	20:06	surveyed position
CF5	59 59.234	42 01.518	1274	9/8/18	10:12	surveyed position
CF4	60 00.3732	42 12.2452	386	9/7/18	9:32	surveyed position
CF3	60 01.851	42 25.710	183	9/4/18	20:48	anchor splash
CF2	60 02.8533	42 35.9765	178	9/25/18	18:24	anchor splash
CF1	60 04.2080	42 49.5271	166	9/4/18	18:36	anchor splash
OSNAP WEST						
Name	Latitude	Longitude	Bottom depth	Date	Anchor Drop Time	Position Method
LS8	59 6.347	47 20.090	2932	9/21/18	16:10	surveyed position
LS7	59 18.6389	46 52.3873	2460	9/20/18	11:15	surveyed position
LS6	59 27.2342	46 31.9499	2025	9/18/18	15:36	surveyed position
LS5	59 32.667	46 19.746	1521	9/16/18	14:17	surveyed position
LS4	59 37.3139	46 08.6225	737	9/16/18	19:12	surveyed position
LS3	59 41.3574	45 58.2398	190	9/17/18	11:11	anchor splash
LS2	59 44.5846	45 50.7405	157	9/17/18	9:46	anchor splash
LS1	59 47.5973	45 43.2264	144	9/17/18	8:34	anchor splash

OSNAP WEST new tripod deployments						
Name	Latitude	Longitude	Bottom depth	Date	Anchor Drop Time	Position Method
LSA	59 52.8423	45 30.9967	121	9/11/18	8:25	anchor splash
LSB	59 50.6997	45 36.0899	134	9/11/18	9:35	anchor splash

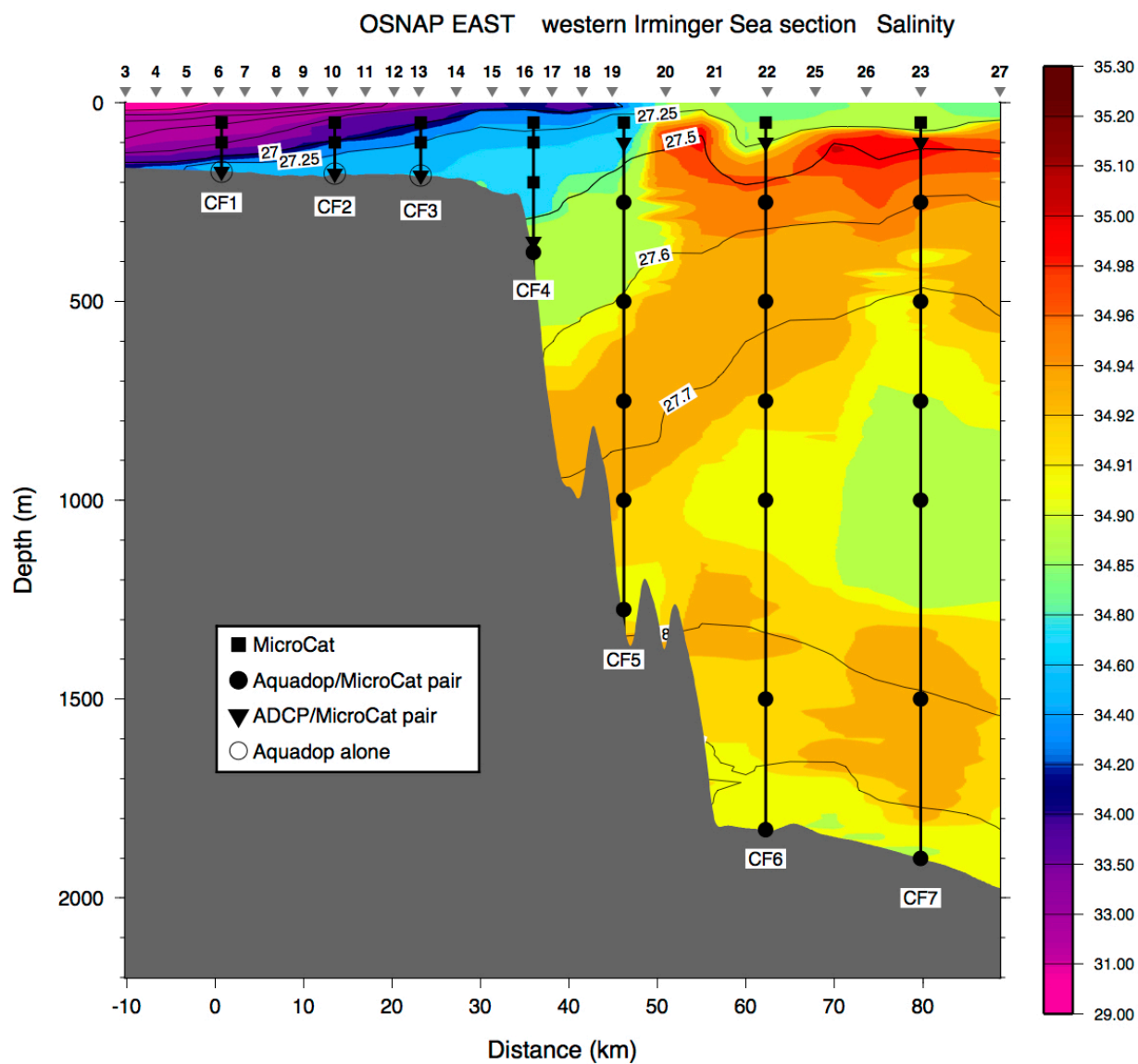


Figure 3: Locations of the OSNAP East Irminger Sea moorings and the instrumentation used (see the key), overlaid on the CTD salinity section (color) and potential density (contours, kg/m^3).

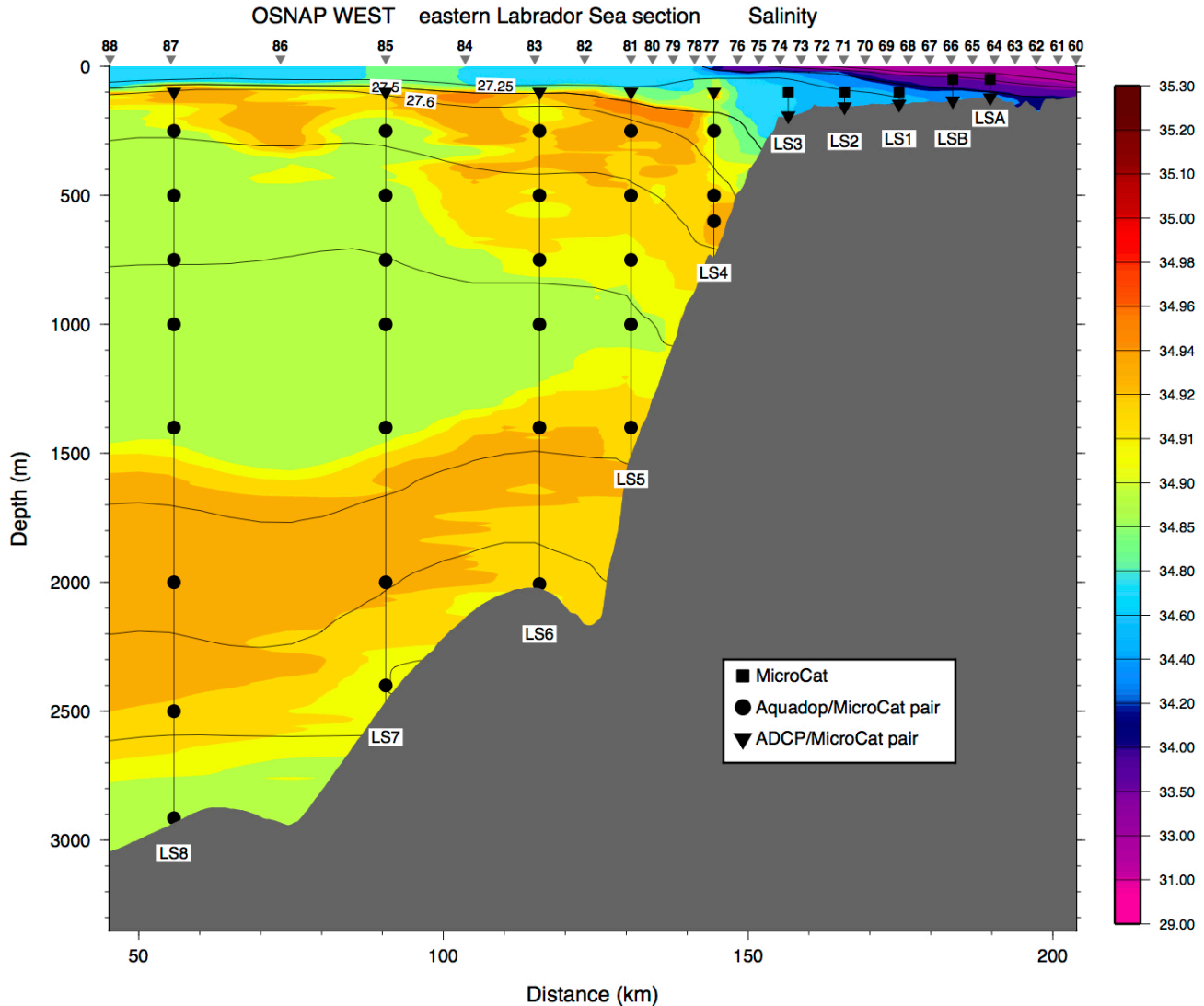


Figure 4: Locations of the OSNAP West Labrador Sea moorings and the instrumentation used (see the key), overlaid on the CTD salinity section (color) and potential density (contours, kg/m^3).

CTD Measurements

Contributing author: Leah McRaven (ltrafford@whoi.edu)

CTD configuration and operation

A total of 296 casts were performed using a SeaBird 911plus CTD and deck unit configured to measure pressure, temperature, conductivity, and oxygen. The CTD data were acquired by an SBE Model 11 plus V2 CTD Deck Unit providing demodulated data to a personal computer running SEASAVE (SeaBird). Bottom approach was controlled by real time altimeter data

together with the ship's echosounder data. For each cast, water samples were collected at up to 12 discrete intervals and analyzed for salinity. A rosette frame holding 12 10-L Niskin bottles was used for collecting water samples. A list of the completed CTD stations is given in Table 3.

Overall CTD performance for AR30-06 cruise was very good. A detailed outline of important events and problems encountered can be found in the AR30-06_CTD_Calibration_Report.pdf document.

CTD calibrations

Calibrations of the CTD sensors were performed by the manufacturer before the cruise. As per manufacturer recommendations, CTD data were processed using SeaBird data processing software. The raw CTD data were converted from HEX to ASCII, lag corrected, edited for large spikes, smoothed according to sensor, and pressure averaged into 2 dB bins for final data quality control and analysis. CTD salinity data were then further calibrated using Niskin water measurements.

Once calibrated, the overall standard deviation of the primary CTD conductivity measurements (s/n 2707) and water sample differences was 0.0025 psu. The overall standard deviation of the secondary CTD conductivity measurements (s/n 3089) and water sample differences was 0.0025 psu. Details regarding all data processing methods and calibration results are outlined in the AR30-06_CTD_Calibration_Report.pdf document.

Shipboard ADCP/Lowered ADCP Measurements

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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 one downward-facing and one 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 LADCP cast were edited and combined with CTD, GPS, and shipboard ADCP 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 declination using a magnetic declination model from NOAA/NODC. The profiles were subsequently de-tided using tidal models developed at Oregon State University's College of Earth, Ocean, and Atmospheric Sciences. A 1/12th degree resolution model was used for stations 1 - 256. A higher-resolution (1/60th degree) regional model was used to de-tide stations 257 - 296 which were occupied in the vicinity of Iceland.

Shipboard ADCP

Underway vessel-mounted ADCP data were collected throughout the cruise using two independent systems: a 150 kHz Ocean Surveyor (OS150) and a 38 kHz Ocean Surveyor (OS38) both from Teledyne RD Instruments. UHDAS data acquisition software from University of Hawaii was used to collect raw ADCP data from each instrument. The OS150 was set up to collect 50 8-meter bins of data every ping in narrowband mode. The OS38 was set up to collect 80 16-meter bins of data every ping in narrowband 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 models used for the LADCP data.

Shipboard Chipod Measurements

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Chipods are instrument packages that measure turbulence and mixing in the ocean. Specifically, they are used to compute turbulent diffusivity of heat (K) which is inferred from measuring dissipation rate of temperature variance (χ) from a shipboard CTD. Chipods are self-contained, robust and record temperature and derivative signals from FP07 thermistors at 100 Hz; they also record sensor motion at the same sampling rate. Details of the measurement and the methods for processing χ can be found in Moum and Nash [2009] (Moum, J., and J. Nash, Mixing Measurements on an Equatorial Ocean Mooring, *Journal of Atmospheric and Oceanic Technology*, 26(2), 317–336, 2009).

Two chipods were lent by J. Nash (Oregon State University) to operate on this cruise. The chipods were attached to the CTD rosette frame facing upward, on opposite sides of the rosette (Figure 5). They were placed higher than the Niskin bottles facing upward on the rosette in order to avoid measuring turbulence generated by flow around the rosette and/or its wake while its profiling speed oscillates as a result of swell-induced ship-heave.

The chipods deployed on this cruise were logger # SN2027, with pressure case Ti44-3 and SN2030 with pressure case Ti44-11. The chipods were attached to the rosette during all casts and recorded data throughout with minor exceptions: casts 37-45 were unsuccessful and SN2030 was unresponsive from casts 115-179. The issue was resolved by replacing the memory card in SN2030. Data were downloaded typically once a day and chipods were re-initialized through a direct command as the autostart capability was unreliable. Data that could not be downloaded on the cruise may still be salvaged directly from the SD cards.

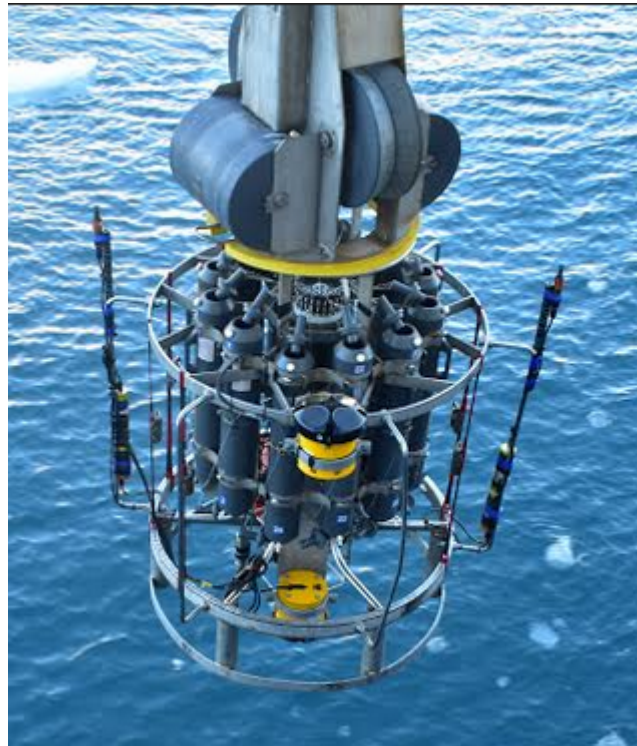


Figure 5: CTD rosette with chipods mounted on two sides of the rosette frame with sensors facing upward above the Niskin bottles.

Table 3: CTD station log for AR30-6.

OSNAP 2018 CTD Stations										
CTD Number	Station Name	Time	Latitude	Longitude	Latitude		Latitude		Corrected Depth (m)	Notes
			(dec N)	(dec W)	(deg N)	(min N)	(deg W)	(min W)		
1		8/29/18 18:08	60.4078	34.4168	60	24.468	34	25.008	2701.1	Cal dip cast, stopped at 2650m, 1725m, 800m each for 10 min
2		8/29/18 21:44	60.4113	34.386	60	24.678	34	23.16	2703.4	Cal dip cast, stopped at 2650m, 1725m, 800m each for 10 min
Section 1										
3	S1-33	8/31/18 20:42	60.0888	43.0183	60	5.328	43	1.098	161.8	closest distance to rocks: 0.25 n mi, closest distance to shore: 0.9 n mi
4	S1-32	8/31/18 21:52	60.0822	42.9573	60	4.932	42	57.438	191.1	
5	S1-31	8/31/18 22:39	60.0743	42.8965	60	4.458	42	53.79	183	
6	S1-30	8/31/18 23:27	60.0685	42.832	60	4.11	42	49.92	174.9	
7	S1-29	9/1/18 0:21	60.0643	42.7797	60	3.858	42	46.782	174.8	
8	S1-28	9/1/18 1:06	60.0602	42.7162	60	3.612	42	42.972	182.9	
9	S1-27	9/1/18 2:02	60.048	42.6647	60	2.88	42	39.882	181.1	
10	S1-26	9/1/18 3:00	60.0527	42.6027	60	3.162	42	36.162	179.6	
11	S1-25	9/1/18 3:51	60.0362	42.5402	60	2.172	42	32.412	179.1	
12	S1-24	9/1/18 4:27	60.037	42.4812	60	2.22	42	28.872	180.6	
13	S1-23	9/1/18 5:03	60.0345	42.4302	60	2.07	42	25.812	185.5	
CF4 mooring recovery		9/1/18 7:58								
CF3 mooring recovery		9/1/18 10:10								
CF2 mooring recovery		9/1/18 11:45								mooring did not come up
CF2 mooring dragging		9/1/2018 18:00 - 20:24								dragging unsuccessful
CF1 mooring recovery		9/1/18 15:55								
14	S1-22	9/1/18 21:18	60.0218	42.358	60	1.308	42	21.48	192.3	
15	S1-21	9/1/18 21:59	60.0145	42.2862	60	0.87	42	17.172	228.8	
16	S1-20	9/1/18 22:41	60.009	42.2212	60	0.54	42	13.272	297.4	
17	S1-19	9/1/18 23:23	60.0027	42.1672	60	0.162	42	10.032	817.6	
18	S1-18	9/2/18 0:39	59.9953	42.1077	59	59.718	42	6.462	1045.4	
19	S1-17	9/2/18 2:05	59.99	42.0473	59	59.4	42	2.838	1173.3	
20	S1-16	9/2/18 3:42	59.9787	41.9407	59	58.722	41	56.442	1338.6	
CF5 mooring recovery		9/2/18 7:56								
21	S1-15	9/2/18 10:57	59.97	41.8417	59	58.2	41	50.502	1813.1	
CF6 mooring recovery		9/2/18 13:27								
22	S1-14	9/2/18 17:08	59.9623	41.7373	59	57.738	41	44.238	1828.1	
23	S1-11	9/2/18 19:45	59.9228	41.4348	59	55.368	41	26.088	1899	
24		9/2/18 22:04	59.949	41.6432	59	56.94	41	38.592	323.9	Cal dip cast to 300 m, waited for 20 min

25	S1-13	9/2/18 23:03	59.9458	41.6445	59	56.748	41	38.67	1830.8	
26	S1-12	9/3/18 1:05	59.9363	41.5423	59	56.178	41	32.538	1860.7	
27	S1-10	9/3/18 3:43	59.9197	41.273	59	55.182	41	16.38	1974.3	
CF7 mooring recovery		9/3/18 8:08								mooring recovery completed in 3-5 mile visibility in rough conditions
Section 2										
28	S2-25	9/3/18 21:08	60.1315	42.9833	60	7.89	42	58.998	162.9	distance to rocks: 1 n mi, distance to land, 2 n mi
29	S2-24	9/3/18 21:45	60.128	42.9225	60	7.68	42	55.35	202.8	
30	S2-23	9/3/18 22:32	60.1215	42.8392	60	7.29	42	50.352	174	
31	S2-22	9/3/18 23:12	60.1253	42.7992	60	7.518	42	47.952	177.4	
32	S2-21	9/4/18 0:12	60.1195	42.7357	60	7.17	42	44.142	185.9	
33	S2-20	9/4/18 0:59	60.1158	42.6703	60	6.948	42	40.218	196.1	
34	S2-19	9/4/18 1:46	60.1125	42.608	60	6.75	42	36.48	204.7	extremely foggy conditions, steaming was very slow
35	S2-18	9/4/18 2:32	60.1095	42.5463	60	6.57	42	32.778	180.4	
36	S2-26	9/4/18 16:37	60.134	43.0338	60	8.04	43	2.028	360.4	station added to resolve coastal current. closest distance to shore: 0.615 n mi
CF1 mooring deployment		9/4/18 18:36								
CF3 mooring deployment		9/4/18 20:48								
37	S2-9	9/4/18 22:54	60.0758	41.9568	60	4.548	41	57.408	1237.1	mooring release test 50 m off bottom
38	S2-10	9/5/18 0:41	60.0817	42.0502	60	4.902	42	3.012	601.5	
39	S2-11	9/5/18 2:04	60.0855	42.11	60	5.13	42	6.6	463.6	
40	S2-12	9/5/18 3:11	60.0875	42.1717	60	5.25	42	10.302	265.7	
41	S2-13	9/5/18 3:56	60.0905	42.2318	60	5.43	42	13.908	232.6	
42	S2-14	9/5/18 4:40	60.0948	42.2968	60	5.688	42	17.808	206	
43	S2-15	9/5/18 5:29	60.0975	42.3587	60	5.85	42	21.522	219.7	
44	S2-16	9/5/18 6:24	60.1025	42.4208	60	6.15	42	25.248	226.7	
45	S2-17	9/5/18 7:17	60.1047	42.4827	60	6.282	42	28.962	203.8	
46	S2-8	9/6/18 19:55	60.0707	41.8678	60	4.24	41	52.07	1481.7	
47	S2-7	9/6/18 21:58	60.0655	41.7793	60	3.93	41	46.76	1696.4	
48	S2-6	9/6/18 23:56	60.0598	41.6895	60	3.59	41	41.37	1801.5	
49	S2-5	9/7/18 2:00	60.056	41.597	60	3.36	41	35.82	1864.2	
50		9/7/18 5:45	60.0062	42.2057	60	0.37	42	12.34	372.5	SSV cast for CF4 mooring deployment
CF4 mooring deployment		9/7/18 9:32								
51		9/7/18 11:41	59.9872	42.0265	59	59.23	42	1.59	1269	SSV cast for CF5 mooring deployment
52	S2-4	9/7/18 17:38	60.0508	41.5087	60	3.05	41	30.52	1901.2	Release testing
53	S2-3	9/7/18 20:04	60.0453	41.4183	60	2.72	41	25.1	1935.4	
54	S2-2	9/7/18 22:04	60.0407	41.328	60	2.44	41	19.68	2089.4	
55	S2-1	9/8/18 0:14	60.0352	41.242	60	2.11	41	14.52	2163.4	
CF5 mooring deployment		9/8/18 10:12								
56		9/8/18 12:53	59.9578	41.7398	59	57.47	41	44.39	1829	SSV cast for CF6 mooring deployment
CF6 mooring deployment		9/8/18 20:06								

57	S2-27	9/8/18 23:29	60.0293	41.1398	60	1.76	41	8.39	2163.4	
58	S2-28	9/9/18 1:45	60.0243	41.0197	60	1.46	41	1.18	2152.9	
59		9/9/18 5:11	59.9265	41.4337	59	55.59	41	26.02	1899	SSV cast for CF7 mooring deployment
CF7 mooring deployment		9/9/18 11:18								
Section 3										
60	S3-1	9/10/18 14:50	59.9605	45.321	59	57.63	45	19.26	87.8	distance to rocks: 6.6 n mi, distance to land: 8.41 n mi
61	S3-2	9/10/18 15:29	59.9457	45.3648	59	56.74	45	21.89	130.1	
62	S3-3	9/10/18 16:17	59.9267	45.4157	59	55.6	45	24.94	175.7	
63	S3-4	9/10/18 16:59	59.9053	45.463	59	54.32	45	27.78	158.3	
64	S3-5	9/10/18 17:48	59.8862	45.5103	59	53.17	45	30.62	118.5	
65	S3-6	9/10/18 18:26	59.8645	45.5587	59	51.87	45	33.52	123.3	
66	S3-7	9/10/18 19:05	59.8445	45.6062	59	50.67	45	36.37	135.4	
67	S3-8	9/10/18 19:41	59.824	45.6548	59	49.44	45	39.29	138.3	
68	S3-9	9/10/18 20:20	59.8033	45.7035	59	48.2	45	42.21	148.3	
69	S3-10	9/10/18 20:57	59.7825	45.751	59	46.95	45	45.06	149.9	
70	S3-11	9/10/18 21:34	59.7625	45.7997	59	45.75	45	47.98	151	
71	S3-12	9/10/18 22:10	59.7413	45.846	59	44.48	45	50.76	156.8	
72	S3-13	9/10/18 22:46	59.722	45.8957	59	43.32	45	53.74	161	
73	S3-14	9/10/18 23:20	59.702	45.9428	59	42.12	45	56.57	184.1	
74	S3-15	9/11/18 0:01	59.6818	45.9908	59	40.91	45	59.45	199.5	
75	S3-16	9/11/18 0:44	59.6617	46.0375	59	39.7	46	2.25	337.3	
76	S3-17	9/11/18 1:39	59.6423	46.0865	59	38.54	46	5.19	486.8	
77	S3-18	9/11/18 2:36	59.6177	46.1455	59	37.06	46	8.73	749	
LSA mooring deployment		9/11/18 8:25								
LSB mooring deployment		9/11/18 9:35								
LS1 mooring recovery		9/11/18 10:19								
78	S3-19	9/11/18 13:42	59.6012	46.1818	59	36.07	46	10.91	872.7	
79	S3-20	9/11/18 14:55	59.58	46.2292	59	34.8	46	13.75	1091.2	
80	S3-21	9/11/18 16:20	59.5605	46.2753	59	33.63	46	16.52	1285.8	
81	S3-22	9/11/18 17:50	59.5385	46.3207	59	32.31	46	19.24	1534.7	
82	S3-23	9/11/18 20:04	59.496	46.4267	59	29.76	46	25.6	2163.9	
83	S3-24	9/11/18 22:36	59.4472	46.5342	59	26.83	46	32.05	2020.4	
84	S3-25	9/12/18 1:06	59.3807	46.6883	59	22.84	46	41.3	2138	
85	S3-26	9/12/18 3:42	59.3032	46.8613	59	18.19	46	51.68	2456.1	
86	S3-27	9/12/18 6:42	59.2015	47.0907	59	12.09	47	5.44	2928.5	
87	S3-28	9/12/18 10:01	59.1057	47.3457	59	6.34	47	20.74	2939.2	
88		9/12/18 13:01	59.0447	47.4753	59	2.68	47	28.52		Cal dip cast to 900m, 10 min stop at 900m, 700m, and 500m
89	S3-29	9/12/18 15:31	58.9475	47.7038	58	56.85	47	42.23	2886.6	
90	S3-29b	9/12/18 18:25	58.8748	47.8585	58	52.49	47	51.51		Cal dip cast to 550m, 10 min stop at 550m, 250m, and 125m
91	S3-29b	9/12/18 19:45	58.868	47.872	58	52.08	47	52.32	3185.1	Release testing
LS5 mooring recovery		9/13/18 7:58								

LS4 mooring recovery		9/13/18 11:54								
LS3 mooring recovery		9/13/18 14:10								
LS2 mooring recovery		9/13/18 15:07								
Section 4										
92	S4-22	9/13/18 19:16	59.7203	46.4023	59	43.22	46	24.14	1163.1	
93	S4-21	9/13/18 20:38	59.7368	46.3523	59	44.21	46	21.14	1289.2	
94	S4-20	9/13/18 22:05	59.7552	46.3003	59	45.31	46	18.02	891.6	
95	S4-19	9/13/18 23:15	59.7732	46.2502	59	46.39	46	15.01	531	
96	S4-18	9/14/18 0:08	59.7905	46.1988	59	47.43	46	11.93	186.5	
97	S4-17	9/14/18 0:41	59.809	46.1493	59	48.54	46	8.96	148.6	
98	S4-16	9/14/18 1:12	59.8277	46.0933	59	49.66	46	5.6	149.2	
99	S4-15	9/14/18 1:40	59.8452	46.0442	59	50.71	46	2.65	150.4	
100	S4-14	9/14/18 2:09	59.8632	45.9912	59	51.79	45	59.47	139.9	
101	S4-13	9/14/18 2:36	59.8802	45.937	59	52.81	45	56.22	134.9	
102	S4-12	9/14/18 3:02	59.8977	45.8875	59	53.86	45	53.25	137.1	
103	S4-11	9/14/18 3:29	59.9153	45.836	59	54.92	45	50.16	121	
104	S4-10	9/14/18 3:55	59.9353	45.7845	59	56.12	45	47.07	111.8	
105	S4-9	9/14/18 4:19	59.952	45.7333	59	57.12	45	44	114.8	
106	S4-8	9/14/18 4:42	59.97	45.683	59	58.2	45	40.98	122.1	
107	S4-7	9/14/18 5:10	59.9882	45.6305	59	59.29	45	37.83	126.6	
108	S4-6	9/14/18 5:34	60.0048	45.5803	60	0.29	45	34.82	132.5	
109	S4-5	9/14/18 6:02	60.0237	45.5255	60	1.42	45	31.53	127.3	
110	S4-4	9/14/18 6:34	60.0417	45.473	60	2.5	45	28.38	116	
111	S4-3	9/14/18 7:03	60.0593	45.4202	60	3.56	45	25.21	111.9	
112	S4-2	9/14/18 7:33	60.0773	45.3707	60	4.64	45	22.24	120.7	
113	S4-1	9/14/18 8:22	60.0947	45.317	60	5.68	45	19.02	68.1	distance to rocks: 0.2 n mi, distance to land, 1.5 n mi
Section 5										
114	S5-1	9/14/18 21:43	59.8052	45.0232	59	48.31	45	1.39	126.7	distance to rocks: 2.5 n mi, distance to land, 13.1 n mi
115	S5-2	9/14/18 22:16	59.7808	45.0618	59	46.85	45	3.71	135.2	
116	S5-3	9/14/18 22:49	59.7558	45.101	59	45.35	45	6.06	144.6	
117	S5-4	9/14/18 23:23	59.7322	45.1403	59	43.93	45	8.42	127.2	
118	S5-5	9/14/18 23:55	59.7075	45.1792	59	42.45	45	10.75	128.9	
119	S5-6	9/15/18 0:28	59.6822	45.2178	59	40.93	45	13.07	146.8	
120	S5-7	9/15/18 1:01	59.6587	45.2585	59	39.52	45	15.51	155.9	
121	S5-8	9/15/18 1:35	59.6342	45.2963	59	38.05	45	17.78	162.3	
122	S5-9	9/15/18 2:10	59.6083	45.3367	59	36.5	45	20.2	172	
123	S5-10	9/15/18 2:46	59.5863	45.375	59	35.18	45	22.5	182.3	
124	S5-11	9/15/18 3:26	59.5598	45.4137	59	33.59	45	24.82	214.1	
125	S5-12	9/15/18 4:00	59.538	45.4517	59	32.28	45	27.1	276.2	
126	S5-13	9/15/18 20:55	59.5118	45.4922	59	30.71	45	29.53	342.6	
127	S5-14	9/15/18 21:38	59.4863	45.5305	59	29.18	45	31.83	515.5	
128	S5-15	9/15/18 22:29	59.4623	45.5695	59	27.74	45	34.17	889.2	
129	S5-16	9/15/18 23:37	59.4375	45.6105	59	26.25	45	36.63	1441	
130	S5-17	9/16/18	59.414	45.6492	59	24.84	45	38.95	1817.8	

		1:11								
131	S5-18	9/16/18 3:04	59.3883	45.6815	59	23.3	45	40.89	1957.1	
132	S5-19	9/16/18 4:55	59.3483	45.749	59	20.9	45	44.94	2031	
LS5 mooring deployment		9/16/18 14:17								
LS4 mooring deployment		9/16/18 19:12								
Section 3b										
133	S3b-17	9/16/18 20:36	59.6418	46.086	59	38.51	46	5.16	493.3	
134	S3b-16	9/16/18 21:25	59.6622	46.038	59	39.73	46	2.28	336.5	
135	S3b-15	9/16/18 22:09	59.6822	45.9907	59	40.93	45	59.44	194	
136	S3b-14	9/16/18 22:44	59.7017	45.9432	59	42.1	45	56.59	181.2	
137	S3b-13	9/16/18 23:19	59.7233	45.8952	59	43.4	45	53.71	155.1	
138	S3b-12	9/16/18 23:52	59.7425	45.8453	59	44.55	45	50.72	156.2	
139	S3b-11	9/17/18 0:24	59.7632	45.8003	59	45.79	45	48.02	150.8	
140	S3b-10	9/17/18 0:56	59.7845	45.752	59	47.07	45	45.12	148.2	
141	S3b-9	9/17/18 1:27	59.804	45.7032	59	48.24	45	42.19	145.1	
142	S3b-8	9/17/18 1:57	59.825	45.6542	59	49.5	45	39.25	138.1	
143	S3b-7	9/17/18 2:29	59.8488	45.6043	59	50.93	45	36.26	135	
144	S3b-6	9/17/18 3:00	59.8653	45.5578	59	51.92	45	33.47	123.5	
145	S3b-5	9/17/18 3:35	59.8877	45.5082	59	53.26	45	30.49	119.5	
146	S3b-4	9/17/18 4:04	59.9053	45.4597	59	54.32	45	27.58	157.5	
147	S3b-3	9/17/18 4:32	59.9253	45.4115	59	55.52	45	24.69	178.6	
148	S3b-2	9/17/18 5:03	59.945	45.3647	59	56.7	45	21.88	133.8	
149	S3b-1	9/17/18 5:33	59.9592	45.3353	59	57.55	45	20.12	124.9	distance to rocks: 0.88 n mi, distance to shore: 8.56 n mi
LS1 mooring deployment		9/17/18 8:34								
LS2 mooring deployment		9/17/18 9:46								
LS3 mooring deployment		9/17/18 11:11								
LS6 mooring recovery		9/17/18 13:38								
Section 5b										
150	S5-20	9/17/18 19:34	59.2983	45.8288	59	17.9	45	49.73	2101.3	Release testing
151	S5-21	9/17/18 22:06	59.2242	45.9387	59	13.45	45	56.32	2248.1	
152	S5-22	9/18/18 0:38	59.1483	46.0558	59	8.9	46	3.35	2392.1	
153	S5-23	9/18/18 3:21	59.0415	46.2175	59	2.49	46	13.05	2589.2	
154	S5-24	9/18/18 6:12	58.9352	46.3783	58	56.11	46	22.7	2693.5	
LS6 mooring deployment		9/18/18 15:36								
LS7 mooring recovery		9/18/18 18:28								
Section 6										
155	S6-25	9/19/18 2:00	59.0182	45.4415	59	1.09	45	26.49	2386.2	stopped cast at 500m
156	S6-24	9/19/18 3:18	59.0987	45.3625	59	5.92	45	21.75	2214.9	stopped cast at 500m
157	S6-23	9/19/18 4:38	59.1807	45.2705	59	10.84	45	16.23	2100.4	stopped cast at 500m
158	S6-22	9/19/18 5:56	59.2597	45.1785	59	15.58	45	10.71	2005.1	stopped cast at 500m
159	S6-21	9/19/18 7:02	59.314	45.1172	59	18.84	45	7.03	1907.2	stopped cast at 500m
160	S6-20	9/19/18 8:14	59.3688	45.0553	59	22.13	45	3.32	1607.9	stopped cast at 500m

161	S6-19	9/19/18 9:09	59.3968	45.0267	59	23.81	45	1.6	1330	stopped cast at 500m
162	S6-18	9/19/18 10:08	59.4223	44.994	59	25.34	44	59.64	898.8	stopped cast at 500m
163	S6-17	9/19/18 11:19	59.4503	44.9612	59	27.02	44	57.67	369.8	
164	S6-16	9/19/18 12:14	59.4778	44.9315	59	28.67	44	55.89	271.9	
165	S6-15	9/19/18 12:56	59.5052	44.9007	59	30.31	44	54.04	221	
166	S6-14	9/19/18 13:38	59.5317	44.8665	59	31.9	44	51.99	202.2	
167	S6-13	9/19/18 14:15	59.5588	44.8353	59	33.53	44	50.12	167.8	
168	S6-12	9/19/18 14:54	59.586	44.804	59	35.16	44	48.24	148.7	
169	S6-11	9/19/18 15:31	59.6135	44.7742	59	36.81	44	46.45	147.8	
170	S6-10	9/19/18 16:06	59.6412	44.742	59	38.47	44	44.52	145.8	
171	S6-9	9/19/18 16:38	59.6673	44.7108	59	40.04	44	42.65	139.4	
172	S6-8	9/19/18 17:12	59.6953	44.6832	59	41.72	44	40.99	142.5	
173	S6-7	9/19/18 17:51	59.7202	44.6508	59	43.21	44	39.05	144.8	
174	S6-6	9/19/18 18:28	59.7497	44.6197	59	44.98	44	37.18	144	
175	S6-5	9/19/18 19:02	59.7765	44.5877	59	46.59	44	35.26	163.7	
176	S6-4	9/19/18 19:35	59.8043	44.5558	59	48.26	44	33.35	195.4	
177	S6-3	9/19/18 20:10	59.8312	44.523	59	49.87	44	31.38	238.1	
178	S6-2	9/19/18 20:46	59.8578	44.4897	59	51.47	44	29.38	208.5	distance to rocks: 1.6 n mi, distance to shore: 3.2 n mi
179		9/20/18 5:24	59.3105	46.8713	59	18.63	46	52.28	2452.1	Release testing and cal dip cast to 2450m, 10 min stops at 2400m, 1750m, and 1200m
LS7 mooring deployment		9/20/18 11:15								
LS8 mooring recovery		9/20/18 14:54								
Section 5b										
180	S5-25	9/20/18 21:09	58.8282	46.5368	58	49.69	46	32.21	2608.6	
181	S5-26	9/21/18 0:04	58.7202	46.7002	58	43.21	46	42.01	2616.6	
182	S5-27	9/21/18 3:14	58.6162	46.8583	58	36.97	46	51.5	2713.9	
LS8 mooring deployment		9/21/18 16:10								
Sound Source recovery		9/21/18 18:25								Sound Source #3
Section 7										
183	S7-1	9/22/18 5:04	60.3207	48.5092	60	19.24	48	30.55	2385.3	stopped cast at 500m
184	S7-2	9/22/18 6:18	60.3492	48.4837	60	20.95	48	29.02	1197.4	stopped cast at 500m
185	S7-3	9/22/18 7:29	60.377	48.4513	60	22.62	48	27.08	644.3	stopped cast at 500m
186	S7-4	9/22/18 8:34	60.4023	48.4178	60	24.14	48	25.07	559.2	stopped cast at 500m
187	S7-5	9/22/18 9:37	60.4308	48.3855	60	25.85	48	23.13	198.2	
188	S7-6	9/22/18 10:13	60.4582	48.3557	60	27.49	48	21.34	153.3	
189	S7-7	9/22/18 10:45	60.4848	48.3222	60	29.09	48	19.33	137.6	
190	S7-8	9/22/18 11:15	60.5117	48.291	60	30.7	48	17.46	134.6	
191	S7-9	9/22/18 11:46	60.5388	48.2593	60	32.33	48	15.56	145.4	
192	S7-10	9/22/18 12:24	60.567	48.225	60	34.02	48	13.5	133.5	
193	S7-11	9/22/18 12:59	60.5933	48.1942	60	35.6	48	11.65	134.3	
194	S7-12	9/22/18 13:37	60.6212	48.1635	60	37.27	48	9.81	111.1	
195	S7-13	9/22/18 14:12	60.6483	48.1308	60	38.9	48	7.85	101.5	
196	S7-14	9/22/18 14:43	60.666	48.1127	60	39.96	48	6.76	123.3	distance to shore: 1.53 n mi

197		9/24/18 20:20	60.0697	41.872	60	4.18	41	52.32	1427	cal dip cast, 10 min stops at 1355 m, 1100 m, and 800 m
198		9/24/18 22:21	60.0542	41.882	60	3.25	41	52.92	1383.2	cal dip cast, 10 min stops at 1315 m, 1100 m, and 800 m
CF2 mooring recovery		9/25/18 10:31								newly triangulated position for dragging
CF2 mooring deployment		9/25/18 18:24								
Section 8										
199	S8-1	9/25/18 20:47	59.8795	43.3073	59	52.77	43	18.44	155.4	distance to rocks: 1.2 n mi, distance to land, 1.74 n mi
200	S8-2	9/25/18 21:15	59.868	43.2803	59	52.08	43	16.82	159.1	
201	S8-3	9/25/18 21:50	59.8467	43.2325	59	50.8	43	13.95	162.4	
202	S8-4	9/25/18 22:26	59.8262	43.1855	59	49.57	43	11.13	166.1	
203	S8-5	9/25/18 23:00	59.8055	43.1388	59	48.33	43	8.33	178	
204	S8-6	9/25/18 23:35	59.785	43.0908	59	47.1	43	5.45	189.2	
205	S8-7	9/26/18 0:16	59.7638	43.0433	59	45.83	43	2.6	181.2	
206	S8-8	9/26/18 0:54	59.7428	42.9968	59	44.57	42	59.81	179.3	
207	S8-9	9/26/18 1:29	59.7227	42.951	59	43.36	42	57.06	170.4	
208	S8-10	9/26/18 2:09	59.7023	42.9025	59	42.14	42	54.15	193.1	
209	S8-11	9/26/18 2:48	59.6807	42.8527	59	40.84	42	51.16	216.7	
210	S8-12	9/26/18 3:30	59.6602	42.8068	59	39.61	42	48.41	300.1	
211	S8-13	9/26/18 4:15	59.6382	42.7602	59	38.29	42	45.61	458.6	
212	S8-14	9/26/18 5:05	59.6178	42.7178	59	37.07	42	43.07	638	stopped cast at 500m
213	S8-15	9/26/18 5:59	59.5958	42.6697	59	35.75	42	40.18	801.9	stopped cast at 500m
214	S8-16	9/26/18 6:54	59.5747	42.622	59	34.48	42	37.32	1455.5	stopped cast at 500m
215	S8-17	9/26/18 7:50	59.555	42.5762	59	33.3	42	34.57	1672.9	stopped cast at 500m
216	S8-18	9/26/18 8:46	59.5363	42.5283	59	32.18	42	31.7	1716.7	stopped cast at 500m
217	S8-19	9/26/18 9:47	59.5127	42.4848	59	30.76	42	29.09	1717	stopped cast at 500m
218	S8-20	9/26/18 11:07	59.493	42.4365	59	29.58	42	26.19	1774.1	stopped cast at 500m
219	S8-21	9/26/18 12:25	59.4745	42.3873	59	28.47	42	23.24	1796.1	stopped cast at 500m
220		9/27/18 10:14	62.0867	39.692	62	5.2	39	41.52		cal dip cast, 1500 m, 850 m, and 500 m
221		9/27/18 12:09	62.0845	39.6855	62	5.07	39	41.13		cal dip cast, 1500 m, 850 m, and 500 m
222		9/27/18 13:57	62.0895	39.706	62	5.37	39	42.36		cal dip cast, 300 m, 225 m, and 25 m
Section 9										
223	S9-1	9/28/18 19:56	65.7913	33.5972	65	47.48	33	35.83	335.2	
224	S9-2	9/28/18 20:50	65.8282	33.6652	65	49.69	33	39.91	340.3	
225	S9-3	9/28/18 21:41	65.8645	33.7297	65	51.87	33	43.78	332.1	
226	S9-4	9/28/18 22:32	65.9008	33.7955	65	54.05	33	47.73	310.8	
227	S9-5	9/28/18 23:19	65.937	33.8612	65	56.22	33	51.67	266.7	
228	S9-6	9/29/18 0:06	65.9735	33.9252	65	58.41	33	55.51	262.8	
229	S9-7	9/29/18 0:49	66.0087	33.9942	66	0.52	33	59.65	256.8	
230	S9-8	9/29/18 1:34	66.0453	34.0597	66	2.72	34	3.58	262.1	
231	S9-9	9/29/18 2:19	66.0805	34.1227	66	4.83	34	7.36	265.6	
232	S9-10	9/29/18 3:05	66.1165	34.1907	66	6.99	34	11.44	266.6	
233	S9-11	9/29/18 3:56	66.155	34.2538	66	9.3	34	15.23	274.6	
234	S9-12	9/29/18 4:47	66.1888	34.3243	66	11.33	34	19.46	256.2	
235	S9-13	9/29/18 5:33	66.225	34.3895	66	13.5	34	23.37	249.6	

236	S9-14	9/29/18 6:23	66.2617	34.457	66	15.7	34	27.42	214.8	
237	S9-15	9/29/18 7:10	66.2983	34.5248	66	17.9	34	31.49	218.2	
238	S9-16	9/29/18 8:09	66.3343	34.585	66	20.06	34	35.1	182.7	
239	S9-17	9/29/18 9:56	66.3707	34.6498	66	22.24	34	38.99	160.9	distance to land: 0.84 n mi
Section 10										
240	S10-0	9/29/18 18:22	67.0867	33.3343	67	5.2	33	20.06	146.8	station added to increase resolution of coastal jet, distance to land: 2.9 n mi
241	S10-1	9/29/18 19:17	67.0748	33.2687	67	4.49	33	16.12	170.4	
242	S10-1.5	9/29/18 20:10	67.0603	33.1648	67	3.62	33	9.89	345.5	station added to increase resolution of coastal jet
243	S10-2	9/29/18 20:54	67.0502	33.0817	67	3.01	33	4.9	235.8	
244	S10-2.5	9/29/18 21:35	67.0405	32.9987	67	2.43	32	59.92	286.8	station added to increase resolution of coastal jet
245	S10-3	9/29/18 22:18	67.0283	32.9182	67	1.7	32	55.09	371	
246	S10-4	9/29/18 23:16	67.0073	32.7532	67	0.44	32	45.19	382.4	
247	S10-5	9/30/18 0:14	66.9883	32.5892	66	59.3	32	35.35	360.4	
248	S10-6	9/30/18 1:13	66.9665	32.4242	66	57.99	32	25.45	374.6	
249	S10-7	9/30/18 2:12	66.9467	32.2617	66	56.8	32	15.7	343.4	
250	S10-8	9/30/18 3:10	66.9242	32.0977	66	55.45	32	5.86	311.8	
251	S10-9	9/30/18 4:06	66.9045	31.9375	66	54.27	31	56.25	301.3	
252	S10-10	9/30/18 5:02	66.8825	31.773	66	52.95	31	46.38	253.7	
253	S10-11	9/30/18 5:56	66.8612	31.6112	66	51.67	31	36.67	306.3	
254	S10-12	9/30/18 6:54	66.8403	31.4467	66	50.42	31	26.8	325.2	
255	S10-13	9/30/18 7:53	66.8197	31.2863	66	49.18	31	17.18	359	
256	S10-14	9/30/18 8:57	66.7987	31.1213	66	47.92	31	7.28	472.2	
257	S10-15	9/30/18 9:57	66.7778	30.9572	66	46.67	30	57.43	501	
258	S10-16	9/30/18 11:05	66.757	30.7937	66	45.42	30	47.62	494.1	
259	S10-17	9/30/18 12:05	66.7383	30.6297	66	44.3	30	37.78	462.8	
260	S10-18	9/30/18 13:13	66.7147	30.4707	66	42.88	30	28.24	411.7	
261	S10-19	9/30/18 14:14	66.6948	30.311	66	41.69	30	18.66	392.3	
262	S10-20	9/30/18 15:14	66.674	30.1462	66	40.44	30	8.77	343.9	
263	S10-21	9/30/18 16:14	66.652	29.9868	66	39.12	29	59.21	301	
264	S10-22	9/30/18 17:11	66.6308	29.8232	66	37.85	29	49.39	280.8	
265	S10-23	9/30/18 18:07	66.6105	29.6597	66	36.63	29	39.58	295.4	
266	S10-24	9/30/18 18:59	66.5895	29.4993	66	35.37	29	29.96	305	
267	S10-25	9/30/18 19:50	66.5688	29.3363	66	34.13	29	20.18	314.1	
268	S10-26	9/30/18 20:41	66.548	29.1757	66	32.88	29	10.54	321.6	
269	S10-27	9/30/18 21:34	66.5272	29.0142	66	31.63	29	0.85	325.6	
270	S10-28	9/30/18 22:28	66.5062	28.8532	66	30.37	28	51.19	331.4	
271	S10-29	9/30/18 23:19	66.4855	28.6905	66	29.13	28	41.43	326.4	
272	S10-30	10/1/18 0:14	66.464	28.5293	66	27.84	28	31.76	321.4	
Section 11										
273	S11-1	10/1/18 1:09	66.4465	28.3833	66	26.79	28	23	320.8	
274	S11-2	10/1/18 1:56	66.4232	28.293	66	25.39	28	17.58	329.9	
275	S11-3	10/1/18 2:40	66.3973	28.1945	66	23.84	28	11.67	339.8	
276	S11-4	10/1/18 3:29	66.3745	28.1027	66	22.47	28	6.16	342.4	
277	S11-5	10/1/18 4:16	66.3503	28.0078	66	21.02	28	0.47	336.9	

278	S11-6	10/1/18 5:02	66.3267	27.9117	66	19.6	27	54.7	342.8	
279	S11-7	10/1/18 5:55	66.3028	27.8153	66	18.17	27	48.92	358.2	
280	S11-8	10/1/18 6:46	66.2783	27.7218	66	16.7	27	43.31	468.7	
281	S11-9	10/1/18 7:43	66.2552	27.6278	66	15.31	27	37.67	482.9	
282	S11-10	10/1/18 8:44	66.2303	27.5368	66	13.82	27	32.21	491.6	
283	S11-11	10/1/18 9:58	66.2072	27.4428	66	12.43	27	26.57	489.2	
284	S11-12	10/1/18 11:01	66.1828	27.347	66	10.97	27	20.82	489.4	
285	S11-13	10/1/18 12:18	66.1602	27.2563	66	9.61	27	15.38	499	
286	S11-14	10/1/18 13:25	66.135	27.1598	66	8.1	27	9.59	605.4	
287	S11-15	10/1/18 14:45	66.112	27.0675	66	6.72	27	4.05	637.2	
288	S11-16	10/1/18 15:58	66.0868	26.9723	66	5.21	26	58.34	642.5	
289	S11-17	10/1/18 17:08	66.063	26.8743	66	3.78	26	52.46	583.7	
290	S11-18	10/1/18 18:04	66.0378	26.7817	66	2.27	26	46.9	479.1	
291	S11-19	10/1/18 18:56	66.014	26.6893	66	0.84	26	41.36	356.1	
292	S11-20	10/1/18 19:44	65.9898	26.596	65	59.39	26	35.76	282.1	
293	S11-21	10/1/18 20:29	65.9662	26.5017	65	57.97	26	30.1	283.6	
294	S11-22	10/1/18 21:18	65.9422	26.4085	65	56.53	26	24.51	298.1	
295	S11-23	10/1/18 22:07	65.9178	26.3147	65	55.07	26	18.88	292	
296	S11-24	10/1/18 22:56	65.8947	26.2218	65	53.68	26	13.31	283.6	

50 m Depth

(2) 14" Panther Plast Floats (#714) on Tension Rod
MicroCAT (S/N 12216)

48.9 m 1/4" Spectra Line

Note A

Note A

Tidbit mounted at 75 m

Note B

Tidbit mounted at 100

Note C

Dualing Chain has 5 Links
1/2" Trawler Chain

Table A
Tripod Instrumentation

Instrument	Serial Number
ADCP	2225
MicroCat	12217
Aqua Dopp	6525
XEOS Kilo	1457

19.2 m 1/4" Spectra Line

Note B

Hardware Required
(per mooring without spares)

(4)	3/8" Anchor Shackle
(2)	1/2" Anchor Shackle
(1)	200 lb Weak Link
(1)	300 lb Weak Link

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

Table A

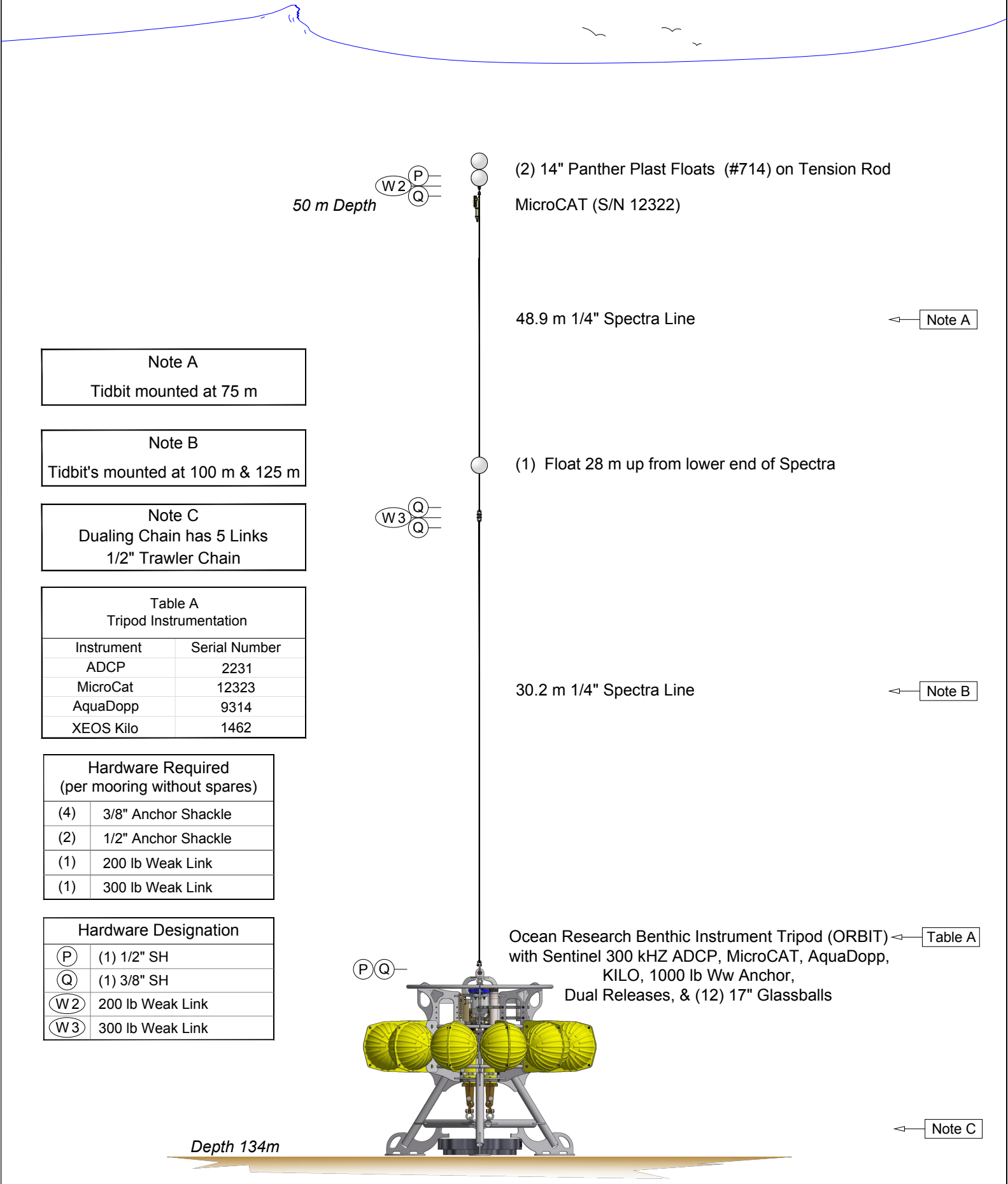
Hardware Designation

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

Note C

Depth 121 m

Pickart OSNAP Mooring LS-A As Deployed 2018



50 m Depth

W2 P Q

(2) 14" Panther Plast Floats (#714) on Tension Rod
MicroCAT (S/N 12322)

48.9 m 1/4" Spectra Line

Note A

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

W3 Q Q

30.2 m 1/4" Spectra Line

Note B

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

Note C

Depth 134m

P Q

Note A
Tidbit mounted at 75 m

Note B
Tidbit's mounted at 100 m & 125 m

Note C
Dualing Chain has 5 Links
1/2" Trawler Chain

Table A Tripod Instrumentation	
Instrument	Serial Number
ADCP	2231
MicroCat	12323
AquaDopp	9314
XEOS Kilo	1462

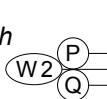
Hardware Required (per mooring without spares)	
(4)	3/8" Anchor Shackle
(2)	1/2" Anchor Shackle
(1)	200 lb Weak Link
(1)	300 lb Weak Link

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

Pickart OSNAP Mooring LS-B As Deployed 2018

OSNAP-LSB

100 m Depth



(2) 14" Panther Plast Floats (#714) on Tension Rod
MicroCAT (S/N 12324)

(1) Float 15 m from upper end of Spectra

Note A

Tidbits mounted at 120 and 140 m

Note B

Dualing Chain has 5 Links
1/2" Trawler Chain

Table A
Tripod Instrumentation

Instrument	Serial Number
ADCP	21229
MicroCat	11500
Aqua Dopp	9309
XEOS Kilo	300234060373130

44.2 m 1/4" Spectra Line

Note A

Hardware Required (per mooring without spares)

(2)	3/8" Anchor Shackle
(2)	1/2" Anchor Shackle
(1)	200 lb Weak Link

Hardware Designation

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

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

Table A



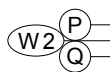
Depth 144 m

Note B

Pickart OSNAP Mooring LS-1 As Deployed 2018

OSNAP-LS1

100 m Depth



(2) 14" Panther Plast Floats (#714) on Tension Rod
MicroCAT (S/N 11498)

(1) Float 15 m from upper end of Spectra

Note A

Tidbits mounted at 120, 140, & 150 m

Note B

Dualing Chain has 5 Links
1/2" Trawler Chain

Table A

Tripod Instrumentation

Instrument	Serial Number
ADCP	15481
MicroCat	11501
Aqua Dopp	9310
XEOS Kilo	300234060378110

55.2 m 1/4" Spectra Line

Note A

Hardware Required

(per mooring without spares)

(2)	3/8" Anchor Shackle
(2)	1/2" Anchor Shackle
(1)	200 lb Weak Link

Hardware Designation

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

Ocean Research Benthic Instrument Tripod (ORBIT) with Long Ranger 75 kHz ADCP, MicroCAT, AquaDopp, KILO, 1000 lb Ww Anchor, Dual Releases, & (12) 17" Glassballs

Table A



Depth 157 m

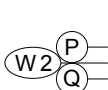
Note B

Pickart OSNAP Mooring LS-2

As Deployed 2018

OSNAP-LS2

100 m Depth



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

MicroCAT (S/N 11499)

(1) Float 15 m from upper end of Spectra

88.2 m 1/4" Spectra Line

Note A

Note A

Tidbits mounted at 120 m, 140 m,
160 m, and 180 m

Note B

Dualing Chain has 5 Links
1/2" Trawler Chain

Table A
Tripod Instrumentation

Instrument	Serial Number
ADCP	1432
MicroCat	11502
Aqua Dopp	9308
XEOS Kilo	1459

Hardware Required (per mooring without spares)

(2)	3/8" Anchor Shackle
(2)	1/2" Anchor Shackle
(1)	200 lb Weak Link

Hardware Designation

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

Ocean Research Benthic Instrument Tripod (ORBIT) with Long Ranger 75 kHz ADCP, MicroCAT, AquaDopp, KILO, 1000 lb Ww Anchor, Dual Releases, & (12) 17" Glassballs

Table A

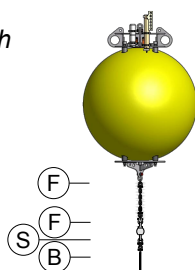
Depth 190 m

Note B

Pickart OSNAP Mooring LS-3 As Deployed 2018

OSNAP-LS3

100 m Depth



Syntactic Sphere
with MicroCAT,
300 kHz Workhorse ADCP,
XEOS KILO Iridium GPS Unit

← Table A

5 m 3/4" Mooring Chain
3 ton Swivel

141.8 m 1/4" Jac.Nil. Wire rope

250 m



Aquadopp / MicroCAT in cage

247.7 m 1/4" Jac.Nil. Wire rope

500 m



Aquadopp / MicroCAT in cage

98.4 m 1/4" Jac.Nil. Wire rope

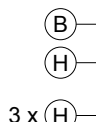
600 m



Aquadopp / MicroCAT in cage

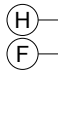
100 m 1/4" Jac.Nil. Wire rope

5 m 1/2" Mooring Chain



(4) Sets of (4) 17" Glassballs on 1/2" Mooring Chain

5 m 1/2" Mooring Chain



Duald ORE Acoustic Releases



5 m 1/2" Mooring Chain

3000 lb Ww Anchor

737 m Depth

Table A Sphere Instrumentation	
Instrument	Serial Number
57" Sphere	
ADCP	21228
MicroCat	11506
XEOS Kilo	300234010825820

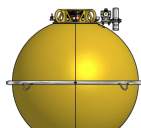
Hardware Required (per mooring without spares)	
(9)	1/2" Anchor Shackle
(23)	5/8" Anchor Shackle
(3)	3/4" Anchor Shackle
(2)	7/8" Anchor Shackle
(18)	5/8" Sling Link
(1)	1-1/4" Master Link
(1)	3 ton Swivel with Anode

Hardware Designation	
(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
(M)	Master Link
(S)	Swivel

Pickart OSNAP Mooring LS-4 As Deployed 2018

OSNAP-LS4

100 m Depth



Syntactic Sphere
with MicroCAT,
300 kHz Workhorse ADCP,
XEOS KILO Iridium GPS Unit

← Table A

(F)
(F) (S) (B)

5 m 3/4" Mooring Chain
3 ton Swivel

← Note A

250 m

(B)

141.8 m 1/4" Jac.Nil. Wire rope

Aquadopp / MicroCAT in cage

(B)

247.7 m 1/4" Jac.Nil. Wire rope

500 m

(B)

Aquadopp / MicroCAT in cage

(B)

247.7 m 1/4" Jac.Nil. Wire rope

750 m

(B)

Aquadopp / MicroCAT in cage

(B)

247.7 m 1/4" Jac.Nil. Wire rope

1000 m

(B)

Aquadopp / MicroCAT in cage

(B)

397.2 m 1/4" Jac.Nil. Wire rope

1400 m

(B)

Aquadopp / MicroCAT in cage

(B)

50 m 1/4" Jac.Nil. Wire rope

(A)

10 m 1/4" Jac.Nil. Wire rope

(B)

5 m 1/2" Mooring Chain

(H)

6 x (H)

(7) Sets of (4) 17" Glassballs on 1/2" Mooring Chain

(H)

5 m 1/2" Mooring Chain

(F)

Dualed ORE Acoustic Releases

(M) (J)

5 m 1/2" Mooring Chain

(J)

4000 lb Ww Anchor

1521 m Depth

Note A
OSU CHIPODS Mounted at
125 m, 180 m, & 245 m

Table A
Sphere Instrumentation

Instrument	Serial Number
64" Sphere	
ADCP	21233
MicroCat	11507
XEOS Kilo	300234060270130

Hardware Required
(per mooring without spares)

(15)	1/2" Anchor Shackle
(33)	5/8" Anchor Shackle
(3)	3/4" Anchor Shackle
(2)	7/8" Anchor Shackle
(26)	5/8" Sling Link
(1)	1-1/4" Master Link
(1)	3 ton Swivel with Anode

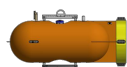
Hardware Designation

(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
(M)	Master Link
(S)	Swivel

Pickart OSNAP Mooring LS-5 As Deployed 2018

OSNAP-LS5

100 m Depth



Stablemoor with MicroCAT,
300 kHz Workhorse ADCP,
XEOS KILO Iridium GPS Unit

← Table A

5 m 1/2" Mooring Chain

(H) (S) (B)

3 ton Swivel

141.8 m 1/4" Jac.Nil. Wire rope

250 m

(B)

Aquadopp / MicroCAT in cage

(B)

247.7 m 1/4" Jac.Nil. Wire rope

500 m

(B)

Aquadopp / MicroCAT in cage

(B)

247.7 m 1/4" Jac.Nil. Wire rope

750 m

(B)

Aquadopp / MicroCAT in cage

(B)

247.7 m 1/4" Jac.Nil. Wire rope

1000 m

(B)

Aquadopp / MicroCAT in cage

(B)

397.2 m 1/4" Jac.Nil. Wire rope

1400 m

(B)

Aquadopp / MicroCAT in cage

(B)

200 m 1/4" Jac.Nil. Wire rope

(A)

200 m 1/4" Jac.Nil. Wire rope

(A)

100 m 1/4" Jac.Nil. Wire rope

(A)

46 m 1/4" Jac.Nil. Wire rope

(A)

20 m 1/4" Jac.Nil. Wire rope

(B)

7 x (H)

(8) Sets of (4) 17" Glassballs on 1/2" Mooring Chain

(H)

(H)

5 m 1/2" Mooring Chain

2009 m

(H)

Aquadopp / MicroCAT in cage

(H)

5 m 1/2" Mooring Chain

(F)

Dualed ORE Acoustic Releases

(M) (J)

5 m 1/2" Mooring Chain

(J)

4000 lb Ww Anchor

2025 m Depth

Table A Stablemoor Instrumentation	
Instrument	Serial Number
StableMoor	
ADCP	21226
MicroCat	11508
XEOS Kilo	300234011288490

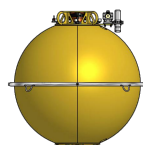
Hardware Required (per mooring without spares)	
(21)	1/2" Anchor Shackle
(39)	5/8" Anchor Shackle
(1)	3/4" Anchor Shackle
(2)	7/8" Anchor Shackle
(31)	5/8" Sling Link
(1)	1-1/4" Master Link
(1)	3 ton Swivel with Anode

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
(M)	Master Link
(S)	Swivel

Pickart OSNAP Mooring LS-6 As Deployed 2018

OSNAP-LS6

100 m Depth



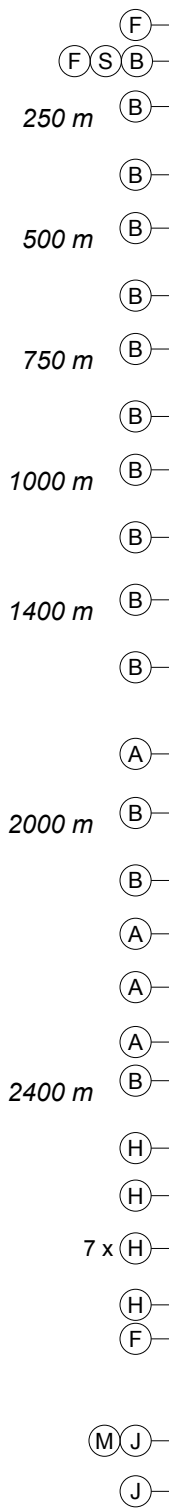
Syntactic Sphere
with MicroCAT,
300 kHz Workhorse ADCP,
XEOS KILO Iridium GPS Unit

← Table A

Table A Sphere Instrumentation	
Instrument	Serial Number
64" Sphere	
ADCP	21231
MicroCat	11510
XEOS Kilo	300234010824810

Hardware Required (per mooring without spares)	
(23)	1/2" Anchor Shackle
(39)	5/8" Anchor Shackle
(3)	3/4" Anchor Shackle
(2)	7/8" Anchor Shackle
(33)	5/8" Sling Link
(1)	1-1/4" Master Link
(1)	3 ton Swivel with Anode

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
(M)	Master Link
(S)	Swivel



5 m 3/4" Mooring Chain
3 ton Swivel

141.8 m 1/4" Jac.Nil. Wirerope

Aquadop / MicroCAT in cage

247.7 m 1/4" Jac.Nil. Wirerope

Aquadop / MicroCAT in cage

247.7 m 1/4" Jac.Nil. Wirerope

Aquadop / MicroCAT in cage

247.7 m 1/4" Jac.Nil. Wirerope

Aquadop / MicroCAT in cage

397.2 m 1/4" Jac.Nil. Wirerope

Aquadop / MicroCAT in cage

500 m 1/4" Jac.Nil. Wirerope

96.5 m 1/4" Jac.Nil. Wirerope

Aquadop / MicroCAT in cage

200 m 1/4" Jac.Nil. Wirerope

100 m 1/4" Jac.Nil. Wirerope

93.3 m 1/4" Jac.Nil. Wirerope

5 m 1/4" Jac.Nil. Wirerope

Aquadop / MicroCAT in cage

5 m 1/2" Mooring Chain

(8) Sets of (4) 17" Glassballs on 1/2" Mooring Chain

5 m 1/2" Mooring Chain

Dualed ORE Acoustic Releases

5 m 1/2" Mooring Chain

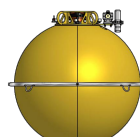
4000 lb Ww Anchor

2460 m Depth

Pickart OSNAP Mooring LS-7 As Deployed 2018

OSNAP-LS7

100 m Depth



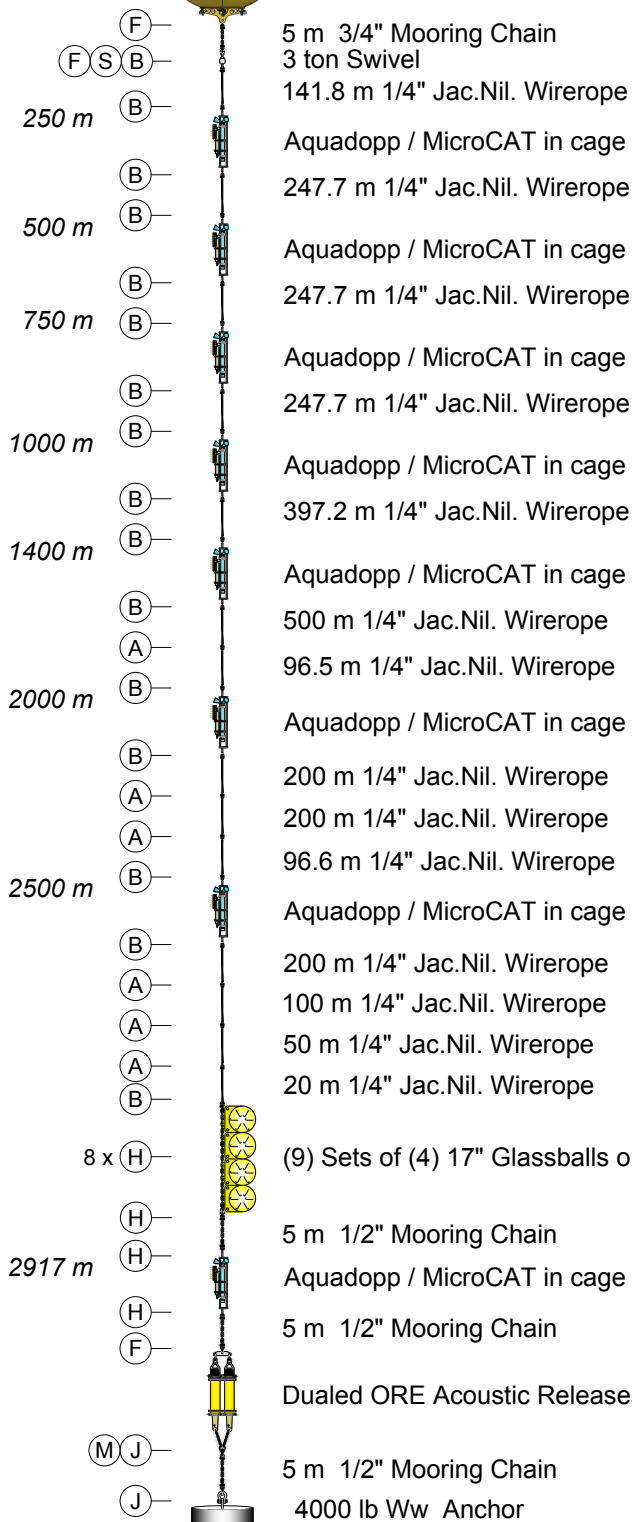
Syntactic Sphere
with MicroCAT,
300 kHz Workhorse ADCP,
XEOS KILO Iridium GPS Unit

← Table A

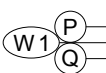
Table A Sphere Instrumentation	
Instrument	Serial Number
64" Sphere	
ADCP	2227
MicroCat	11511
XEOS Kilo	1456

Hardware Required (per mooring without spares)	
(29)	1/2" Anchor Shackle
(43)	5/8" Anchor Shackle
(3)	3/4" Anchor Shackle
(2)	7/8" Anchor Shackle
(38)	5/8" Sling Link
(1)	1-1/4" Master Link
(1)	3 ton Swivel with Anode

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
(M)	Master Link
(S)	Swivel



50 m Depth

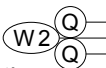


(2) 14" Panther Plast Floats (#714) on Tension Rod
MicroCAT (S/N 16858)

48.9 m 1/4" Spectra Line

(1) Float 28 m above lower end of Spectra

100 m Depth



MicroCAT (S/N 16857)

71 m 1/4" Spectra Line

Note A
Dualing Chain has 5 Links
1/2" Trawler Chain

Table A
Tripod Instrumentation

Instrument	Serial Number
Tripod	
ADCP	15440
MicroCat	16856
XEOS Kilo	300234061561580
Aqua Dopp	9231

Hardware Required
(per mooring without spares)

(4)	3/8" Anchor Shackle
(2)	1/2" Anchor Shackle
(1)	250 lb Weak Link
(1)	350 lb Weak Link

Hardware Designation

(P)	(1) 1/2" SH
(Q)	(1) 3/8" SH
(W1)	250 lb Weak Link
(W2)	350 lb Weak Link

Ocean Research Benthic Instrument Tripod (ORBIT) ← Note A
with Long Ranger 75 kHz ADCP, MicroCAT,
AquaDopp, KILO, 1000 lb Ww Anchor,
Dual Releases, & (12) 17" Glassballs



Depth 173 m

Straneo OSNAP Tripod Mooring CF-1
As Deployed 2018

CF-1

50 m Depth

(2) 14" Panther Plast Floats (#714) on Tension Rod
MicroCAT (S/N 16838)

48.9 m 1/4" Spectra Line

100 m Depth

(1) Float 28 m above lower end of Spectra
MicroCAT (S/N 11503)

76 m 1/4" Spectra Line

Note A
Dualing Chain has 5 Links
1/2" Trawler Chain

Table A
Tripod Instrumentation

Instrument	Serial Number
Tripod	
ADCP	20887
MicroCat	11504
XEOS Kilo	300234061567580
Aqua Dopp	9240

Hardware Required
(per mooring without spares)

(4)	3/8" Anchor Shackle
(2)	1/2" Anchor Shackle
(1)	250 lb Weak Link
(1)	350 lb Weak Link

Hardware Designation

(P)	(1) 1/2" SH
(Q)	(1) 3/8" SH
(W1)	250 lb Weak Link
(W2)	350 lb Weak Link

Ocean Research Benthic Instrument Tripod (ORBIT) ← **Table A**
with Long Ranger 75 kHz ADCP, MicroCAT,
AquaDopp, KILO, 1000 lb Ww Anchor,
Dual Releases, & (12) 17" Glassballs

Depth 178 m

Straneo OSNAP Tripod Mooring CF-2 As Deployed 2018

CF-2

50 m Depth

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

MicroCAT (S/N 16841)

48.9 m 1/4" Spectra Line

100 m Depth

(1) Float 28 m above lower end of Spectra

MicroCAT (S/N 16840)

81 m 1/4" Spectra Line

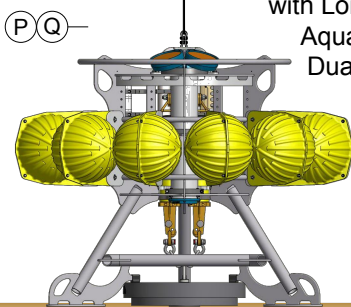
Note A
Dualing Chain has 5 Links
1/2" Trawler Chain

Table A Tripod Instrumentation	
Instrument	Serial Number
Tripod	
ADCP	20888
MicroCat	16839
XEOS Kilo	300234061567540
Aqua Dopp	9217

Hardware Required (per mooring without spares)	
(4)	3/8" Anchor Shackle
(2)	1/2" Anchor Shackle
(1)	250 lb Weak Link
(1)	350 lb Weak Link

Hardware Designation	
(P)	(1) 1/2" SH
(Q)	(1) 3/8" SH
(W1)	250 lb Weak Link
(W2)	350 lb Weak Link

Ocean Research Benthic Instrument Tripod (ORBIT) ← **Table A**
with Long Ranger 75 kHz ADCP, MicroCAT,
AquaDopp, KILO, 1000 lb Ww Anchor,
Dual Releases, & (12) 17" Glassballs



Depth 183 m

Straneo OSNAP Tripod Mooring CF-3

As Deployed 2018

Table A 48 inch Sphere Instrumentation	
Instrument	Serial Number
XEOS Kilo	300234061569580

Note A Mount MicroCat 1 m Below Upper Termination

Note B MicroCat Depth and Marking		
Instrument	Serial No.	Mount at
MicroCat	16905	200 m

Hardware Required (per mooring without spares)	
(6)	1/2" Anchor Shackle (SH)
(25)	5/8" Anchor Shackle
(4)	3/4" Anchor Shackle
(2)	7/8" Anchor Shackle
(17)	5/8" Sling Link (SL)
(1)	1-1/4" Master Link
(1)	3 ton Swivel with Anode

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
(M)	(1) 1-1/4" Master Link
(L)	(1) 1/2" SH
(S)	3 ton Swivel with Anode
(W)	350 lb Weak Link

CF-4

Straneo OSNAP Mooring CF-4 As Deployed 2018

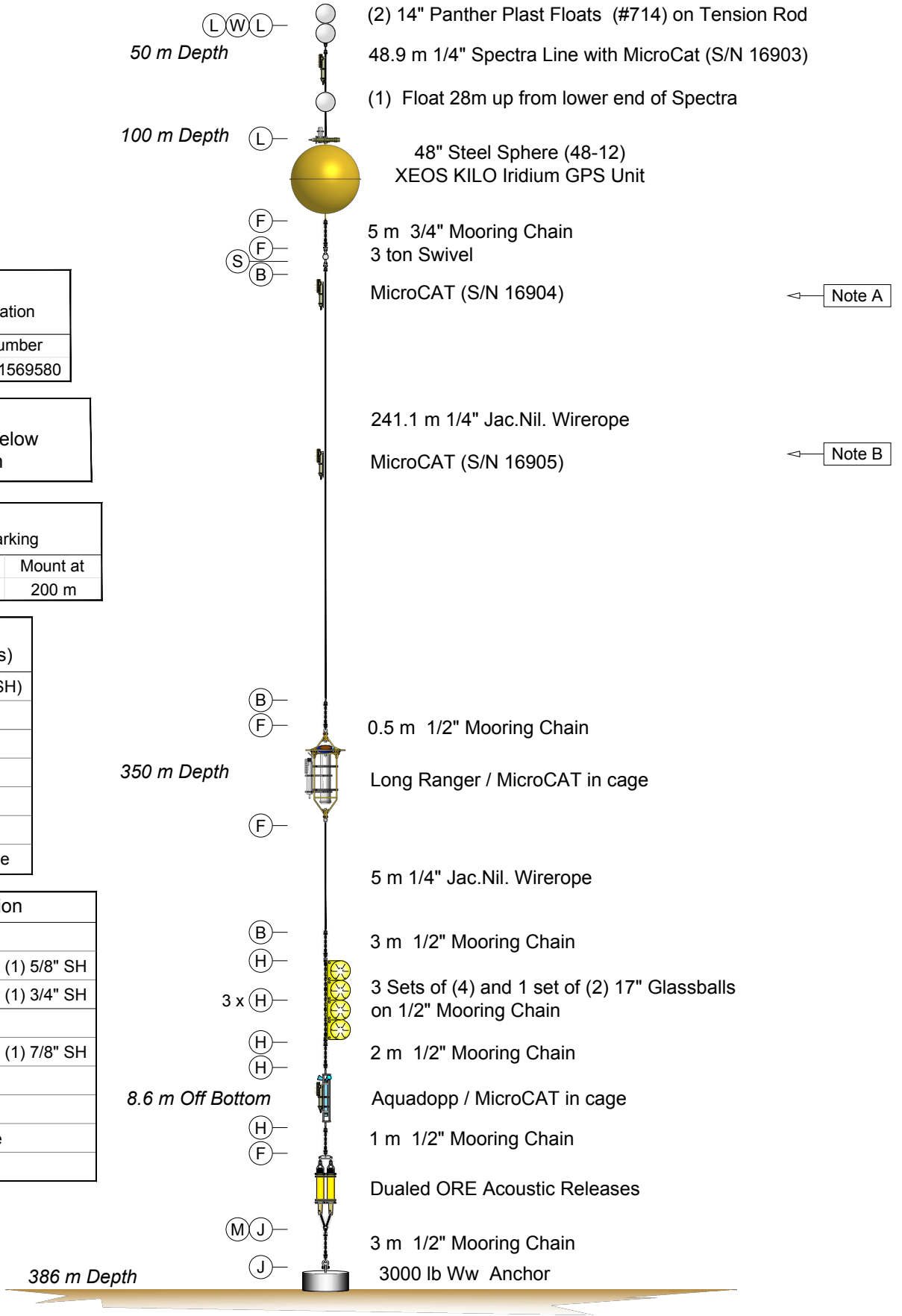


Table A Stablemoor Instrumentation	
Instrument	Serial Number
ADCP	21227
MicroCat	16908
XEOS Kilo	300234061560560

Hardware Required (per mooring without spares)	
(22)	1/2" Anchor Shackle (SH)
(34)	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

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
(M)	(1) 1-1/4" Master Link
(L)	(1) 1/2" SH
(S)	3 ton Swivel with Anode
(W)	350 lb Weak Link

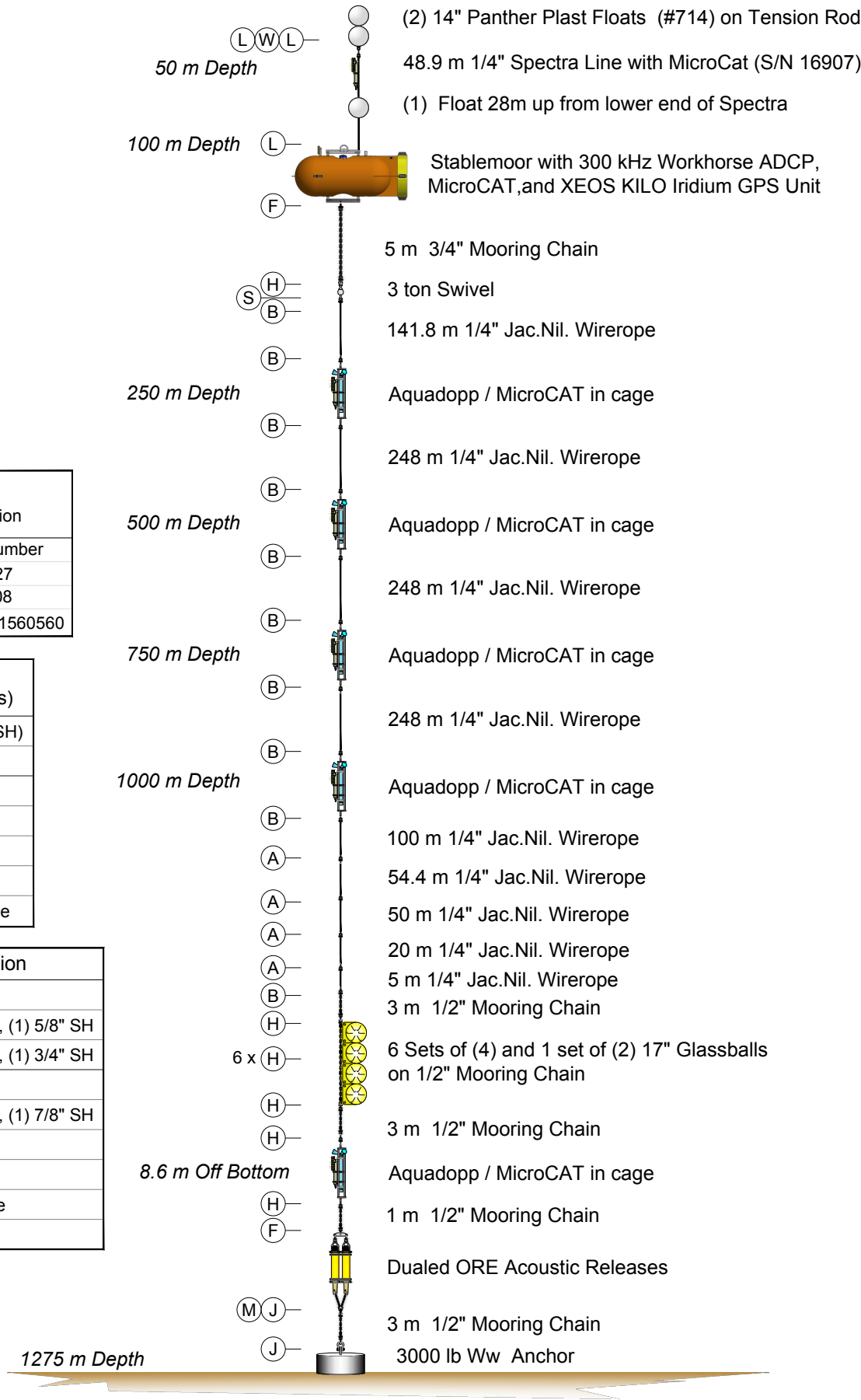
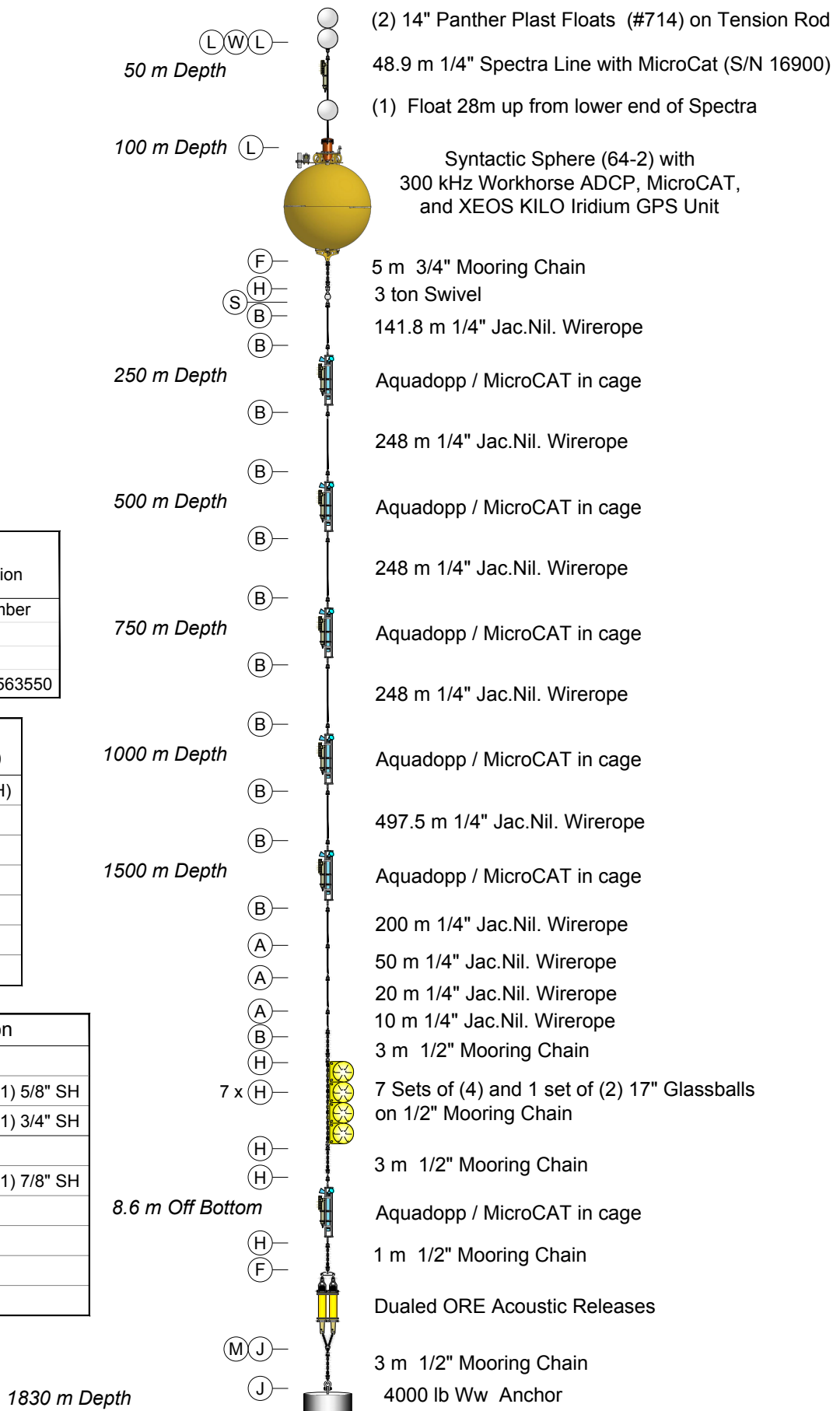


Table A 64 inch Sphere Instrumentation	
Instrument	Serial Number
ADCP	2131
MicroCat	16901
XEOS Kilo	300234061563550

Hardware Required (per mooring without spares)	
(22)	1/2" Anchor Shackle (SH)
(39)	5/8" Anchor Shackle
(2)	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

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
(M)	(1) 1-1/4" Master Link
(L)	(1) 1/2" SH
(S)	3 ton Swivel with Anode
(W)	350 lb Weak Link



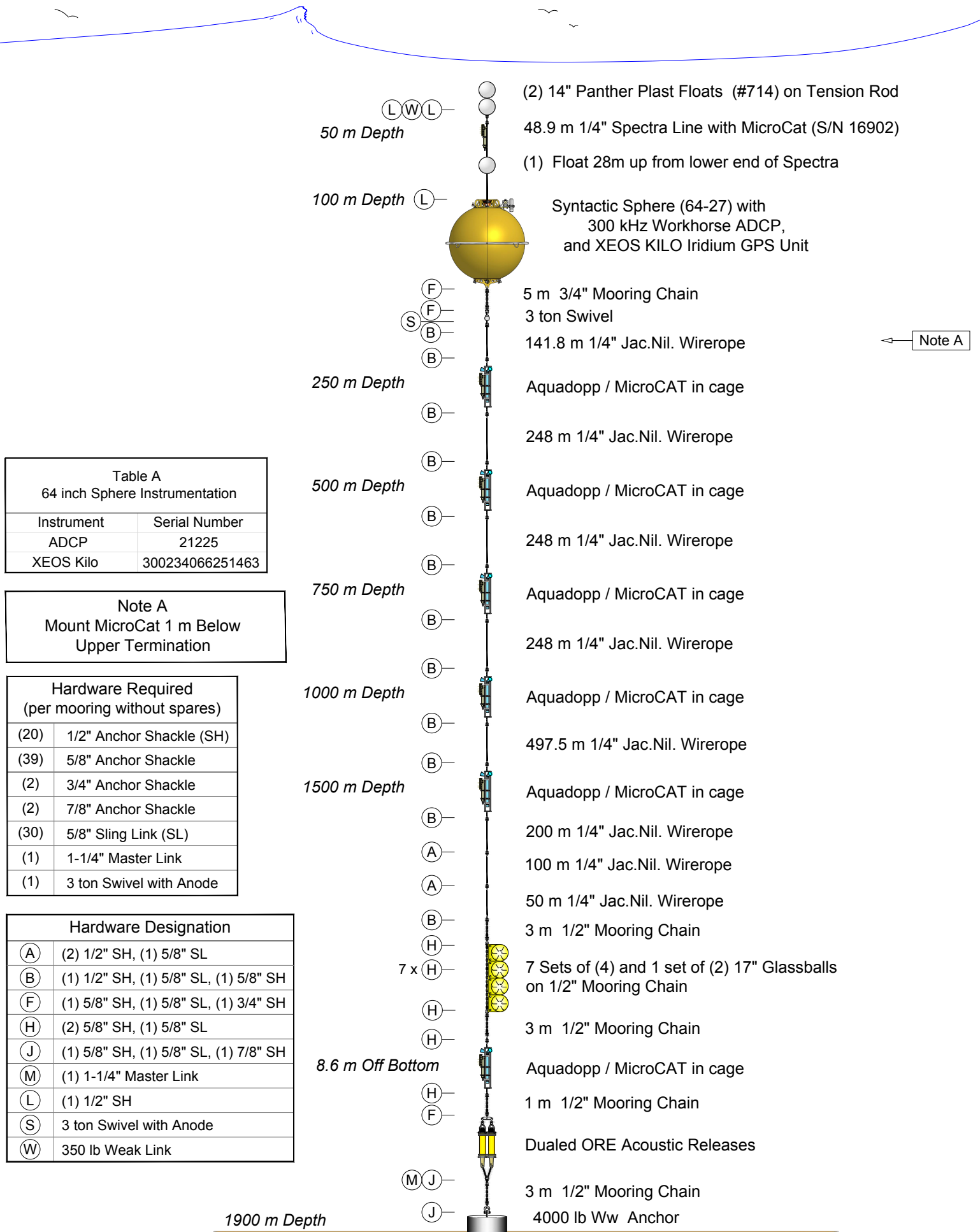


Table A 64 inch Sphere Instrumentation	
Instrument	Serial Number
ADCP	21225
XEOS Kilo	300234066251463

Note A
Mount MicroCat 1 m Below
Upper Termination

Hardware Required (per mooring without spares)	
(20)	1/2" Anchor Shackle (SH)
(39)	5/8" Anchor Shackle
(2)	3/4" Anchor Shackle
(2)	7/8" Anchor Shackle
(30)	5/8" Sling Link (SL)
(1)	1-1/4" Master Link
(1)	3 ton Swivel with Anode

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
(M)	(1) 1-1/4" Master Link
(L)	(1) 1/2" SH
(S)	3 ton Swivel with Anode
(W)	350 lb Weak Link

CF-7 Straneo OSNAP Mooring CF-7 As Deployed 2018