# CCGS Hudson fall cruise 2011, HUD1143
# Report on the recovery and deployment of RAPID-WAVE moorings in the Scotian Slope-Rise
# 23 September-1 October 2011

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# INTRODUCTION

This is the first leg of the annual CCGS Hudson Fall cruise, which combines work for the Canadian AZMP (Atlantic Zone Monitoring Program) and the UK funded Western Atlantic Variability Experiment (WAVE), which is part of the RAPID-WATCH[1] Program. The objective of this cruise is to recover 6 moorings deployed in December 2010 (see cruise report HUD2010049) and redeploy them for a period of 18 months (September 2011-May 2013). the moorings record bottom pressure, currents, temperature, and salinity (conductivity) at various depths. The scientific purpose of these moorings is to measure bottom pressure changes in the western Atlantic and, in this way, infer the variability of the Atlantic Meridional Overturning Circulation, which, to leading order, is governed by variability on the western ocean boundary.

In all previous RAPID-WAVE missions, moorings were deployed for one year. This is the first time that the mooring line is deployed for 18 months. If this deployment proves successful, subsequent deployments will also be made for a duration of 18 months. This will significantly reduce the costs of maintaining the line without, it is expected, significantly endangering it.

1 WATCH stands for “Will the Atlantic Thermohaline Circulation Halt?”

# RS ARRAY RECOVERY

Recovery work was carried out throughout 24-09-2011 and 25-09-2011. The moorings at RS1 to RS5 were recovered without incidents, although work was made difficult by persistent, thick fog. The mooring at RS6 could not be released on 25-09-2011, presumably because the release mechanism failed or because the BPR came out of its holder at some point during deployment and the chain joined the BPR to the release got entangled with the anchor chain. Dragging for the mooring lead to the top part of the mooring (including a syntactic foam float, a Casabel Iridium beacon, a RCM11 and a SBE37) to be severed by the dragging wire. The severed elements drifted away in the fog while the dragging wire was being paid in, but they were tracked regularly thanks to the positions provided by the Iridium beacon on the float (e-mails were received on board at 15-minute intervals reporting the GPS position of the beacon). The package was finally recovered on 26-09-2011. Dragging for the remaining part of the RS6 mooring was resumed on 27-09-2011 but was unsuccessful. An opportunity for dragging during the second leg of the cruise (after the NOC personal had disembarked) allowed us to recover three additional SBE37s (see also BIO cruise report 2011-043).

Calibration dips for all the microCAT recovered were carried out on the nights of 27 and 28 September 2011. The microCATs were clamped to the CTD rosette and submerged to 3300 m. As the rosette was being brought up to the surface, five 15-minute stops were made to allow the microcats to record at reasonably constant and uniform conditions. The microCAT sampling rate was set to 15 seconds for this calibration dip, thus affording about 90 samples per rosette stop. The nominal sampling depths were: 3300 m, 2700 m, 2200 m, 1600 m and 1000 m. Results from these calibration casts will be used, in combination with dips done on the previous cruise, HUD2010049, to correct raw temperature, conductivity and pressure data from the microCATs. Yuri Geshelin, from BIO, will carry out the calibration. The ADCP data, which is typically more difficult to calibrate than CTD or BPR data, will be calibrated first. After this, a preliminary calibration of the microCAT data will be performed using the raw CTD cast data as truth. Subsequently, once the CTD data has been calibrated itself using the bottle samples, a final slope and offset correction will be applied to the SBE37 microCAT measurements.

The following four tables summarise relevant information for all recoveries.

| SITE | LATITUDE (N) | LONGITUDE (W) | DATE RECOVERED | DEPTH (m) | MOORING TYPE |
|---|---|---|---|---|---|
| RS1 | 42 51.1856 | 61 37.9276 | 24-09-2011 | 1108 (cor.) | Short |
| RS2 | 42 44.3552 | 61 34.4191 | 24-09-2011 | 1725 (cor.) | Short |
| RS3 | 42 39.3148 | 61 27.3821 | 24-09-2011 | 2313.5 (cor.) | Short |
| RS4 | 42 33.3851 | 61 22.2472 | 24-09-2011 | 2777 (cor.) | Short |
| RS5 | 42 23.5292 | 61 16.6110 | 24-09-2011 | 3418.2 (cor.) | Short |
| RS6 | 42 09.6849 | 61 04.2094 | 25/26-09-2011 | 3880 (cor.) | Long |

Notes. Positions were calculated during the previous cruise HUD10049 using M-Cal triangulations (see SEANAV's website http://www.seanav.com/).

Table 1: Moorings recovered. RS1 to RS5 were successfully recovered. Only the top part of RS6 was salvaged after dragging.

| Instrument | RS1 | RS2 | RS3 | RS4 | RS5 | RS6 |
|---|---|---|---|---|---|---|
| Casabel Iridium beacon | 300034012408360 | 300034012155420 | 300034012612500 | 300034012722800 | 300034012190230 | 300034012126050 |
| Aanderaa RCM11[1] | | | | | | 679 |
| SBE37 MicroCAT | 6433 | | | | | 8110 |
| SBE37 MicroCAT | | 8263 | | | | 1785 |
| SBE37 MicroCAT | | | 8264 | | | 8111[2] |
| SBE37 MicroCAT | | | | 8265 | | 6436[2] |
| SBE37 MicroCAT | | | | | 8109 | 6467[2] |
| SBE37 MicroCAT | | | | | | 6468 |
| WHADCP | 13592 | 13873 | 13874 | 10941 | 13983 | 10942 |
| Aanderaa RCM11[1] | 678 | | | | | |
| SBE37 MicroCAT with Oxygen Sensor | 9021 | | | | | |
| Benthos 965-A acoustic release | 40081<br>8.5 kHz D/-/E | 890<br>10.5 kHz A/B/C | 40083<br>9 kHz E/-/H | 40047<br>8.0 kHz A/-/B | 44302<br>13.5 kHz C/-/D | 809<br>9.5 kHz E/F/D |
| SBE53 BPR | 50 | 45 | 48 | 66 | 49 | 51 |

1. These current meters are BIO's and not part of the RAPID-WAVE project.
2. 2 Recovered on 12-10-2011 after dragging for mooring at RS6.

Table 2: Summary of equipment recovered.

| Instrument | Site | Sampling interval (seconds) | Averaging interval (seconds) | Number of bins/ bin size (m) | Time of first record (Z) | Time of last record (Z) |
|---|---|---|---|---|---|---|
| SBE37-SM 1785 | RS6 | 1200 | - | - | 13 Dec 2010, 11:00:01 | - |
| SBE37-SM 6433 | RS1 | 1200 | - | - | 18 Dec 2010, 20:40:01 | 24 Sep 2011, 11:40:01 |
| SBE37-SM 6436 | RS6 | 1200 | - | - | 19 Dec 2010, 11:00:01 | - |
| SBE37-SM 6467 | RS6 | 1200 | - | - | 19 Dec 2010, 11:00:01 | - |
| SBE37-SM 6468 | RS6 | 1200 | - | - | 19 Dec 2010, 11:00:01 | - |
| SBE37-SM 8263 | RS2 | 1200 | - | - | 18 Dec 2010, 20:20:01 | 24 Sep 2011, 14:00:01 |
| SBE37-SM 8264 | RS3 | 1200 | - | - | 18 Dec 2010, 20:00:01 | 24 Sep 2011, 15:40:01 |
| SBE37-SM 8265 | RS4 | 1200 | - | - | 18 Dec 2010, 17:20:01 | 24 Sep 2011, 18:00:01 |
| SBE37-SM 8109 | RS5 | 1200 | - | - | 18 Dec 2010, 14:00:01 | 24 Sep 2011, 21:20:01 |
| SBE37-SM 9021 | RS1 | 3600 | - | - | 19 Dec 2010, 01:00:51 | 24 Sep 2011, 12:00:50 |
| SBE37-SM 8110 | RS6 | 1200 | - | - | 19 Dec 2010, 11:00:01 | 27 Sep 2011, 11:40:01 |
| SBE37-SM 8111 | RS6 | 1200 | - | - | 19 Dec 2010, 11:00:01 | - |
| WHADP Sentinel 10941 | RS4 | 3600 | - | 30/4 | 13 Dec 2010, 1:00:00 | 24 Sep 2011, 10:00:00 |
| WHADP Sentinel 10942 | RS6 | 3600 | - | 30/4 | 13 Dec 2010, 19:00:00 | - |
| WHADP Sentinel 13592 | RS1 | 3600 | - | 30/4 | 13 Dec 2010, 19:00.00 | 24 Sep 2011, 10:00:00 |
| WHADP Sentinel 13873 | RS2 | 3600 | - | 30/4 | 13 Dec 2010, 19:00.00 | 24 Sep 2011, 10:00:00 |
| WHADP Sentinel 13874 | RS3 | 3600 | - | 30/4 | 13 Dec 2010, 19:00:00 | 24 Sep 2011, 10:00:00 |
| WHADP Sentinel 13893 | RS1 | 3600 | - | 30/4 | 13 Dec 2010, 19:00:00 | 24 Sep 2011, 10:00:00 |
| SBE53 45 | RS2 | 1200 | 300[1] | - | 15 Dec 2010, 20:20:00 | 26 Sep 2011, 17:40:00 |
| SBE53 48 | RS3 | 1200 | 300[1] | - | 15 Dec 2010, 16:20:00 | 26 Sep 2011, 16:40:00 |
| SBE53 49 | RS5 | 1200 | 300[1] | - | 15 Dec 2010, 17:00:00 | 26 Sep 2011, 16:00:00 |
| SBE53 50 | RS1 | 1200 | 300[1] | - | 15 Dec 2010, 17:20:00 | 26 Sep 2011, 17:20:00 |
| SBE53 51 | RS6 | 1200 | 300[1] | - | 18 Dec 2010, 23:40:00 | - |
| SBE53 66 | RS4 | 1200 | 300[1] | - | 15 Dec 2010, 20:00:00 | 26 Sep 2011, 15:20:00 |

1. Sensor warming up period was set to 300 seconds too. The time stamp for SBE53 samples corresponds to the beginning of each 300- second averaging interval

Table 3: Summary of instrument setup.

| SBE37 serial number | Date of calibration cast | Sensors | Pump | Depth rating (m) | Notes |
|---|---|---|---|---|---|
| 6433 | 27 Sept. 2011 | CTD | Yes | 3500 | Good |
| 8109 | 28 Sept. 2011 | CTD | Yes | 7000 | Good |
| 8110 | 28 Sept. 2011 | CTD | Yes | 7000 | Good |
| 8263 | 27 Sept. 2011 | CTD | Yes | 3500 | Good |
| 8264 | 27 Sept. 2011 | CTD | Yes | 3500 | Good |
| 8265 | 27 Sept. 2011 | CTD | Yes | 3500 | Good |
| 9021 | 27 Sept. 2011 | CTD-Oxygen | Yes | 3500 | Good |

Table 4: Summary of calibration dips for recoveries. Note: stops at 2700, 2200, 1600, 1000, 400 m for the 3500-m rated SBE37s; stops at 3300, 2700, 2200, 1600, 1000 m for the 7000-m rated SBE37s.

## *Notes on recovered instruments*

## 1. Bottom pressure recorders

**SBE53s**. All the recovered SBE53s performed very well. Pressure ranges in all 5 recovered sites were approximately 2 decibars, with trends over the period of measurement of less than ~0.1 decibars per year. The BPRs will be returned to Sea Bird for refit and calibration.

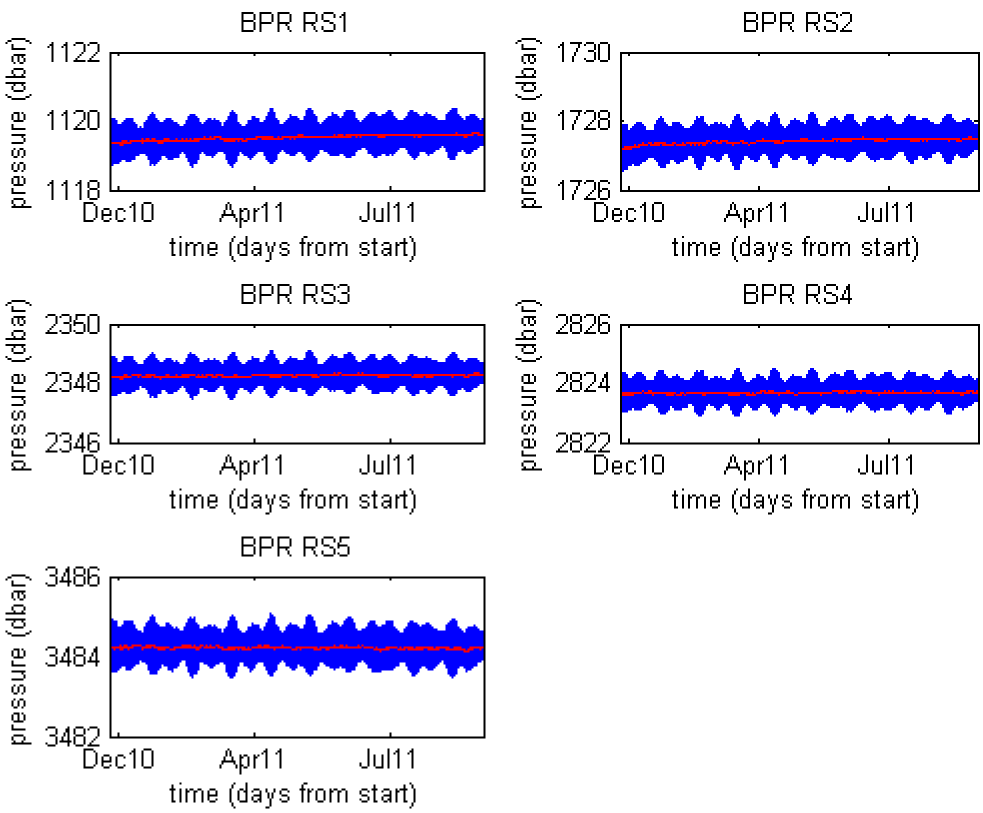



Figure 1: Time series of bottom pressures from recovered SBE53s. The blue line traces the raw data and the red line depicts a moving averaged version of the data calculated with a 1 day and 20 minutes averaging window.

## 2. RDI Workhorse ADCPs

All ADCPs provided fairly good data, and none of them run out of batteries prematurely, as happened in the 2008-2009 deployment. The effective ADCP range decreases with depth, presumably as a result of fewer scatterers. The presence of the mooring float 50-55 m above the ADCP causes contamination of the bins in the range >50 m. This is a problem that we hope to have solved this year by putting the mooring's float higher up in the water column (see mooring diagrams in the Appendix). In all sites, the measured velocities are very coherent in the vertical (see figure below). However, it might be possible to exploit the vertical uniformity of the currents to extrapolate velocity values into those bins. At all sites, the vertical profile of the current appears to be somewhat distorted at a range of ~50 m. This is possible due to the presence of a float and microcat at that depth.

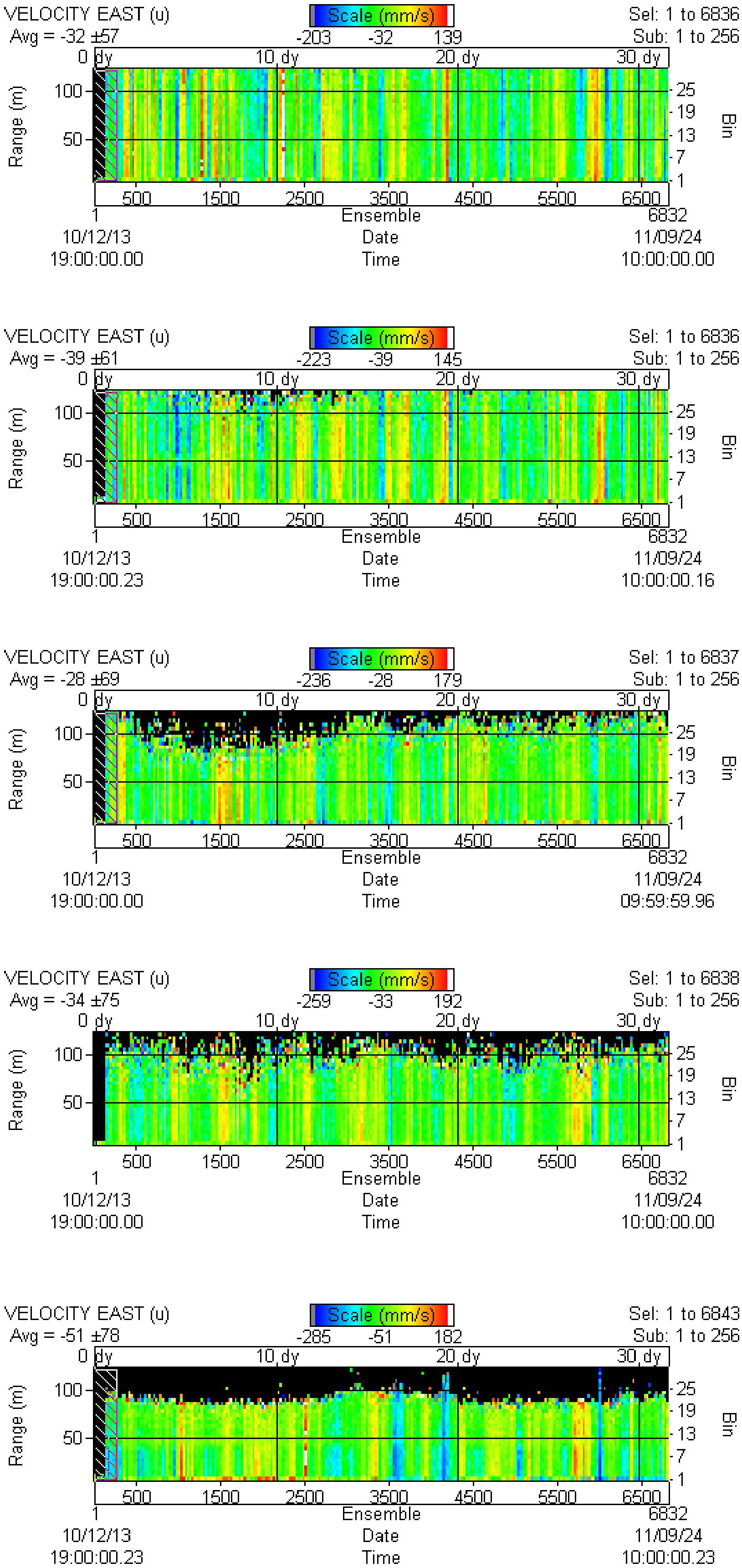



Figure 1: Zonal current component from ADCP measurements at RS1(top) through RS5 (bottom).

## 3. SBE37 Microcats

The mooring microCAT data was summarily examined soon after recovery. All data seemed of acceptable quality. Drift of the strain gauge sensors amounted to ±0.2 decibars or less in all instruments, except SBE37-8110, the sole microCAT recovered at RS6, which exhibited a drift of allmost – 2 decibars.

## 4. CTD data

CTD casts were made adjacent to all six RS mooring sites. BIO are currently performing quality control and calibration of these CTD data.

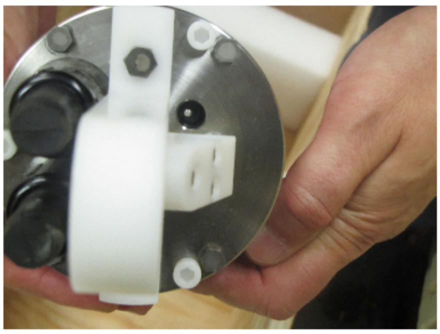
## RS ARRAY REDEPLOYMENT

### *Preparation of BPRs for deployment*

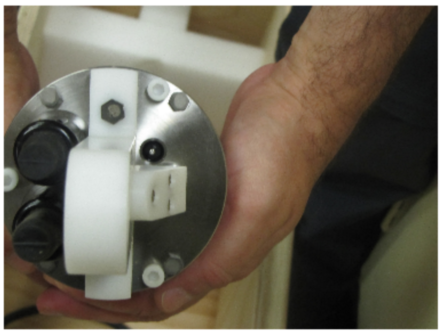
Six Sea Bird 53 BPRs were made available for deployment in the line. Of these, 5 were old BPRs that had been deployed previously either in the RS line or in line W. One of them was brand new. The five old BPRs were sent to Sea Bird for recalibration and recertification in August 2008. Upon return to BIO, the boxes containing the BPRs must have been dropped from a height or badly bashed around, as they all showed evidence of strong impacts. All six instruments were tested at atmospheric pressure before deployment (see below). The accompanying table summarises relevant data about these instruments.

| Part # | Serial # | Batteries | Notes |
|---|---|---|---|
| 5349607 | 5349607-0023 | New alkaline batteries | Brought from Woods Hole Oceanographic Institution (WHOI). Previously deployed in Endeavor 2008 EN454 cruise). Pressure sensor probe slightly off-centre, probably as a result of the instrument having been dropped while in transit from Sea Bird to BIO (see Figure). BPR box shows evidence of impact. |
| 5349607 | 5349607-0024 | New alkaline batteries | Sent from WHOI. Previously deployed in HUD2009048. BPR box shows evidence of impact. |
| 5349607 | 5349607-0025 | New alkaline batteries | Previously deployed in HUD2009048. BPR box shows evidence of impact. |
| 5340415 | 5340415-0047 | New alkaline batteries | Previously deployed in HUD2009048. BPR box shows evidence of impact. |
| 5353201 | 5353201-0052 | New alkaline batteries | Previously deployed in HUD2009048. BPR box shows evidence of impact. |
| 5353201B | 5353201-0073 | New alkaline batteries | Newly bought BPR (May 2011). |

Table 5: Summary of SBE53 BPRs ready for deployment.



a



b

Figure 2: a) Thermistor probe in SBE53-0023 (the bright pin surrounded by a dark circle to the right of the white plastic bar and above the oil bladder protective cap). This BPR was probably dropped or hit in transit from Sea Bird to BIO. Note that the probe is markedly off-centre. b) Thermistor probe in a BPR that has not suffered damage.

All 6 BPRs were turned on in the laboratory on 22nd September 2011 and left recording in air for approximately 20 hours. For this dry test, the BPRs were left standing, as this is the sole position that ensures good contact between the pressure sensor oil and the pressure sensor itself (see SBE53 manual). Instrument SBE53-0023 was accidentally placed upside down, and so its recorded dry pressure is very different (lower) than that of the other sensors. Figure 3 Shows the pressures and temperatures recorded by all the instruments. The disagreement in pressure between the BPRs is consistent with the accuracy of the instruments (0.0001 times full scale = 0.6885 m). However, the disagreement in temperature is somewhat puzzling given that the nominal accuracy of the thermistors is 0.002 C. The cause of this discrepancy must be discussed with the manufacturer. It is also evident that the temperature, like the pressure, is sensitive to the orientation of the instrument, which requires an explanation as well.

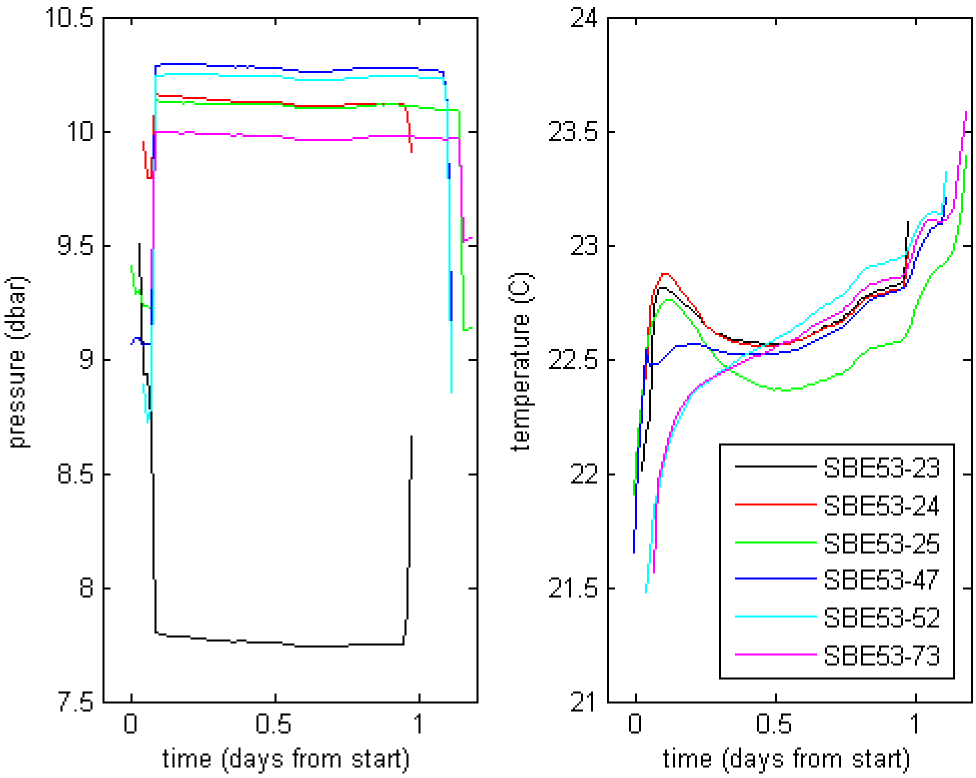



Figure 3: Pressures (left panel) and temperatures (right panel) measured in dry tests by the SBE53s that were deployed in HUD2011043.

## *Preparation of microCATs for deployment (calibration dips)*

Prior to deployment all microCATs were clamped to the CTD rosette and dipped to 3300 m. On its ascent, the rosette was stopped for 15 minutes at 3300 m, 2700 m, 2200, 1600 m and 1000 m. The microCAT sampling period was 15 seconds. The objective of this calibration dip is to obtain simultaneous conductivity, temperature and pressure data from both the microCAT and the CTD system. The CTD system is frequently calibrated against standards and, therefore, its data is of high accuracy and precision. The CTD data area used to calibrate the microCAT measurements. Combining a pre-deployment calibration dip, such as the one described here, with a post-deployment one, it is possible to calibrate the microCAT data to an accuracy comparable to that of the ship's CTD system. A summary of the calibration dips carried out can be found in Table 6.

The agreement in temperature between microCATs is very good, with a temperature spread that is not larger than 0.004 ºC at any depth. Excluding microCAT SBE37-1696, the spread in conductivity is 0.001 S/m, and that in pressure in 30 dbar. The SBE37-1696 had a conductivity that is ~0.004

S/m smaller than that of any other microCAT and its pressure sensor was not working.

| SBE37 serial number | Date of calibration cast | Sensors | Pump | Depth rating (m) | Notes |
|---|---|---|---|---|---|
| 1696 | 24-25 Sept. 2011 | CTD | No | 7000 | Bad conductivity and pressure |
| 2165 | 24-25 Sept. 2011 | CTD | No | 3500 | Good |
| 3675 | 24-25 Sept. 2011 | CT | Yes | 7000 | Good |
| 3680 | 24-25 Sept. 2011 | CT | Yes | 7000 | Good |
| 3681 | 24-25 Sept. 2011 | CTD | Yes | 7000 | Good |
| 3682 | 28 Sept. 2011 | CTD | Yes | 7000 | Good |
| 3709 | 24-25 Sept. 2011 | CTD | Yes | 7000 | Good |
| 3710 | 24-25 Sept. 2011 | CTD | Yes | 7000 | Good |
| 3713 | 24-25 Sept. 2011 | CTD | Yes | 7000 | Good |
| 3714 | 24-25 Sept. 2011 | CTD | Yes | 7000 | Good |
| 4028 | | CTD | Yes | 2000 | Not calibrated |
| 4614 | 24-25 Sept. 2011 | CTD | No | 3500 | Good |
| 4617 | 24-25 Sept. 2011 | CTD | No | 3500 | Good |
| 6432 | 24-25 Sept. 2011 | CTD | No | 3500 | Good |
| 6434 | 24-25 Sept. 2011 | CTD | No | 3500 | Good |
| 6435 | 24-25 Sept. 2011 | CTD | No | 3500 | Good |
| 6437 | 24-25 Sept. 2011 | CTD | No | 3500 | Good |
| 7647 | 28 Sept. 2011 | CTD | No | 7000 | Good |

Table 6: Summary of calibration dips for deployments. Note: stops at 3300, 2700, 2200, 1600, 1000 m.

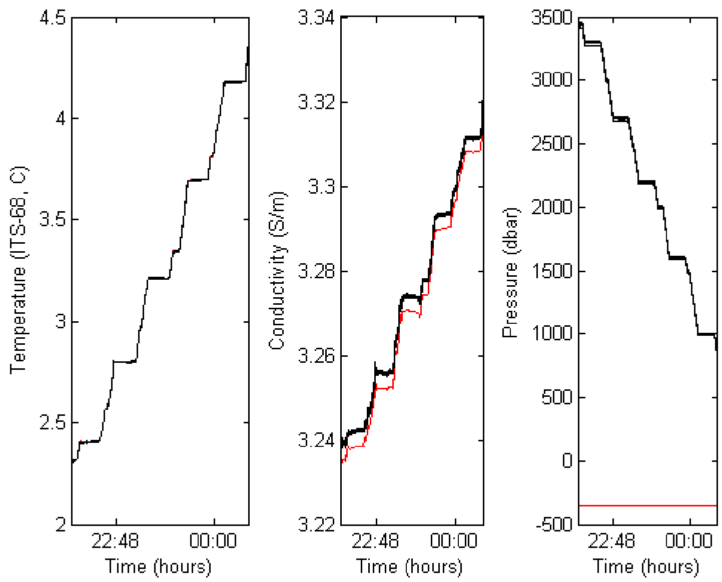



Figure 4: Results from the calibrations dip done between the 24th and 25th September 2011. Each panel includes data from all the microCATs (left: temperature; centre: conductivity; right: pressure). The red curve corresponds to microCAT SBE37-1696, whose pressure sensor was not working and whose conductivity cell gave readings systematically lower than those of the other conductivity sensors.

| Site | Latitude (N) | Longitude (W) | Date & time at bottom | Depth (m) | Mooring type |
|---|---|---|---|---|---|
| RS1 | 42 51.1523 | 61 38.1068 | 29-09-2011, 11:41 Z | 1106 | Short |
| RS2 | 42 44.3020 | 61 34.4829 | 29-09-2011, 13:39 Z | 1718 | Short |
| RS3 | 42 39.3558 | 61 27.3860 | 29-09-2011, 16:24 Z | 2325 | Short |
| RS4 | 42 33.4337 | 61 22.2630 | 26-09-2011, 18:57 Z | 2783 | Short |
| RS5 | 42 23.3777 | 61 16.8417 | 26-09-2011, 14:48 Z | 3428 | Short |
| RS6 | 42 10.8283 | 61 00.3925 | 28-09-2011, 17:27 Z | 3836 | Long |
| RS6A | 42 12.3469 | 61 09.1772 | 28-09-2011, 20:22 Z | 3873 | Short |

Note. Positions were calculated from M-Cal triangulations (see SEANAV's website http://www.seanav.com/). All times record the moment when the mooring anchor hit bottom (except for RS6, for which the bridge position for anchor on water is given). Echo sounder depths with assumed sound velocity of 1500 m/s.

Table 7: Moorings deployed.

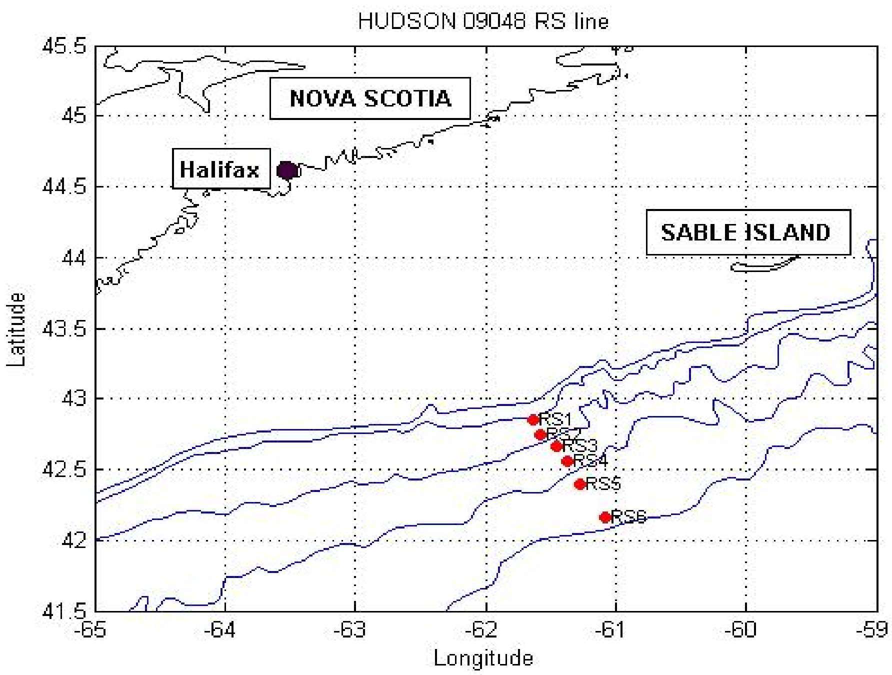



Figure 5: Location of moorings deployed in 2009. The blue lines correspond to the bathymetric contours: 500 m, 1000 m, 2000 m, 3000 m and 4000 m.

The following table includes the serial number of all the instruments, beacons and releases deployed in the line. Mooring schematics can be found in the Appendix.

| | RS1 | RS2 | RS3 | RS4 | RS5 | RS6 |
|---|---|---|---|---|---|---|
| Casabel Irid. beacon | x | x | | | | RS6: 300034012152420<br><br>RS6A: 300034012153420 |
| Sable Iridum beacon | | | x | x | x | |
| Aanderaa RCM11[1] | 595 | | | | | 594 |
| SBE37 MicroCAT | 6437 | | | | | |
| SBE37 MicroCAT | 3682 | | | | | 4614 |
| SBE37 MicroCAT | | 3709 | | | | 6435 |
| SBE37 MicroCAT | | | 6434 | | | |
| SBE37 MicroCAT | | | 3681 | | | 4617 |
| SBE37 MicroCAT | | | | 3710 | | 6432 |
| SBE37 MicroCAT | | | | | 2165 | |
| SBE37 MicroCAT | | | | | 3713 | 3675 |
| SBE37 MicroCAT | | | | | | 3680 |
| SBE37 MicroCAT | | | | | | 3714 |
| WHADCP | 11432 | 11433 | 13153 | 12455 | 11089 | 16405 |
| Aanderaa RCM11[1] | 595 | | | | | |
| Benthos 865-A acoustic release | 47462<br>13.0 kHz, R:D/E:G | 40082<br>8.75 kHz; R:G | 53468<br>8.5 kHz; R:B | 47464<br>14.0 kHz; R:A/E:F | 51819<br>14.5 kHz;<br>R:H/E:A/D:G<br><br>40080<br>8.25 kHz; R:C/E:B | RS6:<br>805<br>11.25 kHz; R:D/E:E<br><br>889<br>9.25 kHz; R:C/E:A<br><br>RS6A:<br>47463<br>13.5 kHz; R:G |
| SBE53 BPR | 24 | 52 | 73 | 47 | 23 | 25 |

1. This current meter is BIO's and not part of the RAPID-WAVE project.

Table 8: Summary of equipment deployed

| Instrument | Site | Sampling (ensemble) interval (seconds) | Averaging interval | Number of bins/ bin size (m) | Time of first record (Z) | Time of last record (Z) |
|---|---|---|---|---|---|---|
| SBE37-SM 2165 CTD/3500 m | RS5 | 1800 | Note 1 | - | 26/09/2011 14:00:01 | |
| SBE37-SMP 3675 CT/7000 m | RS6 | 1800 | Note 1 | - | | |
| SBE37-SMP 3680 CT/7000 m | RS6 | 1800 | Note 1 | - | | |
| SBE37-SMP 3681 CTD/7000 m | RS3 | 1800 | Note 1 | - | 29/09/2011 16:00:01 | |
| SBE37-SMP 3682 CTD/7000 m | RS1 | 1800 | Note 1 | - | 29/09/2011 11:00:01 | |
| SBE37-SMP 3709 CTD/7000 m | RS2 | 1800 | Note 1 | - | 29/09/2011 13:00:01 | |
| SBE37-SMP 3710 CTD/7000 m | RS4 | 1800 | Note 1 | - | 26/09/2011 18:00:01 | |
| SBE37-SMP 3713 CTD/7000 m | RS5 | 1800 | Note 1 | - | 26/09/2011 14:00:01 | |
| SBE37-SMP 3714 CTD/7000 m | RS6 | 1800 | Note 1 | - | | |
| SBE37-SM 4614 CTD/3500 m | RS6 | 1800 | Note 1 | - | | |
| SBE37-SM 4617 CTD/3500 m | RS6 | 1800 | Note 1 | - | | |
| SBE37-SM 6432 CTD/3500 m | RS6 | 1800 | Note 1 | - | | |
| SBE37-SM 6434 CTD/3500 m | RS3 | 1800 | Note 1 | - | 29/09/2011 16:00:01 | |
| SBE37-SM 6435 CTD/3500 m | RS6 | 1800 | Note 1 | - | | |
| SBE37-SM 6437 CTD/3500 m | RS1 | 1800 | Note 1 | - | 29/09/2011 11:00:01 | |
| WHADP Sentinel 11089 | RS5 | 3600 | 50 pings/ensemble 1 ping/36 s | 30/4/50 | 26/09/2011 14:00:00 | |
| WHADP Sentinel 11432 | RS1 | 3600 | 50 pings/ensemble 1 ping/36 s | 30/4/50 | 29/09/2011 10:00:00 | |
| WHADP Sentinel 11433 | RS2 | 3600 | 50 pings/ensemble 1 ping/36 s | 30/4/50 | 29/09/2011 13:00:00 | |
| WHADP Sentinel 12455 | RS4 | 3600 | 50 pings/ensemble 1 ping/36 s | 30/4/50 | 26/09/2011 19:00:00 | |
| WHADP Sentinel 13153 | RS3 | 3600 | 50 pings/ensemble 1 ping/36 s | 30/4/50 | 29/09/2011 16:00:00 | |
| WHADP Sentinel 16405 | RS6 | 3600 | 50 pings/ensemble 1 ping/36 s | 30/4/50 | 28/09/2011 12:00:00 | |
| SBE53 23 | RS5 | 1200 | 300 s[2] | - | 23/09/2011 17:50:00 | |
| SBE53 24 | RS1 | 1200 | 300 s[2] | - | 23/09/2011 17:20:00 | |
| SBE53 25 | RS6 | 1200 | 300 s[2] | - | 23/09/2011 21:20:00 | |
| SBE53 47 | RS4 | 1200 | 300 s[2] | - | 23/09/2011 20:00:00 | |
| SBE53 52 | RS2 | 1200 | 300 s[2] | - | 23/09/2011 20:00:00 | |
| SBE53 73 | RS3 | 1200 | 300 s[2] | - | 23/09/2011 21:40:00 | |

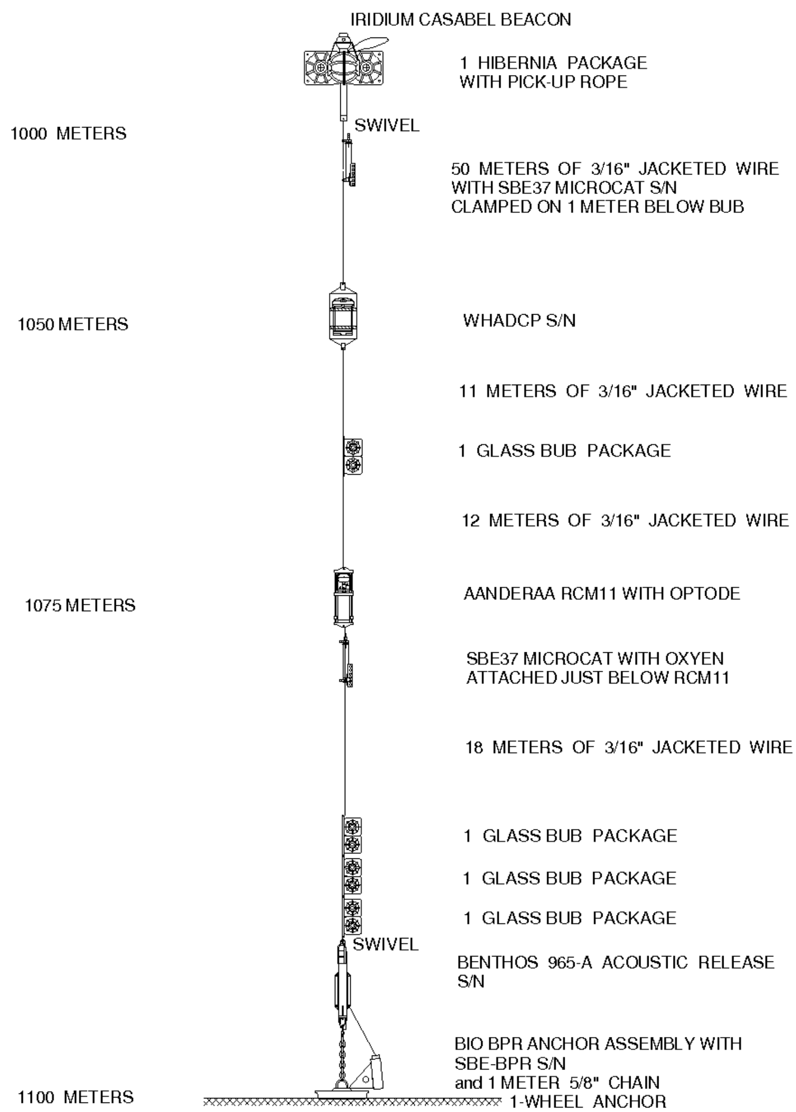
1. The most recent SBE73s no longer have a tunable averaging option: each sample is calculated as the average of 4 consecutive measurements (because of this, the fastest possible sampling rate is about 15 seconds).
2. Sensor warming up period was set to 300 seconds too. The time stamp for SBE53 samples correspond to the beginning of each 300- second averaging interval. The reference frequency measurement was set to once per week. With these settings, and taking into account that all SBE53s were fitted with alkaline batteries, the estimated maximum battery endurance should be 805.6 days.

Table 9: Summary of instrument set up.

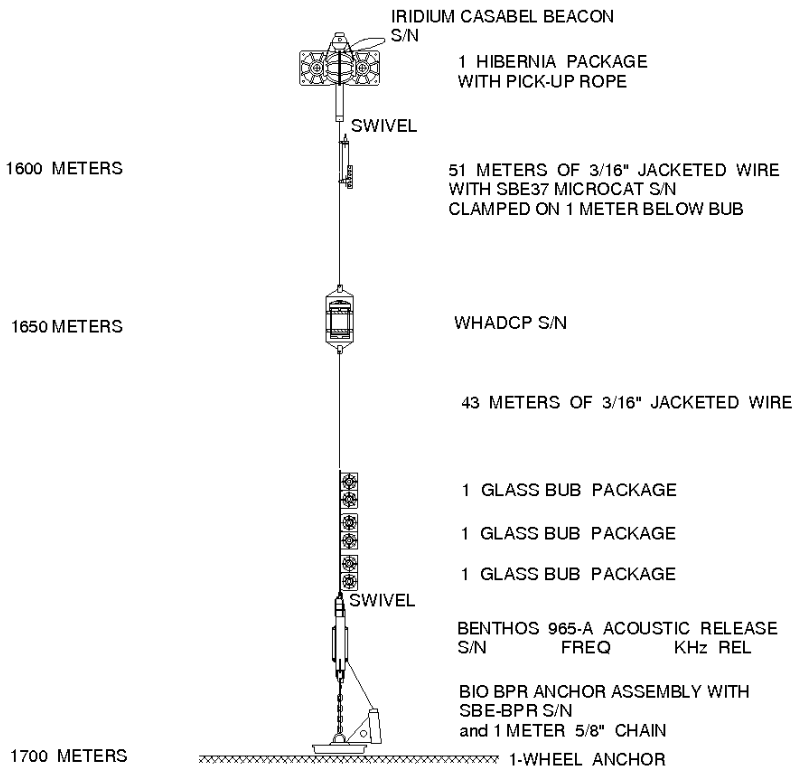
# APPENDIX. MOORING DIAGRAMS

## *Recoveries 2011*

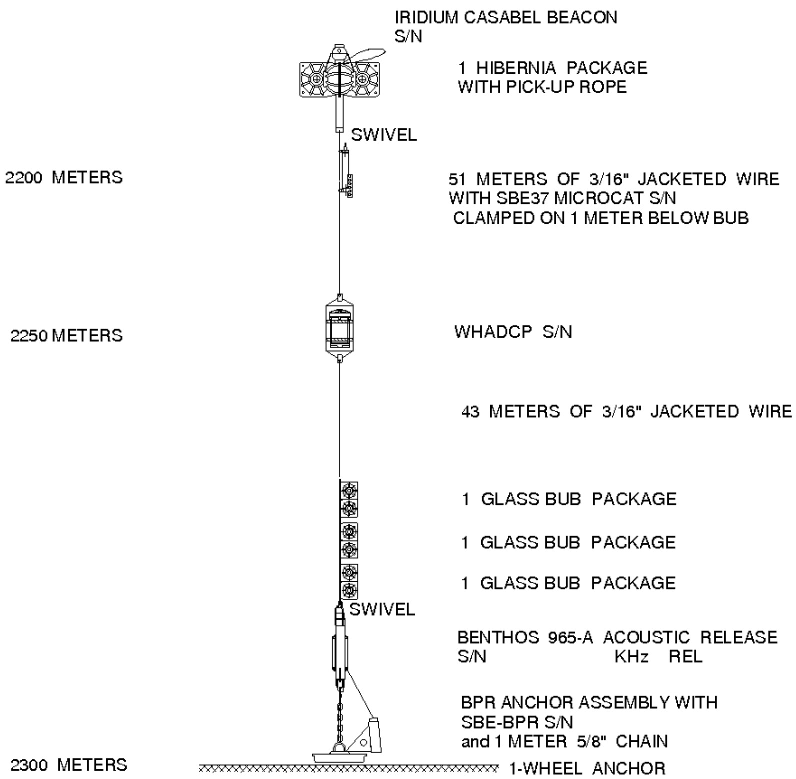
**MOORING # 1777 RS1 LODER/POL SCOTIAN SLOPE DEC 2010**



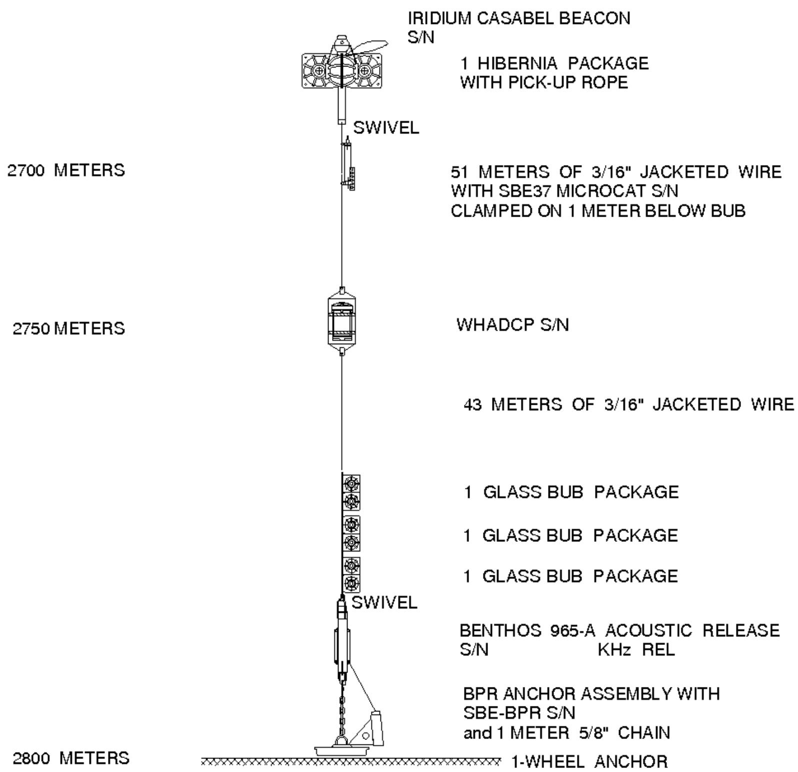
# MOORING # 1778 RS2 LODER/POL SCOTIAN SLOPE DEC 2010



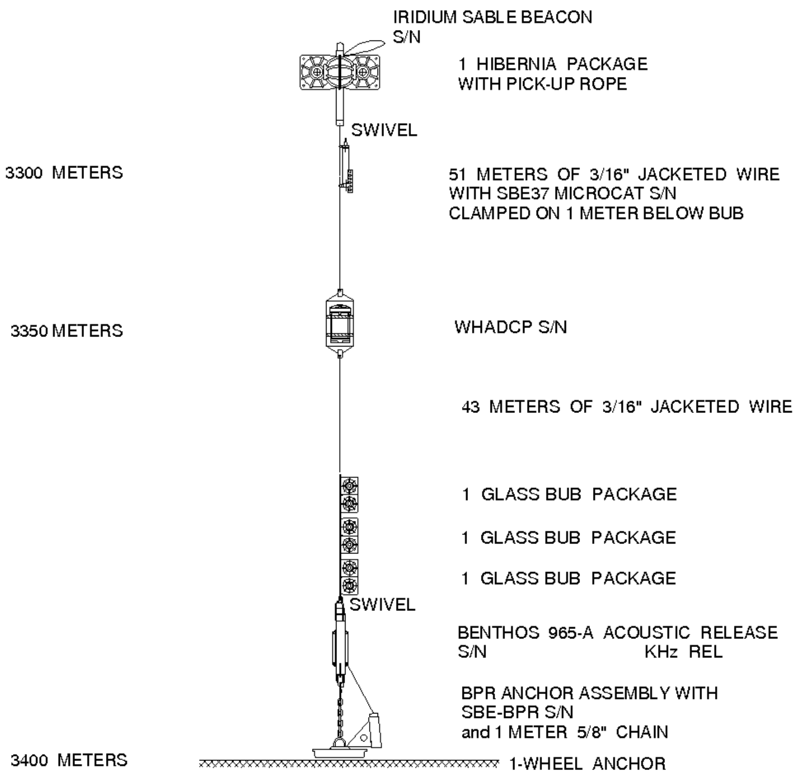
**MOORING # 1779 RS3 LODER/POL SCOTIAN SLOPE DEC 2010**



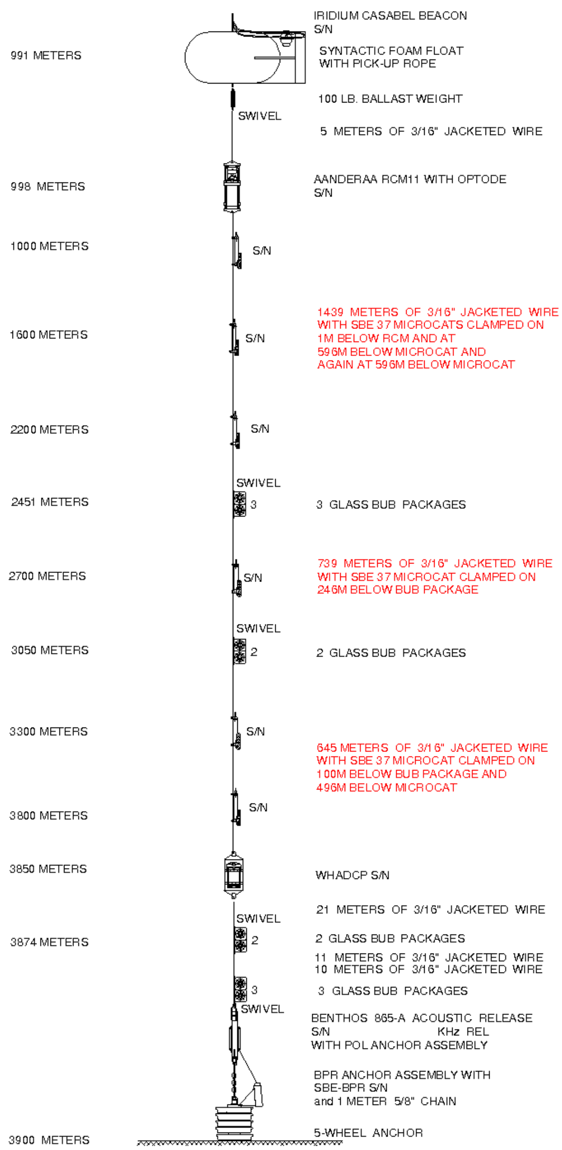
# MOORING # 1780  RS4   LODER/POL   SCOTIAN SLOPE  DEC 2010



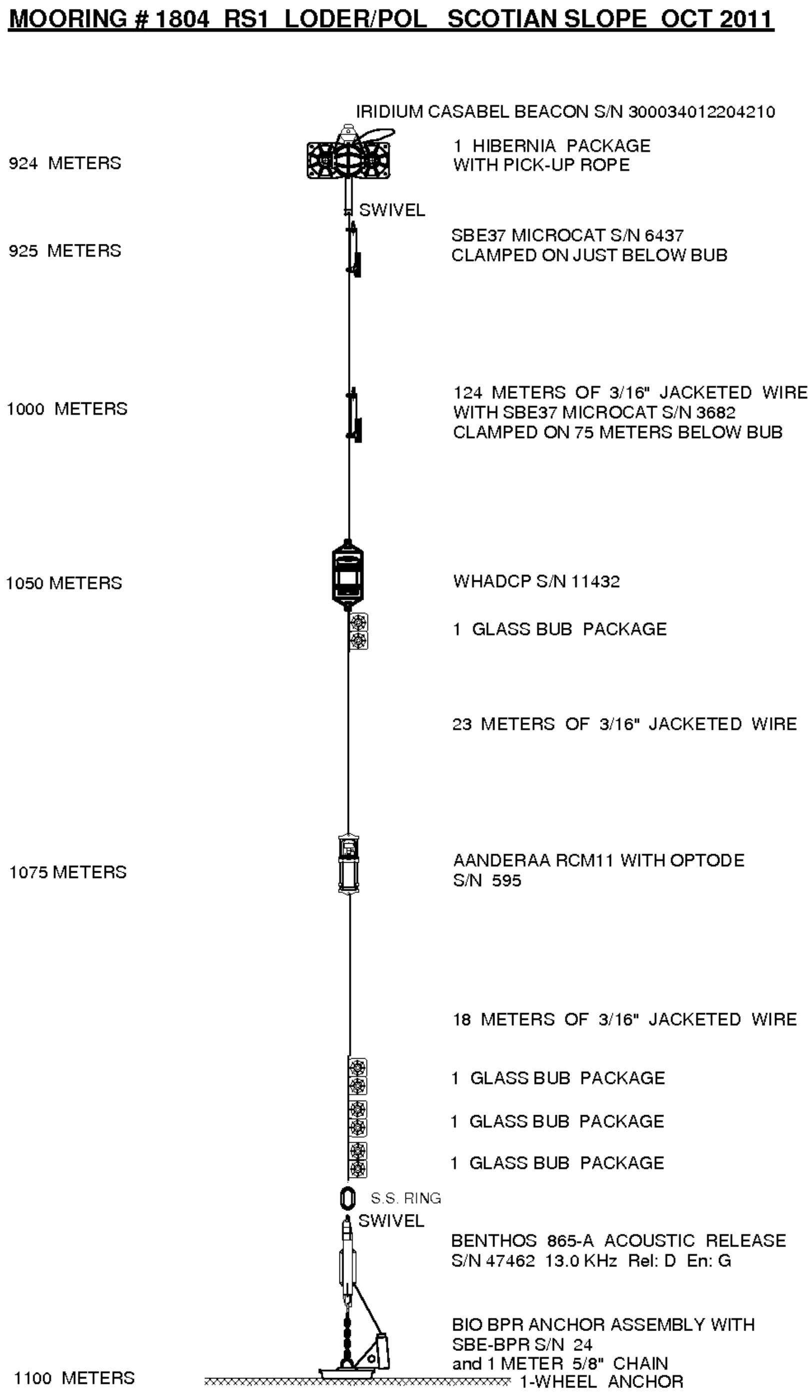
## MOORING # 1781 RS5 LODER/POL SCOTIAN SLOPE DEC 2010



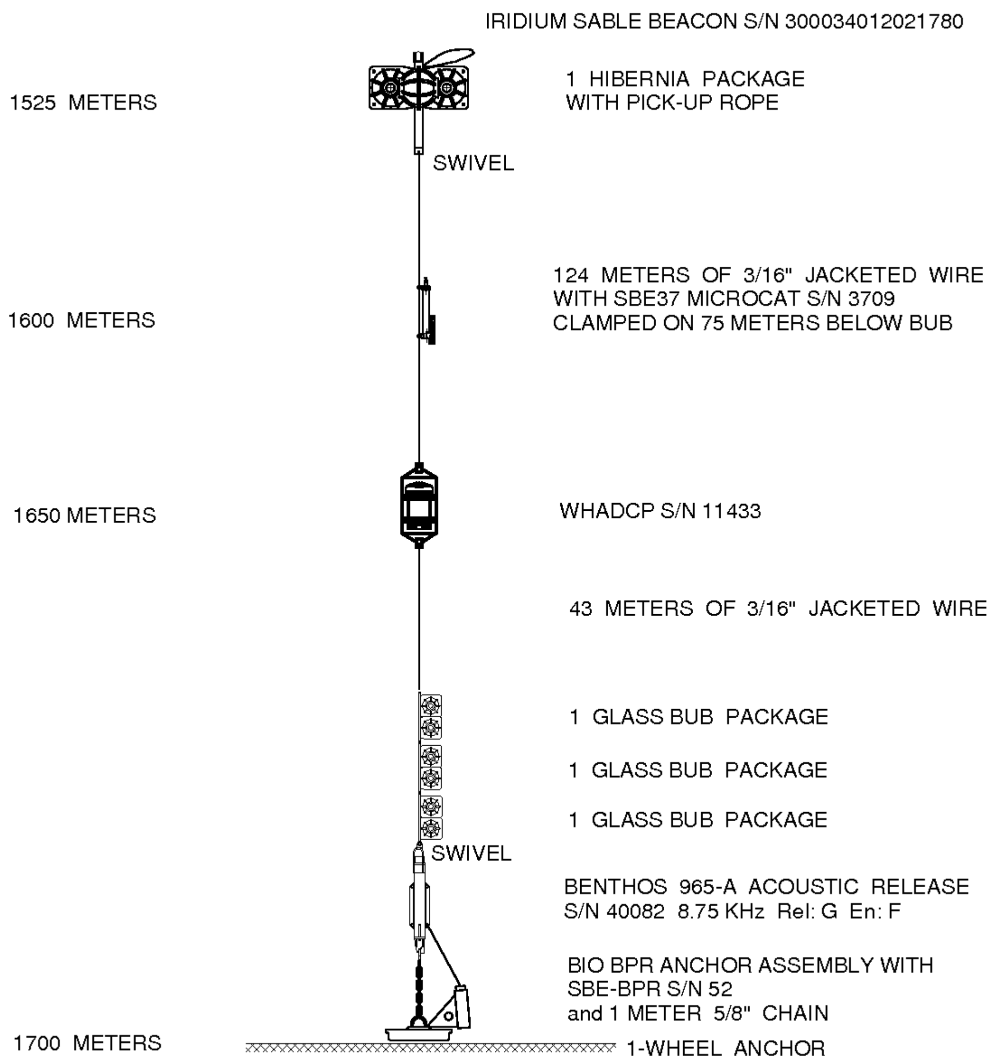
**MOORING # 1782 RS6 LODER/POL SCOTIAN SLOPE DEC 2010**



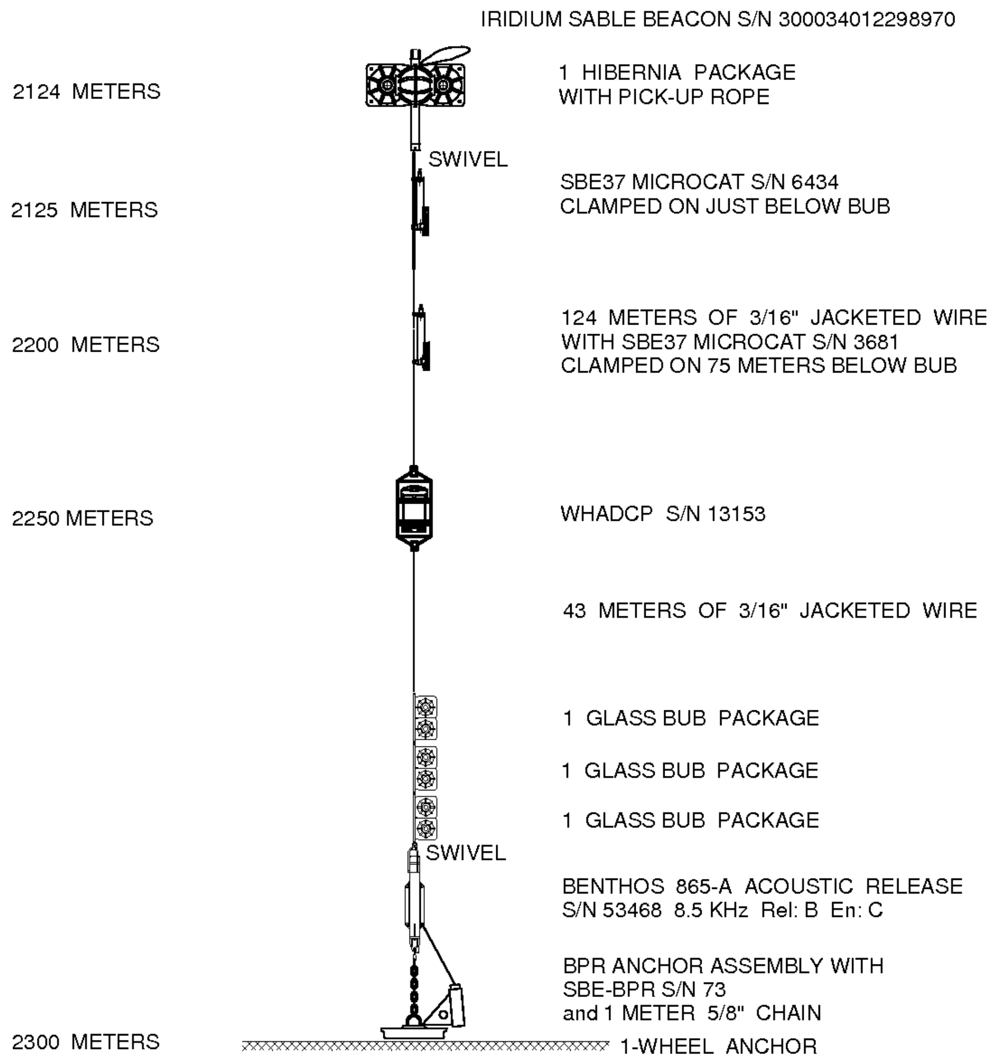
*Deployments 2011*



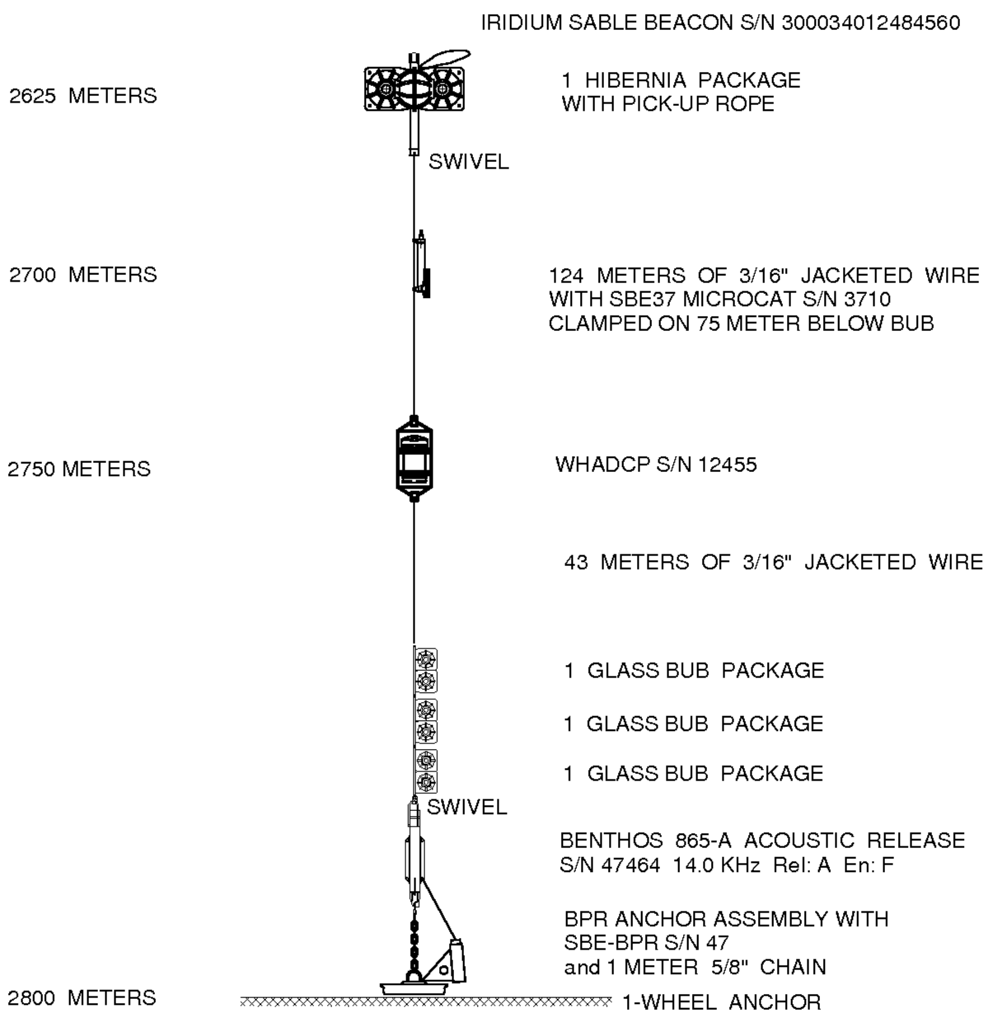
## MOORING # 1805  RS2  LODER/POL   SCOTIAN SLOPE  OCT 2011



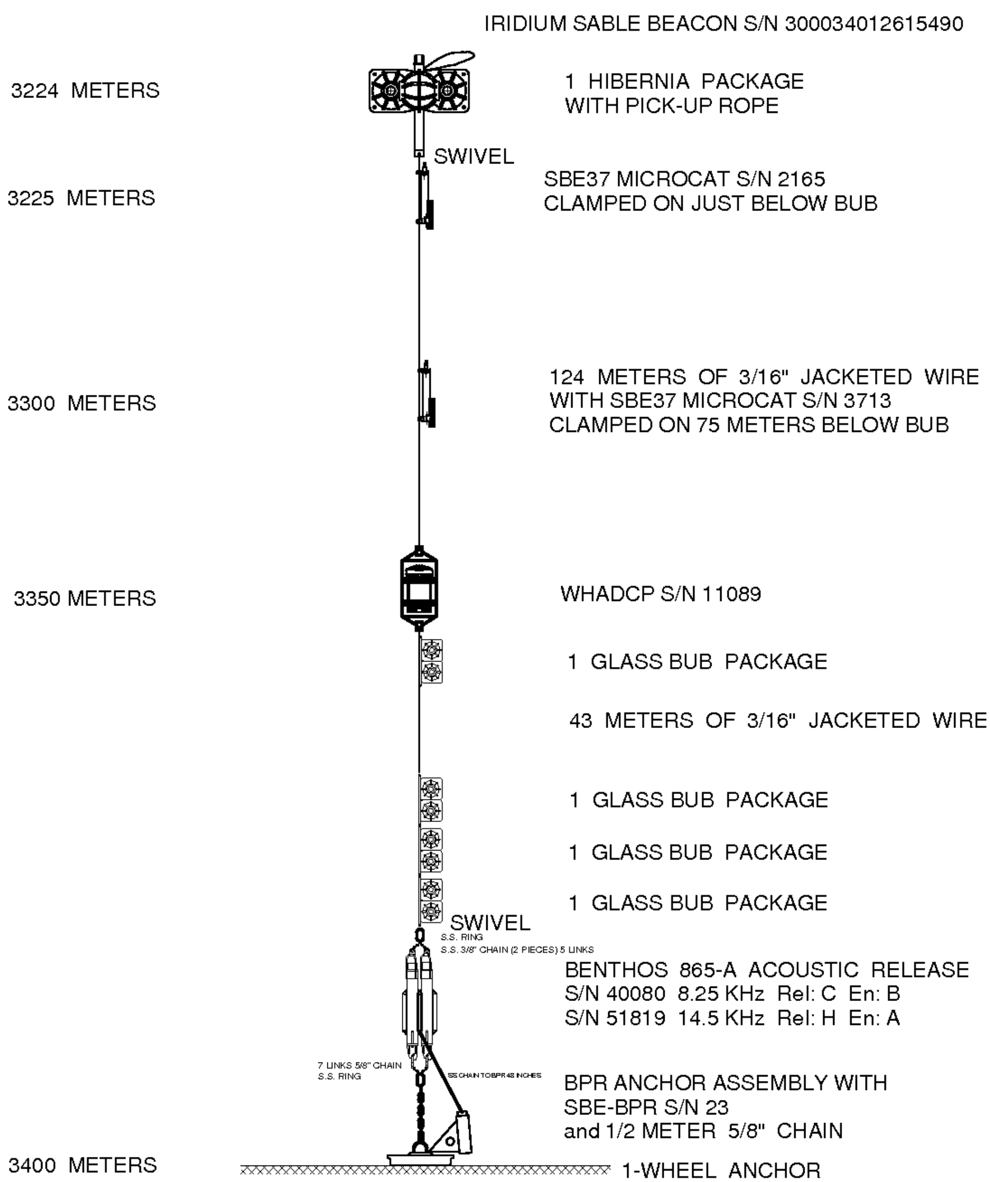
# MOORING # 1806 RS3 LODER/POL SCOTIAN SLOPE OCT 2011



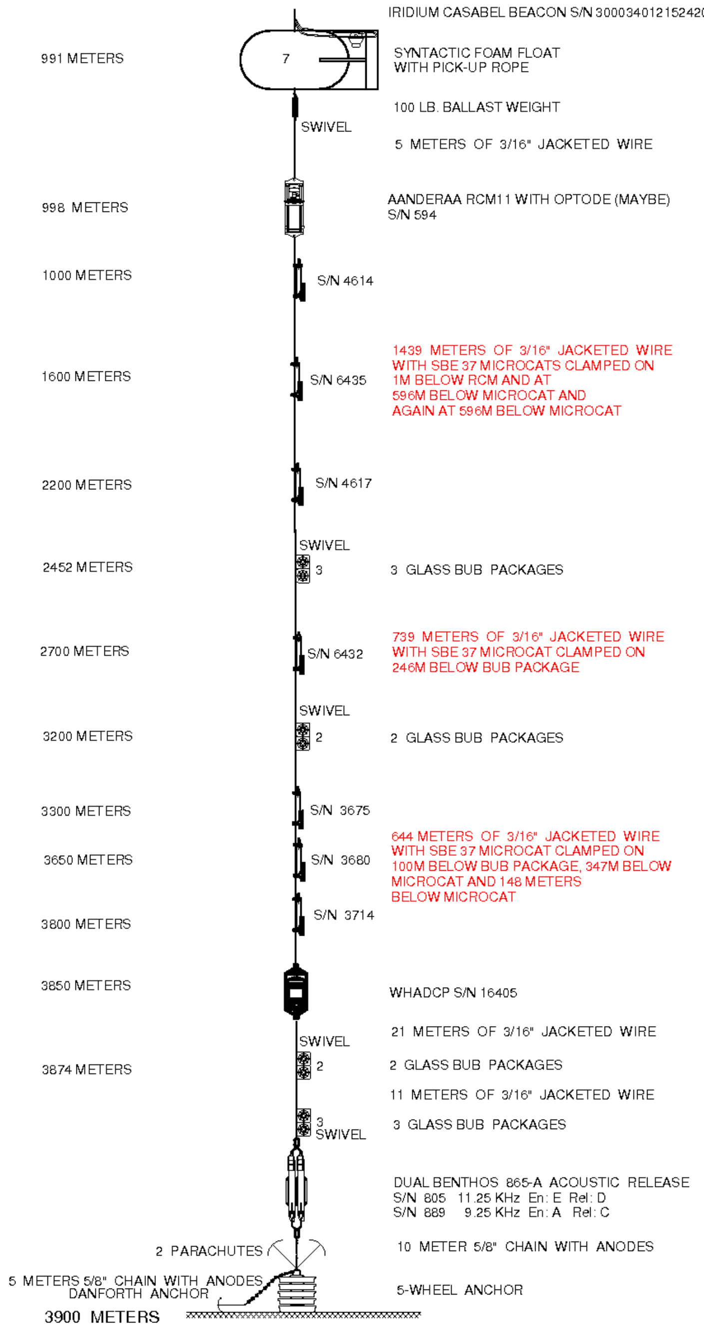
# MOORING # 1807 RS4 LODER/POL SCOTIAN SLOPE OCT 2011



## MOORING # 1808 RS5 LODER/POL SCOTIAN SLOPE OCT 2011



**MOORING # 1809 RS6 LODER/POL SCOTIAN SLOPE OCT 2011**



## MOORING # 1810 RS6A LODER/POL SCOTIAN SLOPE OCT 2011