National Oceanography Centre
NATURAL ENVIRONMENT RESEARCH COUNCIL

National Oceanography Centre

Cruise Report No. 07

RV *Knorr* Cruise KN200-4

13 APR-03 MAY 2011

RAPID Mooring Cruise

Principal Scientists
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2011

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ABSTRACT

This report describes the mooring operations conducted during RV *Knorr* cruise KN200-4 between 13 April and 3 May 2011.

These mooring operations were completed as part of the United Kingdom Natural Environment Research Council (NERC) funded RAPID-WATCH Programme to monitor the Atlantic Meridional Overturning Circulation (MOC) at 26.5°N. The primary purpose on this cruise for the UK team was to service the RAPID Western Boundary moorings while the US teams worked on the Western Boundary Time Series project and the RAPID-MOCHA Western Boundary moorings.

Cruise KN200-4 was from Port Everglades, Florida to Port Everglades, Florida and covered the Western Boundary moorings deployed on RB0901 and OC459. This cruise was the ninth annual refurbishment of the Western Boundary section of an array of moorings deployed across the Atlantic in order to continuously observe the MOC. This array will be further refined and refurbished during subsequent years.

The instruments deployed on the array consist of a variety of current meters, bottom pressure recorders, and CTD loggers, which, combined with time series measurements of the Florida Straits Current and wind stress estimates, will be used to determine the strength and structure of the MOC at 26.5°N.

(http://www.noc.soton.ac.uk/rapid)

KEYWORDS

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1 Scientific and Ship's Personnel

Ship's Crew	
Name	*Position*
Adam Seamans	Master
Deidra Emrich	Chief Mate
Jennifer Hickey	2nd Mate
Michael Chretien	3rd Mate
William Dunn	Bosun
Jose Andrade	Able Seaman
Kevin Butler	Able Seaman
Susan Coleman	Able Seaman
Michael Singleton	Ordinary Seaman
Paul St. Onge	Ordinary Seaman
Stephen Walsh	Chief Engineer
Piotr Marczak	1st Assistant Engineer
Wayne Sylvia	2nd Assistant Engineer
Joseph Bastoni	3rd Assistant Engineer
Rogelio Fong	Oiler
Michael Gaylord	Oiler
James Proctor	Oiler
Russell Adams	Electrician
Bobbie Bixler	Steward
Erskine Goddard	Cook
Anthony Reveira	Messman
Anthony Skinner	Comm/ET
Amy Simoneau	SSSG
Anton Zafereo	SSSG

Table 1.1 *Details of ship's crew on cruise KN200-4.*

Scientific and Technical	
Name	*Institute*
William Johns (PSO, US)	Rosenstiel School of Marine and Atmospheric Sciences, University of Miami (RSMAS)
Christopher Meinen (Co-chief, US)	National Oceanic and Atmospheric Administration (NOAA)/Atlantic Oceanographic and Meteorological Laboratory (AOML)
Robert McLachlan	National Marine Facilities Division (NMFD)
Steve Whittle	NMFD
Pedro Pena	AOML
Eleanor Frajka-Williams (PSO, UK)	National Oceanography Centre (NOC)
Erik van Sebille	RSMAS

David Childs	NMFD
Thomas Roberts	NOC
Colin Hutton	NMFD
Darren Rayner	NOC
Christopher Hughes	School of Ocean and Earth Sciences, University of Southampton
Rigoberto Garcia	NOAA/AOML
Kyle Seaton	NOAA/AOML
Kyle McDermott	Woods Hole Oceanographic Institute
Rob Jones	RSMAS
Marcus Graham	RSMAS
Adam Houk	RSMAS
Greta Leber	RSMAS
Andy Stefanick	NOAA/AOML

Table 1.2 *Details of science personnel on cruise KN200-4.*

2 R/V *Knorr*

Summarized from the www.whoi.edu website:

The R/V Knorr is owned by the U.S. Navy and operated by WHOI for the ocean research community. The R/V Knorr was launched in 1968, delivered to Woods Hole in 1970, and completely overhauled in 1991.

Length	279 feet (85 m)
Beam	46 feet (14 m)
Draft	16.5 feet (5 m)
Laboratories	2,756 sq feet
Cruising speed	11 knots
Cruising range	12,000 nm
Fuel capacity	160,500 gallons
Displacement	2,685 LT
Endurance	60 days
Complement	22 crew, 32 scientists, 2 technicians

Table 2.1 *Operating characteristics of the R/V Knorr.*

Computing

The mac mini hydrosea5 was used to collect and process data. It was equipped with a standalone Matlab license for processing. Additional login screens were setup to allow multiple users to login and process data. A wireless connection between the mac mini and PCs was used to transfer raw data from the PCs to the mac mini. Hydrosea5 was backed up using Time Machine.

A Canon flatbed scanner was brought on the cruise for scanning of hand-written logsheets. The ship was equipped with several color and black and white printers that could be used by the science party.

3 Itinerary

Depart Port Everglades, FL 13th of April 2011, arrive Port Everglades, FL 3rd May 2011.

4 Acknowledgements

We would like to thank the officers and the crew of the R/V Knorr for their expert and cheerful work in safely recovering and deploying moorings. The NMFD technicians were efficient and careful, successfully executing a complex set of mooring operations. Thanks as well to the chief scientist Bill Johns, and co-chief Chris Meinen, for a well-organized cruise.

5 Introduction

The RAPID-MOC observing system has been operational since spring 2004. The purpose of this cruise was to recover and redeploy the western boundary mooring sub-array deployed off Abaco Island, Bahamas.

This cruise is the 22nd in total since spring 2004. The cruises to date are shown in Table 5.1. The project web site is http://www.noc.soton.ac.uk/rapidmoc. The RAPID-MOC programme was completed and has now moved into a second phase (NERC Directed Programme RAPID-WATCH http://www.noc.soton.ac.uk/rapid) through to 2014.

5.1 Scientific Background

The Atlantic Meridional Overturning Circulation (AMOC) at 26.5°N carries a northward heat flux of 1.3 PW. Northward of 26.5°N over the Gulf Stream and its extension, much of this heat is transferred to the atmosphere and subsequently is responsible for maintaining UK climate about 5°C warmer than the zonal average at this latitude. However, previous sparse observations did not resolve the temporal variability of the AMOC and so it is unknown whether it is slowing in response to global warming as suggested by recent model results. In 2004 NERC, NSF and NOAA funded a system of observations in the Atlantic at 26.5°N to observe on a daily basis the strength and structure of the AMOC. Two papers ([*Cunningham, et al.*, 2007] and [*Kanzow, et al.*, 2007]) demonstrated that not only does the system of observations achieve a mass balance for the AMOC, it reveals dramatic and unexpected richness of variability. In the first year the AMOC mean strength and variability is 18.7±5.6 Sv. From estimates of the degrees-of-freedom the year-long mean AMOC is defined with a resolution of around 1.5 Sv so abrupt changes would be readily identified and long-term changes will be measured relative to the 2004-2005 average.

The NERC contribution to the first four years of continuous AMOC observations was funded under the directed programme RAPID Climate Change. Following an international review of the system NERC will continue funding to 2014 under the programme RAPID-WATCH. The NSF and NOAA have also continued funding and commitments so that the system can continue operating at the same level of activity as during the period 2004-2008.

The objectives of RAPID-WATCH are: To deliver a decade-long time series of calibrated

and quality-controlled measurements of the Atlantic MOC from the RAPID-WATCH arrays and; To exploit the data from the RAPID-WATCH arrays and elsewhere to determine and interpret recent changes in the Atlantic MOC, assess the risk of rapid climate change, and investigate the potential for predictions of the MOC and its impact on climate.

The AMOC System

The 26.5°N Atlantic section is separated into two regions: a western boundary region, where the Gulf Stream flows through the narrow (80 km), shallow (800 m) Florida Straits between Florida and the Bahamas, and a transatlantic mid-ocean region, extending from the Bahamas at about 77°W to Africa at about 15°W (Figure 5.1). Variability in Gulf Stream flow is derived from cable voltage measurements across the Florida Straits, and variability in wind-driven surface-layer Ekman transport across 26.5°N is derived from QuikSCAT satellite-based observations. To monitor the mid-ocean flow we deployed an array of moored instruments along the 26.5°N section. The basic principle of the array is to estimate the zonally integrated geostrophic profile of northward velocity on a daily basis from time-series measurements of temperature and salinity throughout the water column at the eastern and western boundaries. Inshore of the most westerly measurement of temperature and salinity, the transports of the Antilles current and deep western boundary current are monitored by direct velocity measurements.

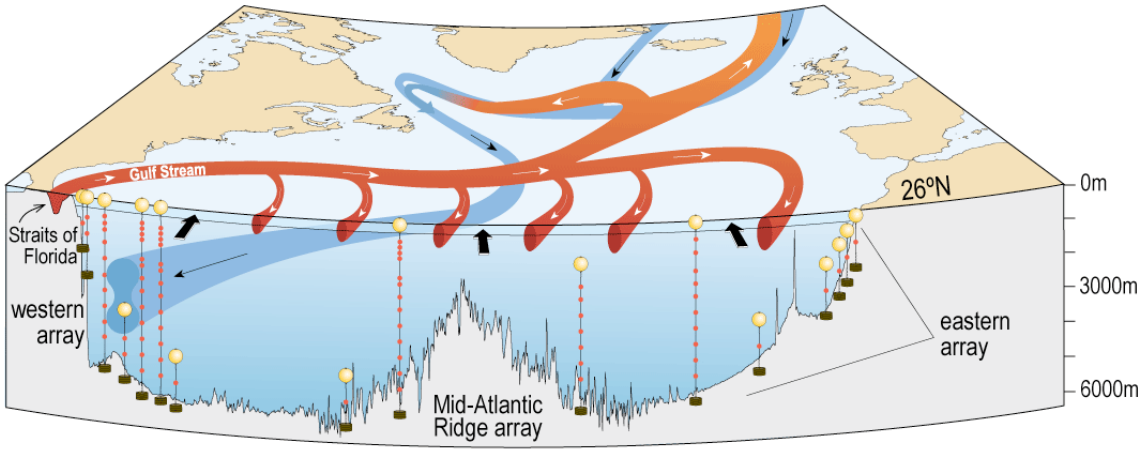


Figure 5.1 *Schematic of the principal currents of the Atlantic Meridional Overturning Circulation. The vertical red lines across the Atlantic at 26.5°N indicate the main areas where moorings instrumented to measure the vertical density profile are located. The Gulf Stream transport is measured by submarine cable and the western boundary array includes current meters to directly measure transports of the shallow and deep western boundary currents. Bottom pressure recorders are located at several sites across the Atlantic to measure depth independent fluctuations of the basin-wide circulation. Figure based on one by Louise Bell and Neil White, CSIRO.*

Cruise	Vessel	Date	Objectives	Cruise Report
D277	RRS Discovery	Feb - Mar 2004	Initial deployment of Eastern Boundary and Mid-Atlantic Ridge moorings	RRS Discovery Cruise D277 and D278, Southampton Oceanography Centre, Cruise Report No. 53, 2005
D278	RRS Discovery	Mar 2004	Initial deployment of UK and US Western Boundary moorings	RRS Discovery Cruise D277 and D278, Southampton Oceanography Centre, Cruise Report No. 53, 2005
P319	RV Poseidon	Dec 2004	Emergency deployment of replacement EB2 following loss	Appendix in RRS Charles Darwin Cruise CD170 and RV Knorr Cruise KN182-2 National Oceanography Centre, Southampton, Cruise Report No. 2, 2006
CD170	RRS Charles Darwin	Apr 2005	Service and redeployment of the Eastern Boundary and Mid-Atlantic Ridge moorings	RRS Charles Darwin Cruise CD170 and RV Knorr Cruise KN182-2 National Oceanography Centre, Southampton, Cruise Report No. 2, 2006
KN182-2	RV Knorr	May 2005	Service and redeployment of UK and US Western Boundary moorings and Western Boundary Time Series (WBTS) hydrographic section	RRS Charles Darwin Cruise CD170 and RV Knorr Cruise KN182-2 National Oceanography Centre, Southampton, Cruise Report No. 2, 2006
CD177	RRS Charles Darwin	Nov 2005	Service and redeployment of key Eastern Boundary moorings	RRS Charles Darwin Cruise CD177. National Oceanography Centre, Southampton, Cruise Report No. 5, 2006
WS05018	RV F. G. Walton Smith	Nov 2005	Emergency recovery of drifting WB1 mooring	No report published
RB0602	RV Ronald H. Brown	Mar 2006	Service and redeployment of UK and US Western Boundary moorings and Western Boundary Time Series (WBTS) hydrographic section	RV Ronald H. Brown Cruise RB0602 and RRS Discovery Cruise D304, Southampton Oceanography Centre, Cruise Report No. 16, 2007
D304	RRS Discovery	May - Jun 2006	Service and redeployment of the Eastern Boundary and Mid-Atlantic Ridge moorings	RV Ronald H. Brown Cruise RB0602 and RRS Discovery Cruise D304, Southampton Oceanography Centre, Cruise Report No. 16, 2007
P343	RV Poseidon	Oct 2006	Service and redeployment of key Eastern Boundary moorings	PS Poseidon Cruise P343 and P345, National Oceanography Centre, Southampton, Cruise Report No. 28, 2008
P345	RV Poseidon	Dec 2006	Emergency redeployment of EB1 and EB2 following problems on P343	PS Poseidon Cruise P343 and P345, National Oceanography Centre, Southampton, Cruise Report No. 28, 2008
SJ06	RV Seward Johnson	Sep - Oct 2006	Recovery and redeployment of WB2 and US Western Boundary moorings and Western Boundary Time Series (WBTS) hydrography section	Appendix G in RV Ronald H. Brown Cruise RB0701, National Oceanography Centre, Southampton, Cruise Report No. 29
RB0701	RV Ronald H. Brown	Mar - Apr 2007	Service and redeployment of UK Western Boundary moorings and Western Boundary Time Series (WBTS) hydrography section	RV Ronald H. Brown Cruise RB0701, National Oceanography Centre, Southampton, Cruise Report No. 29
D324	RRS Discovery	Oct - Nov 2007	Service and redeployment of the Eastern Boundary and Mid-Atlantic Ridge moorings	RRS Discovery Cruise D324, Southampton Oceanography Centre, Cruise Report No. 34, 2007
SJ0803	RV Seward Johnson	Apr 2008	Service and redeployment of the Western Boundary moorings	RV Seward Johnson Cruise SJ0803, National Oceanography Centre, Southampton, Cruise Report No. 37, 2008

Cruise	Vessel	Date	Objectives	Cruise Report
D334	RRS Discovery	Oct - Nov 2008	Service and redeployment of the Eastern Boundary and Mid-Atlantic Ridge moorings	RRS Discovery D334, National Oceanography Centre, Southampton, Cruise Report No. 38, 2009
RB0901	RV Ronald H. Brown	Apr - May 2009	Service and redeployment of UK and US Western Boundary moorings and Western Boundary Time Series (WBTS) hydrographic section	RV Ronald H. Brown Cruise RB0901, National Oceanography Centre, Southampton, Cruise Report No. 39, 2009
D344	RRS Discovery	Oct - Nov 2009	Service and redeployment of the Eastern Boundary and Mid-Atlantic Ridge moorings	RRS Discovery D344, National Oceanography Centre, Southampton, Cruise Report No. 51, 2010
D345	RRS Discovery	Nov - Dec 2009	Recovery and redeployment of US Western Boundary moorings, and WBTS hydrographic section	Cruise report to be published
OC459	RV Oceanus	Mar - Apr 2010	Service and redeployment of UK Western Boundary moorings	RV Oceanus Cruise OC459-1, National Oceanography Centre, Cruise Report No. 01, 2011
RB10-09	RV Ronald H. Brown	Nov - Dec 2010	Service and redeployment of WB4 that could not be completed on OC459	Appendix in RV Oceanus Cruise OC459-1, National Oceanography Centre, Cruise Report No. 01, 2011
D359	RRS Discovery	Dec 2010 - Jan 2011	Service and redeployment of the Eastern Boundary and Mid-Atlantic Ridge moorings	Cruise report to be published
KN200-4	RV Knorr	Apr - May 2011	Service and redeployment of UK and US Western Boundary moorings and Western Boundary Time Series (WBTS) hydrographic section	This report

Table 5.1 *Summary of RAPID MOC cruises.*

5.2 Array Specification

The array as deployed in 2011 consists of a total of twenty-one moorings, twelve landers and two inverted echo sounders. Figures 5.2 and 5.3 are schematics showing each mooring and instrumentation in 2011. The eastern boundary moorings were serviced in the December-January cruise D359. Moorings are named in three sub-arrays. Western Boundary **WB#** with mooring number increasing to the east; Mid-Atlantic Ridge **MAR#**; Eastern Boundary **EB#**. The letter **H** is a historical reference to moorings originally intended to be HOMER profilers. Bottom landers instrumented with pressure recorders are indicated by **L** in the name. **ADCP** indicates an Acoustic Doppler Current Profiler mooring.

Western Boundary Sub-Array

At the western boundary, **WB2** is the pivotal mooring and provides a full-depth density profile very close to the western boundary "wall". As from April 2011, WB2 comprises seventeen CTDs and eight current meters, whereas **WB1** comprises fifteen CTDs and four current meters. Inshore of WB1 there is **WBADCP** that comprises a Longranger ADCP at a depth of 600 m to measure the shallow Antilles current. East of WB2 is **WBH2** consisting of three CTDs and five current meters. At the normal offshore extent of the Deep Western Boundary Current (DWBC) is **WB4**, which comprises fifteen CTDs and nine current meters. Further offshore is **WB6**, comprising five CTDs, one current meter and two bottom pressure recorders – which combined with MAR0 measures the contribution to the MOC of deep water below 5200 m, including the Antarctic Bottom Water. There are six landers in this sub-array; two at the site of WB2; two at the site of WB4; and two at the site of WBADCP. Each lander comprises two BPRs.

In addition to the moorings listed above, the western boundary sub-array also contains three full depth moorings and four landers from the University of Miami, which were serviced on this same cruise. **WB0** comprises four CTDs, four current meters and an upward looking ADCP. **WB3** is 22 km east of WB2 and so acts as a critical backup in case of loss of WB2. WB3 consists of seven CTDs and current meters. Combined with the other inshore moorings it provides the thermal-wind shear and measured velocities from the core of the DWBC. **WB5** is located 500 km offshore and is instrumented with seventeen CTDs and provides the thermal-wind shear across the full width of the boundary currents including any recirculation.

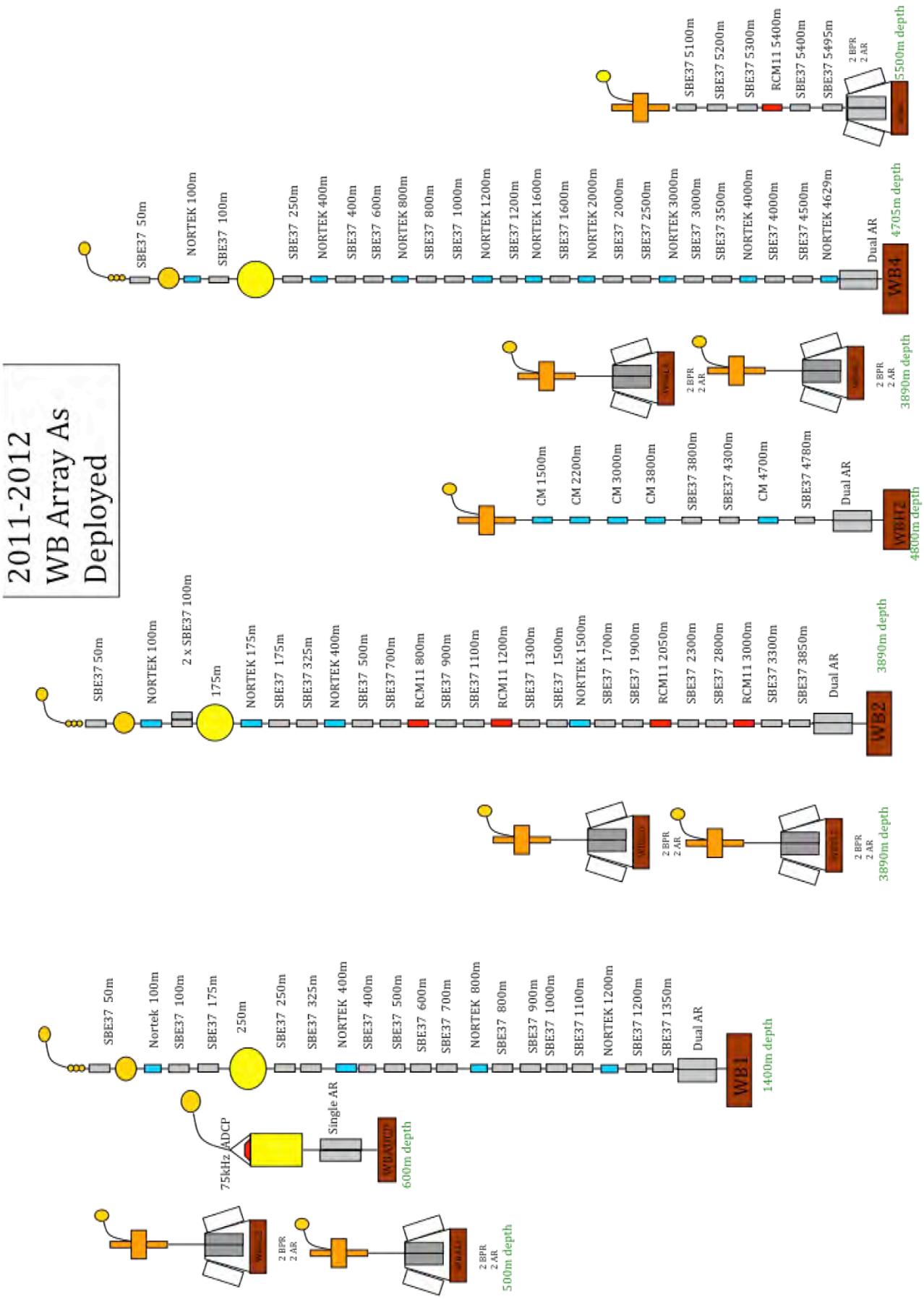


Figure 5.2 *Western boundary moorings as deployed on Kn200-4.*

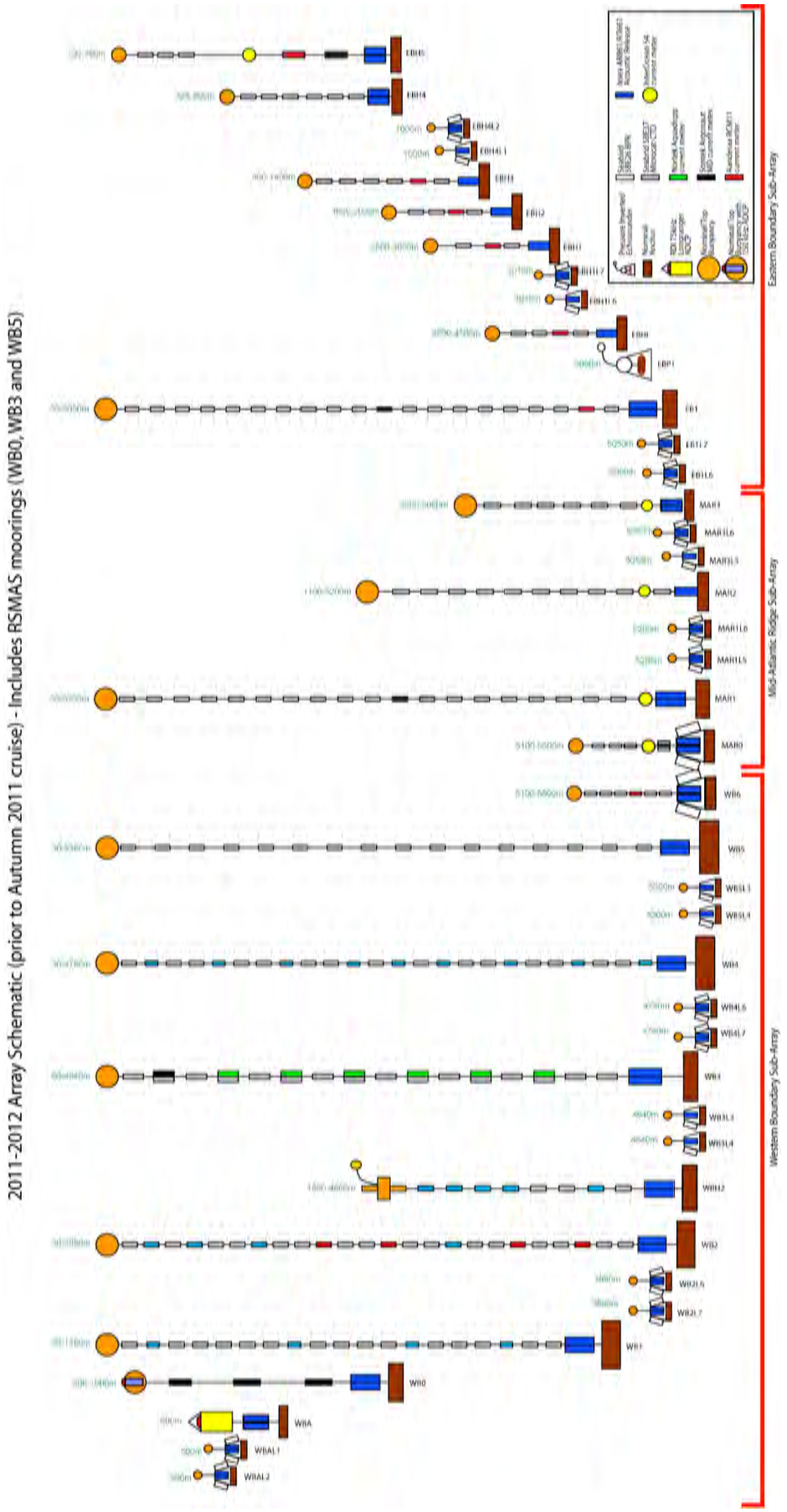


Figure 5.3 *Array schematic after Kn200-4 cruise.*

6 Diary of Events

E. Frajka-Williams

All times are local time unless specified.

Sunday, 10th April 2011
Eleanor, Darren and Chris travelled from Heathrow to Miami. Arrived in Miami at 17:30 local, drove to Ft. Lauderdale. (Moorings team arrived Friday.) Eleanor lost a filling in flight and had to find a dentist.

Monday, 11th April 2011
Loading and lab setup on the ship. We had some trouble getting to the ship as the berth had changed, but we were unaware. Additionally, access to the ship was only possible when escorted by someone carrying a TWIC card and a Ft. Lauderdale port pass (for $75/week) or a merchant marine card. Onboard, Darren and Chris set up the computers and network. The moorings team unloaded gear and set up the lab. After some negotiation, lab space was allocated. One container was delayed and deferred until tomorrow. Eleanor got a temporary filling, as well as some spare in case the filling falls out again mid-cruise.

Tuesday, 12th April 2011
Final containers arrive. One box of five microcats was not shipped from the NOC so Darren reallocates the mooring array with the 45 microcats onboard, expecting to redeploy 5 that we will recover. All science party moved onboard.

Wednesday, 13th April 2011
We sailed just after 08:30; Beautiful weather, partly cloudy and warm but breezy. We are aiming to reach Freeport, Bahamas by 15:30 to clear customs before they close for the day. Customs were cleared quickly and without issue. The first CTD was started before dinner, and the primary and secondary sensors match very well.

Thursday, 14th April 2011
The short CTD section was completed Wednesday evening, and caldips started this morning at 10:00. The weather continues to be good, with very calm seas and a slight breeze. Four caldips were planned for today (cast 6-9), with most of the microcats onboard scheduled for these dips. The dips are only to 3500 m (cast 8 to 4000 m) so the deepest instruments are being reserved for two final caldips at the end of the hydrographic section. The first caldip was completed after lunch, and the next begun. The first two dips had the new 150 kHz LADCP package on it, which successfully returned data. Acoustic release tests were planned for the 3rd and 4th caldips. Shortly after the 3rd caldip began, it was recalled that the pinger wasn't turned off, so the package was brought back to the deck after 1000 m and the pinger removed. The CTD frame with microcats and releases was turned around and cast 8 restarted around 20:00. Casts 8 and 9 had UK microcats and releases only, and were done overnight.

Friday, 15th April 2011
Caldips 8 and 9 were completed overnight. One microcat was not turned on (or the date set incorrectly) and so will be re-dipped later. Microcat 3229 had a bad conductivity

cell, but it had recently been returned from Seabird, so appears not to have been fixed. Today the moorings team is doing some wire winding, and RCM servicing. The hydrographic section began. Moorings are scheduled to begin with WB6 on Thursday, 21st April.

Saturday, 16th April 2011
The hydrographic section and wire winding continue. In the evening, one cast had to be cut short (bottle stops skipped above 1000 m) due to the sighting of 3 flares. As the nearest ship, we were the first responders. It turned out to be a fishing vessel that had run out of fuel, so the Knorr acted as relay until a coast guard could respond, and then returned to the hydrographic section.

Sunday, 17th April 2011
The hydrographic section continues. Servicing RCMs.

Monday, 18th April 2011
The hydrographic section continues. Wire winding, building glass.

Tuesday, 19th April 2011
The hydrographic section continues. Weather is still good, but the forecast has heavy winds kicking in Wednesday afternoon (20 knots) and possibly higher on Thursday, with a low pressure region moving in from the east. Additionally, there appears to be a high pressure area with 35 knot winds to the northeast which will likely create swell for us.

Wednesday, 20th April 2011
Weather picked up this morning, so there was more activity tying things down in the lab. Hydrographic section continues, but is expected to end around midnight. Afternoon revision: Forecast was updated for some very bad weather (>30 knot winds) over the weekend, so we've dropped the last two hydrographic stations and released WB6 at 17:07 GMT (13:07 local) this afternoon. We'll continue with tomorrow's schedule today, hopefully finishing the second caldip (cast 37) in the wee hours of Thursday morning. Thursday we'll be at WB5 and possibly compress the two day recover-deploy from Friday-Saturday into all day Thursday, and continue west, away from the weather.

WB6 was successfully recovered. We used the ship's landtec winch to pull in the recovery line, and then switched to a block on the crane, which was also secured using two handlines to cleats. Recovery took 2.5 hours from time of first ranging to deck secure. The 5th caldip was set up (CTD cast 36) with pre-cal microcats for WB6 replacement, and some additional deep microcats for WB4.

The weather system is now being monitored as invest 91L.

WB6 was deployed, with a conservative setup distance of 0.5 nm at 01:37 GMT (21:37 local). We dropped the anchor at 01:56 GMT about 200 m off the target.

Thursday, 21st April 2011

We arrived at site E (WB5) around 10:00, and started mooring recovery just after lunch. The mooring was successfully recovered, followed by the lander surfacing after dinner. After cleaning the deck, the replacement lander was deployed. It was a late night. PIES telemetry continued until the early hours of the morning.

Friday, 22nd April 2011
WB5 replacement was deployed after breakfast, starting around 09:30, with triangulation finishing around 3pm. We left for WB4. The lander frame for WB4L was built in the afternoon, and winch and reeler set up for WB4 recovery tomorrow.

Saturday, 23rd April 2011
We arrive at WB4 site at 10:30, check winds and currents then move off by 0.5 nm to release it. Discussed with the bridge that we'd go to the site, and check the currents and wind speed, then move off by 0.5 nm for the release. We released the mooring around 11:15 local, then started pickup shortly after. However, due to the way the mooring was laying, we steamed for 50+ min before hauling. There was also some nearby traffic that was not responding to the bridge when they called. Mooring recovery was completed at 16:30 local, and the lander deployed before 18:00. A caldip of the WB5 microcats is scheduled for 20:00. The PIES deployment was delayed until tomorrow.

Sunday, 24th April 2011: Easter Sunday
We fired WB4L5 at 06:00 local, with a setup distance of 0.3 nm away. The lander surfaced at 07:13 local, behind us off the starboard side. After some maneuvering, it was all onboard at 07:55 local. After breakfast (08:15-11:30 local) we built the 8 strings of 5 rugby ball floats. It took over 3 hours for 5-7 people working continuously (except for a short tea break) to assemble them all. After lunch, preparation continues for WB4, with moving anchors and syntactic foam floats. Mooring deployment started with the first float in the water at 12:55 local. We were running against a current of 0.4-0.5 kts, so in the first 1 hr 10 min and 1200 m out, we only made 0.4 nm overground. After 3 hours of towing, the mooring was deployed at 18:30, followed by a triangulation of both WB4 and WB4L. It was discovered that the lander had moved more from its anchor drop than WB4 (0.23 nm for the lander, vs 0.17 nm for the tall mooring), suggesting that it is necessary to triangulate its position every time. CTD cast 39 proceeded overnight to caldip the microcats from WB4 recovery.

Monday, 25th April 2011
The RSMAS group recovered WB3 then WB3L, then redeployed WB3L. The weather has turned wet, with gray clouds everywhere, and raincoats for all the people working on deck. Overnight, PIES C was deployed, and a calibration cast done for the PIES.

Tuesday, 26th April 2011
Mooring deployment of WB3L started after breakfast. Weather is brighter today than yesterday, and dry, but not as sunny as it has been. After checking the sites for past deployments of WBH2, WB2 and WB1, sites were chosen for their redeployment. In particular, the site used for WBH2 on the Oceanus 459 spring 2010 cruise was some distance away from the target site, since the mooring was deployed before it was recovered. We will be using the previous deployment site (from RB0901) for WBH2, which is 26°29.08'N, 76°37.45'W. The site chosen for WB2 is in the middle of the past WB2 sites, at 26°30.8'N, 76°44.65'W. For WB1 it is 26°30'N, 76°49'W. Fallback for

WBH2 was 0.42 nm on RB0901 and 0.47 nm on OC459. Fallback for WB2 was 0.35 nm on RB0901 and 0.24 nm on OC459. Fallback for WB1 was 0.11 nm on RB0901 and 0.06 nm on OC459. In these cases, we'll pass the deployment site by 800 m (0.43 nm) for WBH2, 500 m (0.27 nm) for WB2 and 150 m (0.08 nm) for WB1.

WB3 deployment finished at 12:45. Watching to the bottom, then on to WBH2.

Wednesday, 27th April 2011

We deployed WBH2 after breakfast. Everything went quickly and smoothly. The usual setup distance of 2.5 nm was doubled to 5 nm because we were running with a 0.8 kt current. However, Rob asked for the ship to do 1.8 kt through water, which resulted in a fast time over ground. The mooring anchor was released shortly after 10:30. We planned to survey, but after watching it down, decided to move on to recover WB2 instead. We couldn't hear the releases at first, but it turned out it was because of the strong surface current, which was causing the transducer to lay out alongside the ship rather than hang down. We asked the bridge to drift, and were able to sound and release the mooring. It was on the surface before we had a confirmed ascent rate.

Approach took slightly longer than expected, possibly due to a less experienced driver. However the approach was calm and controlled, which is better than haphazard or rushed. During the approach, a sport-fishing vessel was sited off the starboard bow, heading towards the mooring in the water. The deck officers were finally able to raise it on the radio, and ask them to turn away. Recover from then on was smooth, though several instruments had problems. It appeared as though WB2 was subject to vibration or strumming. One RCM11 had broken bolts. Two microcats had lost their guards, and one microcat was flooded (the last not expected to be related to strumming).

We then triangulated WBH2 and found that it had not fallen back, but instead drifted south—likely with the deep currents—by 0.22 nm from the anchor drop position. The result was that WBH2 is now deployed in deeper water than intended, by about 60 m. We will attempt to allow for an unexpected anchor drift tomorrow, with WB2's deployment.

Thursday, 28th April 2011

We began with deploying WB2. We chose to deploy it upcurrent, downwind, with a 2 nm setup distance. This was assuming a current speed of 1 kt, 1.5 kts through water and 4 hours to work. However, the current was up to 1.5 kts for part of the time, meaning that after the first hour, we'd only made 0.3 nm over ground. Deployment began around 09:00, and ended around 14:00. Even so, the lander WB2L5 was recovered, and WB2L7 deployed before dinner. Triangulation showed that WB2 had only moved 0.17 nm from the anchor drop point, and so was well within the desired target area. In the evening, the microcats from WB2 were caldipped.

Friday, 29th April 2011

The day began with WB0 release after breakfast, and quickly finished around 09:00. WB1 was released just before 10:00, and after a quick approach and grapple, was all onboard by 11:40. It was decided to redeploy WB1 in the afternoon, rather than wait till the following day, and deployment started around 13:00. We had surface currents of nearly 2 kts, so after discussions with the bridge, it was decided to start slightly

upcurrent of the anchor dropsite (by about 0.2 nm) and by steaming upcurrent at 1.5 kts, end up sliding backwards to the drop site. This was quite effective, though relative to other drop positions, the stern of the ship was further along the track than when we are moving ahead over ground.

After surveying the anchor position of WB1, we recovered WBADCP. There was some debate about whether to recover tonight or tomorrow, due to a rainsquall that was about 5 nm off the recovery site. After watching the radar for a few minutes, it was determined that the squall was not moving, and there were 10 kts of wind holding it back. We released the mooring at 17:48, and soon after, lightening and thunder were seen in the squall. The squall moved forward and there was heavy rain on the ship by 18:06, as well as lightening that was a bit close for comfort. All instruments were onboard at 18:10, and people under cover a minute or two later. Pies telemetry continues tonight.

Saturday, 30th April 2011

After breakfast, the US team deployed their WB0, then surveyed until shortly after 11:00. We steamed to the site of WBADCP and deployed after lunch. The lander was deployed shortly after, and moorings work concluded by 14:00. The last caldip began around 16:00 with instruments from WB1. Following the caldip, an ADCP survey of the Antilles current was executed.

7 Mooring Operations

R. McLachan

7.1 Mooring Summary

Tables 7.1 and 7.2 summarise the mooring operations on KN200-4.

Mooring name	NMFD mooring number	Deployment cruise	Deployment date/time	Recovery date/time
WB6_4	2010/01	OC459-1	28/03/2010 15:45	20/04/2011 17:03
WBH2_4	2010/04	OC459-1	01/04/2010 13:42	26/04/2011 18:05
WB2_8	2010/03	OC459-1	31/03/2010 15:20	27/04/2011 16:30
WB1_7	2010/08	OC459-1	03/04/2010 13:18	29/04/2011 13:30
WBADCP_7	2010/06	OC459-1	02/04/2010 01:05	29/04/2011 21:30
WB2L5_5	2009/10	RB0901	30/04/2009 15:00	28/04/2011 17:30
WB4L5_5	2009/11	RB0901	26/04/2009 22:39	04/05/2011 12:00

Table 7.1 *Summary of UK mooring recoveries on KN200-4.*

Mooring name	NMFD mooring number	Latitude N	Longitude E	Depth (m)	Deployment date/time
Wb6_5	2011/17	26.4930	70.5255	5500	21/04/2011 01:56
Wbh2_5	2011/16	26.4768	76.6220	4763	27/04/2011 14:36
WB2_9	2011/14	26.5153	76.7428	*	28/04/2011 17:21
WB1_8	2011/13	26.5032	76.8152	1375	29/04/2011 19:01
WBADCP_8	2011/18	26.5250	76.8680	617	30/04/2011 16:32
WB2L7_7	2011/19	26.5072	76.7425	*	28/04/2011 20:19
WB4L7_7	2011/20	26.4840	75.8103	+	23/04/2011 21:56
WBAL2_2	2011/21	26.5262	76.8759	501	30/04/2011 17:21

Table 7.2 *Summary of UK mooring deployments on KN200-4. * echo sounder not on. + not recorded.*

7.2 Diary of Events

13th April
Mobilisation complete, set sail at 09:00.

14th April
Wound on moorings WB4 and WBH2. Eight releases were got ready for dip cast. Four casts will be carried out for Seabird calibration, four releases on each of the last two, down to 4000 m and 3500 m respectively.
The four releases that went down to 4000 m all worked well, good communication. Four releases down to 3500 m all worked fine with good communication.

15th April
Wound on mooring WB2. Downloaded Seabird calibration data. Prepared instruments.

16th April
Wound on WB11. Got ready WB6 ropes. Assembled WB6 buoyancy packages. Doubled up all of the releases that have been tested.

17th April
Assembled Nortek frames.
Assembled buoyancy packages for WB4L7 and WHB2.

18th April
Started working on RCM11s, new DSUs checked, time updated and erased. Installed in to the RCM11s.

19th April
Installed batteries in to Nortek. Updated mooring diagrams.

20th April
Installed new batteries and tested all Novatech lights and Argos beacons.
Due to the weather it has been decided to cancel the last two CTD casts in order to get mooring recoveries underway, to this end we steamed to WB6 site and started communication with the releases, both releases responded well and serial number 361 was used to release the mooring, the accent rate was calculated as 92 m/min.
Whilst this was on its way up we readied four more releases and 8 Seabirds 37s for cal/test dip. Two BPRs were also prepared for deployment. An Argos beacon; sn Z02-003, ID 53128 and light sn Z02-018 were also got ready for deployment on WB6.
WB6 was recovered without problems, though the two glass spheres at 5300 m had imploded.
The 4 releases and 8 Seabirds were then secured to the CTD frame and the CTD was subsequently deployed.
The releases all responded well to communication, once the echo sounder was turned off.
Six more releases were bench tested and all worked fine, ready for the next CTD deployment.
Two of the releases from the four that were last tested were used on WB6, serial numbers 498 and 324. The releases were assembled in to the tripod and the mooring was then deployed, there was hardly any light on deck, combined with the ship movement due to weather and the limited deck space, this operation was far from ideal.
The deployment also took place at 20:45 in the evening.

21st April
All of the 6 releases communicated well, upon recovery all had fired. These were then assembled in to doublers ready for deployment.
Deck being prepared for Miami WB5 mooring recovery.
WB5 recovered with a few tangles to contend with but otherwise ok. WB5 Lander was then recovered without problem.
We then got a replacement Lander ready and deployed that.

22nd April
Deployment of Miami WB5 mooring.

23rd April

We started by readying the deck for the recovery of WB4, recovery was delayed whist the ship manoeuvred. Recovery was completed without incident. Fish bite was noticed; see photos.
We then deployed WB4L7 and moved the recovered rugby floats up to the next deck.

24th April
Steve and Dave up at 05:30 to fire the release of WB4L5, the rest of us up at 06:15, the Lander was then recovered. We then got things ready for the WB4 deployment, this took quite a while as we had to build the rugby floats and these are difficult to assemble. We are now towing the mooring to the deployment site. Mooring anchor released and the mooring was watched to the sea bed, 190 m/min decent rate.
We then triangulated both WB4 and WB4L7 at the same time as both are near each other. We did this by entering the arm code of both releases at the same time, one into the arm command box and one into the command box, this worked well.

25th April
Tom and Colin up at 06:30 for winch driving for the Miami moorings although the mooring was not released until 07:20. WB3 was then recovered followed by the Lander recovery then a replacement Lander was deployed.
All of the Seabird 37s for WBH2 and WB2 had a complete service, see spreadsheet for details. The Seabird spares boxes were then replenished. Updated mooring diagrams.

26th April
Started deployment of WB3 at 08:00. Arranged labs ready for WBH2 and WB2 recovery. Set up Norteks for WBH2 and WB2.
WB3 deployed, releases watched to bottom, we then steamed to WBH2 site and started communication with the releases, both releases responded well and gave good ranges, serial number 911 was used to release and an accent rate of 80 m/min was recorded. The recovery line was tangled with the 1500 m current meter; a couple more small tangles presented themselves both nothing major.
We then started to break down the recovered glass and re-assemble into buoyancy packages for WB2. We also removed the recovered ropes from the winch and put the drum with WBH2 to deploy in its place.

27th April
Finished preparation for WBH2 deployment, deployment then commenced and all went well, the releases were watched to the bottom.
We then prepared for WB2 recovery. At first we had difficulty establishing communication but the Superducer was trailing fwd. Once this was sorted out the releases both worked fine. The mooring was then recovered with a few tangles to deal with.
We then dismantled the recovered glass and then finished off assembling the glass for WB2 to deploy. We then triangulated WBH2 that was deployed earlier.

28th April
WB2 lower buoy Argos and light will use the recovered ones from the same mooring. Argos for the upper buoy y01-030 46503, light x01-052.

Started at 07:00. Got everything ready for the WB2 deployment, deployment went well, though we had to tow for a while before dropping the anchor. We then watched the releases to the bottom.
We then set up for the recovery of WB2L5, the releases responded well and the mooring was released, recovery commenced.
We then prepared for WB2L7 deployment, this went well. We then steamed to the first triangulation point for both WB2 and WB2L. Triangulation of both moorings was then undertaken.
After this we assembled all of the buoyancy ready for the WB1 deployment.
The CTD frame was then loaded with seabirds ready for the calibration dip.
WB1 to deploy will use Argos sn z02-007 id 53156 and light sn x01-049 on the small buoy.

29th April
Started with the recovery of WB0, this went well. We then repositioned and started the recovery of WB1, this also went well.
We decided to do a quick turn around and redeploy WB1, so we did this and all went well, so well that we had time to recover the ADCP west mooring. There was some confusion on the bridge and we ended up steaming off while the chain and release was still in the water, all was recovered in the end with no harm done.

30th April
The day started with the deployment of WB0, this went well. We then repositioned while we got the ADCP west ready for deployment. This was subsequently deployed without incident.
We then repositioned ready for the WBAL2 deployment whilst getting it ready. The Lander was then deployed without incident.
There will be one final Seabird calibration dip.

End of mooring operation.

8 Instruments

8.1 Summary of Instruments Recovered and Deployed

Table 8.1 gives a summary of the instruments recovered and deployed on cruise KN200-4. Appendix B gives more detailed information on which instruments were recovered from each mooring along with a summary of the length of record obtained. Complete setup details of deployed instruments can be found in Appendix C.

Instrument type	Manufacturer and model	Total intended for recovery	Total recovered	Total lost	Total deployed
CTD	Seabird SBE37 SMP MicroCAT Seabird SBE37 IMP MicroCAT	54 0	54 (2 flooded) 0	0 0	49 5
Single Point Current Meter	Sontek Argonaut MD Aanderaa RCM11 Nortek Aquadopp	2 10 15	2 10 15	0 0 0	0 5 22
Current Profiler	RD Instruments 75 kHz Longranger ADCP	1	1	0	1
BPR	Seabird SBE53 BPR	5	5	0	8

Table 8.1 *Summary of instruments recovered and deployed*

8.2 Instrument Problems

D. Rayner

Seabird MicroCATs

Sn:3229 had a slow conductivity response on the caldip, most likely caused by a faulty pump. This was exactly as seen on OC459 and this instrument had been back to Seabird but obviously wasn't fixed. I think this is because Seabird were not told of the specific problem so performed a standard calibration and service (the Seabird calibrations switch the pump off so the fault was not noticed).

Sn:5246 was under reading pressure by approximately 100 dbar on the pre-deployment caldip so was not deployed. Sn:6819 was over-reading the pressure on the post-deployment caldip. This was as expected as it was seen to over-read on the pre-deployment caldip aboard cruise RB1009, but the fault was not noticed until after the instrument had been deployed.

Sn:6112 needs a new bulkhead connector. The thread is broken due to a likely impact with the guide clamp, which we suspect came off when the mooring was subject to strumming.

Sn:3906 flooded on WB2 at approximately 500 m. This instrument has had a Kistler pressure sensor fitted and went on a pre-deployment caldip on the Oceanus. Strumming

had caused the guide clamp to shake loose and the pins were bent - probably from the impact of the guide, but the cause of flood is unknown.

Sn:3930 flooded on WB1 at approximately 500 m. It was recovered with the end cap blown off but the reason for the flooding is unknown. It too has recently been changed to a Kistler pressure sensor.

Sn:3231 had a bad T response on the post-deployment caldip and needs to be recalibrated. Sn:6118 has a poor conductivity response on the post-deployment caldip and therefore a suspect pump.

Nortek Aquadopps

Sn:5897 had the pressure sensor under-reading on WB4. This was excepted as it was not zeroed before deployment on RB1009 despite being noticed to be under-reading previously. There were however four other Norteks that were not zeroed prior to deployment and therefore are also under-reading pressure. The pressure sensor under-reads by a fixed amount and so offsets of 1575 dbar, 1170 dbar, 1135 dbar and 1090 dbar need to be applied to correct the data for instruments with serial numbers 5897 (from WB4), 6743, 6751 and 6753 (all three from WBH2) respectively. Sn:5963 cannot be corrected as it was deployed at approximately 100 m depth and the offset was evidently greater than this as the record does not deviate from zero for the duration of the deployment. The setup procedures will be modified to ensure that the pressure sensor is zeroed when the instrument is readied for deployment.

Nortek 5963 has a broken pin in the connector. The cap was fouled with a hard calcareous growth which when twisting off the end cap sleeve caused the pin to break. It was downloaded with an end cap from another instrument instead, but this needs fixing.

Sontek Argonaut MDs

There were problems when downloading the Sontek from WB2 (sn D295). At first the instrument would not connect at any baud rate. It eventually connected at 600 baud and I sent the command “userdefaultbaudrate set 115200”. The instrument replied with an “ok” acknowledgement so I changed the software to 115200 to match. The instrument would not connect at this higher baud rate. After much playing around (including using an external power supply instead of the battery) I eventually found that it could hear commands but not reply properly so I reduced the baud rate till communications were reliable. The highest baud rate that could get it to talk "cleanly" was at 2400 but this was still causing problems. If using the recorder button in SonTerm (part of Sonutils) then it would say there was a problem with the recorder and to check that it was installed correctly. This didn't work at any baud. However when trying the ViewArgonaut recorder function at 2400 the recorder showed two files. The main deployment file (WB2001) being 882424 bytes and a second file (WB2002) being 1330 bytes. These files were then at 2400 . The download took place on Paul's old laptop using SontekRecorder v2.61.

Aanderaa RCM11s

Sn:450 frequently didn't record the 8th channel (and sometimes the 7th channel too). The records therefore ended up joined together and had to be manually split during the download process and the missing channel data filled with “0000”. This may cause spikes in the signal strength record.

9 Mooring Instrument Processing

9.1 SBE 37 MicroCAT Processing

E. Frajka-Williams

The standard processing scripts were used for this cruise, based on those used for D359. Raw data and capture files for calibration casts (caldips) are located on hydrosea5 mac mini, in directory `raw/kn200-4/microcat_cal_dip/` (relative to `/Users/hydrosea5/kn200-4/rpdmoc/rapid/data/moor/`) and for moorings, in directory `raw/kn200-4/microcat/`. Stage 1 caldip data is in `proc_calib/kn200_4/cal_dip/microcat/cast[cast number]/` along with the `info.dat` file. Stage 1 and later processing stages for moorings are located in `proc_kn200_4/[mooring name]/`.

Stage 0 – Download

The MicroCAT data were downloaded with Seabird SBE Seaterm software (for SMPs with firmware<3.0d), with Seabird SBE SeatermV2 software (for SMPs with firmware>=3.0d) and with Darren's IMPDownload routine (for IMPs). For instruments recovered from moorings, the standard filenames were `XXXX_data.asc` (or `.cnv` and `.xml` for the version 3.0 firmware microcats) and `XXXX_recover.cap` where `XXXX` is the serial number. For instruments recovered from caldips, it was `XXXX_cal_dip_data.asc` and `caldip_XXXX.cap` for calibration dip files.

Stage 1 – Conversion from .asc to the RDB format .raw

The file used for processing mooring data was `mc_call_2_kn200.m` (copied from `mc_call_2_d359.m`), and that for processing calibration dips was `mc_call_caldip_kn200.m` (copied from `mc_call_caldip_d359.m`). For calibration dips, a function called `parse_cnv.m` was created to process the SBE911 CTD data in `.cnv` format to `.mat` format with appropriate filenames, and CTD data were located in `/Users/hydrosea5/kn200-4/ctd/` . This function is located in directory `exec/kn200_4/calibration/` .

Stage 2 – Trimming of Data Record

The script used was `microcat_raw2use_003.m` with no cruise name appended. The script is modified with the addition of mooring names, data directories, and plot interval, but the start and end dates used are read in from the `info.dat` files.

CTD Calibration Casts

To estimate any trend in conductivity, temperature and pressure reported by the SBE37 MicroCATs during their year-long deployment (for example due to biofouling or sensor drift), each instrument is lowered on the CTD package to provide pre or post deployment

calibrations. Up to 24 SBE37 CTDs are clamped to straps on the CTD frame and secured by plastic cable ties. The sampling rate is set to a period of 10 s, which is the fastest available. For pre deployment instruments the sample number is set to zero, for post deployment instruments the sample number is one more than the last sample number from the year-long deployment. The lowered CTD is a Seabird 9/11 with recently calibrated CTP sensors with the C being adjusted to absolute values of conductivity by reference to seawater samples drawn and analysed against standard sea water.

The CTD is lowered to a minimum depth of 3500 m into where the ocean temperature and salinity distribution is stable. The maximum depth of the cast is then chosen to be the depth at which the deepest MicroCAT was deployed on a mooring. This maximum depth requirement is important for providing accurate pressure calibrations, but is not critical for temperature or conductivity. During the upcast the CTD is stopped for five minute bottle stops at several depths, providing stable comparisons between CTD and MicroCATs. CTD bottle samples are also obtained at these depths. On this cruise there were 12 Niskin bottles, so 12 five minute comparisons between CTD and MicroCAT are available.

On recovery, MicroCATs are downloaded in the usual way. Microcat data are then processed together using `mc_call_caldip_kn200.m`. This now reads a CTD 1 hz file in `.cnv` format which was provided by the NOAA group, Rigoberto. Particularly for pre-deployment instruments, comparisons between the CTD and MicroCATs at bottle stops are inspected for anomalies in the MicroCAT records. Examples are lagged conductivities due to pump problems or bad pressures. These instruments are withheld from deployment. More serious calibration work to adjust mooring MicroCAT data is a post cruise activity

9.2 Current Meter Processing

D. Rayner

Current meter data were simply processed with the available scripts. Stage 0 is downloading the data from the instruments, converting it to a Matlab-readable format, and transferring it to the computer system. Files for Anderaa RCM11 current meters are found in `rcm/` or `rcm11/` directories; those for Nortek Aquadopp current meters are found in `nor/` or `nortek/`; those for Sontek Argonaut current meters are found in `argonaut/` or `arg/` or `argocat/`. The files used are listed below for each stage with any noteworthy comments.

RCM11	
Stage 1	`rcm2rodb_05.m` This script requires a version of Matlab with the "brush" function to correct conductivity wrapping.
Stage 2	`rcm11raw2use.m`
Nortek	
Stage 1	`nortek2rodb_01.m`
Stage 2	`nortek_raw2use_01.m`
Sontek	
Stage 1	`argocat2rodb_004.m.` Has been updated to fix a bug where the data format changed slightly for files produced in ViewArgonaut version 3.71. New format has 2 fewer columns in it (CellBegin and CellEnd are missing).
Stage 2	`argocat_raw2use_003.m`

The Longranger ADCP data were downloaded from the instrument into a binary format using RDI software. The data are then passed on to our American colleagues for post processing.

9.3 Seabird SBE26 or SBE53 BPR Processing

E. Frajka-Williams

The standard processing scripts were used for this cruise, based on those used for D359. Raw data and capture files are located on hydrosea5 in directory `raw/kn200-4/seagauge/` (relative to `/Users/hydrosea5/kn200-4/rpdmoc/rapid/data/moor/`) while later processing stages are located in `proc/[mooring_name]/`.

Stage 0

Data are downloaded with Seabird SBE Seaterm and transferred to the processing computer, and any comments are recorded in written logs.

Stage 1

This step is performed with `seagauge2rdb_003.m`, which is essentially unmodified from previous cruises. No clock offsets were needed, hence the file `raw/kn200-4/clock_offset.dat` does not exist. These offsets typically come from incorrect dates entered during initial setup or while downloading from the instrument, rather than clock drift (see stage 2).

Stage 2

The filename `seagauge_raw2use_kn200.m` was used, which was originally called `seagauge_processing_002.m` a few cruises ago. Clock offsets at the end for the cast are treated as linear drifts and are recorded in `raw/kn200-4/seagauge/bpr_clock_offset.dat`.

Appendix A – Details of Instruments Lowered on CTD Calibration Casts

Pressure offsets greater than 15 dbar during a calibration cast are noted. Timing off indicates that the microcat clock does not match the CTD clock.

Cruise Cast Number	Team	s/n	Notes
	US	3164	
	US	3166	
	US	3168	
	US	3861	
	US	3865	
	US	4624	
	US	5871	
	US	5872	
	US	5873	
	US	5874	
6	US	5875	
	US	3868	Timing off
	UK	3483	
	UK	3486	
	UK	4714	Timing off
	UK	3248	
	UK	3249	
	UK	3251	
	UK	3252	
	UK	3253	
	UK	3257	
	UK	3216	Large pressure offset
7	US	3150	
	US	3154	
	US	3155	
	US	3162	
	US	3866	
	US	3867	
	US	3869	
	US	3870	
	US	3871	
	US	3872	
	US	4619	
	US	4621	
	US	5878	
	US	5881	
	UK	3259	
	UK	3264	
	UK	3268	
	UK	3220	

	UK	3900	
	UK	3901	
	UK	3903	
	UK	4066	
8	UK	5242	Large pressure offset
	UK	5765	Large pressure offset
	UK	6839	Large pressure offset
	UK	3229	Slow conductivity response
	UK	3284	
	UK	3484	
	UK	5788	
	UK	3904	
	UK	3910	Timing off
	UK	4461	
	UK	3916	
	UK	4464	Timing off
	UK	6823	
9	UK	7681	
	UK	6841	
	UK	6838	
	UK	6837	
	UK	6834	
	UK	6833	
	UK	6832	
	UK	6831	Large pressure offset
	UK	6829	
	UK	6817	
	UK	6818	
36	UK	3247	
	UK	5246	Large pressure offset - 110 dbar
	UK	6820	
	UK	6821	
	UK	6822	
	UK	3209	
	UK	6816	Large pressure offset
	UK	6840	
37	UK	3207	Large pressure offset
	UK	5238	
	UK	3212	
	UK	3213	Large pressure offset
	UK	3214	
39	UK	3206	
	UK	3215	
	UK	6819	Large pressure offset - 230 dbar
	UK	3219	
	UK	3221	
	UK	6798	
	UK	6799	Slow conductivity response
	UK	6800	
	UK	6801	

	UK	6802	
	UK	3222	
	UK	3234	
	UK	3224	
	UK	3913	
	UK	3225	

Table A.1 *Details of instruments lowered on CTD calibration casts.*

Appendix B – Instrument Record Lengths

Mooring name	Type	s/n	Approx depth	Date of first useable record [YYYY MM DD HH]	Date of last useable record [YYYY MM DD HH]
WB6	SBE	3207	5100	2010 03 28 17.00028	2011 04 20 17.00028
	SBE	5238	5200	2010 03 28 17.00028	2011 04 20 17.00056
	SBE	3212	5300	2010 03 28 17.0028	2011 04 20 17.00056
	Sontek	D273	5400	2010 03 28 17:00:00	2011 04 20 16:30:00
	SBE	3213	5400	2010 03 28 17.00028	2011 04 20 17.00028
	SBE	3214	5495	2010 03 28 17.00028	2011 04 20 17.00056
	BPR	418	5500	2010 03 28 17.00000	2011 04 20 16.50000
	BPR	32	5500	2010 03 28 17.00000	2011 04 20 16.50000
WB4	SBE	3206	50	2010 12 01 0.50028	2011 04 23 15.00028
	Nortek	5879	100	2010 11 30 23.50000	2011 04 23 15.00000
	SBE	3215	100	2010 12 01 0.50028	2011 04 23 15.00028
	SBE	6819	250	2010 12 01 1.00028	2011 04 23 15.00028
	Nortek	5884	400	2010 11 30 23.50000	2011 04 23 15.00000
	SBE	3219	400	2010 12 01 0.50028	2011 04 23 15.00028
	SBE	3221	600	2010 12 01 0.50028	2011 04 23 15.00028
	Nortek	5889	800	2010 11 30 23.50000	2011 04 23 15.00000
	SBE	3222	800	2010 12 01 0.50000	2011 04 23 15.0000
	SBE	3224	1000	2010 12 01 0.50028	2011 04 23 15.0000
	Nortek	5890	1200	2010 11 30 23.50000	2011 04 23 15.00000
	SBE	3225	1200	2010 12 01 0.50056	2011 04 23 15.00056
	Nortek	6132	1600	2010 11 30 23.50000	2011 04 23 15.00000
	SBE	3234	1600	2010 12 01 0.50028	2011 04 23 15.00028
	Nortek	5897[$]	2000	2010 11 30 23.50000	2011 04 23 15.00000
	SBE	3913	2000	2010 12 01 0.50028	2011 04 23 15.00028
	SBE	6798	2500	2010 12 01 0.50028	2011 04 23 15.00028
	Nortek	5967	3000	2010 11 30 23.50000	2011 04 23 15.00000
	SBE	6799	3000	2010 12 01 0.50028	2011 04 23 15.00028
	SBE	6800	3500	2010 12 01 0.50028	2011 04 23 15.00028
	Nortek	6119	4000	2010 11 30 23.50000	2011 04 23 15.00000
	SBE	6801	4000	2010 11 30 23.50028	2011 04 23 15.00028
	SBE	6802	4500	2010 11 11 23.50028	2011 04 23 15.00028
	Nortek	6765	4629	2010 11 30 23.50000	2011 04 23 15.00000
WB4L	BPR	33	4715	2009 04 26 23.50000	2011 04 24 9.50000
WBH2	Nortek	6176	1500	2010 04 01 17.00000	2011 04 26 18.00000
	Nortek	6743[%]	2200	2010 04 01 17.00000	2011 04 26 18.00000
	Nortek	6747	3000	2010 04 01 17.00000	2011 04 26 18.00000
	Nortek	6751[£]	3800	2010 04 01 17.00000	2011 04 26 18.00000
	SBE	3258	3800	2010 04 01 17.00028	2011 04 26 18.00028
	SBE	5245	4300	2010 04 01 17.00028	2011 04 26 18.00000
	Nortek	6753[@]	4700	2010 04 01 17.00000	2011 04 26 18.00000
	SBE	3905	4780	2010 04 01 17.00028	2011 04 26 18.00028
WB2	SBE	3223	50	2010 03 31 21:30:01	2011 04 27 16:30:01
	RCM11	305	100	2010 03 31 21.50000	2011 04 27 16.36667

	SBE	5239	100	2010 03 31 21:30:01	2011 04 27 16:30:02
	RCM11	306	175	2010 03 31 21.50000	2011 04 27 16.46667
	SBE	3228	175	2010 03 31 21:30:00	2011 04 27 16:30:00
	SBE	5243	325	2010 03 31 21:30:01	2011 04 27 16:30:02
	RCM11	445	400	2010 03 31 21.50000	2011 04 27 16.35000
	SBE	3906	500	Bent end cap - flooded	
	SBE	5244	700	2010 03 31 21:30:01	2011 04 27 16:30:02
	RCM11	448	800	2010 03 31 21.50000	2011 04 27 16.41667
	SBE	3230	900	2010 03 31 21:30:01	2011 04 27 16:30:01
	SBE	6113	1100	2010 03 31 21:30:01	2011 04 27 16:30:01
	RCM11	449	1200	2010 03 31 21.50000	2011 04 27 16.45000
	SBE	3231	1300	2010 03 31 21:30:01	2011 04 27 16:30:02
	SBE	6114	1500	2010 03 31 21:30:01	2011 04 27 16:30:01
	Sontek	D295	1500	2010 03 31 21:30:00	2011 04 27 16:30:00
	SBE	3232	1700	2010 03 31 21:30:01	2011 04 27 16:30:00
	SBE	5247	1900	2010 03 31 21:30:02	2011 04 27 16:30:03
	RCM11	450	2050	2010 03 31 21.50000	2011 04 27 16.40000
	SBE	3233	2300	2010 03 31 21.50028	2011 04 27 16.50056
	SBE	6112	2800	2010 03 31 21.50028	2011 04 27 16.50028
	RCM11	451	3000	2010 03 31 21.50000	2011 04 27 16.48333
	SBE	3244	3300	2010 03 31 21:30:01	2011 04 27 16:30:02
	SBE	3907	3850	2010 03 31 21:30:01	2011 04 27 16:30:01
WB2L	BPR	34	3890	2009 04 30 15:00:00	2011 04 28 17:30:00
	BPR	36	3890	2009 04 30 15:00:00	2011 04 28 17:30:00
	SBE	5764	50	2010 04 03 17:30:02	2011 04 29 13:30:02
	Nortek	5963*	100	2010 04 03 17.50000	2011 04 29 14.00000
	SBE	6115	100	2010 04 03 17:30:01	2011 04 29 13:30:01
	SBE	3919	175	2010 04 03 17:30:01	2011 04 29 14:00:02
	SBE	6116	250	2010 04 03 17:30:01	2011 04 29 13:30:01
	SBE	3928	325	2010 04 03 17:30:01	2011 04 29 13:30:02
	RCM11	301	400	2010 04 03 17.50000	2011 04 29 13.93333
	SBE	6117	400	2010 04 03 17:30:01	2011 04 29 13:30:01
	SBE	3930	500	Missing end cap - flooded	
WB1	SBE	6118	600	2010 04 03 17:30:01	2011 04 29 13:30:01
	SBE	3931	700	2010 04 03 17:30:01	2011 04 29 13:30:02
	RCM11	302	800	2010 04 03 17.50000	2011 04 29 13.95000
	SBE	6119	800	2010 04 03 17.50028	2011 04 29 14.00028
	SBE	3932	900	2010 04 03 17.50028	2011 04 29 14.00028
	SBE	6120	1000	2010 04 03 17.00028	2011 04 29 13.50028
	SBE	6324	1100	2010 04 03 17.00028	2011 04 29 13.50028
	RCM11	303	1200	2010 04 03 17.50000	2011 04 29 13.98333
	SBE	6321	1200	2010 04 03 17:30:01	2011 04 29 13:30:01
	SBE	7723	1350	2010 04 03 17:30:01	2011 04 29 13:30:01
WBADCP	75 kHz ADCP	10311	600	2010 04 02 23.50000	2011 04 29 21.50000

Table B.1 *Record of the instrument record lengths recovered during KN200-4. 4 (* indicates no valid pressure data. $ indicates pressure offset of approx 1575 dbar. % indicates pressure offset of approx 1170 dbar. £ indicated pressure offset of approx 1135 dbar. @ indicates pressure offset of approx 1090 dbar.)*

Appendix C – Instrument Setup Details

WBADCP

RDI Longranger	75 kHz Workhorse ADCP s/n:	**10311**
	System frequency:	76.8 kHz
	Beam angle:	20 degrees
	Water salinity:	35
	Depth of transducer:	600 m
	Heading alignment:	0
	Heading bias:	0
	Depth cell size:	1600 cm
	Number of depth cells:	40
	Blank after transmit:	0704
	Pings per ensemble:	00010
	Ambiguity velocity:	175 cm/s radial
	Time per ensemble:	00:30:00
	Start date:	30/4/11 15:00

WBAL2

SBE53 BPR	s/n, Start time:	**0039**, 30/4/11 14:00 **0417**, 30/4/11 14:00
	Header:	wbal2_deployed2011_kn200-4
	Tide interval:	30 min
	Tide measurements duration:	30 min
	Frequency of reference measurement:	Every 96 samples
	Nominal depth:	500 m

WB1

SBE37 MicroCAT SMP CTD	s/n (nominal depth), Start time:	**3284** (50 m), 29/4/11 17:00 **3264** (105 m), 29/4/11 17:00 **3257** (175 m), 29/4/11 17:00 **7681** (255 m), 29/4/11 17:00 **6841** (325 m), 29/4/11 17:00 **6816** (405 m), 29/4/11 17:00 **6838** (500 m), 29/4/11 18:00 **6837** (600 m), 29/4/11 18:00 **6834** (700 m), 29/4/11 17:00 **6833** (805 m), 29/4/11 17:00 **6832** (900 m), 29/4/11 17:00 **6831** (1000 m), 29/4/11 17:00 **6829** (1100 m), 29/4/11 17:00 **6817** (1205 m), 29/4/11 17:00 **6818** (1350 m), 29/4/11 17:00

	Sample interval:	1800 s
Nortek Aquadopp CM	s/n (nominal depth), Start time:	**5831** (100 m), 26/4/11 22:30 **5896** (400 m), 26/4/11 22:30 **6765** (800 m), 29/4/11 14:00 **5899** (1200 m), 26/4/11 22:30
	Deployment name:	5896=wb1_a 5899=wb1_b 5831=wb1_c 6765=wb1_d
	Sampling interval:	1800 s
	Averaging interval:	30 s
	Blanking distance:	1.5 m
	Compass update rate:	10 s
	Speed of sound:	Fixed
	Salinity:	35.0
	Diagnostic interval:	720 min
	No. diagnostic samples:	20

WB2

SBE37 MicroCAT SMP CTD	s/n (nominal depth), Start time:	**3220** (50 m), 28/4/11 12:00 **5242** (105 m), 28/4/11 12:00 **5765** (180 m), 28/4/11 12:30 **3903** (325 m), 28/4/11 12:00 **3904** (500 m), 28/4/11 12:00 **3910** (700 m), 28/4/11 12:00 **3916** (1300 m), 28/4/11 12:00 **3216** (1500 m), 28/4/11 12:30 **6823** (1700 m), 28/4/11 12:00 **3900** (1900 m), 28/4/11 12:00 **3901** (2300 m), 28/4/11 12:00 **6939** (2800 m), 28/4/11 12:00 **6798** (3300 m), 28/4/11 12:00 **3247** (3850 m), 28/4/11 12:00
SBE37 MicroCAT IMP CTD	s/n (nominal depth), Start time:	**4066** (900 m), 28/4/11 12:00 **4461** (1100 m), 28/4/11 12:00
SBE37 MicroCAT IM CTD	s/n (nominal depth), Start time:	**4619** (105 m), 28/4/11 12:00 (This is a RSMAS loan unit – without a pump)
	Sample interval for all CTDs:	1800 s
Nortek Aquadopp CM	s/n (nominal depth), Start time:	**9204** (100 m), 26/4/11 22:30 **9210** (175 m), 26/4/11 23:00 **9213** (400 m), 26/4/11 23:00 **5893** (1500 m), 26/4/11 23:00
	Deployment name:	9204=wb2_a 9210=wb2_b

		9213=wb2_c 5893=wb2_d
	Sampling interval:	1800 s
	Averaging interval:	30 s
	Blanking distance:	1.5 m
	Compass update rate:	10 s
	Speed of sound:	Fixed
	Salinity:	35.0
	Diagnostic interval:	720 min
	No. diagnostic samples:	20
Aanderaa RCM11 CM	s/n (nominal depth), Start time:	**428** (800 m), 28/4/11 12:00 **518** (1200 m), 28/4/11 12:00 **519** (2050 m), 28/4/11 12:00 **520** (3000 m), 28/4/11 12:00
	Recording interval:	30 mins
	No. of channels:	8
	Mode:	Burst
	Temperature range: *NB: these were not recorded properly and will need to be checked when recovered*	428 = unknown 518 = unknown 519 = unknown 520 = unknown
	Conductivity range: *NB. These have not been confirmed and may be incorrect – again check on recovery*	428 = 36-40 mS/cm 518 = 32-35 mS/cm 519 = 32-34 mS/cm 520 = 32-34 mS/cm

WB2L7

SBE53 BPR	s/n, Start time:	**0055**, 27/4/11 13:00 **0056**, 27/4/11 13:00
	Header:	wb2l_deployed_kn200-4
	Tide interval:	30 min
	Tide measurements duration:	30 min
	Frequency of reference measurement:	Every 96 samples
	Nominal depth:	3890

WBH2

SBE37 MicroCAT SMP CTD	s/n (nominal depth), Start time:	**3214** (3805 m), 27/4/11 12:30 **3213** (4300 m), 27/4/11 12:30 **3212** (4780 m), 27/4/11 12:30
	Sample interval:	1800 s
Nortek	s/n (nominal depth), Start	**6723** (1500 m), 26/4/11 22:30

Aquadopp CM	time:	**6083** (2200 m), 26/4/11 22:30 **6805** (3000 m), 26/4/11 22:30 **8052** (3800 m), 26/4/11 22:30 **8120** (4700 m), 26/4/11 22:30
	Deployment name:	6723=wbh2_a 6083=wbh2_b 6805=wbh2_c 8052=wbh2_d 8120=wbh2_e
	Sampling interval:	1800 s
	Averaging interval:	30 s
	Blanking distance:	1.5 m
	Compass update rate:	10 s
	Speed of sound:	Fixed
	Salinity:	35.0
	Diagnostic interval:	720 min
	No. diagnostic samples:	20

WB4

SBE37 MicroCAT SMP CTD	s/n (nominal depth), Start time:	**3483** (105 m), 24/4/11 12:00 **3486** (250 m), 24/4/11 12:00 **4714** (405 m), 24/4/11 12:00 **3248** (600 m), 24/4/11 12:00 **3249** (805 m), 24/4/11 12:00 **3251** (1000 m), 24/4/11 12:00 **3252** (1205 m), 24/4/11 12:00 **3253** (1600 m), 24/4/11 12:00 **5788** (2005 m), 24/4/11 12:00 **3259** (2505 m), 24/4/11 12:00 **3484** (3005 m), 24/4/11 12:00 **3268** (3505 m), 24/4/11 12:00 **5238** (4005 m), 24/4/11 12:00 **3207** (4500 m), 24/4/11 12:00
SBE37 MicroCAT IMP CTD	s/n (nominal depth), Start time	**4464** (50 m), 24/4/11 12:00
	Sample interval for all CTDs:	1800 s
Nortek Aquadopp CM	s/n (nominal depth), Start time:	**5490** (100 m), 24/4/11 13:30 **5590** (400 m), 24/4/11 13:30 **5611** (800 m), 24/4/11 13:00 **5955** (1200 m), 24/4/11 13:30 **6049** (1600 m), 24/4/11 13:30 **6050** (2000 m), 24/4/11 13:30 **6088** (3000 m), 24/4/11 13:30 **6516** (4000 m), 24/4/11 13:30 **6534** (4630 m), 24/4/11 13:30
	Deployment name:	5490=wb4_a

		5590=wb4_b 5611=wb4_c 5955=wb4_f 6049=wb4_h 6050=wb4_j 6088=wb4_e 6516=wb4_d 6534=wb4_g
	Sampling interval:	1800 s
	Averaging interval:	30 s
	Blanking distance:	1.5 m
	Compass update rate:	10 s
	Speed of sound:	Fixed
	Salinity:	35.0
	Diagnostic interval:	720 min
	No. diagnostic samples:	20

WB4L7

SBE53 BPR	s/n, Start time:	**0057**, 23/4/11 14:00 **0014**, 23/4/11 14:30
	Header:	wb4l_deployed_2011
	Tide interval:	30 min
	Tide measurements duration:	30 min
	Frequency of reference measurement:	Every 96 samples
	Nominal depth:	4745 m

WB6

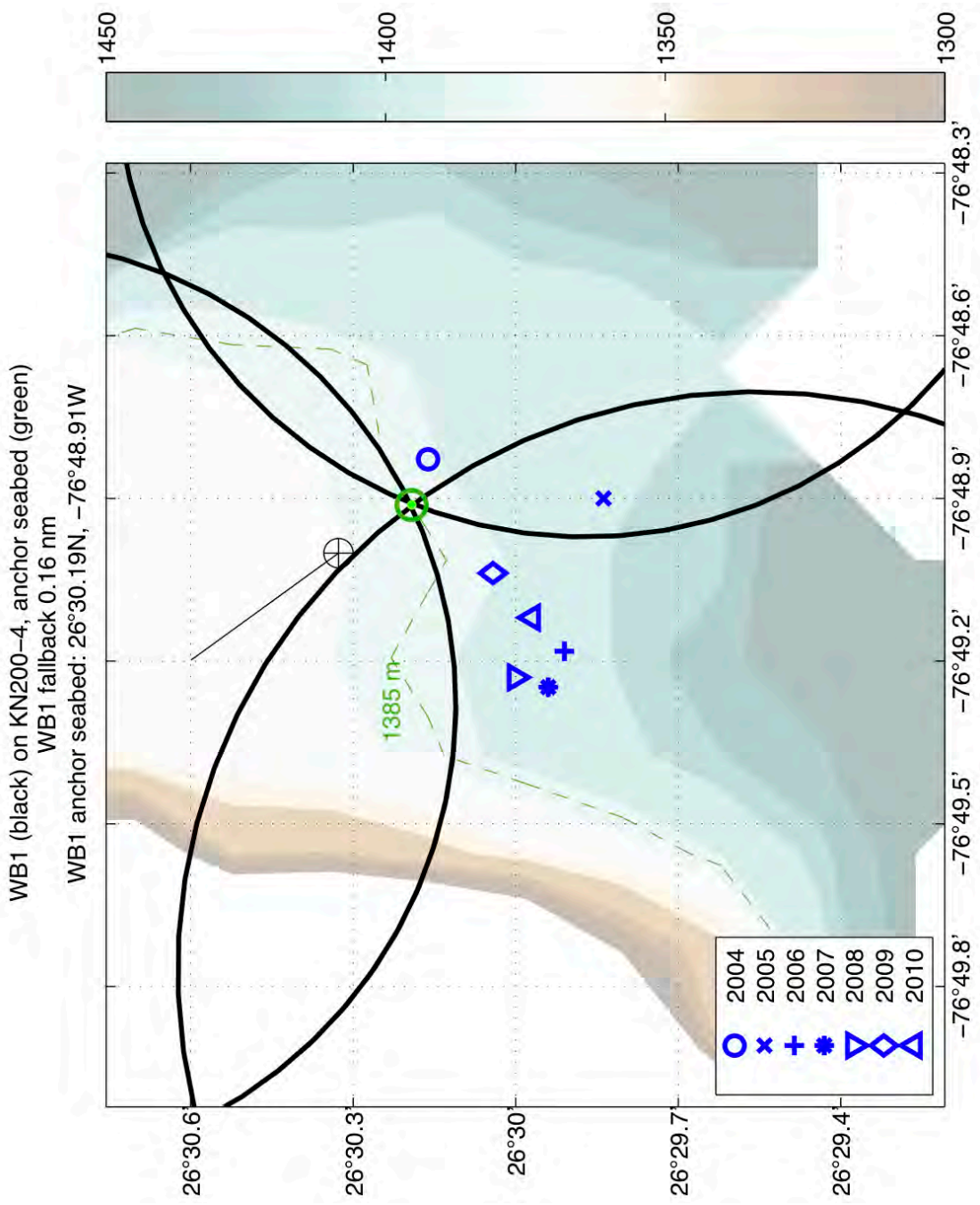
SBE37 MicroCAT SMP CTD	s/n (nominal depth), Start time:	**3209** (5100 m), 21/4/11 01:30 **6840** (5200 m), 21/4/11 01:30 **6820** (5300 m), 21/4/11 01:30 **6821** (5400 m), 21/4/11 01:30 **6822** (5491 m), 21/4/11 01:30
	Sample interval:	1800 s
	Start:	

SBE53 BPR	s/n, Start time:	**0059**, 20/4/11 23:30 **0053**, 20/4/11 23:30
	Header:	wb6_deployed_2011_kn200-4
	Tide interval:	30 min
	Tide measurements duration:	30 min
	Frequency of reference:	Every 96 samples

	measurement:	
	Nominal depth:	4745 m
Aanderaa RCM11 CM	s/n (nominal depth), Start time:	**515** (5400 m), 20/4/11 20:30
	Recording interval:	30 mins
	No. of channels:	8
	Mode:	Burst
	Temperature range:	Arctic
	Conductivity range:	32-34 mS/cm

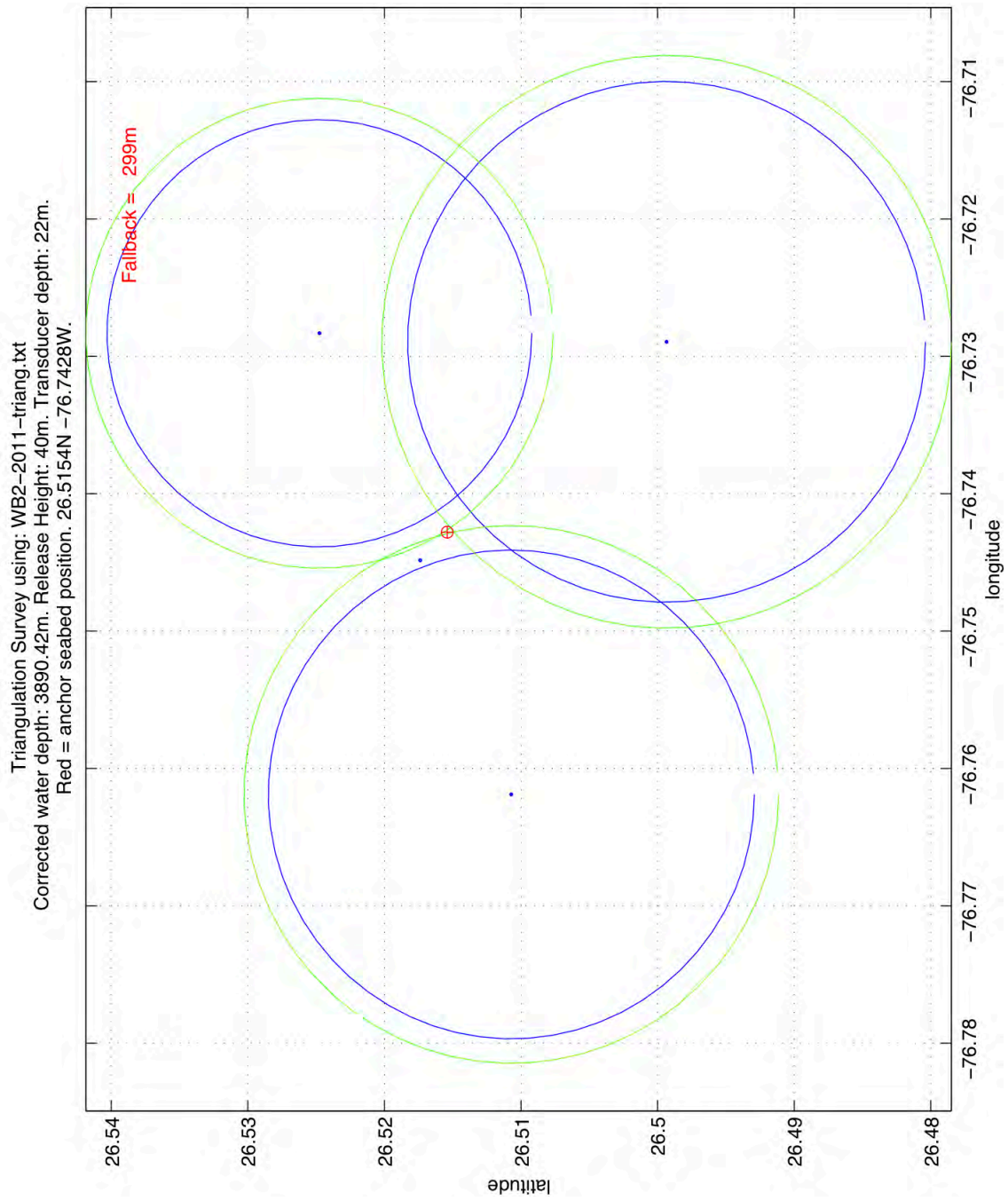
Appendix D – Deployment Tracks and Triangulation Surveys

WB1 triangulation, approach and final position

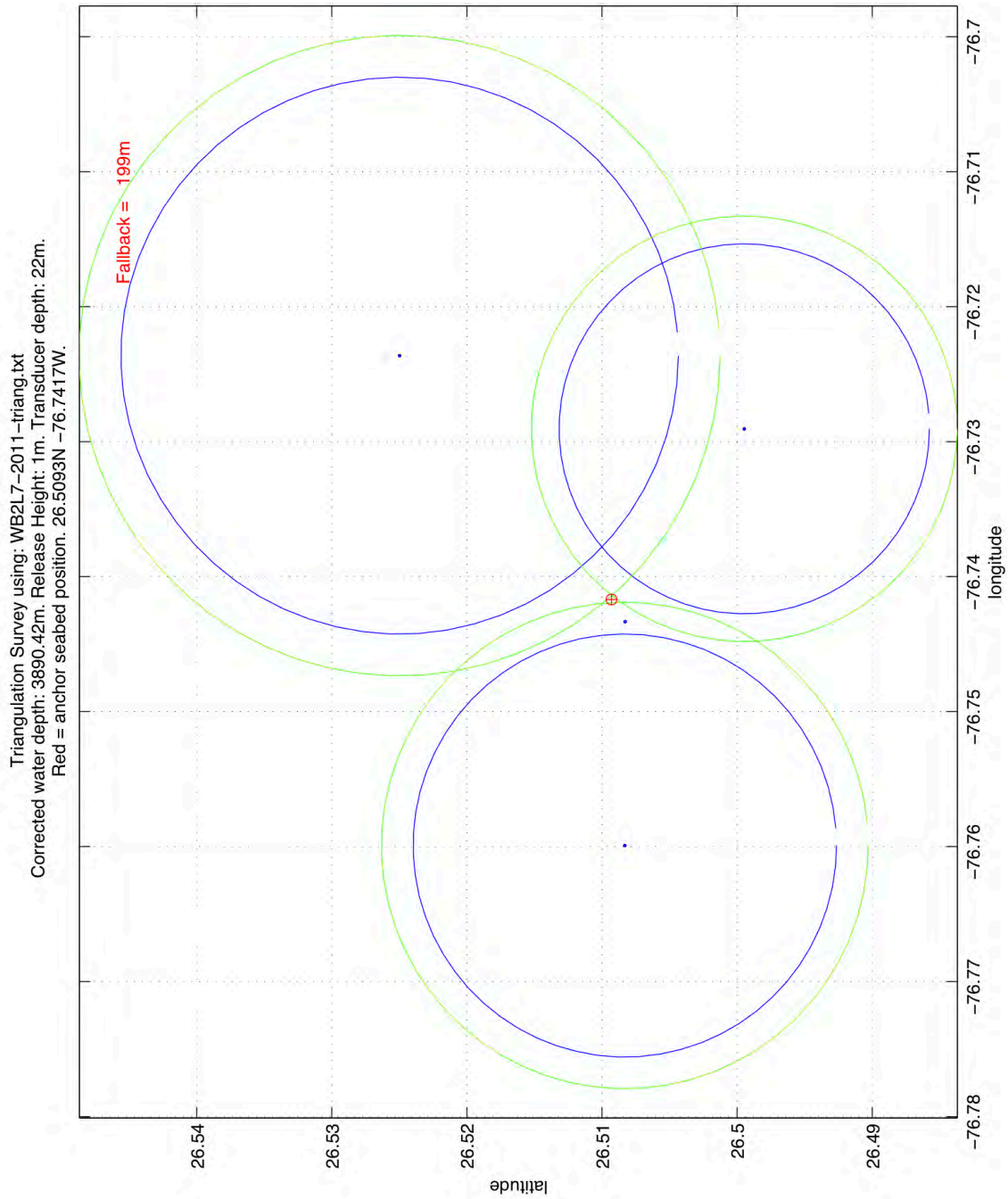


Note: WB1 was approached backwards, as in, the stern was leading along the short black line as the ship steamed slowly into a strong current.

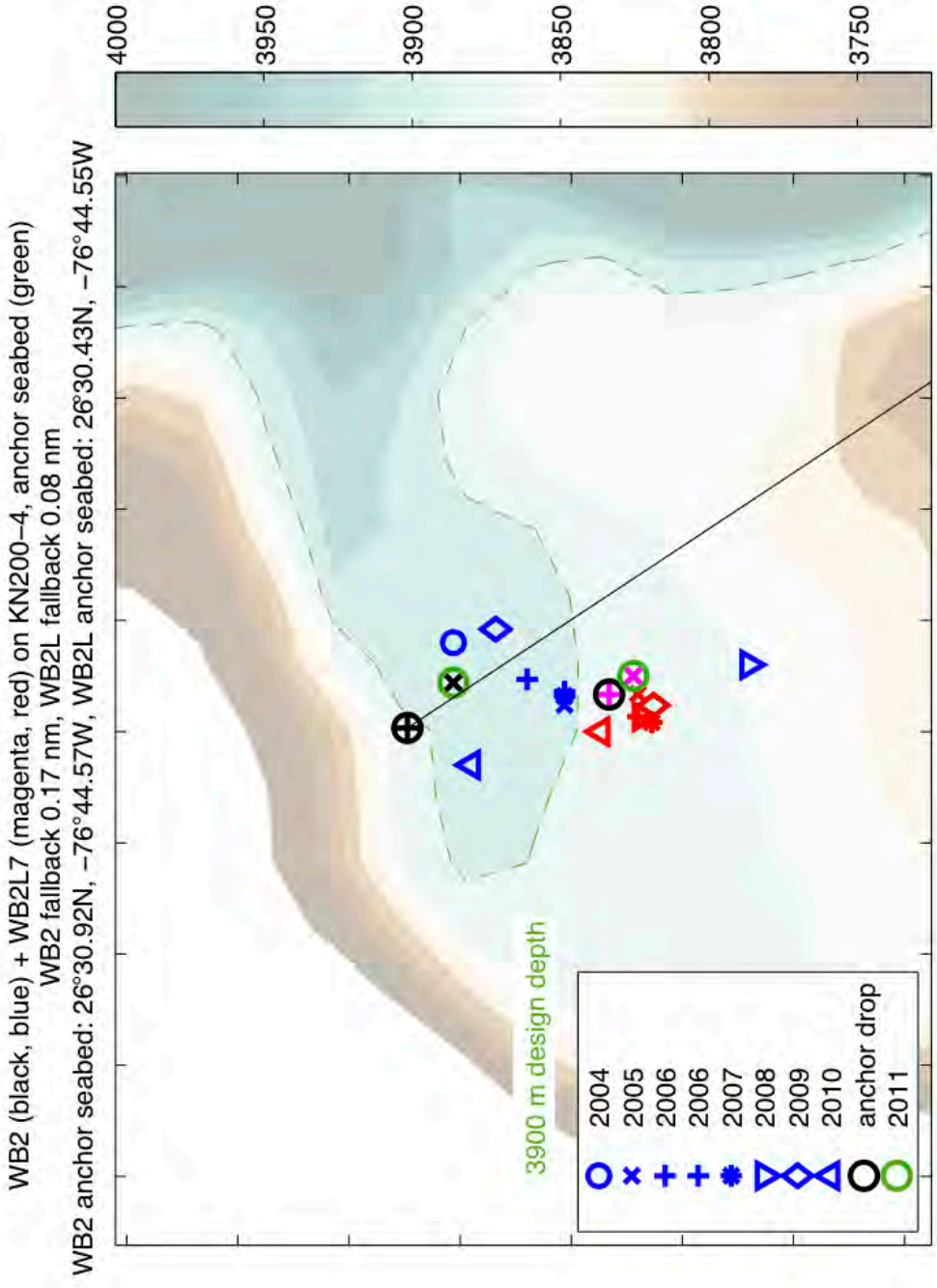
WB2 triangulation



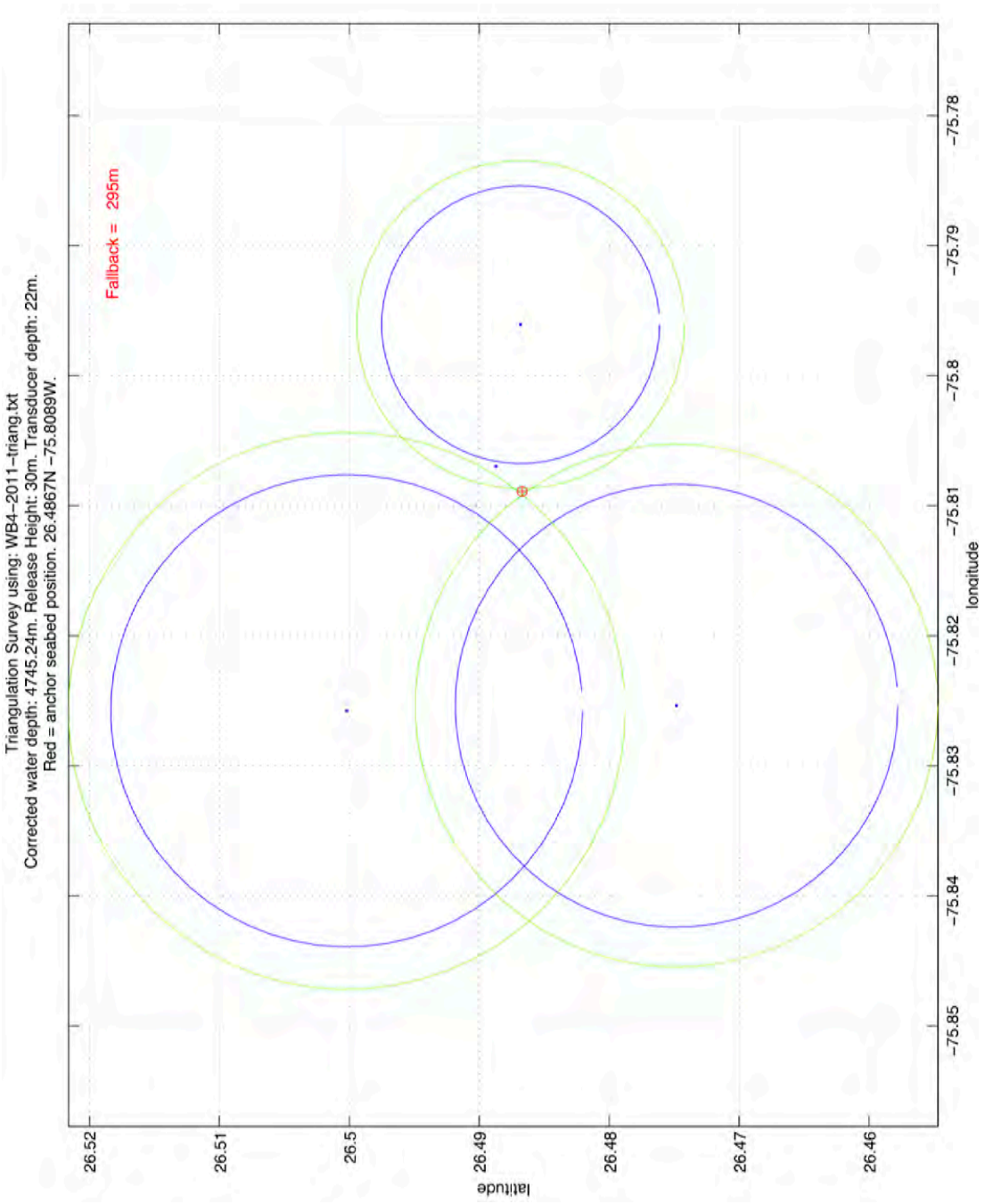
WB2L7 triangulation



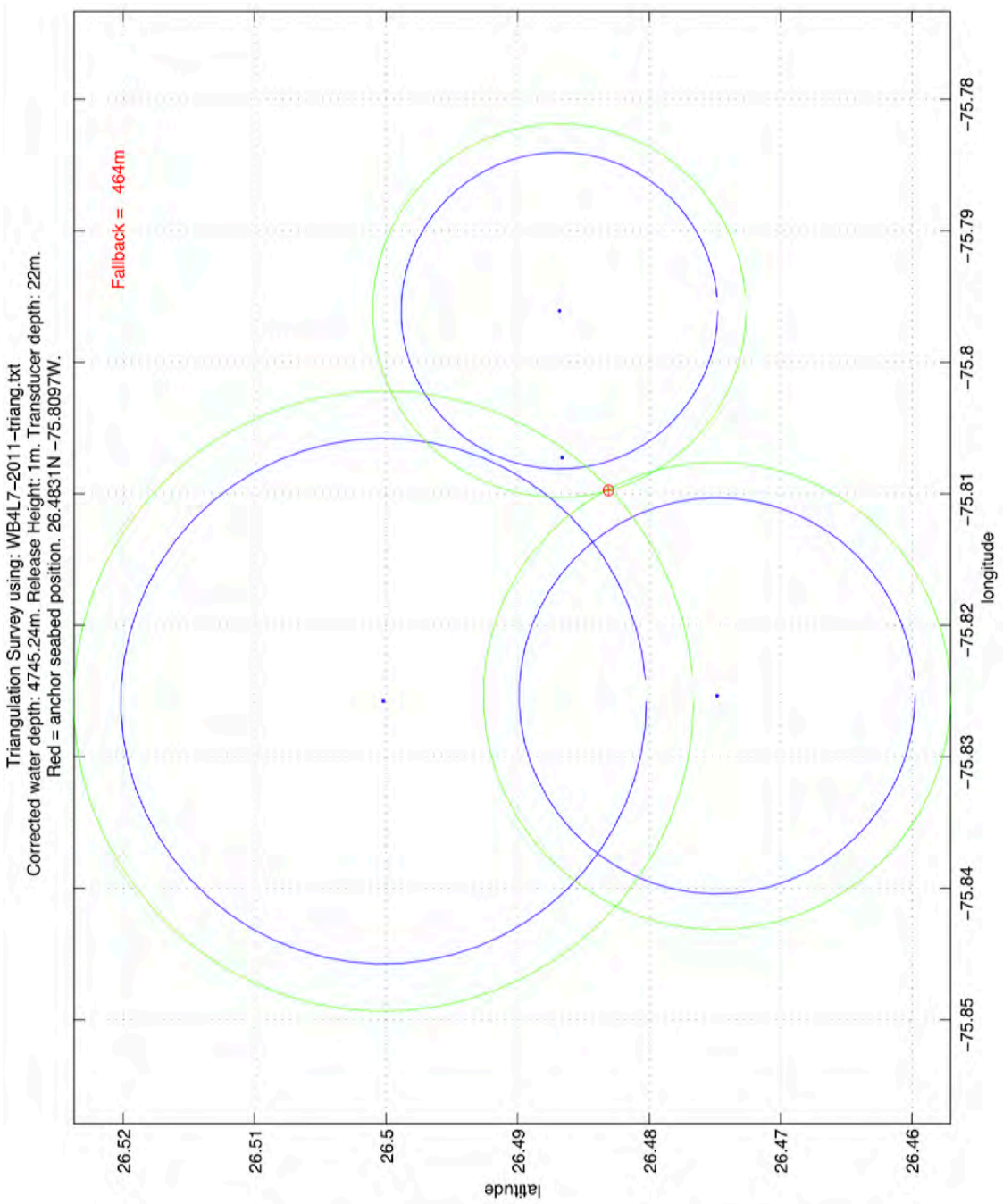
WB2 and WB2L approach and final position



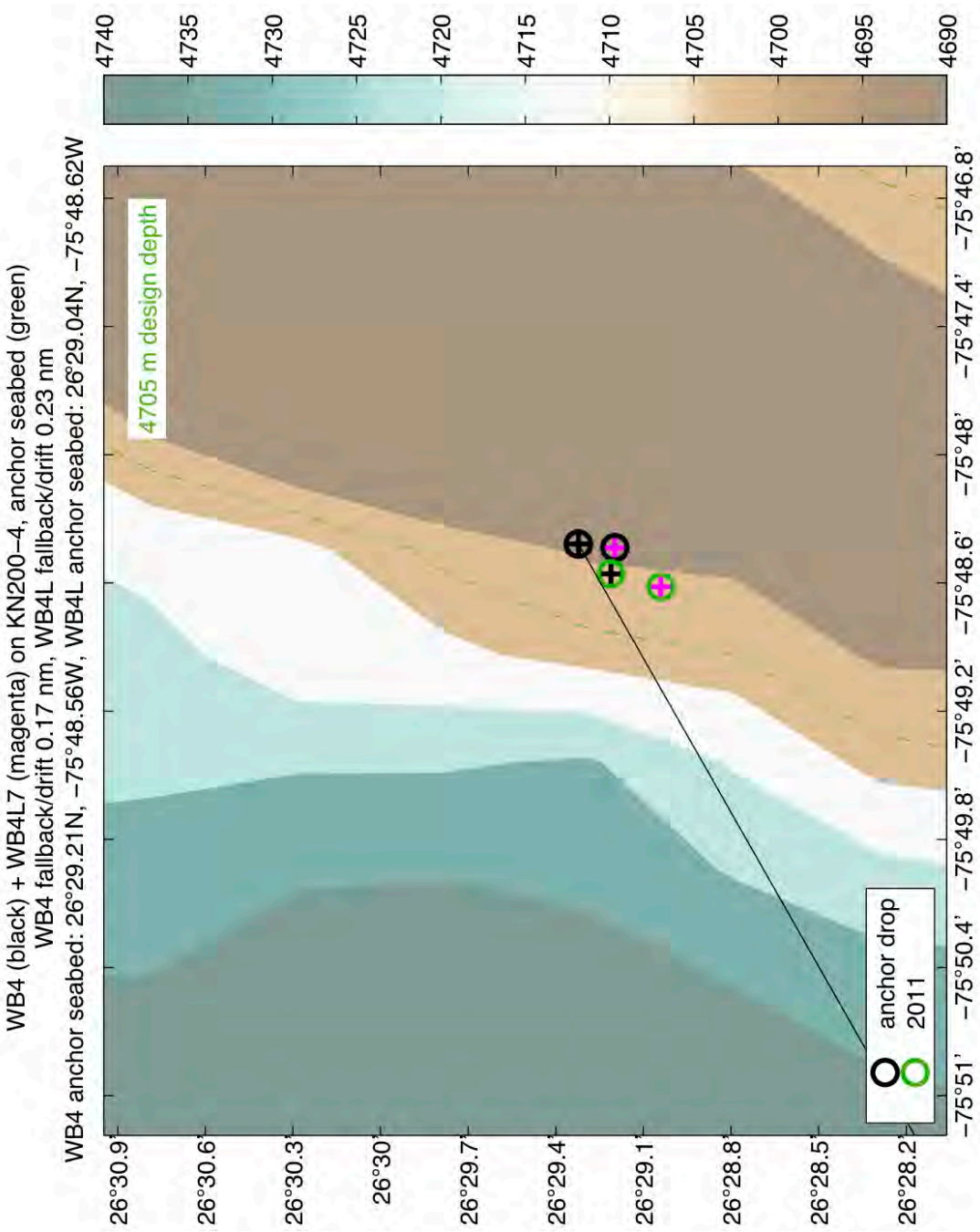
WB4 triangulation



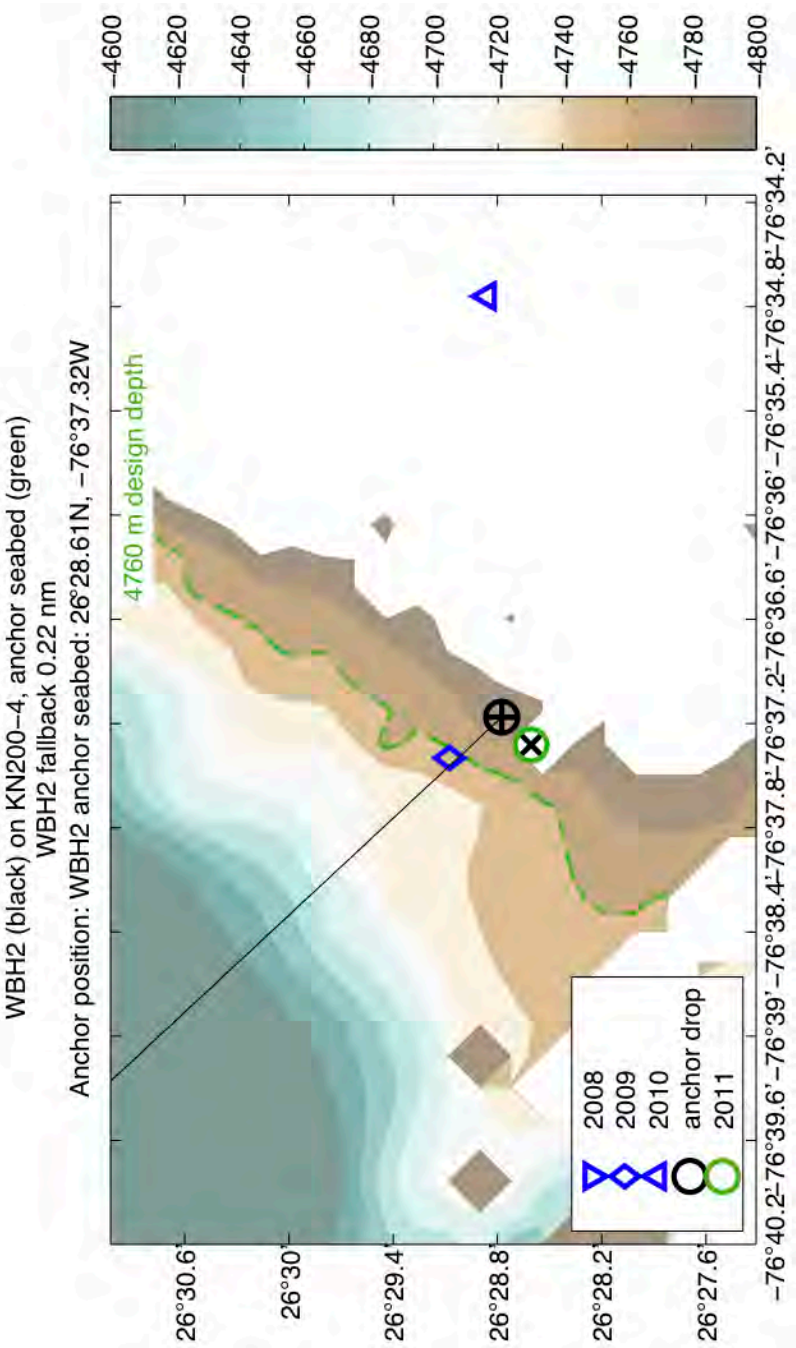
WB4L7 triangulation



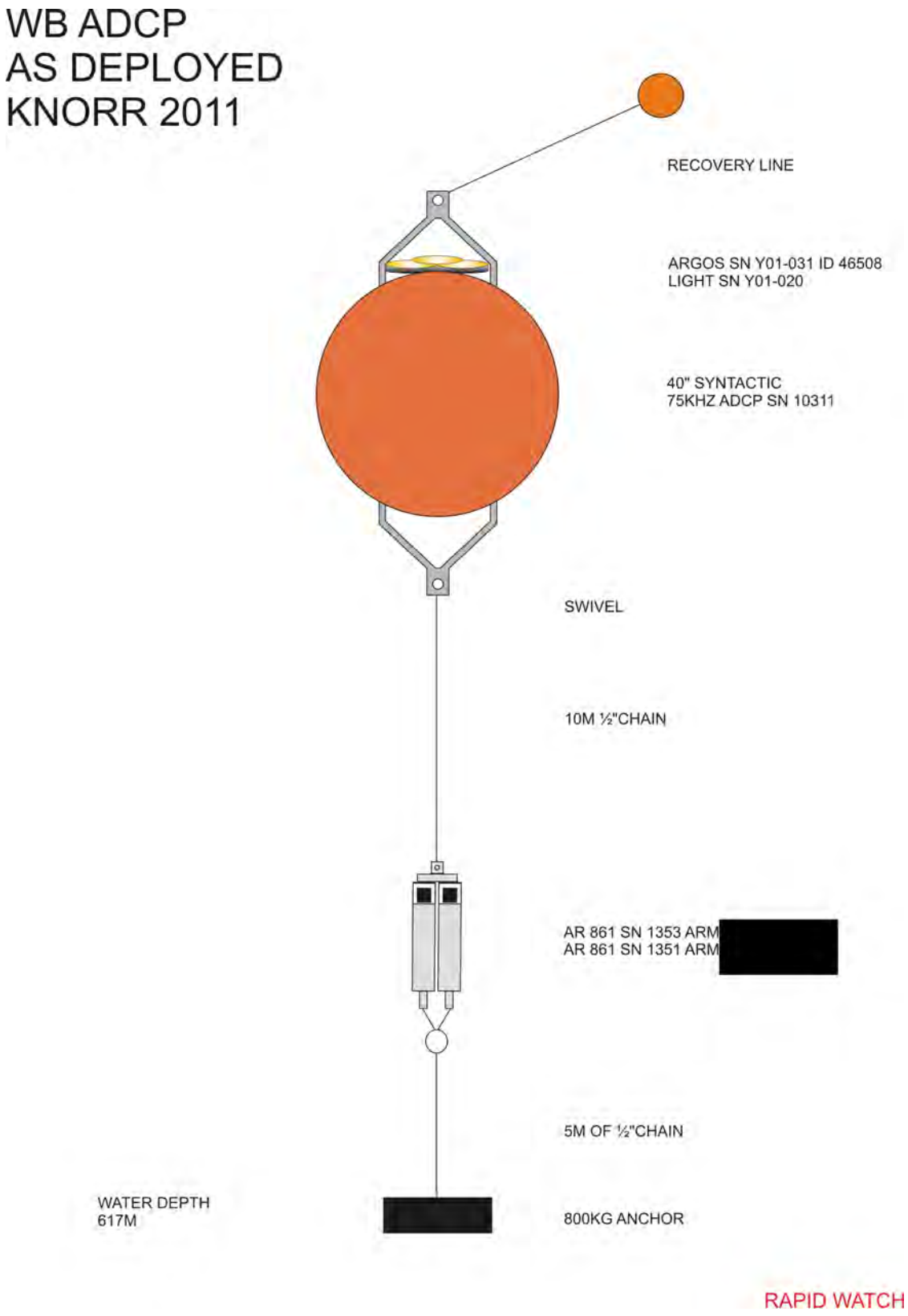
WB4 and WB4L7 approach and final position

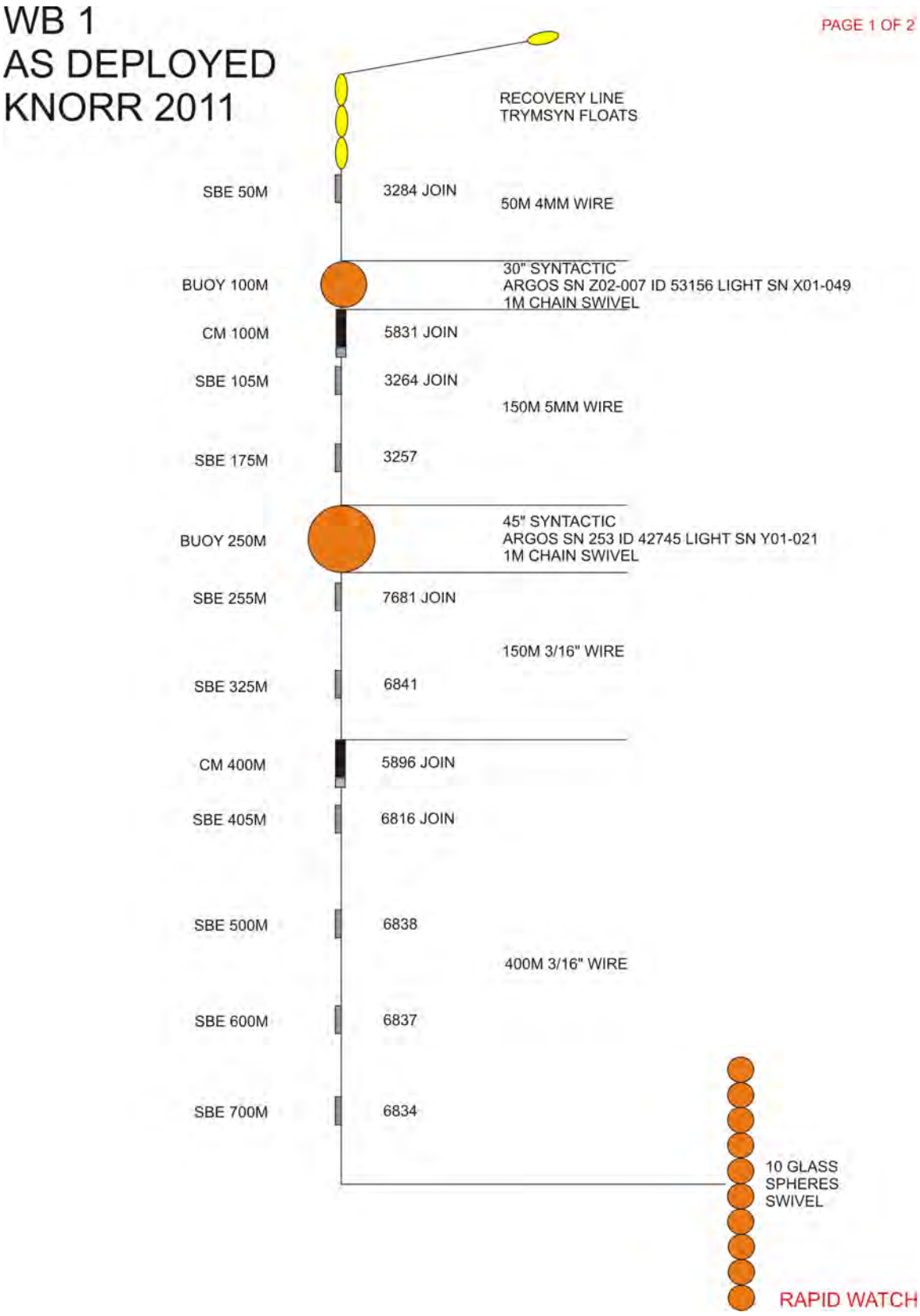


WBH2 approach and final position



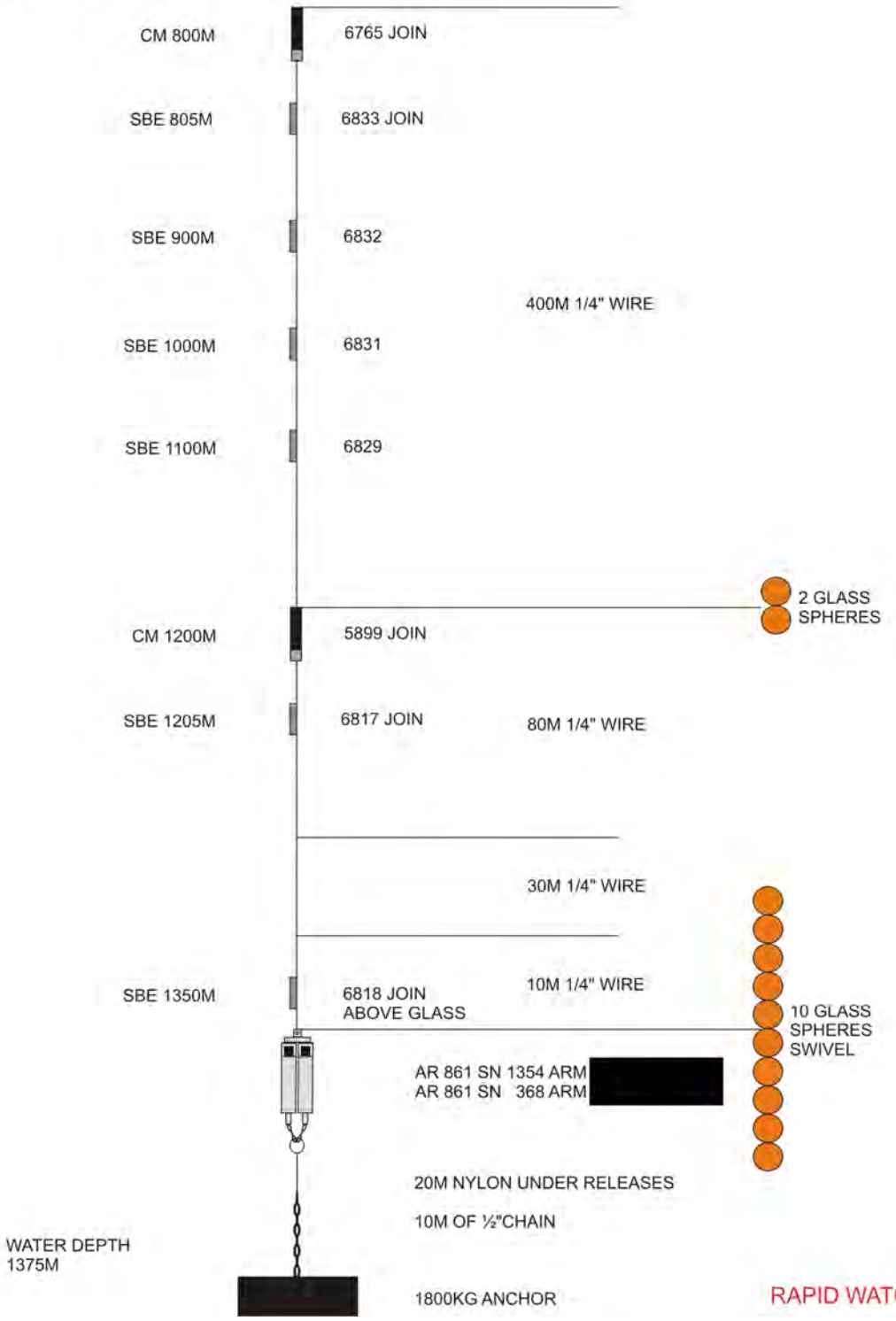
Appendix E – Mooring Diagrams as Deployed

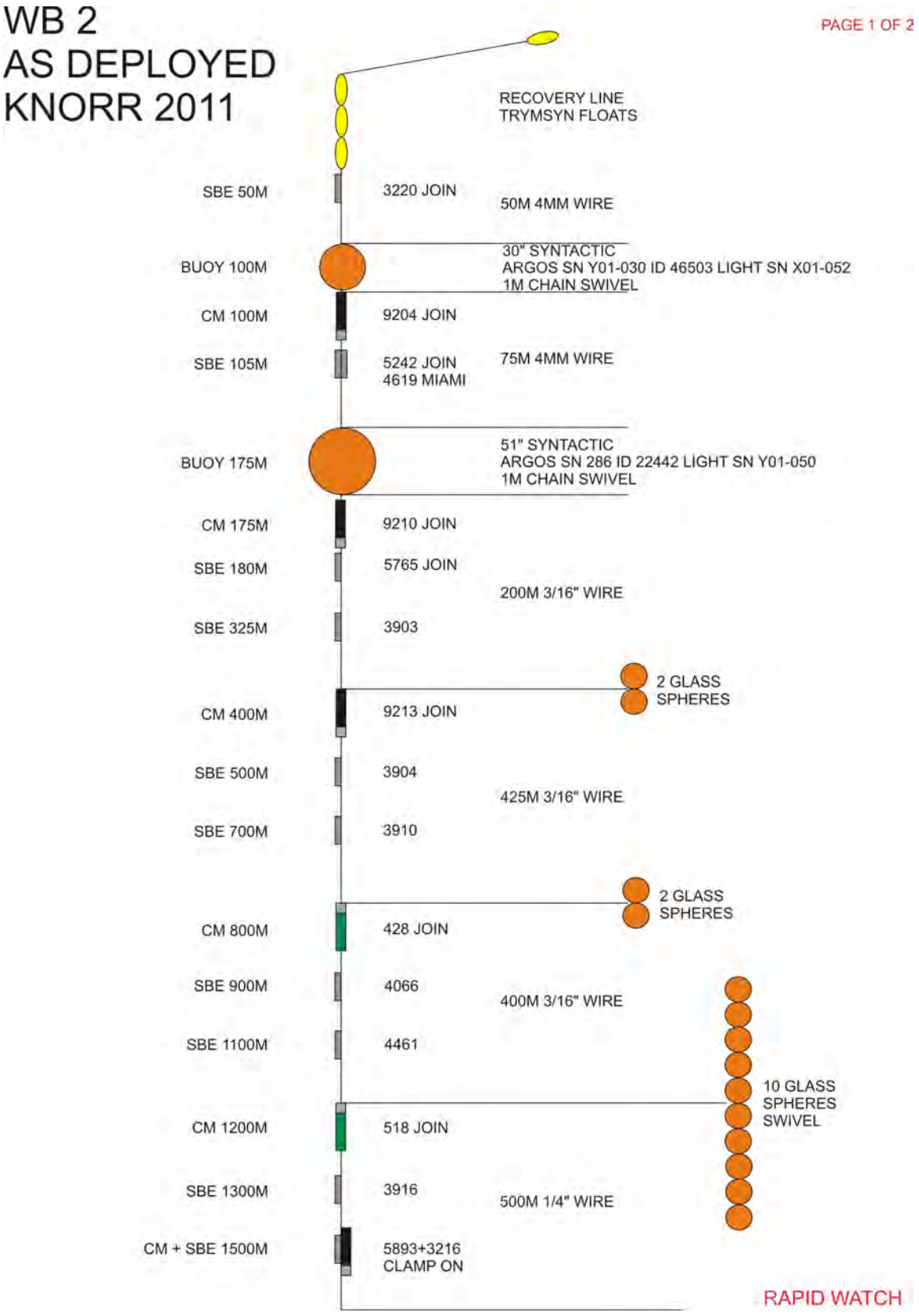


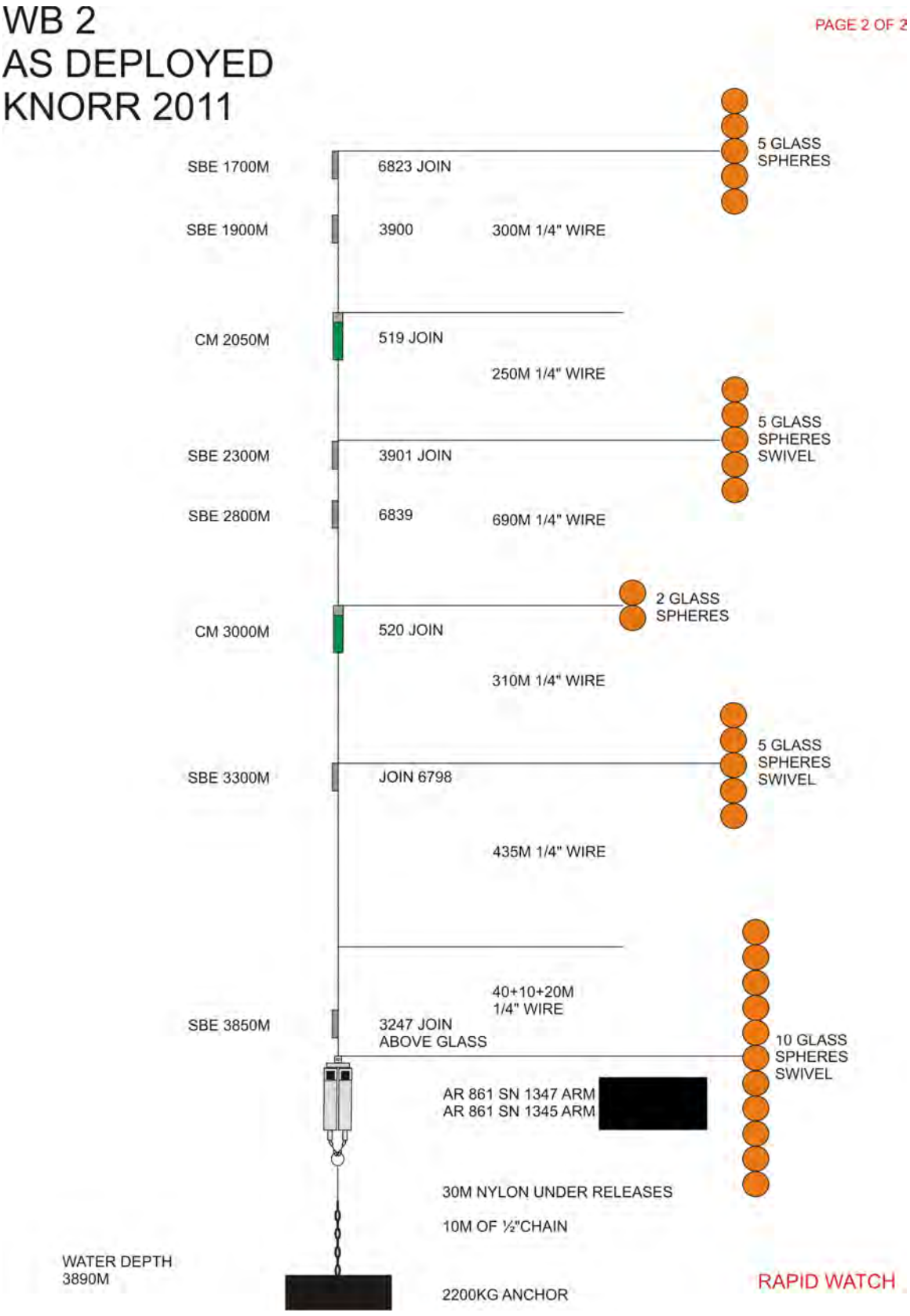

WB 1
AS DEPLOYED
KNORR 2011
PAGE 1 OF 2
RECOVERY LINE
TRYMSYN FLOATS
SBE 50M
3284 JOIN
50M 4MM WIRE
BUOY 100M
30" SYNTACTIC
ARGOS SN Z02-007 ID 53156 LIGHT SN X01-049
1M CHAIN SWIVEL
CM 100M
5831 JOIN
SBE 105M
3264 JOIN
150M 5MM WIRE
SBE 175M
3257
BUOY 250M
45" SYNTACTIC
ARGOS SN 253 ID 42745 LIGHT SN Y01-021
1M CHAIN SWIVEL
SBE 255M
7681 JOIN
150M 3/16" WIRE
SBE 325M
6841
CM 400M
5896 JOIN
SBE 405M
6816 JOIN
SBE 500M
6838
400M 3/16" WIRE
SBE 600M
6837
SBE 700M
6834
10 GLASS
SPHERES
SWIVEL
RAPID WATCH

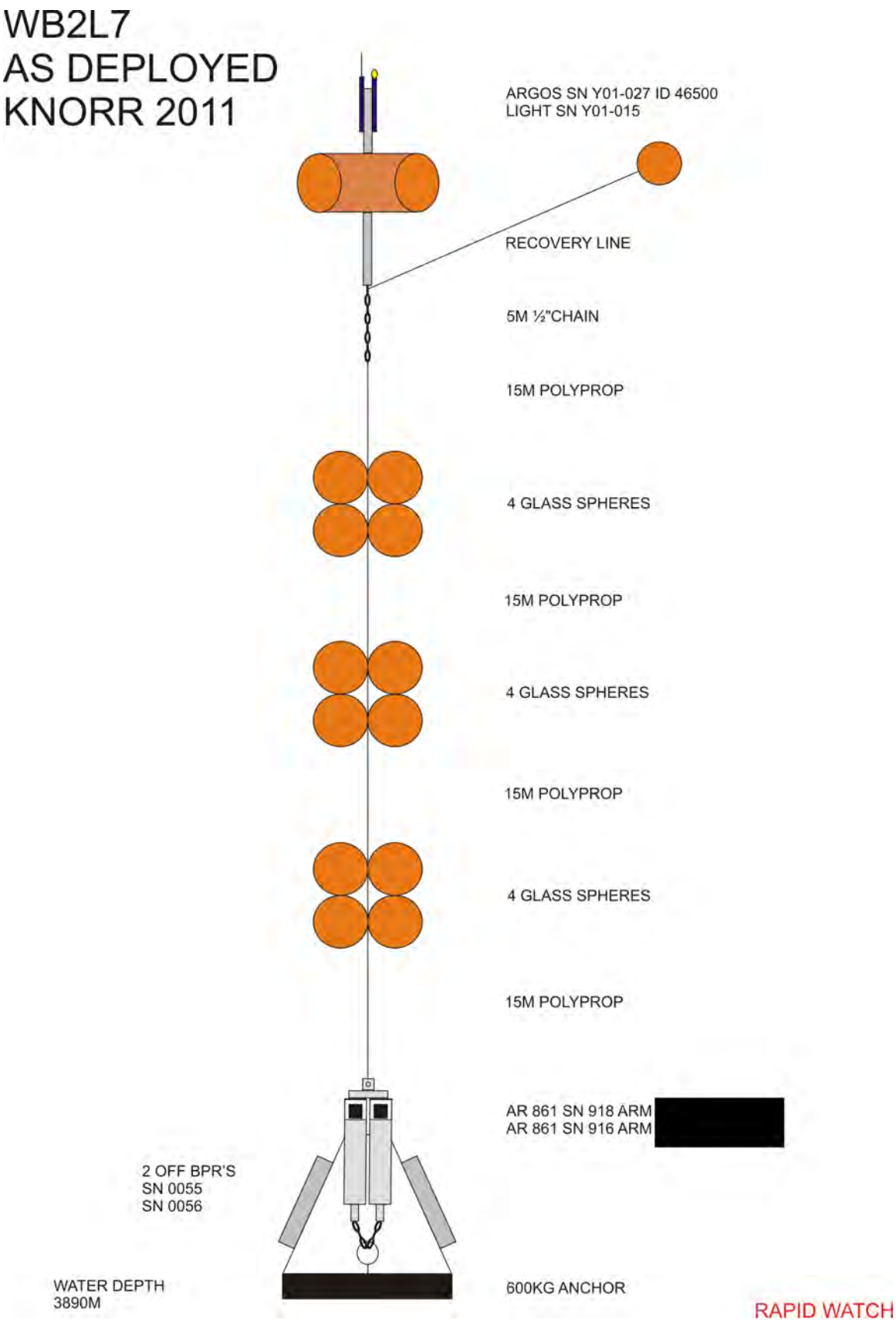
WB 1
AS DEPLOYED
KNORR 2011

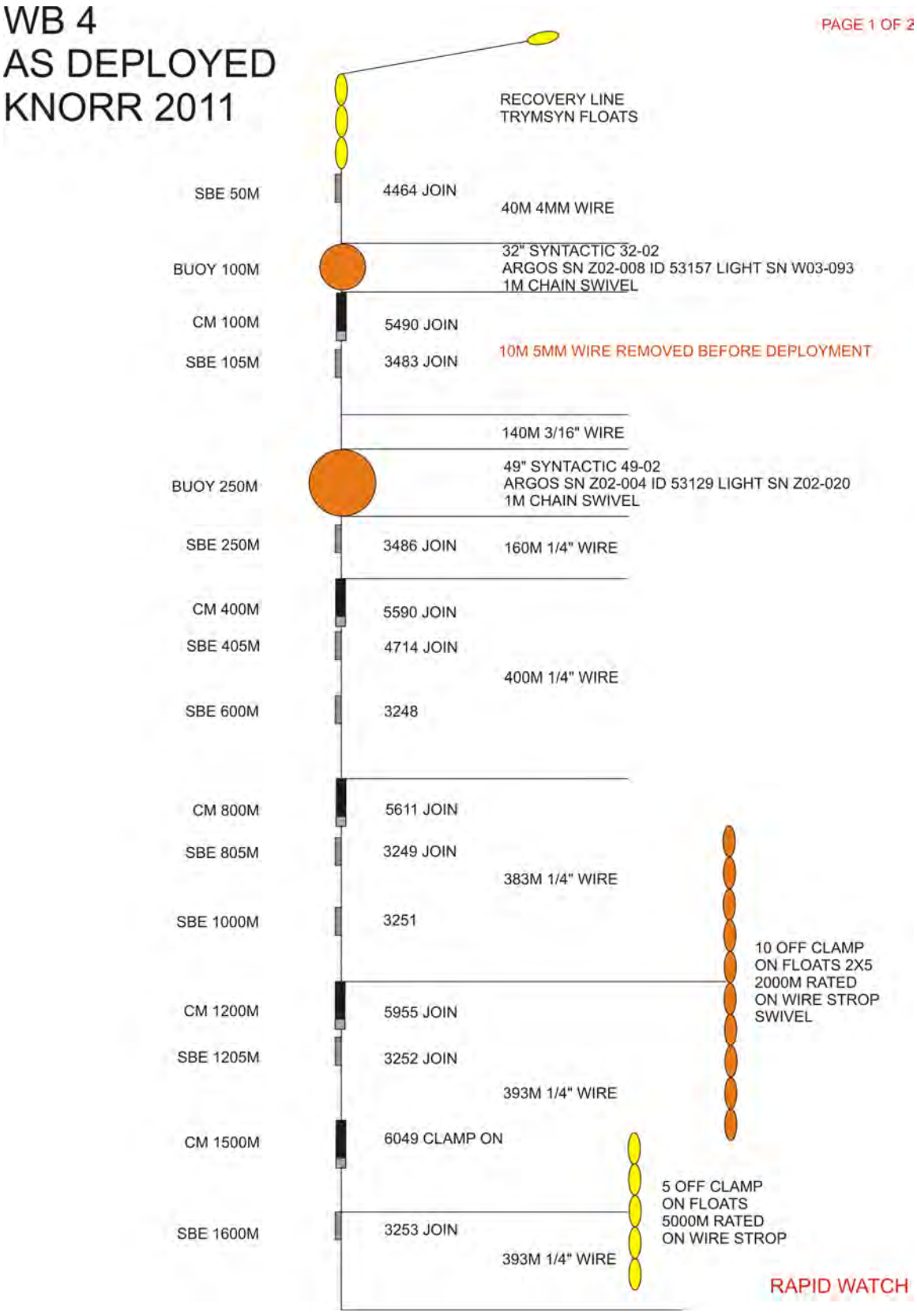
PAGE 2 OF 2

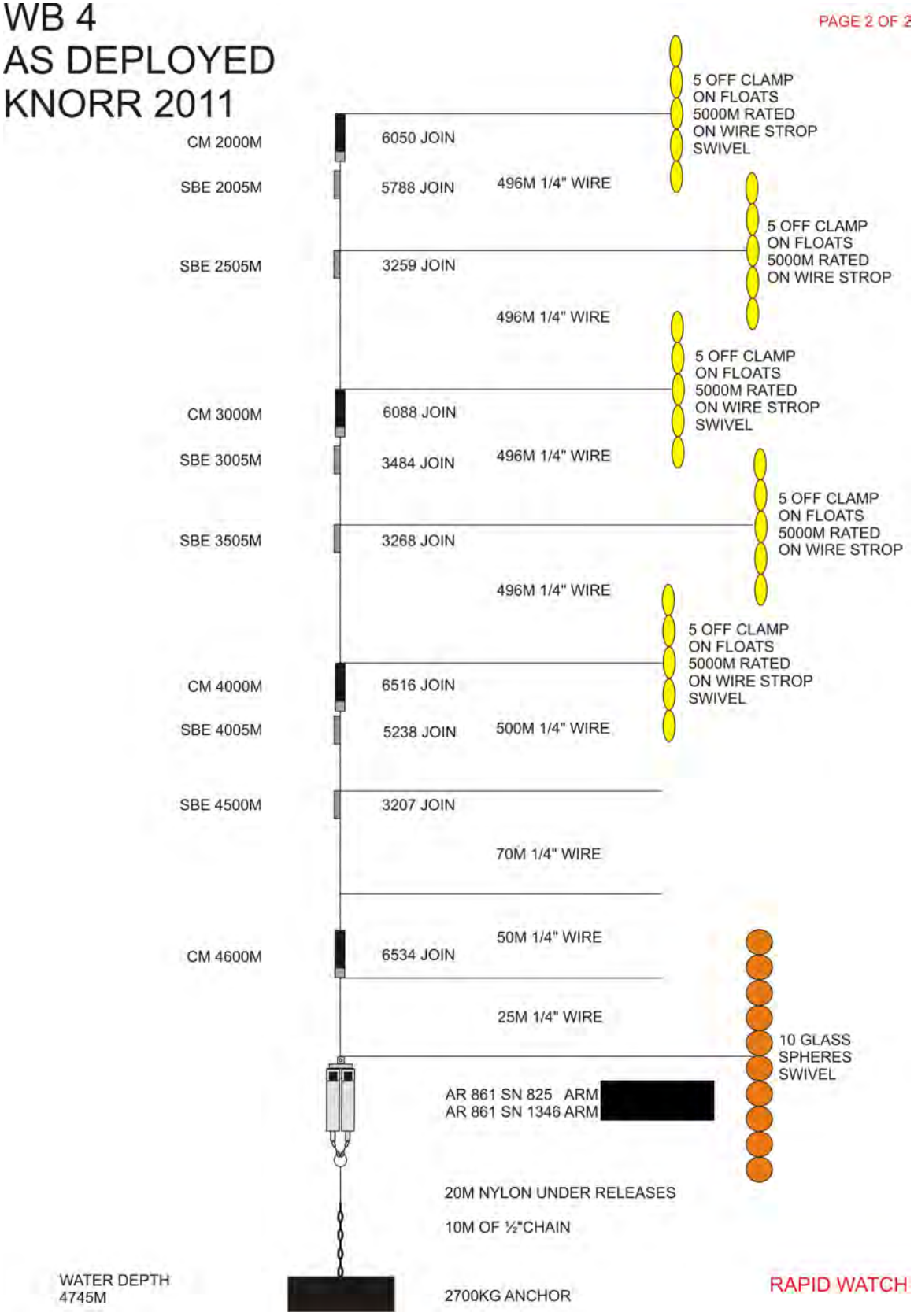


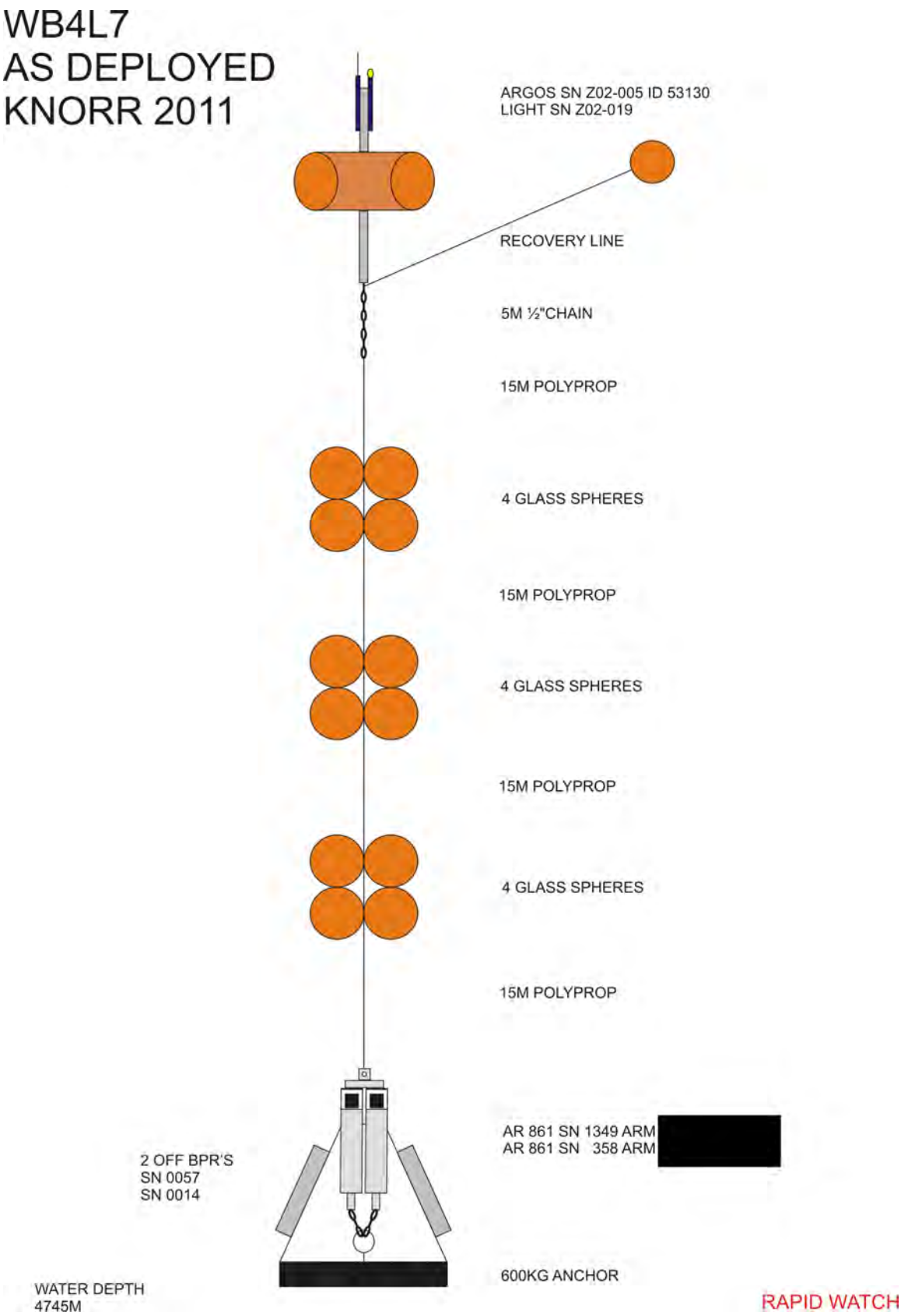

WB 2
AS DEPLOYED
KNORR 2011
PAGE 1 OF 2
RECOVERY LINE
TRYMSYN FLOATS
SBE 50M
3220 JOIN
50M 4MM WIRE
BUOY 100M
30" SYNTACTIC
ARGOS SN Y01-030 ID 46503 LIGHT SN X01-052
1M CHAIN SWIVEL
CM 100M
9204 JOIN
SBE 105M
5242 JOIN
4619 MIAMI
75M 4MM WIRE
BUOY 175M
51" SYNTACTIC
ARGOS SN 286 ID 22442 LIGHT SN Y01-050
1M CHAIN SWIVEL
CM 175M
9210 JOIN
SBE 180M
5765 JOIN
200M 3/16" WIRE
SBE 325M
3903
2 GLASS
SPHERES
CM 400M
9213 JOIN
SBE 500M
3904
425M 3/16" WIRE
SBE 700M
3910
2 GLASS
SPHERES
CM 800M
428 JOIN
SBE 900M
4066
400M 3/16" WIRE
SBE 1100M
4461
10 GLASS
SPHERES
SWIVEL
CM 1200M
518 JOIN
SBE 1300M
3916
500M 1/4" WIRE
CM + SBE 1500M
5893+3216
CLAMP ON
RAPID WATCH

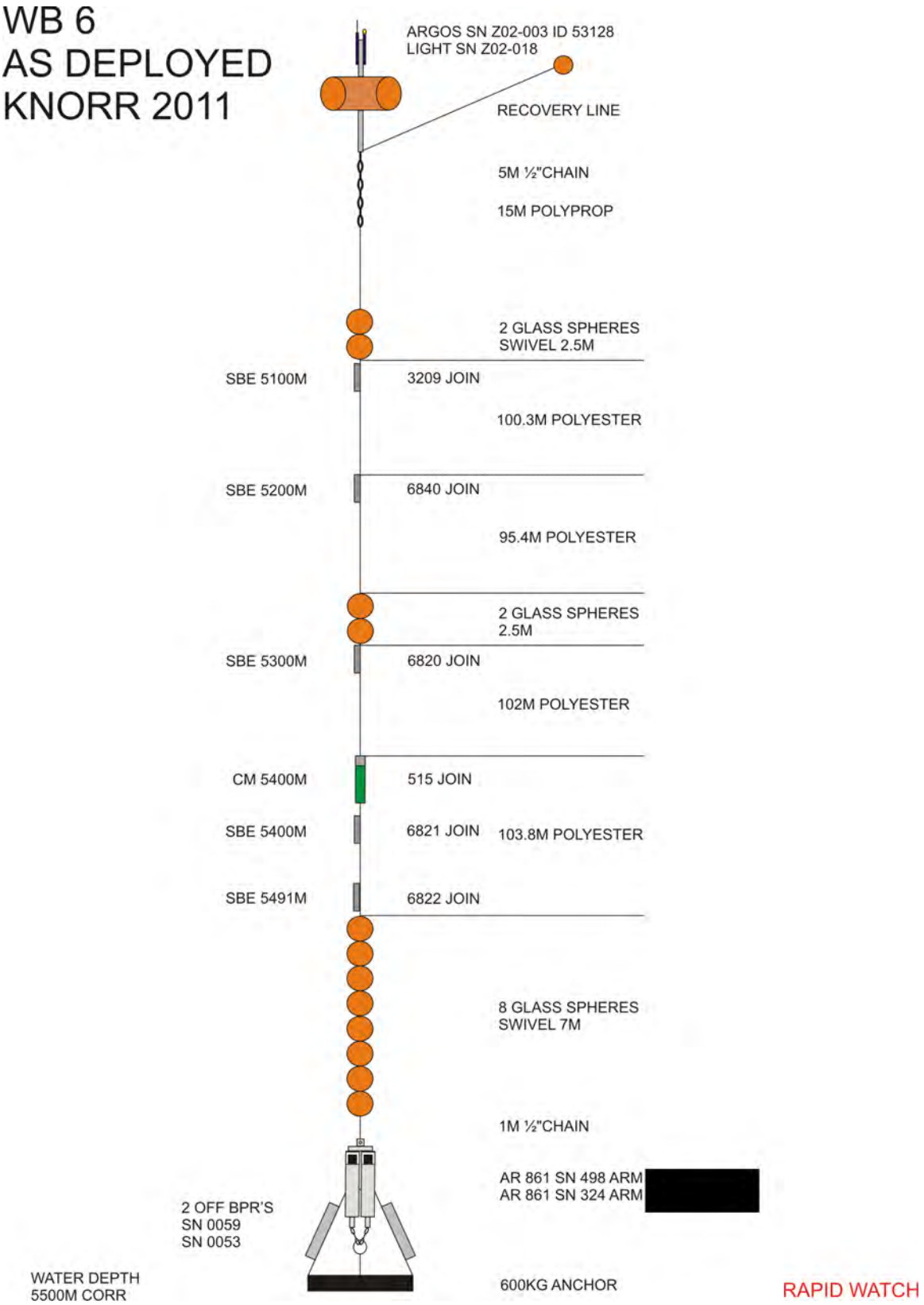

WB 2
AS DEPLOYED
KNORR 2011
PAGE 2 OF 2
SBE 1700M
6823 JOIN
5 GLASS SPHERES
SBE 1900M
3900
300M 1/4" WIRE
CM 2050M
519 JOIN
250M 1/4" WIRE
5 GLASS SPHERES SWIVEL
SBE 2300M
3901 JOIN
SBE 2800M
6839
690M 1/4" WIRE
2 GLASS SPHERES
CM 3000M
520 JOIN
310M 1/4" WIRE
5 GLASS SPHERES SWIVEL
SBE 3300M
JOIN 6798
435M 1/4" WIRE
40+10+20M 1/4" WIRE
SBE 3850M
3247 JOIN ABOVE GLASS
10 GLASS SPHERES SWIVEL
AR 861 SN 1347 ARM
AR 861 SN 1345 ARM
30M NYLON UNDER RELEASES
10M OF ½"CHAIN
WATER DEPTH 3890M
2200KG ANCHOR
RAPID WATCH

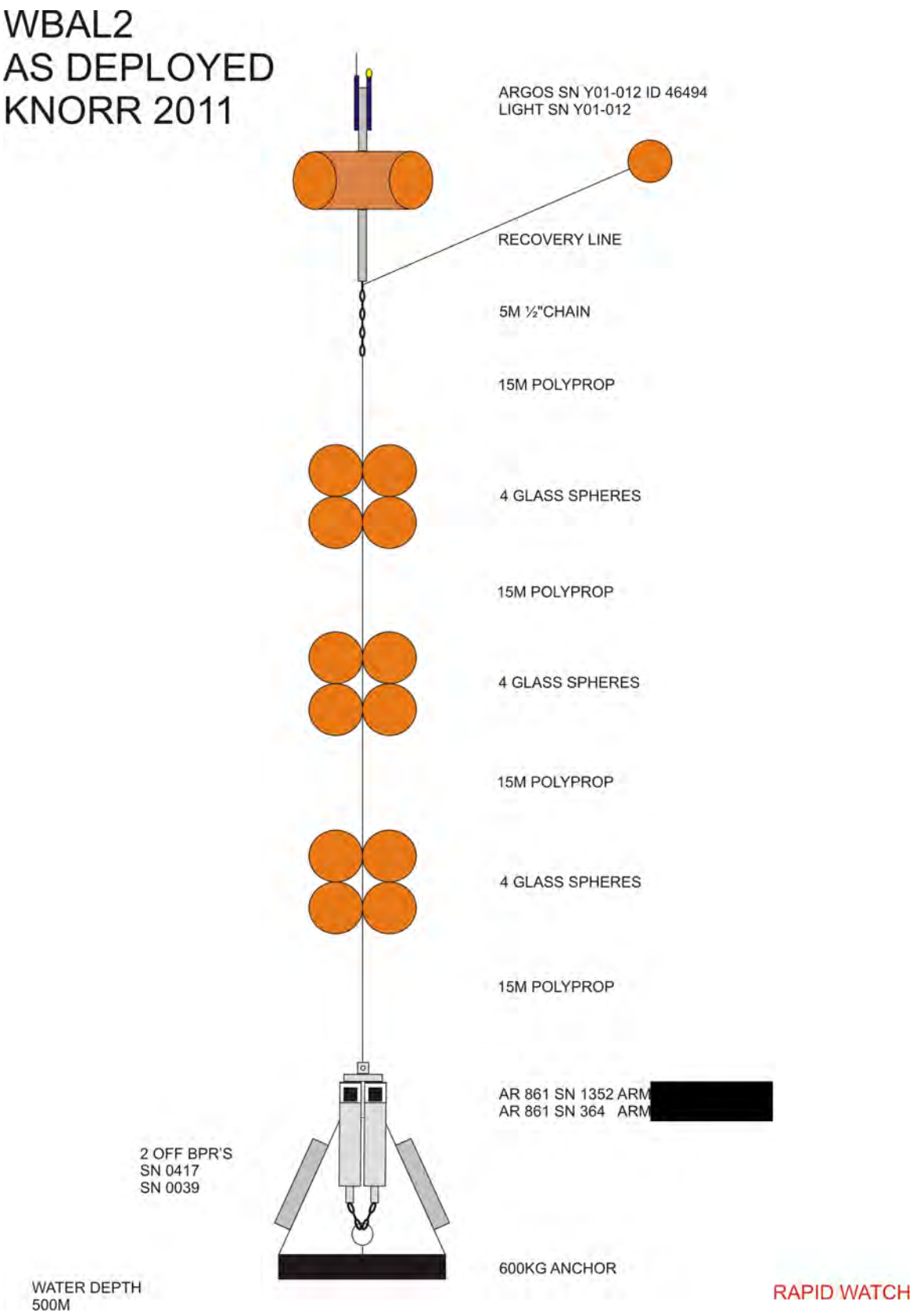

WB2L7
AS DEPLOYED
KNORR 2011
ARGOS SN Y01-027 ID 46500
LIGHT SN Y01-015
RECOVERY LINE
5M ½"CHAIN
15M POLYPROP
4 GLASS SPHERES
15M POLYPROP
4 GLASS SPHERES
15M POLYPROP
4 GLASS SPHERES
15M POLYPROP
AR 861 SN 918 ARM
AR 861 SN 916 ARM
[redacted]
2 OFF BPR'S
SN 0055
SN 0056
WATER DEPTH
3890M
600KG ANCHOR
RAPID WATCH

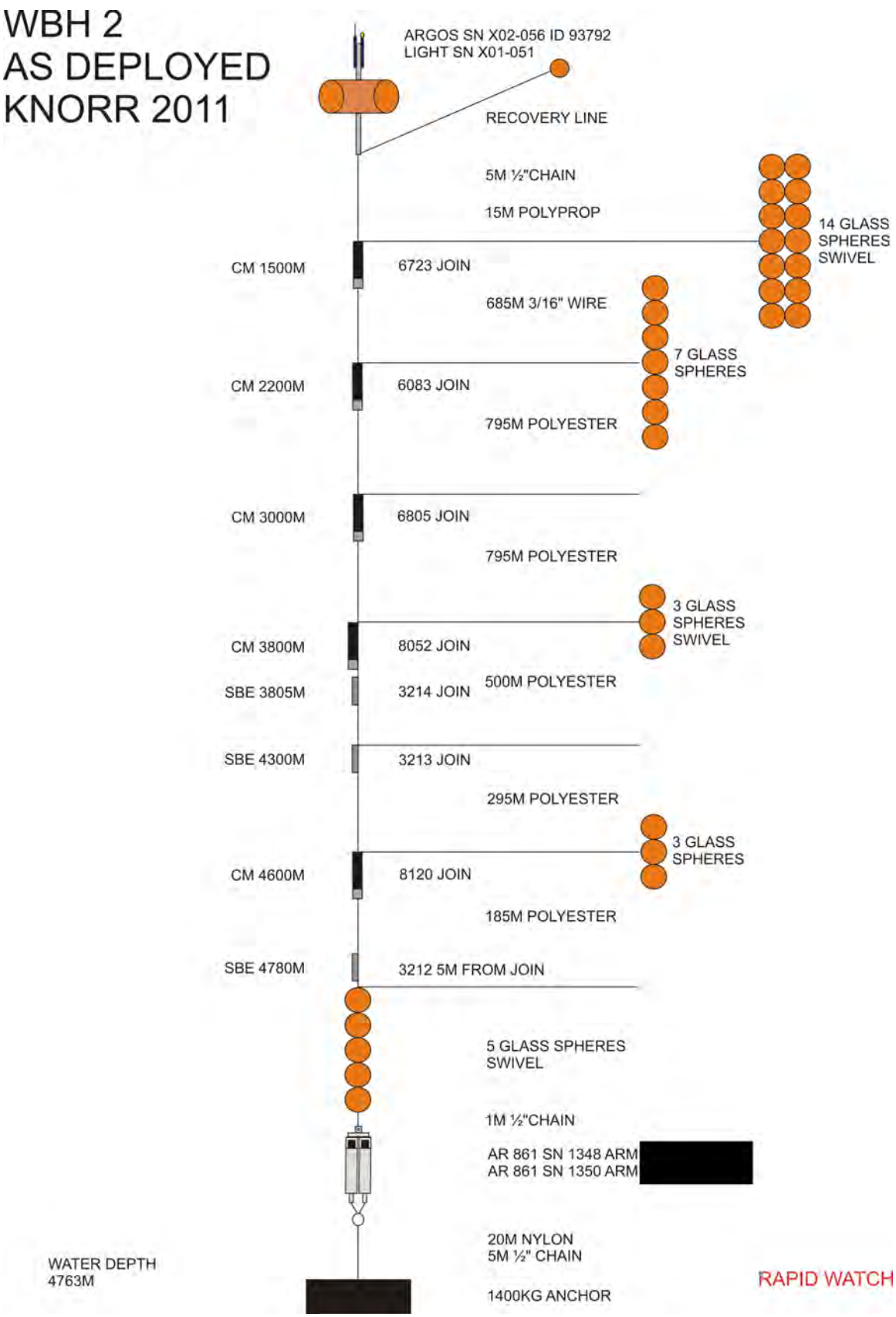

WB 4
AS DEPLOYED
KNORR 2011
PAGE 1 OF 2
RECOVERY LINE
TRYMSYN FLOATS
SBE 50M
4464 JOIN
40M 4MM WIRE
BUOY 100M
32" SYNTACTIC 32-02
ARGOS SN Z02-008 ID 53157 LIGHT SN W03-093
1M CHAIN SWIVEL
CM 100M
5490 JOIN
SBE 105M
3483 JOIN
10M 5MM WIRE REMOVED BEFORE DEPLOYMENT
140M 3/16" WIRE
BUOY 250M
49" SYNTACTIC 49-02
ARGOS SN Z02-004 ID 53129 LIGHT SN Z02-020
1M CHAIN SWIVEL
SBE 250M
3486 JOIN
160M 1/4" WIRE
CM 400M
5590 JOIN
SBE 405M
4714 JOIN
400M 1/4" WIRE
SBE 600M
3248
CM 800M
5611 JOIN
SBE 805M
3249 JOIN
383M 1/4" WIRE
SBE 1000M
3251
10 OFF CLAMP
ON FLOATS 2X5
2000M RATED
ON WIRE STROP
SWIVEL
CM 1200M
5955 JOIN
SBE 1205M
3252 JOIN
393M 1/4" WIRE
CM 1500M
6049 CLAMP ON
5 OFF CLAMP
ON FLOATS
5000M RATED
ON WIRE STROP
SBE 1600M
3253 JOIN
393M 1/4" WIRE
RAPID WATCH


WB 4
AS DEPLOYED
KNORR 2011
PAGE 2 OF 2
5 OFF CLAMP
ON FLOATS
5000M RATED
ON WIRE STROP
SWIVEL
CM 2000M
6050 JOIN
SBE 2005M
5788 JOIN
496M 1/4" WIRE
5 OFF CLAMP
ON FLOATS
5000M RATED
ON WIRE STROP
SBE 2505M
3259 JOIN
496M 1/4" WIRE
5 OFF CLAMP
ON FLOATS
5000M RATED
ON WIRE STROP
SWIVEL
CM 3000M
6088 JOIN
SBE 3005M
3484 JOIN
496M 1/4" WIRE
5 OFF CLAMP
ON FLOATS
5000M RATED
ON WIRE STROP
SBE 3505M
3268 JOIN
496M 1/4" WIRE
5 OFF CLAMP
ON FLOATS
5000M RATED
ON WIRE STROP
SWIVEL
CM 4000M
6516 JOIN
SBE 4005M
5238 JOIN
500M 1/4" WIRE
SBE 4500M
3207 JOIN
70M 1/4" WIRE
50M 1/4" WIRE
CM 4600M
6534 JOIN
25M 1/4" WIRE
10 GLASS
SPHERES
SWIVEL
AR 861 SN 825 ARM
AR 861 SN 1346 ARM
20M NYLON UNDER RELEASES
10M OF ½"CHAIN
WATER DEPTH
4745M
2700KG ANCHOR
RAPID WATCH


WB4L7
AS DEPLOYED
KNORR 2011
ARGOS SN Z02-005 ID 53130
LIGHT SN Z02-019
RECOVERY LINE
5M ½"CHAIN
15M POLYPROP
4 GLASS SPHERES
15M POLYPROP
4 GLASS SPHERES
15M POLYPROP
4 GLASS SPHERES
15M POLYPROP
AR 861 SN 1349 ARM
AR 861 SN 358 ARM
2 OFF BPR'S
SN 0057
SN 0014
600KG ANCHOR
WATER DEPTH
4745M
RAPID WATCH


WB 6
AS DEPLOYED
KNORR 2011
ARGOS SN Z02-003 ID 53128
LIGHT SN Z02-018
RECOVERY LINE
5M ½"CHAIN
15M POLYPROP
2 GLASS SPHERES
SWIVEL 2.5M
SBE 5100M
3209 JOIN
100.3M POLYESTER
SBE 5200M
6840 JOIN
95.4M POLYESTER
2 GLASS SPHERES
2.5M
SBE 5300M
6820 JOIN
102M POLYESTER
CM 5400M
515 JOIN
SBE 5400M
6821 JOIN
103.8M POLYESTER
SBE 5491M
6822 JOIN
8 GLASS SPHERES
SWIVEL 7M
1M ½"CHAIN
AR 861 SN 498 ARM
AR 861 SN 324 ARM
2 OFF BPR'S
SN 0059
SN 0053
WATER DEPTH
5500M CORR
600KG ANCHOR
RAPID WATCH


WBAL2
AS DEPLOYED
KNORR 2011
ARGOS SN Y01-012 ID 46494
LIGHT SN Y01-012
RECOVERY LINE
5M ½"CHAIN
15M POLYPROP
4 GLASS SPHERES
15M POLYPROP
4 GLASS SPHERES
15M POLYPROP
4 GLASS SPHERES
15M POLYPROP
AR 861 SN 1352 ARM
AR 861 SN 364 ARM
2 OFF BPR'S
SN 0417
SN 0039
600KG ANCHOR
WATER DEPTH
500M
RAPID WATCH


WBH 2
AS DEPLOYED
KNORR 2011
ARGOS SN X02-056 ID 93792
LIGHT SN X01-051
RECOVERY LINE
5M ½"CHAIN
15M POLYPROP
14 GLASS SPHERES SWIVEL
CM 1500M
6723 JOIN
685M 3/16" WIRE
7 GLASS SPHERES
CM 2200M
6083 JOIN
795M POLYESTER
CM 3000M
6805 JOIN
795M POLYESTER
3 GLASS SPHERES SWIVEL
CM 3800M
8052 JOIN
500M POLYESTER
SBE 3805M
3214 JOIN
SBE 4300M
3213 JOIN
295M POLYESTER
3 GLASS SPHERES
CM 4600M
8120 JOIN
185M POLYESTER
SBE 4780M
3212 5M FROM JOIN
5 GLASS SPHERES SWIVEL
1M ½"CHAIN
AR 861 SN 1348 ARM
AR 861 SN 1350 ARM
[redacted]
20M NYLON
5M ½" CHAIN
WATER DEPTH
4763M
1400KG ANCHOR
RAPID WATCH

Appendix F – Acoustic Release Record

Serial No	Type	Previous Location	Current Location	Date Deployed	Position		Water Depth	Serviced	New Batts	Bench Tested	Wire Tested	Depth Tested
					Lat	Long						
1345	AR861	NEW	WB2 11	28/04/2011	26 31.043	76 44.691		New	New	Y	Y	5430
1346	AR861	NEW	WB4 11	24/04/2011	26 29.323	75 48.418		New	New	Y	Y	5430
1347	AR861	NEW	WB2 11	28/04/2011	26 31.043	76 44.691		New	New	Y	Y	5430
1348	AR861	NEW	WBH2 11	27/04/2011	26 28.775	76 37.163		New	New	Y	Y	5430
1349	AR861	NEW	WB4L7	23/04/2011	26 29.198	70 48.435		New	New	Y	Y	5430
1350	AR861	NEW	WBH2 11	27/04/2011	26 28.775	76 37.163		New	New	Y	Y	5430
1351	AR861	NEW	ADCP 11	30/04/2011	26 31.497	76 52.080		New	New	Y	Y	4000
1352	AR861	NEW	WBAL2	30/04/2011	26 31.574	76 52.552		New	New	Y	Y	4000
1353	AR861	NEW	ADCP 11	30/04/2011	26 31.497	76 52.080		New	New	Y	Y	4000
1354	AR861	NEW	WB1 11	29/04/2011	26 30.327	76 49.041		New	New	Y	Y	3500
916	AR861	D359	WB2L7	28/04/2011	26 30.50	76 15.40		Y	Y	Y	Y	3500
364	AR861	D359	WBAL2	30/04/2011	26 31.574	76 52.552		Y	Y	Y	Y	4000
918	AR861	D359	WB2L7	28/04/2011	26 30.50	76 15.40		Y	Y	Y	Y	3500
368	AR861	D359	WB1 11	29/04/2011	26 30.327	76 49.041		Y	Y	Y	Y	3500
258	AR861	D359	KNORR	UNUSED				Y	Y			
324	AR861	NOC	WB6 11	20/04/2011	26 29.58	70 31.53		Y	Y	Y	Y	5430
825	AR861	NOC	WB4 11	24/04/2011	26 29.323	75 48.418		Y	Y	Y	Y	5430
358	AR861	NOC	WB4L7	23/04/2011	26 29.198	70 48.435		Y	Y	Y	Y	5430
498	AR861	NOC	WB6 11	20/04/2011	26 29.58	70 31.53		Y	Y	Y	Y	5430
823	AR861	ADCP	KNORR					Y	Y	Y	Y	
906	AR861	WB1 10	KNORR					Y	Y	Y	Y	5400
223	RT661	WB1 10	KNORR					Y	Y	Y	Y	5400
354	AR861	WB2L5	KNORR					Y	Y	Y	Y	3320
264	AR861	WB2L5	KNORR					Y	Y	Y	Y	3320
1200	AR861	WB4 10	KNORR					NEW	NEW	Y	Y	5000
1242	AR861	WB4 10	KNORR					NEW	NEW	Y	Y	5000
282	AR861	WB4L5	KNORR					Y	Y	Y	Y	5120
361	AR861	WB6 10	KNORR					Y	Y	Y	Y	5200
827	AR861	WB6 10	KNORR					Y	Y	Y	Y	5200
911	AR861	WBH2	KNORR					Y	Y	Y	Y	5400
249	AR861	WBH2	KNORR					Y	Y	Y	Y	5400
910	AR861	WB2 10	KNORR					Y	Y	Y	Y	5400
256	AR861	WB2 10	KNORR					Y	Y	Y	Y	5400

Table F.1 *Record of the acoustic releases recovered, used and tested on KN200-4.*

Appendix G – Logsheets

These are scanned images due to past cases of typos being discovered in the logsheets.

RAPID-WATCH MOORING LOGSHEET **DEPLOYMENT**

Mooring **WB1** Cruise **KN200-4**

NB: all times recorded in GMT

Date 29/04/2011 **Site arrival time** before 1700

Setup distance 0nm - 1.8 kt current

Start time 17:27 **End time** _____

Start Position

Latitude _____ **Longitude** _____

ITEM	SER NO	COMMENT	TIME
1 x Trimsyn pick up float			17:31
3 Trimsyn floats			17:32
SBE37 MicoCAT	3284		17:32
30" SYNTACTIC	~~5~~		17.34
ARGOS		Record PTT } check Rob's	
Light			
1m chain and swivel			
NORTEK in frame	5831 ✓	Up(down) looking?	17.34
SBE37 MicoCAT	3264 ✓		
SBE37 MicoCAT	3257 ✓		17.37
45" syntactic buoy with beacons			17.49
ARGOS		Record PTT	
LIGHT			
1m chain and swivel			
SBE37 MicoCAT	7681 ✓		17:51
SBE37 MicoCAT	6841 ✓		17:54
NORTEK in frame	~~6765~~ 5896 ✓		17:59
SBE37 MicoCAT	6816 ✓	(5m down from Nortek)	18:00
SBE37 MicoCAT	6838 ✓		18:03
SBE37 MicoCAT	6837 ✓		18:06
SBE37 MicoCAT	6836 ✓		18:09
10 x 17" glass			18:16
NORTEK in frame	6765 ✓		18:16
SBE37 MicoCAT	6833 ✓	(5m down from Nortek)	18:18
SBE37 MicoCAT	6832 ✓		18:21
SBE37 MicoCAT	6831 ✓		18:23
SBE37 MicoCAT	6829 ✓		18:26
2 x 17" glass			18:31
NORTEK in frame	5899 ✓		18:31
SBE37 MicoCAT	6817 ✓	(5m down from Nortek)	18:33
SBE37 MicoCAT (at 1st join above glass)	6818 ✓		18:40
10 x 17" glass			18:45

Acoustic release #1	1354	Record release codes	18:45
Acoustic release #2	368	Record release codes	18:45
20m NYLON TWIST			18:45
10m ½" chain			19:00
Anchor 1800kg			19:04

Release #1 arm code
Release #1 release code
Release #2 arm code
Release #2 release code

[redacted] } not independently checked - NUMISCAS for codes + SERIAL NUMBER GOT FROM ROV MEDIA DISPLAYMENT

Anchor Drop Position
Latitude 26 30.327 **Longitude** 76 49.061

Uncorrected water depth 1367 (at anchor launch)
Corrected water depth 1375 (at anchor launch)

J

	r1	r2	
0929 20:21:50	—	2248.6	SE site 26°29.557' N 76°49.77' W
20:22:27	2252.7	2253.8	

E site

20:43:43	1972.4	1976.4	26°29.871' 76°48.105'
20:44:02	1984.2	1989.0	
20:44:20	1994.7	1997.9	

N SITE

21:10:00	93	1980	26° 30.968' N 76° 49.281' W
21:10:20	1975	1973	
21:10:38	1967	1964	

RAPID-WATCH MOORING LOGSHEET **RECOVERY**

Mooring **WB1** Cruise **KN200-4**

NB: all times recorded in GMT

Date 29 Apr 2011 **Site arrival time** 13:55

Time of first ranging 13:57

Time of release 13:59 14:01 surf

Latitude _____ **Longitude** _____

(record positions at time of pickup only if likely to be very different from deployment position)

grapple 14:25

ITEM	SER NO	COMMENT	TIME
Recovery line			
3 TRYMSYN floats			14:30
SBE37 Microcat	5764 ✓	some growth in cell	14:34
30" SYNTACTIC		~~for~~	14:35
ARGOS		broken antenna	
Light			
1m chain and swivel			
NORTEK	5963 ✓	(multisegmented worms)	14:36
SBE37 Microcat	6115 ✓	cell looks ok	14:36
SBE37 Microcat	3919 ✓	light growth	14:42
45" syntactic buoy			14:47
ARGOS			
LIGHT			
1m chain and swivel			
SBE37 Microcat	6116 ✓		14:48
SBE37 Microcat	3928 ✓		14:55
RCM11	301 ✓		14:57
SBE37 Microcat 6117 ✓	~~3930~~		14:59
SBE37 Microcat	3930 ✓	missing end cap, guard + cell (was down the line)	15:01
SBE37 Microcat	6118 ✓		15:05
SBE37 Microcat	3931 ✓		15:06
10 x 17" glass			
RCM11	302 ✓	tangled w/glass	15:11
SBE37 Microcat	6119 ✓		
SBE37 Microcat	3932 ✓	missing guide	15:15
SBE37 Microcat	6120 ✓	loose guide	15:19
SBE37 Microcat	6324 ✓		15:22
2 x 17" glass			15:25
RCM11	303 ✓		15:25
SBE37 Microcat	6321 ✓		15:26
SBE37 Microcat	7723 ✓		15:31
10 x 17" glass		tangled	

Acoustic release #1			15:32
Acoustic release #2			

Ascent rate _____

Time at end of recovery _____

Ranging

Time	Range 1	Range 2	Command /comment
	~~1519~~		
1357	1516.5	1515.3	
135805	1507.2	—	
135908	1495		ARM+REL REL OK
1400:			
1359:49	1440	1429	120 m/min
140049	1381.2	1369.4	116 m/min
140049	1324.3	1311	

s/n 906 [redacted]

s/n 223 [redacted]

30s

RAPID-WATCH MOORING LOGSHEET **RECOVERY**

Mooring **WB2L5** Cruise **KN200-4**

NB: all times recorded in GMT

Date 28 Apr 2011 **Site arrival time** _____

Time of first ranging 18:11

Time of release 18:15 surf 19:03

Latitude _____ **Longitude** _____

(record positions at time of pickup only if likely to be very different from deployment position)

ITEM	SER NO	COMMENT	TIME
17" glass			19:15
Recovery line			
Billings Float with VHF and	~~701 [illegible]~~		
Light	~~701 015~~ NO8-027		
5m of 3/8" chain			
4 x 17" glass			19:21
15m polyprop			
4 x 17" glass			19:23
15m polyprop			
BPR #1 in tripod	34		19:27
BPR #2 in tripod	36		
Release #1 in tripod			
Release #2 in tripod			

Ascent rate 81

Time at end of recovery _____

Ranging

sin arm 354 [redacted]

Time	Range 1	Range 2	Command /comment
18:11:23	—	3861.7	V - 12.7
18:12:12	—	3859.6	V - 12.7
18:13:11	3858.8	3858.0	ARM + REL REL OK
18:13:47	3831.1	3822.3	86 m/min
18:14:48	3745	3736.7	81 m/min
18:15:47	3664.0	3654.8	

RAPID-WATCH MOORING LOGSHEET **DEPLOYMENT**

Mooring **WB2L7** Cruise **KN200-4**

NB: all times recorded in GMT

Date 28 Apr 2011 **Site arrival time** _____

Start time 20:15 **End time** _____

ITEM	SER NO	COMMENT	TIME
12 " glass pick up float			20:15
15m polyprop			
Billings Float with beacons			20:15
Argos Beacon	Y01-027	Record PTT number 46504	
Light	Y01-015		
5m of 1/2" chain			
15m of polyprop			
4 x 17" glass			
15m polyprop			
4 x 17" glass			20:17
15m polyprop			
4 x 17" glass			20:19
15m polyprop			
BPR #1 in tripod	0056		
BPR #2 in tripod	0055		
Release #1 in tripod	918	Record release codes	
Release #2 in tripod	916	Record release codes	
Anchor 500 KG			20.19

Argos beacon #1 ID (PTT)
Release #1 arm code
Release #1 release code
Release #2 arm code
Release #2 release code
Anchor Drop Position
Latitude _____ **Longitude** _____
Uncorrected water depth _____ (at anchor launch)
Corrected water depth _____ (at anchor launch)

site 1	r1 [redacted]	r2
20:48:30	—	3388.7
20:49:30	3435	3442
20:51:33	3563	3569
20:53:42	3700	3708
20 56 55	3922	
20 58:55	4064.9	4074
21 00 25	4176.	4185

site 1	r1	r2
210125	4259	4237.7
210150	4235.8	4234.9
site 2		
212020	4153.7	4153.8
2039	4155.4	4155.6

site 3		
21:45:00	4494	4496
21:45:21	4494	4493

RAPID-WATCH MOORING LOGSHEET **DEPLOYMENT**

Mooring **WB2** Cruise **KN200-4**

NB: all times recorded in GMT

Date 28 Apr 2011 / fair wind upcurrent 1 kt **Site arrival time** before 12 GMT

Setup distance 2 nm **End time** _____

Start time 13:08

Start Position

Latitude 26°29.152' **Longitude** 76°43.442'

ITEM	SER NO	COMMENT	TIME
1 x Trimsyn pickup float			13:08
3 x Trimsyn floats			
SBE 37 MicroCAT	3228		13:09
30" SYNTACTIC with beacons			13:13
ARGOS beacon	Y01-030	Record Argos ID 46503	
Light	X01-052		
1m chain and swivel			
~~RCM11~~ NORTEK	9204	above both cage grids, 1m apart	13:13
SBE 37 MicroCAT	5242	(5m down from RCM11) & 4619	13:16
51" syntactic with beacons			13:28
ARGOS beacon	286	Record Argos ID 22442	
Light	X01-050		
1m chain with swivel			
~~RCM11~~ NORTEK	9210		13:28
SBE 37 MicroCAT	5765	(5m down from RCM11)	13:29
SBE 37 MicroCAT	3903		
2 x 17" glass			
~~RCM11~~ NORTEK	9213		13:40
SBE 37 MicroCAT	3904		13:44
SBE 37 MicroCAT	3910		
2 x 17" glass			
RCM11	428		13:54
SBE 37 MicroCAT	4066		
SBE 37 MicroCAT	4461		14:02
10 x 17" glass			14:07
Swivel			
RCM11	518	Some question about integrity of frame	14:08
SBE 37 MicroCAT	3916		14:12
NORTEK in frame	5893	3 paired	14:18
SBE37 MicroCAT	3216	~~(5m down from Nortek)~~	
5 x 17" glass			
Swivel			
SBE 37 MicroCAT	6823	(5m down from glass)	

1.9nm to target
4.45 ETime
1.3 kt thru water

SBE 37 MicroCAT	3900		
RCM11	579		
5 x 17" glass			14:45
Swivel			
SBE 37 MicroCAT	3902	(5m down from glass)	14:45-14:56
SBE 37 MicroCAT	6839		14:57
2 x 17" glass			
RCM11	520		15:04
5 x 17" glass			15:13
SBE 37 MicroCAT	6798	(5m down from glass)	15:14
SBE 37 MicroCAT	3247	(at 1st join above glass) 45m above join	15:32
11 x 17" glass			15:35
Swivel			
Release #1 1345	[redacted]	Record release codes	15:38
Release #2 1347		Record release codes	
30M nylon			
10M 1/2" chain			
Anchor 2200 KG			17:21:33

START TOWING 15:50 ~~15:50~~ 15:50

Release #1 arm code [redacted]
Release #1 release code
Release #2 arm code
Release #2 release code
Argos beacon #1 ID 46503
Argos beacon #2 ID 22442

Towing 0.2 nm past drop point
Echo sounder not working as passed over anchor

Anchor Drop Position
Latitude 26° 31.0425 **Longitude** 76° 44.6905
Uncorrected water depth _____ (at anchor launch)
Corrected water depth _____ (at anchor launch)

arm [redacted]

	r1	r2	
17:31:38	~~4379.~~	echo sounder	
17:32:20	2028.4	2045.4	} 141 m/min
17:33:20	2169	2186	
17:34:20	2334.5	2350.6	
17:40:00	3162.9	3178.5	} 128 m/min
17:41.00	3293.3	3306.3	
17:44.00	~	~	
17:44:19	3708.8	3722.4	
17:45:19	3827.8	3827.6	23 min to bottom
17:45~~45~~	3828.4	3829.7	

site 1 (0920)	r1	r2
20:50:37	4310.	4309
20 50.57	4307.6	4306.7
site2 (0920)		
21:21:12	4364.9	4366.2
21:21:31	4368.2	4368.3
SITE 3		
21:46:12	4198	4198
21:46:32	4198	4198

RAPID-WATCH MOORING LOGSHEET **RECOVERY**

Mooring **WB2** Cruise **KN200-4**

NB: all times recorded in GMT

Date ~~27/4/11~~ 27/4/11 **Site arrival time** 16:36

Time of first ranging 16:38

Time of release 16:52 on surf 16.55 range 10 m @ 17:10 + approach FISHING VESSEL

Latitude approx 26° 31.4' **Longitude** 76° 44.78'

(record positions at time of pickup only if likely to be very different from deployment position) 17:40 hooked

ITEM	SER NO	COMMENT	TIME
Recovery line			
3 x TRYMSYN floats			17:44
SBE 37 MicroCAT	3223 ✓	Oresgroom - light fuzz in cell	17:48
30" SYNTACTIC			17:53
ARGOS beacon		Record Argos ID Broke antenna while moving ball	
Light			
1m chain and swivel			
RCM11	305 ✓		1753
SBE 37 MicroCAT	5239 ✓	1m below join, light fuzz in cell	17:56
51" syntactic buoy			18:04
Argos		Record Argos ID	
Light			
1m chain with swivel			
RCM11	306 ✓	Lost bolts in frame - was loose	1805
SBE 37 MicroCAT	3228 ✓	very lightly fuzzy	18:05
SBE 37 MicroCAT	5243 ✓		18:19
2 x 17" glass			18:21
RCM11	445 ✓		18:21
SBE 37 MicroCAT	3906 ✓	bent dust plug — flooded	18:26
SBE 37 MicroCAT	5244 ✓		18:33
2 x 17" glass			18:35
RCM11	448 ✓		18:35
SBE 37 MicroCAT	3230 ✓		18:40
SBE 37 MicroCAT	6113 ✓		18:45
10 x 17" glass		tangle - black + white	18:48
Swivel			
RCM11	449 ✓		18:48
SBE 37 MicroCAT	3231 ✓		18:57
SBE 37 MicroCAT	6114 ✓		
SONTEK ARGONAUT	D295 ✓	Rusty - discolored head	19:02
5 x 17" glass			19:09
SBE 37 MicroCAT	3232 ✓		19:10

SBE 37 MicroCAT	5247 ✓	missing clamp (A) slid down to join	19:16
RCM11	450 ✓		19:19
5 x 17" glass			19:27
SBE 37 MicroCAT	3233 ✓		19:29
SBE 37 MicroCAT	6112 ✓	missing clamp (B) – slid down to join	19:41
2 x 17" glass	←		19:47
RCM11	451	↓ changing drum tangles above glass.	19:48
5 x 17" glass			
SBE 37 MicroCAT	3244 ✓		20:07
SBE 37 MicroCAT	3907 ✓		20:24
11 x 17" glass		tangled in itself	
Swivel			
Release #1			
Release #2			20:26

Ascent rate ?

Time at end of recovery 20:26

position is NW of site } blocked by bathy?

Ranging

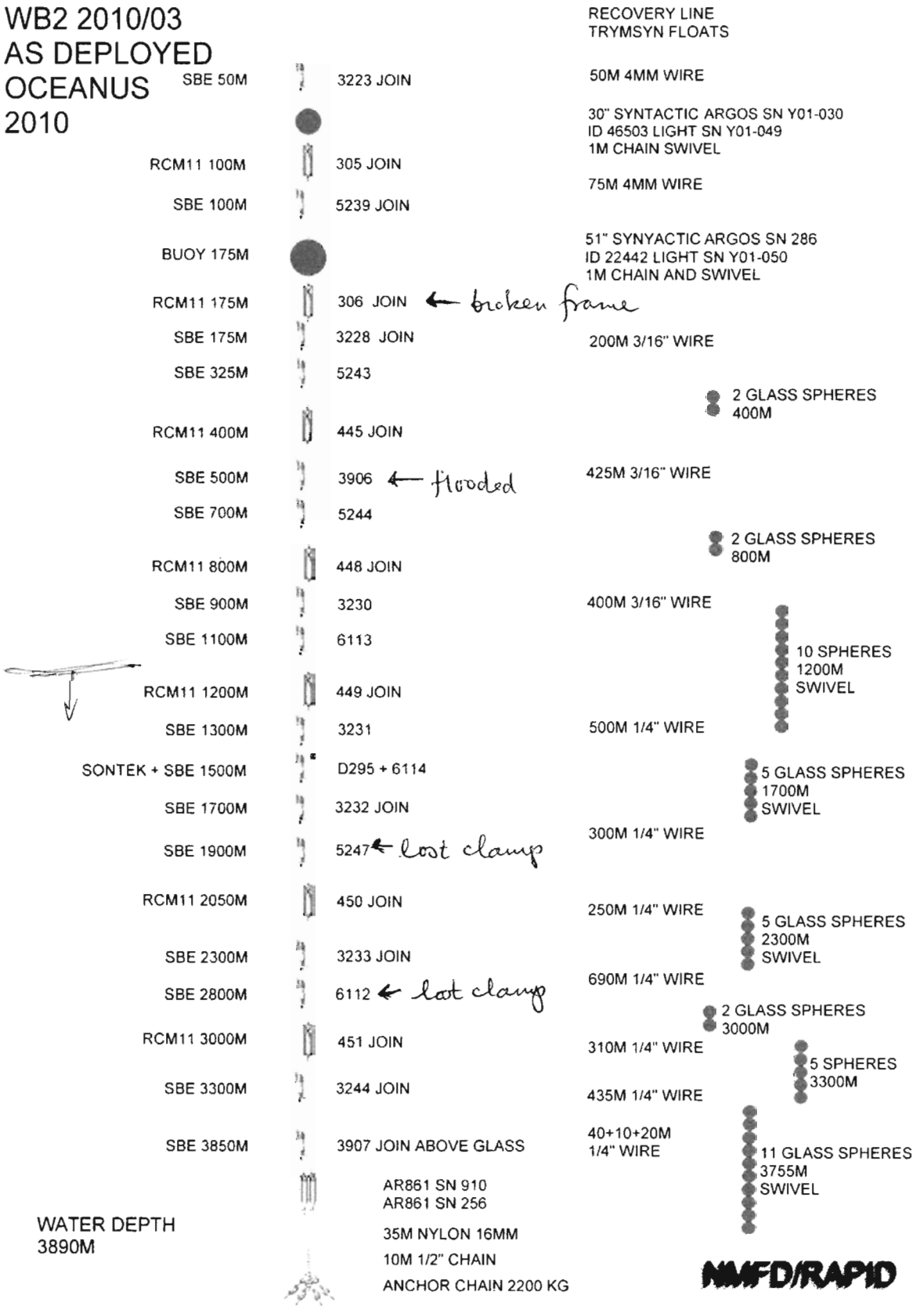
acm [redacted] s/n 910

s/n 258 acm [redacted]

Time	Range 1	Range 2	Command /comment
16:38:38	—	—	
16:39:20	—	—	
16:39:57	—	—	
16:40:56	—	—	
16:41:38	—	—	
16:42:26	—	—	
16:43:03	—	10829.6	V -12.7
16:44:01	—	12881.7	—
[redacted]			
16:51:10	—	3882.2 m	V -12.7
16:51:46	3882.9	3884.7	V 8.6
[redacted]			
16 52 45	3886.5	—	ARM + REL
16 53 22	—	—	
16 54 10	—	3726.8	REL OK
16 54 22	—	—	
			Bridge called - on surface

PROBLEMS AT START OF RANGING LIKELY CAUSED BY X-DUCER HUGGING THE SHIP IN THE STRONG SURFACE CURRENT. GOOD RANGES ONCE SHIP DRIFTING WITH CURRENT.

WB2 2010/03
AS DEPLOYED
OCEANUS
2010



NEED TO RECORD FREQUENCIES

VHF ch. 72

mismatch → 156.625

RAPID-WATCH MOORING LOGSHEET RECOVERY

Mooring **WB4L5** Cruise **KN200-4**

on radio 401.636 MHz

NB: all times recorded in GMT

Date 24 Apr 2011 **Site arrival time** ~~early~~ predawn ~~mid-morning~~

Time of first ranging 10:06

Time of release 10:07

11:13 on surface Starboard stern

Latitude _____ **Longitude** _____

(record positions at time of pickup only if likely to be very different from deployment position)

⇒ 0.3 nm setup dist is not enough.

ITEM	SER NO	COMMENT	TIME
17" glass		yellow	11:39
Recovery line			
Billings Float with VHF and	X02-052	yellow, antenna intact	11:45
Light	W03-093	tangles - chain & line	
2 x 17" glass		orange	11:45
15m polyprop		very twisted	
3 x 17" glass		orange	11:49
15m polyprop			
BPR #1 in tripod	0033		11:54
Release #1 in tripod			

doing 1 thin ½ kt

couldn't hear VHF on bridge

67 min

70 | 4400

estimate surface @ 11:13 ≈ 07:13

Ascent rate _____

Time at end of recovery _____

70 m/min

Ranging

Time	Range 1	Range 2	Command /comment
10:06	—	4668.	
10:06:48	4668	4668	
10:07:32	4667	4666	ARM + REL OK
10:08:30	4613	4603	
10:09:30	4540	4530	
10:10:30	4471	4461	

RAPID-WATCH MOORING LOGSHEET **DEPLOYMENT**

Mooring **WB4L7** Cruise **KN200-4**

NB: all times recorded in GMT

Date _____ **Site arrival time** 21:35 ~ needed to move glass to setup

Start time 21:53 **End time** _____

ITEM	SER NO	COMMENT	TIME
12 " glass pick up float		ORANGE	21:53
15m polyprop			
Billings Float with beacons		YELLOW	
Argos Beacon	mx ID 53130 ←	Record PTT number sla Z02-055	
Light		Z02-019	
5m of 1/2" chain			
15m of polyprop			
4 x 17" glass		ORANGE	21:54
15m polyprop			
4 x 17" glass		ORANGE	21:55
15m polyprop			
4 x 17" glass		ORANGE	21:55
15m polyprop			
BPR #1 in tripod	0014		
BPR #2 in tripod	0057		
Release #1 in tripod	1349	Record release c arm [redacted]	
Release #2 in tripod	358	Record release c [redacted]	
Anchor 500 KG			21:56:50

Argos beacon #1 ID (PTT) 53130
Release #1 arm code [redacted]
Release #1 release code
Release #2 arm code
Release #2 release code
Anchor Drop Position
Latitude 26° 29.198' N **Longitude** 75° 48.435' W
Uncorrected water depth _____ (at anchor launch)
Corrected water depth _____ (at anchor launch)

@21:58:38
26° 29.1996'
75° 48.4311'
4717 m
using mean
w/ 1534.9 m/s
corrected at

RAPID-WATCH MOORING LOGSHEET **DEPLOYMENT**

NOTE: TOOK 1:45 to build the first 4 strings of 5 rugby floats

Mooring **WB4** Cruise **KN200-4**

NB: all times recorded in GMT

Date 24 Apr 2011 **Site arrival time** ~1315

Setup distance 5nm

Start time 16:55 **End time** _____

Start Position

Latitude _____ **Longitude** _____

ITEM	SER NO	COMMENT	TIME	
1 x Trimsyn pickup float		YELLOW	16:55	
3 TRiMSYN floats				
SBE37 Microcat	4464 ✓			
32" syntactic buoy with beacons		ORANGE	16:59	
ARGOS } check Rob's		Record beacon ID		
LIGHT }				
1m Chain and swivel				
NORTEK in frame	5490 ✓		16:59	
SBE37 Microcat	3483 ✓	(5m down from Nortek)	17:03	
49" syntactic buoy with beacons		ORANGE	17:13	
ARGOS } check Rob's		Record beacon ID		
LIGHT }				
1m chain and swivel				
SBE37 Microcat	3486 ✓	~10m below float	17:16	
NORTEK in frame	5590 ✓		17:24	
SBE37 Microcat	4714 ✓	(5m down from Nortek)	17:28	
SBE37 Microcat	3248 ✓		17:33	
NORTEK in frame	5611 ✓		17:41	
SBE37 Microcat	3249 ✓	(5m down from Nortek)	17:42	
SBE37 Microcat	3251 ✓		17:47	
10x 2000m rated rugby floats			18:02	
NORTEK in frame	5955 ✓		18:02	4.6nm
SBE37 Microcat	3252 ✓	(5m down from Nortek)		
NORTEK in frame	6049	SLS BETWEEN FLOATS + ANCHOR | DEPLOYED SEPARATELY FLOATS	18:18	
5x 5000m rated rugby floats			18:18	
SBE37 Microcat	3253 ✓	(5m down from floats)	18:21	
5x 5000m rated rugby floats			18:35	
NORTEK in frame	6050	LOOSENED AND ROTATED JUST BEFORE PAYING OUT.	18:38	
SBE37 Microcat	5788	(5m down from Nortek)	18:37	
5x 5000m rated rugby floats			18:52	
SBE37 Microcat	3259	(5m down from floats)	18:53	
5x 5000m rated rugby floats			19:07	4.1nm
NORTEK in frame	6088		19:07	

INCREASE SPEED TO 1KT

SBE37 Microcat	3484	(5m down from Nortek)	19:10
5x 5000m rated rugby floats			19:24
SBE37 Microcat	3268	(5m down from floats)	19:26
5x 5000m rated rugby floats			19:41
NORTEK in frame	6516		19:41
SBE37 Microcat	5238	(5m down from Nortek)	19:42
SBE37 Microcat at join of 500m and 70m	3207	above @ the join	19:59
NORTEK in frame between 50m and 25m lengths	6534		20:07
10x Benthos glass			20:15
Swivel			
Acoustic release #1	825	Record release codes [redacted]	20:15
Acoustic release #2	1346	Record release codes	
20m nylon			20:16
10m 1/2" chain		Towed for 2.8 nm	23:40
Anchor 2700 KG			23:43:04

3.6 nm 1-1.5 kt over ground

ready at 3:21 from dist

Release #1 arm code [redacted]
Release #1 release code
Release #2 arm code [redacted]
Release #2 release code
Argos beacon #1 ID } see Rob's spheres built, contd'd read 53157
Argos beacon #2 ID 53129

0.3 nm fallback
~15 min for 1.2 nm over ground

Anchor Drop Position
Latitude 26° 29.323 **Longitude** 75° 48.418 Target was 26° 29.2' N 75° 48.7' W

Uncorrected water depth 4708 (at anchor launch)
Corrected water depth 4745 (at anchor launch)

~~looking for ~~ drop site with 4730 m corrected water depth~~

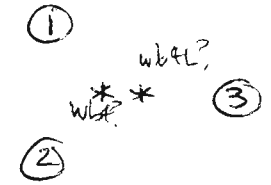
Going 0.3 nm past site of 26° 29.2' 75° 48.7' w/ water depth 4704 m uncorr

Note - remove 10 m of wire so design is for 4705 m but due to expected wire mean error, past 2 top mcats were at 25 m instead of 50 m. ∴ 4705 + 25 = 4730 m desired corrected water depth.

23:55:00	[redacted]	2477	2497
23:56:00		2674	2691
23:57:00		2870	2889
00:02:17		3859	3880

S/n 1346

00:05:29	4433.	4454
00:06:28	4575	4599
00:07:33	4695	—
00:08:30	—	—
00:09:25	4646.	



WB4 WB4L

0921 0924

s/n ARM	time	range	range	diag	lat	lon
WB4L 0924	00:36:25	5106.8	5217.5		26° 30.012'	75° 49.456'
	00.36'50	5110.3	5220.4	North site		
WB4 0921	00:37.14	5113.6	5223.2			
②	00:55:25	5059.4	5008.5		26° 28.489'	75° 49.522
	00:55:52	5062.5	5011.0			
	00:56:15	5064.3	5014.4			
	01:16:55	4838.7	4901.5		26° 29.209	75° 47.760
	01 17 20	4836.3	4899.7			
	01 17 46	4834.2	4897.3			

/WB4
TO DEPLOY
KNORR 2011

RECOVERY LINE
TRYMSYN FLOATS

SBE 50M — JOIN 4464 — 40M 4MM WIRE

BUOY 90M — 32" SYNTACTIC
ARGOS SN ID LIGHT

CM100M — JOIN ✓5490 — CHAIN + SWIVEL

SBE 100M — JOIN 3483

10M 5MM WIRE – REMOVED

140M 3/16" WIRE

BUOY 250M — 49" SYNTACTIC
ARGOS SN ID LIGHT
1M CHAIN AND SWIVEL

SBE 250M — JOIN 3486 — 160M 1/4" WIRE

CM 400M — JOIN 5590

SBE 400M — JOIN 4714 — 400M 1/4" WIRE

SBE 600M — 3248

CM 800M — JOIN 5611

SBE 800M — JOIN 3249 — 380 – shown 383M 1/4" WIRE

SBE 1000M — 3251

10 OFF
CLAMP ON
FLOATS
2000M
RATED
~~7M~~ 10M WIRE
SWIVEL

CM 1200M — JOIN 5955

SBE 1200M — JOIN 3252 — 392-5 393M 1/4" WIRE
— WAS A MISTAKE BUT NOT DEPLOYED HERE AS IN FRANCE

CM ~~1500M~~ 1600M — JOIN 6049

SBE 1600M — JOIN 3253 — 392-5 393M 1/4" WIRE

5289

NMFD/RAPID

WB4
TO DEPLOY
KNORR 2011

SWIVEL

CM 2000M JOIN 6050 ✓ 495

SBE 2000M JOIN 5788 ✓ 496M 1/4" WIRE

SBE 2500M JOIN 3259 ✓ 495 496M 1/4" WIRE

SWIVEL

CM 3000M JOIN 6088 ✓

SBE 3000M JOIN 3484 ✓ 495 496M 1/4" WIRE

SBE 3500M JOIN 3268 495 496M 1/4" WIRE

SWIVEL

CM 4000M JOIN 6516 ✓

SBE 4000M JOIN 5238 ✓ 500M 1/4" WIRE

SBE 4500M JOIN 3207

70M 1/4" WIRE

CM 4600M JOIN 6534

50M 1/4" WIRE

25M 1/4" WIRE

S-L-S BETWEEN ALL FLOAT-NORTH JOINS AS WELL AS ABOVE FLOATS + BELOW NORTH

10 BENTHOS
4650M
SWIVEL ~~AT TOP~~

AR861 SN 825 [redacted] ARM REL
AR861 SN 1346 [redacted] ARM REL

20M NYLON UNDER RELEASES

10M 1/2" CHAIN

ANCHOR CHAIN 2700 KG

WATER DEPTH
4713M

NMFD/RAPID

anchor seabed
26° 21.77'
75° 44.27

RAPID-WATCH MOORING LOGSHEET **RECOVERY**

Mooring **WB4** Cruise **KN200-4**

NB: all times recorded in GMT

Date 23/4/11 **Site arrival time** 15:02

Time of first ranging 15:04 spotted 15:19

Time of release 15:15 top 2000m up buoy 15:52

Latitude _____ **Longitude** _____

(record positions at time of pickup only if likely to be very different from deployment position)

15:19 SPOTTED

ITEM	SER NO	COMMENT	TIME
Recovery line		TOWING MOORING STRAIGHT TO WIND/Traffic	16:03
3 TRYMSYN floats		STARTED HAULING 16:53	16:57
SBE37 Microcat	3206 ✓	1m BELOW FLOATS — LIGHT FOULING	16:57
32" syntactic buoy			17:06
ARGOS			↓
LIGHT			↓
1m Chain and swivel			↓
NORTEK	5879 ✓		↓
SBE37 Microcat	3215	4m DOWN FROM NORTEK	17:09
49" syntactic buoy		KINK IN WIRE JUST ABOVE BUOY	17:19
ARGOS		NEED TO DISCONNECT BLOCK FROM CRANE TO	↓
LIGHT		MOVE OUT THE WAY THEN REATTACH IN	↓
1m chain and swivel		LINE TO CONTINUE RECOVERY	↓
SBE37 Microcat	6819 ✓		17:30
NORTEK	5884 ✓	fish bite above join - PHOTOS	17:35
SBE37 Microcat	3219 ✓		17:38
SBE37 Microcat	3221 ✓		17:44
NORTEK	5889 ✓		17:49
SBE37 Microcat	3222 ✓	~6m from nortek	17:51
SBE37 Microcat	3224 ✓		17:55
10x 2000m rated rugby floats		~C 18:15	18:02
NORTEK	5890 ✓		18:12
SBE37 Microcat	3225 ✓	4m down	18:16
~~NORTEK~~	6765!	nortek after floats @ join	
5x 5000m rated rugby floats			18:26
SBE37 Microcat	3234 ✓	6m after nortek	18:30
5x 5000m rated rugby floats			18:41
NORTEK	~~5897~~ 5967!		18:42
SBE37 Microcat	3913 ✓	~5m after nortek	
5x 5000m rated rugby floats		CHANGING DRUMS	18:58
SBE37 Microcat	2798		19:10

halfway

5x 5000m rated rugby floats			19.22
NORTEK	5897!		19.22
SBE37 Microcat	6799 ✓	~4m below nortek	19.24
5x 5000m rated rugby floats			19.37
SBE37 Microcat	6800 ✓	4m below join	19.40
5x 5000m rated rugby floats			19.52
NORTEK	6119 ✓		19.53
SBE37 Microcat	~801 ✓	slip side - down the wire One clamp missing	19.56
SBE37 Microcat	6802 ✓	One clamp missing - other side of join	20.06
NORTEK	6132		20.12
10x Benthos glass		(7) bottom glass imploded	20.17
Acoustic release #1			20.17
Acoustic release #2			20.17

Ascent rate _____

Time at end of recovery _____

Ranging

Time	Range 1	Range 2	Command /comment
15:04	✓	~~4760~~ 4761	[redacted] ARM + ARM
15:04:55	✓	—	ARM + ARM
15:05:35	4768	4768	ARM + ARM
15:06:42	4772	4773	ARM + DIAG VERTICAL 8.6V
15:15:00	4792	4792	ARM + REC REC OK
15:16:00	4693	4677	

WB4 2010/26
TO RECOVER
KNORR 2010

RECOVERY LINE
TRYMSYN FLOATS

SBE 50M — 3206 JOIN ✓

40M 4MM WIRE

BUOY 90M

32" SYNTACTIC
ARGOS SN304 ID 82895 LIGHT X01-051

NORTEK 100M — 5879 JOIN ✓

SBE 100M — 3215 JOIN ✓

10M 5MM WIRE] CHECK WHY HAVE THIS 10m LENGTH

140M 3/16" WIRE

BUOY 250M

49" SYNTACTIC
LIGHT X01-052
1M CHAIN AND SWIVEL
SPOTTED 15:19

SBE 250M — 6819 JOIN

160M 1/4" WIRE

NORTEK 400M — 5884 JOIN

SBE 400M — 3219 JOIN

400M 1/4" WIRE

SBE 600M — 3221

NORTEK 800M — 5889 JOIN

SBE 800M — 3222 JOIN

383M 1/4" WIRE

SURFACED 15:27

10 OFF
CLAMP ON
FLOATS
2000M
RATED
7M WIRE
SWIVEL

SBE 950M — 3224

NORTEK 1200M — 5890 JOIN

SBE 1200M — 3225 JOIN

393M 1/4" WIRE

SURFACED 15:35

Nortek 6765 @ join → SBE 1600M — 3234 JOIN

393M 1/4" WIRE

SWIVEL 15:48

NORTEK 2000M — ~~5897 JOIN~~ 5967!

SBE 2000M — 3913 JOIN

496M 1/4" WIRE

SBE 2500M — 6798 JOIN

496M 1/4" WIRE

3000M

NMFD/RAPID

JB4 2010/26
TO RECOVER
KNORR 2011

SWIVEL

NORTEK 3000M

~~5967 JOIN~~ 5897

SBE 3000M

6799 JOIN

496M 1/4" WIRE

SBE 3500M

6800 JOIN

496M 1/4" WIRE

SWIVEL

NORTEK 4000M

6119 JOIN

SBE 4000M

6801 JOIN

500M 1/4" WIRE

SBE 4500M

6802 JOIN

70M 1/4" WIRE

50M 1/4" WIRE

6132

NORTEK 4620M

~~6765~~ JOIN

25M 1/4" WIRE

10 BENTHOS
4650M
SWIVEL AT TOP

1 GLASS IMPLODED

AR861 SN 1242 ARM [redacted]
AR861 SN 1200 ARM

20M NYLON UNDER RELEASES

10M 1/2" CHAIN

WATER DEPTH
4713M CORR.

ANCHOR CHAIN 2700 KG

RAPID-WATCH MOORING LOGSHEET **DEPLOYMENT**

Mooring **WB6** Cruise **KN200-4**

NB: all times recorded in GMT

Date 21/Apr/2011 **Site arrival time** 01.00 approx

Setup distance 0.5 nm – rough / Kent current **End time** 01:56

Start time 01:37

Start Position

Latitude 26° 29.65 **Longitude** –70° 31.4

ITEM	SER NO	COMMENT	TIME
12" glass pick up float		ORANGE	01 44
15m polyprop			
Billings float with beacons		YELLOW	
Argos beacon		Record PTT – TUBE OVER AERIAL	0144
Light			
5m chain			
15m polyprop			
2 x 17" glass		ORANGE	0145
MicroCAT below join	3209		0145
100m polyester			
MicroCAT at halfway	6870		0148
100m polyester			
2 x 17" glass		ORANGE	01 50
MicroCAT below join	6820		01 50
100m polyester			
MicroCAT at halfway	6821		
~~Sontek Argonaut as halfway~~ RCM11	515		
100m polyester			
MicroCAT above join	6822	2m UP FROM JOIN	01:54
8 x 17" glass		ORANGE	
BPR #1 on tripod	0059		
BPR #2 on tripod	0053		
Release #1 in tripod	498	Record release codes	
Release #2 in tripod	324	Record release codes	
Anchor 600 KG			01:56

3/10 nm – halfway

Argos beacon #1 ID (PTT) 53128

Release #1 arm code [redacted]

Release #1 release code

Release #2 arm code

Release #2 release code

+60m
5534 dbar
5541 m
echo sounder

Anchor Drop Position

Latitude 26° 29.58' **Longitude** 70° 31.53 200m off

Uncorrected water depth 1535 m/s 5440 ~~5564~~ (at anchor launch)

Corrected water depth 5500 (at anchor launch)

RAPID-WATCH MOORING LOGSHEET **RECOVERY**

Mooring **WB6** Cruise **KN200-4**

NB: all times recorded in GMT

Date 20/4/11 **Site arrival time** 16:57

Time of first ranging 17:00

Time of release 17:03

18:09 surface

Latitude _____ **Longitude** _____

(record positions at time of pickup only if likely to be very different from deployment position) 18 28 hook

ITEM	SER NO	COMMENT	TIME
Pick Up float			18:28
15m polyprop		landtee winch is slow	
3 x 17" glass		(on deck to slot barrel 18:51)	18:46
Microcat at join	3207 ✓		18:51
100m polyester		1852 -	
Microcat about halfway	5238 ✓		18:56
100m polyester			
2 x 17" glass		imploded	1907
Microcat at join	3212 ✓		19:02
SONTEK ARGONAUT	D273 + 3213 ✓		19:06
100m polyester		(twisted rope)	
Microcat about halfway			
100m polyester			
Microcat at join	3214 ✓		19:11
8 x 17" glass			19:12
BPR #1 on tripod	418 ✓		19:15
BPR #2 on tripod	0232 ✓		
Release #1 in tripod	361 ✓		
Release #2 in tripod	~~603~~		

Ascent rate 92 m/min

Time at end of recovery 19:15 clean up deck + secure till 19:27

Ranging

Time	Range 1	Range 2	Command /comment
17:00:14	✓	✓	SN 361 ARM + ARM
	5563	5563	
17:01:45	✓	5563	SN 817 ARM + ARM
17:03:05	5560	5560	361 ARM + REL REL OK.
17:04:00	5500	✓	
17:05:00	5408	5393	

92m/min

17:06:00	5316 J 92 m/sec	5301	

ESTIMATE 53 Mins FOR TOP OF MOORING TO SURFACE FROM 17:06

⇒ 17:59 ETA

RAPID-WATCH MOORING LOGSHEET **DEPLOYMENT**

Mooring **WBADCP** Cruise **KN200-4**

NB: all times recorded in GMT

Date 30 Apr 2011 **Site arrival time** 15:20
Start time 16:24 **End time** 16:32

ITEM	SER NO	COMMENT	TIME
1 x 12" glass pickup float			16:24
15m polyprop			
Syntactic ADCP buoy		2 anodes replaced	16:25
75 KHZ ADCP	10311		
ARGOS BEACON +Light		Record PTT	
Titanium swivel			
10m 5/8" chain			
Acoustic Release #1	1351		
Acoustic Release #2	1353		
5m 5/8" chain			
Anchor 850 KG			16:32:20

Argos beacon #1 ID 46508 ← from Rob
Release #1 arm code [redacted]
Release #1 release code
Release #2 arm code
Release #2 release code

Anchor Drop Position
Latitude 26°31.4968 **Longitude** 76°52.0800
Uncorrected water depth 608m (at anchor launch)
Corrected water depth 617 (at anchor launch)

RAPID-WATCH MOORING LOGSHEET **RECOVERY**

Mooring **WBADCP** Cruise **KN200-4**

NB: all times recorded in GMT

Date 29 Apr 2011 **Site arrival time** _____

Time of first ranging 21:48

Time of release 21:49

Latitude _____ **Longitude** _____

(record positions at time of pickup only if likely to be very different from deployment position)

grappled 21:59

ITEM	SER NO	COMMENT	TIME
1 x glass			21:59
15m POLYPROP 24mm			
SYNTACTIC ADCP BUOY			22:06
75 KHZ ADCP			
ARGOS BEACON			
Titanium swivel			
10m 5/8" chain			
Release			22:10

Ascent rate _____

Time at end of recovery 22:10

Ranging

Time	Range 1	Range 2	Command /comment
21:48:58	—	631.7	
	631.1	631.	
21:49:56	630.5	630.1	ARM + REL no answer
21:50:30	592	580	—
21:50:52	—	—	
21	464	453	

S/n arm 823 [redacted]

RAPID-WATCH MOORING LOGSHEET **DEPLOYMENT**

Mooring **WBAL2** Cruise **KN200-4**

NB: all times recorded in GMT

Date 30 Apr 2011 **Site arrival time** 17:16

Start time 17:17 **End time**

ITEM	SER NO	COMMENT	TIME
12 " glass pick up float			17:18
15m polyprop			
Billings Float with beacons			17:18
Argos Beacon	Y01-012	Record PTT number 46494	
Light	Y01-016		
5m of 1/2" chain			
15m of polyprop			
4 x 17" glass			17:19
15m polyprop			
4 x 17" glass			17:19
15m polyprop			
4 x 17" glass			17:20
15m polyprop			
BPR #1 in tripod	417	not tied above	
BPR #2 in tripod	39		
Release #1 in tripod	1352	Record release codes	
Release #2 in tripod	364	Record release codes	
Anchor 500 KG			17:21:20

Argos beacon #1 ID (PTT) 46494

Release #1 arm code [redacted]

Release #1 release code

Release #2 arm code

Release #2 release code

Anchor Drop Position

Latitude 26° 31.574' N **Longitude** 76° 52.552' W

Uncorrected water depth 493 (at anchor launch)

Corrected water depth 501 (at anchor launch)

RAPID-WATCH MOORING LOGSHEET **DEPLOYMENT**

Mooring **WBH2** Cruise **KN200-4**

NB: all times recorded in GMT

Date 27 Apr 2011 **Site arrival time** ~7am GMT (overnight)

Setup distance 5nm due to 0.8 kts current against us. May mean ~~more~~ less with Fallback.

Start Position

Latitude 26° 32.937' **Longitude** 76°41.039'

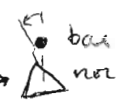
Start time 12:22 **End time** 14:36

ITEM	SER NO	COMMENT	TIME
1 x 12" glass pickup		YELLOW	12:23
Recovery line			
Billings float with beacons		YELLOW	12:24
ARGOS beacon	X02-057	Record PTT 93792/9AE7A00	
Light	X01-051		
5m chain			
14 x 17" glass		ORANGE	~~12:57~~
Swivel			
NORTEK	6723	up/down looking?	~~12:5~~
7 x 17" glass		ORANGE	12:57
NORTEK	6083	up/down looking?	12:51
NORTEK	6805	up/down looking?	13:12
3 x 17" glass		ORANGE	13:32
Swivel			
NORTEK	8052	Up/down looking?	13:33
SBE37 Microcat	3214	(5m down from Nortek)	13:34
SBE37 Microcat at join	3213		13:48
3 x 17" glass		ORANGE	13:57
NORTEK	8120	Up/down looking? team not quite away from buoy	13:58
SBE37 Microcat	3212	~5m	14:06
5 x 17" glass		(5m above glass)	14:08
Swivel			
Release #1	1348	Record release codes } See Rels	14.09
Release #2	1350	Record release codes }	14:09
20m Nylon		down to anchor only @	14:20
5m ½" chain			
Anchor 1400kg			14:36:07

low tension
doing 1.8kt thru water = 2.5kt over grnd

2.88nm to target

1.5nm 10:37 to drop (800m past)



@ 14:22 ETA 06 am 15 min

Release #1 arm code [redacted]
Release #1 release code
Release #2 arm code
Release #2 release code
Anchor Drop Position

26° 28.775 76° 37.163'

Latitude _____ **Longitude** _____
Uncorrected water depth 4698 (at anchor launch)
Corrected water depth _____ (at anchor launch)

FROM Anchor seabed - looks to be in 4780m deep.

Descent -

		r1	r2	
0923	14 42 23	–	1271.2m	
	14:42:56	1323.6	1342.1m	} 184 m/min
	14:43:56	1507.7	1527.1	
0925	14:45:10	1731.0	1749.5	} 180 m/min
	14:46:10	1911.7	1930.8	
	14:51:50	2871	~~3027~~	} 156 m/min
	~~14:51:50~~			
	14:52:50	3027		
	14:55:15	3369	3383	} 126 m/min
	14:56:15	3495	3509	
	14:57:15	3619	3631	} 127 m/min
	15:04:30	4458	4472	] 113 m/min
	15:05:30	4571	4585	
	15:07:30	4673	4673	
	15:07:53	4677	4673	

Site 1 r1 SE

21:10:50	~~1398.~~	echo sounder on
21:11:30	2413.	316.
21:15:40	4939	4940
21:16:05	4944.6	4946.5
26°28.288	76°36.406	

NE site

21:49:30	5088.4	5087.4 ↔ 26°29.815 76°37.385
21:49:52	5085.2	5083.7

site 3 r1 r2

22 11 30	4967.8	4966.2
22 11 53	4964.9	4964.9
26° 28.847	76° 38.311	

RAPID-WATCH MOORING LOGSHEET **RECOVERY**

Mooring **WBH2** Cruise **KN200-4**

NB: all times recorded in GMT

Date 26 Apr 2011 **Site arrival time** 18:01

Time of first ranging 18:02

Time of release 18:05

Setting up 0.5nm from anchor seabed 18:26 - over 1nm appears to have drifted South

Latitude _____ **Longitude** _____

(record positions at time of pickup only if likely to be very different from deployment position)

Only waited for top 3 (Billings + 2 × orange) 1854 hooked

ITEM	SER NO	COMMENT	TIME
1 x 17" glass		really tangled under 14 glass	
Recovery line			
Billings float	Y01-027 ✓	Rex 46500	19:03
Light	Y01-015 ✓		
14 x 17" glass		tangle w/ line below	19:07
Swivel			
NORTEK	6176 ✓		19:09
7 x 17" glass		ALL ORANGE - corroded links missing bush?	19:28
NORTEK	6743 ✓		19:28
NORTEK	6747 ✓		19:53
3 x 17" glass		ALL ORANGE	20:14
Swivel			
NORTEK	6751 ✓	tangled line	20:14
SBE37 Microcat	3258 ✓	banged on deck	20:14
SBE37 Microcat	5245 ✓		20:29
3 x 17" glass			20:38
NORTEK	6753 ✓		20:38
SBE37 Microcat	3905 ✓		20:46
5 x 17" glass			
Swivel			
Release #1	911		
Release #2	249		20:47

Ascent rate 80 m/min

Time at end of recovery 20:47

Ranging

Acm sln 911 249

Time	Range 1	Range 2	Command /comment
18:02	4154	3692	
18:02 57	4715.6	4715.7	V 8.7
18 03 40	4714		V 12.7
18 04 24	4714.8	4714 1	V 8.4

[redacted]

86.
80

180528	4712.9	4712.9	ARM+Rel Rel OK
180619	4641.6	—	
180718	4555.2	4544	
180818	4476	4464	

$$80\overline{)4476} = 55 \text{ R } 47$$

$$80\overline{)1500} = 19$$