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Cruise Report No. 21

RRS *Discovery* Cruise 382

08 OCT – 24 NOV 2012

RAPID moorings cruise report

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2012

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ABSTRACT

This cruise report covers scientific operations conducted during RRS *Discovery* Cruise 382. The purpose of the cruise was the refurbishment of an array of moorings spanning the latitude of 26.5°N from the Canary Islands to the Bahamas. Di382 departed from Southampton on Monday 8th October 2012, calling at Santa Cruz de Tenerife and Nassau, Bahamas before finally docking in Freeport, Bahamas on the 24th November 2012 after 47 days at sea. The full itinerary is described in Section 2.

The moorings are part of a purposeful Atlantic wide mooring array for monitoring the Atlantic Meridional Overturning Circulation and Heat Flux. The array is a joint UK/US programme and is known as the RAPID-WATCH/MOCHA array. The array as serviced on Di382 consisted of a total of 17 moorings, 7 landers. This added to 7 landers and a single inverted echo sounder that had been deployed already. The US contributes 3 full depth moorings and 2 landers to the array. A full introduction is included in Section 3.

During Di382 we recovered and redeployed: EBH1, EBH1L, EBH2, EBH3, EBHi, EB1, EB1L, EBH4, EBH4L, MAR3, MAR3L, MAR2, MAR1, WB6, WB1, WB4, WB4L, WB2, WB2L, WBH2, WBAL, WBADCP. EBH5 was recovered but not re-deployed. MAR1L, MAR0 were not recovered but were redeployed. WBP1 was the first deployment of a PIES lander in the western boundary. A sediment trap mooring NOGST was also recovered and redeployed for the Ocean Biogeochemistry and Ecosystems Group at the NOCS. Mooring operations and data processing are described in Sections 8 and 9. Diagrams of deployed moorings are included in Section 20. Logsheets of all recoveries and deployments of moorings are included in Sections 21 and 22.

CTD stations were conducted throughout the cruise for purposes of providing pre- and post-deployment calibrations for mooring instrumentation and for testing mooring releases prior to deployment. CTD operations and data processing are described in Sections 6 and 7.

Shipboard underway measurements were systematically logged, processed and calibrated, including: surface meteorology, 6m depth sea temperatures and salinities, water depth, navigation. Water velocity profiles from 15 m to approximately 800 m depth were obtained using a ship mounted 75 kHz acoustic Doppler current profiler. Shipboard measurements are described in Sections 4 and 5.

Five APEX argo floats and five SVPs (surface velocity probes), supplied by the Met Office, were deployed during the cruise. Nine SVP plus salinity drifters were deployed for the SPURS project. These are described in Section 10.

Summaries of instruments tested on CTDs, moored instrument record lengths, lost/damaged instruments, deployments, recoveries, acoustic releases and all RAPID cruises are included in Sections 13 to 19.

KEYWORDS

ISSUING ORGANISATION

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Southampton-Nassau

Scientific Personnel

Gerard McCarthy	Principal Scientist, NOC
Darren Rayner	Senior Scientist, NOC
David Smeed	Senior Scientist, RAPID PI, NOC
Ben Moat	Senior Scientist, NOC
Charlotte Mielke	PhD Student, Universitat Hamburg
Rafael Jaume Catany	MSc Student, NOC
Alex Clarke	Volunteer

Technical Personnel

Rob McLachlan	Senior Technical Officer, Moorings
Jeff Benson	CTD Technician
Steve Whittle	Moorings
Colin Hutton	Moorings
Dave Childs	Sensors
Chris Crowe	Sensors
Ian Murdoch	Base Engineering
Zoltan Nemeth	ITO

Ship's Personnel

Peter Sarjeant	Master
Phil Gauld	Chief Mate
Mike Hood	2nd Officer
Liam McClintock	3rd Officer
Ian Slater	Chief Engineer
Mike Murray	2nd Engineer
John Harnett	3rd Engineer
Ian Collin	3rd Engineer
Denis Jakobaufderstroht	E.T.O.
Emeylyn Williams	Motorman
Stuart Cook	Bosun
Martin Harrison	Scientific Bosun
Steve Duncan	Bosun's Mate
Mark Moore	A.B.
Dickie Deal	A.B.
Stephen Gallagher	A.B.
Stephen Toner	A.B.
David Hartshorne	Purser
Peter Lynch	Head Chef
Dean Hope	Chef
Jacqueline Waterhouse	Steward

Nassau-Freeport Changes

Ship's Personnel

Peter Newton	Chief Mate
Bernie McDonald	Chief Engineer
John Hagan	2nd Engineer
Declan Goode	3rd Engineer
John Smyth	Motorman
Greg Lewis	Bosun
John MacDonald	Scientific Bosun
Robert Spencer	Bosun's Mate
William McLennan	A.B.
Garry Crabb	A.B.
Graham Bullimore	Purser
Mark Preston	Head Chef
Lloyd Sutton	Chef
Jeffery Osborn	Steward

Technical Personnel

Jason Scott	Senior Technical Officer
Paul Provost	CTD Technician
Dan Comben	Cruise Manager

2 Itinerary

Gerard McCarthy

RRS Discovery departed Empress Docks, Southampton on the 8 October 2012 on her last scientific cruise: Cruise 382. This was to be our 25th RAPID cruise–8th on *RRS Discovery*–and was to be our most ambitious expedition to date.

Underway data systems (ADCP, TSG, Navigation, Bathymetry and Meteorological systems) were all activated shortly after leaving port. These are described in Section 5. Ashtech data were poor at the start of the cruise and gave persistent problems. The system was restored to working order on 10 October following removal and reattachment of the cable to aerial 4. The transmissometer and fluorometer components of the TSG system were regularly cleaned during the trip but gave consistent problems. The TSG itself was not cleaned, to preserve calibration, and was stable for the trip.

From Southampton, the ship sailed towards the RAPID moorings sites south of the Canary Islands. A deployment of an Argo float and Met Office SVP (Surface Velocity Probe) was undertaken on the transit down. Full details of Argo float and drifter deployments can be found in Section 10 and will not be described further in this itinerary. Two CTDs for pre-calibration of MicroCATs and testing of acoustic releases were also undertaken. Full details of the CTDs and the instruments tested on them are in Sections 6 and 7.

Moorings work began on the 15 October at the EBH1 mooring site. From here, we worked eastwards through EBH1, EBH1L, EBH2 to EBH3. Diplomatic clearance for work in Moroccan waters had not arrived at this stage so we could not complete EBH4, EBH5 and EBH4L that were in Moroccan waters. We resorted to a plan that had been created in the case of this eventuality: when redeployed EBH3 was extended to the surface and a new lander, EBH3L1, was deployed at this site.

The ship returned to port in Santa Cruz on the 18 October for repairs to the starboard lifeboat and to pick up an air conditioning unit. We departed Santa Cruz on the 21 October and headed for the offshore moorings of the Eastern Boundary: EBHi, EB1 and EB1L. The top MicroCAT on EB1 was observed to be at 12 m depth and the top floats were damaged with fishing gear. We concluded that the top float must have been on the surface. This lead to the decision to remove 20 m of wire from the mooring when redeployed.

Diplomatic clearance arrived from Morocco on the 23 October. Following work at the EB1 site, which finished on the 25 October, we returned to recover the moorings at EBH3L1 (deployed earlier in the cruise), EBH4, EBH4L2 and EBH5. We deployed EBH4 and EBH4L4. A new EBH5 was not deployed as the extended EBH3 acted as sufficient back up for EBH4. This work in Moroccan waters was accomplished in one day on the 28 October.

From here we transited to MAR3 at 41°W: we encountered unseasonal weather in the form of the tail end of tropical storm Tony, which reduced our speed to around six knots for the time period 30 October to 2 November. The ship suffered a power cut at 08.00 on 31 October due to a short-out of a main circuit board. Most systems rebooted immediately. Oceanus was switched to a UPS to allow for safe shut down in the event of a reoccurrence. Mount points were restored manually to Oceanus. A problem with the gyro feed to the ADCP was only discovered on the 6 November. This was eventually sorted by the rebooting of the gyro feed in the Comms room.

Surface velocity and salinity drifters were deployed for the SPURS project at 0.1° intervals from 37.7°W on 4 November (Section 10).

To regain time lost, no CTDs were performed at the MAR3 site. An excellent effort was put in by the technical team and crew at this site to keep the work to a single day that included the recovery and redeployment of MAR3, MAR3L and NOGST.

Good time was made transiting to the MAR1/2 site, allowing the recovery of MAR2 on 7 November. The first overnight CTD suffered from scrolling problems. A second CTD was successfully completed but scrolling problems remained. Attempts to release MAR1L6 on the morning of 8 November were unsuccessful in the morning. Communication with the releases were good; releases were believed to have fired but the lander did not move. An implosion was suspected. MAR1, the tallest mooring of the array, was recovered and deployed on the same day. A shortened MAR2 and a lander, MAR1L8, were deployed on the morning of 9 November.

MAR0 was due to be recovered on 10 November. However, the mooring failed to surface. Communications were intermittent but both releases returned a 'Release OK' command. In spite of attempts to release the mooring from four separate locations, it failed to move from the seafloor. A possible implosion of the large pack of eight glass near the bottom of the mooring was suspected: the remaining buoyancy would not have been enough to bring the mooring to the surface. The craggy seabed around this mooring location could also have been a factor. We redeployed MAR0 with extra buoyancy towards the top and in an apparently flatter region nearby.

WB6 was recovered and redeployed on 14 November. An extra glass was added to the mooring so that it was the same as the newly deployed MAR0.

We docked in Nassau on 16 November for a crew change (Section 1) and a change of a few of the technical staff. Mysteriously, Oceanus shut down in the morning between 06.00 and 07.15 and needed to be rebooted. We departed Nassau at 5.00 pm local time.

WB1 was recovered and re-deployed on the 17 November with the new crew and technicians slotting in quickly to the moorings operations. The 18 November saw the first day's work at the WB4 site, with a lander turned around and WB4 itself recovered. The rugby float chain gang kicked into action that afternoon in preparation for the deployment of WB4 on the 19th.

The 20th November saw the turnaround of WB2 and WB2L. WB2 is the backbone of the RAPID array–the most important mooring. The scientific party worked hard on the data and produced an updated MOC timeseries that night (See Figure 1 for a previous example).

Moorings work continued apace. WBH2, WBADCP and WBAL were recovered on 21 and redeployed on the 22 November. The weather had deteriorated on the 21st and remained against us for the rest of the trip.

A final bonus piece of work was completed on the 23rd with the deployment of WBP1–a PIES lander. A frame had to be fashioned for the PIES by modifying an old lander frame. This entailed a long evening of angle grinders and welding for some members of the technical party. The finished product was to be the final deployment from *RRS Discovery*. CTD 18 was the final scientific act of the cruise and the final scientific act in *RRS Discovery*'s long career.

We docked to Freeport on 24 November after a long and successful cruise.

3 Introduction

Gerard McCarthy

The Atlantic Meridional Overturning Circulation (AMOC) at 26.5°N carries a northward heat flux of 1.3 PW (Johns et al., 2010). 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 north eastern European climate about 5°C warmer than the zonal average at this latitude. 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 (Bindoff et al., 2007).

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. It is fair to say that this programme has revolutionised our understanding of the AMOC. Early in the project, Cunningham et al. (2007) demonstrated that the AMOC reveals dramatic richness of variability. As the timeseries has been extended, modes of variability have been revealed on seasonal (Kanzow et al., 2010; Chidichimo et al., 2010) and interannual (McCarthy et al., 2012) timescales. The latest published version of the timeseries from McCarthy et al. (2012) can be seen in Figure 1.

The RAPID-MOC programme is now in its eighth year. The NERC contribution to the first four years of continuous AMOC observations was funded under the directed programme RAPID Climate Change. A commitment to fund the array until 2014 was made 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 to 2014. A number of operational changes have been implemented on Di382, namely switching to an 18 month turnaround of the mooring, servicing the whole array in a single cruise and reductions in some of the moorings, that will allow funding to be stretched to 2015. Following a second successful international review in 2012, plans are being made to secure funding beyond 2015.

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 array , to exploit the data from the RAPID-WATCH array and elsewhere to determine and interpret recent changes in the Atlantic MOC and to investigate the potential for predictions of the AMOC and its impacts on climate.

3.1 The AMOC system

The Atlantic at 26.5°N 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 2). Variability in Gulf Stream flow is derived from cable voltage measurements across the Florida Straits (Baringer & Larsen, 2001), and variability in wind-driven surface-layer Ekman transport across 26.5°N is derived from either CCMP (Atlas et al.,

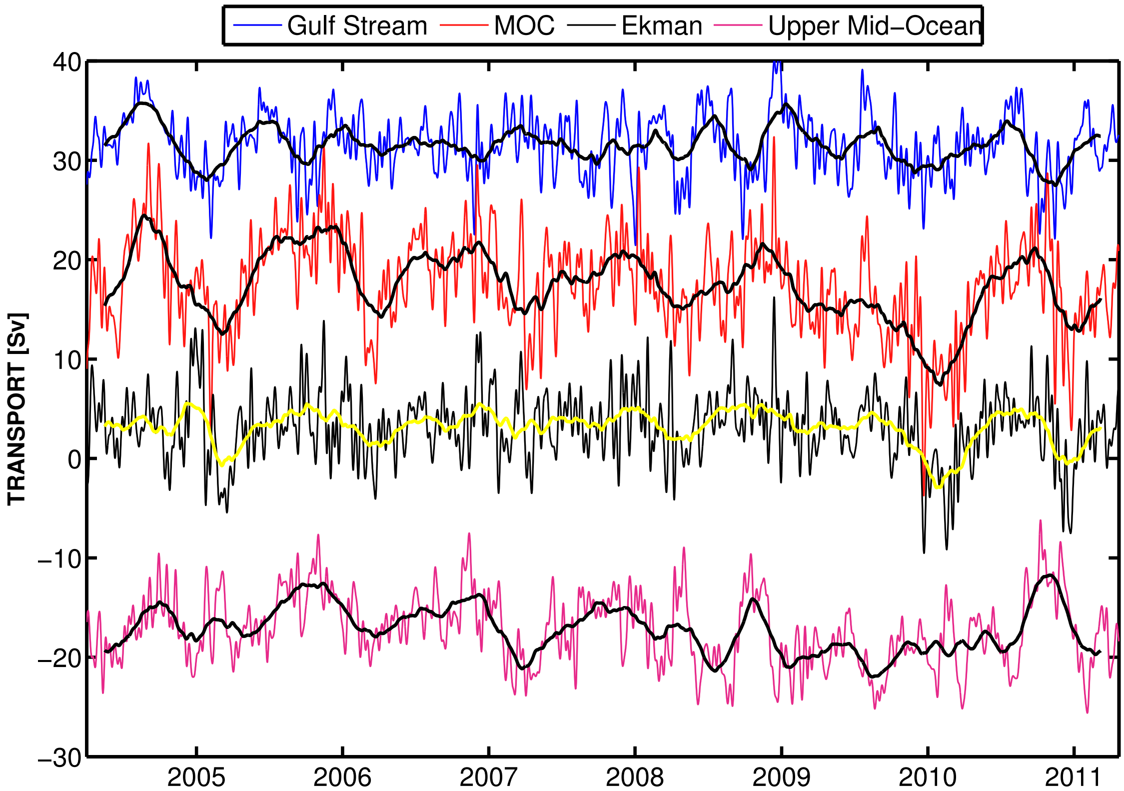


Figure 1: Ten-day (colors) and three month low-pass (black or yellow for Ekman) timeseries of Gulf Stream transport (blue), Ekman transport (black), upper mid-ocean transport (magenta), and overturning transport (red) for the period 1 April 2004 to 22 April 2011 based on the figure in McCarthy et al. (2012).

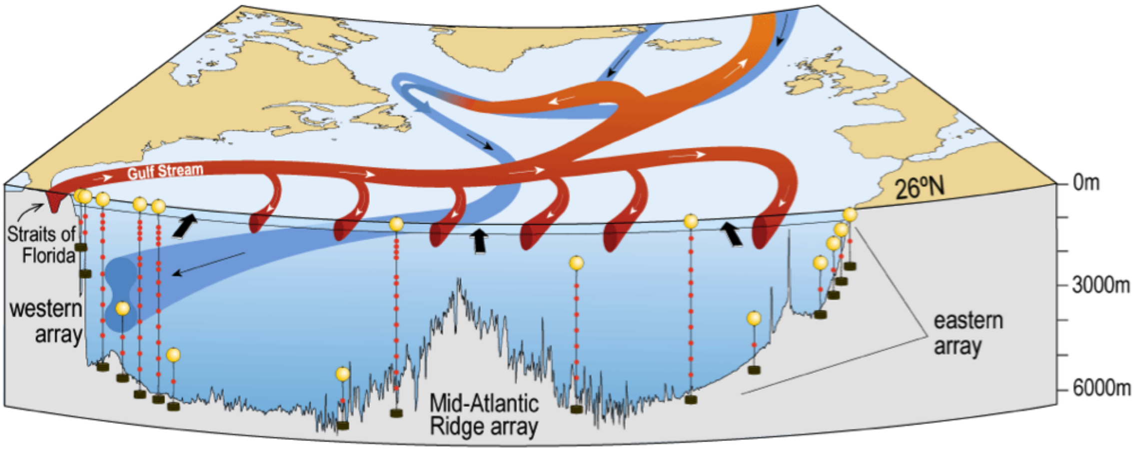


Figure 2: Schematic of the principal currents of the Atlantic meridional overturning circulation. The vertical lines across the Atlantic at 26.5°N indicate moorings instrumented to measure the vertical density profiles. The Gulf Stream (red) transport is measured by a submarine cable in the Straits of Florida and the western boundary array includes current meters to directly measure transports of the shallow and deep western boundary currents (blue). Bottom pressure recorders are located at several sites across the Atlantic to measure depth-independent fluctuations of the basin-wide circulation.

2011) or ERA-Interim winds (Dee & co authors, 2011).

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, components of the Antilles current and deep western boundary current are monitored by direct velocity measurements. For a review, see Rayner et al. (2011).

3.2 Array Specification

The array refurbished on Di382 consists of a total of 17 moorings, 7 landers. This is added to the 7 landers and a single inverted echo sounder that had been deployed on previous cruises. Figure 3 shows the array before and after Di382.

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.

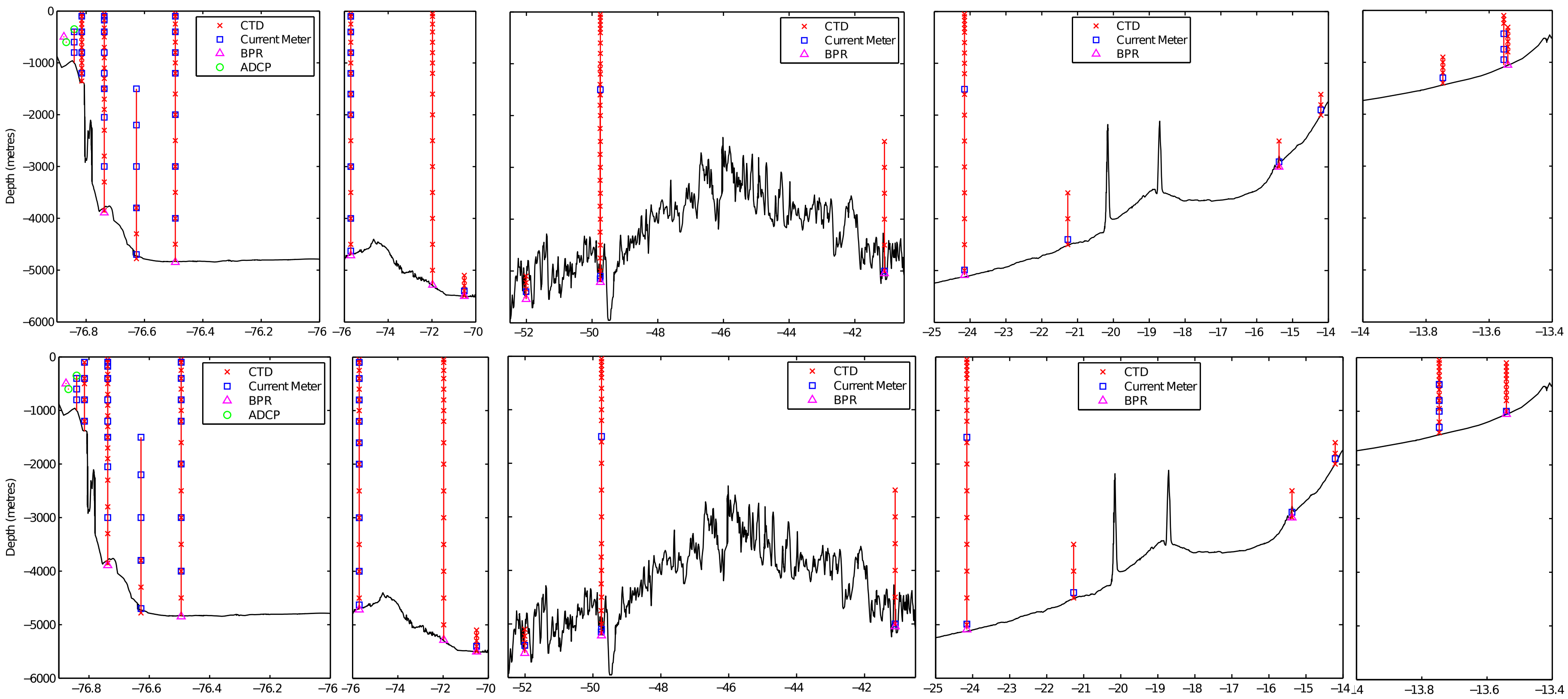


Figure 3: The RAPID/MOCHA array (top) before and (bottom) after Di382. Panels show, from left, the western boundary array at the continental shelf including WBADCP, WBAL, WB0,WB1, WB2, WBH2, WB2L and WB3. The deep western boundary array including WB4, WB4L, WB5 and WB6. The Mid-Atlantic Ridge array including MAR0, MAR1, MAR1L, MAR2, MAR3 and MAR3L. The deep eastern boundary array including EB1, EB1L, EBHi, EBH1, EBH1L and EBH2. The slope eastern boundary array including EBH3, EBH4, EBH4L and EBH5. Moorings WB0, WB3 and WB5 comprise the MOCHA element of the array. Modifications on this cruise include removing 11 MicroCATs from WB1, reducing the height of MAR2 to the permeable height of the ridge, extending EBH3 to the surface instead of EBH5 and extending EBH4 so that it covers the full water column from 0 to 1000 m.

Eastern Boundary Sub-array

The Eastern Boundary sub-array currently consists of one tall mooring EB1, consisting of eighteen MicroCATs and two current meters, and a series of shorter dynamic height moorings EBHi, EBH1, EBH2, EBH3 and EBH4 that step up the slope reducing the influence of bottom triangles when combined with the more offshore EB1 mooring. The Eastern sub-array includes six bottom pressure landers; two at the site of EB1, comprising two bottom pressure recorders (BPRS) each, two at the site of EBH1, comprising one bottom pressure recorder each and two at the site of EBH4. EBH4L was deployed close to the site of EBH4 as a replacement for the Inverted Echo Sounder with a pressure sensor (PIES) instrument that could not be redeployed during this cruise. The landers are serviced in alternate cruises so that each recovery provides a two-year record with a year overlap with the previous lander to help remove instrument drift. There is currently one PIES deployed in the eastern boundary sub-array, EBP2, which was serviced on Di359.

On Di382, a change was made to the array at the eastern margins: where previously EBH4 and EBH5 had been co-located providing a single density profile of the top 1000 m, on this cruise, EBH3 was extended to the surface and EBH4 modified to provide the full density profile on its own from 1000 m. EBH5 was not redeployed.

Mid-Atlantic Ridge Sub-array

The sub-array at the Mid-Atlantic Ridge consists of one full depth mooring MAR1, three shorter moorings MAR0, MAR2 and MAR3, and four landers: two at the site of MAR1, and two at the site of MAR3. MAR0 is a recent addition to the array and consists of five MicroCATs, one current meter and two BPRs to capture the Antarctic Bottom Water (AABW) contribution to the MOC to the west of the ridge. MAR1 provides a full depth density profile through eighteen MicroCATs, with MAR2 acting as a backup to 1000 m on the west of the ridge. MAR3 is sited to the east of the ridge and allows separation of the eastern and western basin MOC contributions.

On Di382, MAR2 was reduced in height by 2500 m to the permeable height of the ridge at 3800 m. MAR3 was extended 500 m to 2000 m so that it extends to the depth at which Argo profiling data are available.

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. WB2 comprises sixteen MicroCATs and eight current meters. WB1 comprises four MicroCATs and four current meters. Inshore of WB1 there is WBADCP (sometimes referred to as WBA) 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 MicroCATs and five current meters. At the normal offshore extent of the Deep Western Boundary Current (DWBC) is WB4, which comprises fifteen MicroCATs and nine current meters. Further offshore is WB6 comprising five MicroCATs and two bottom pressure recorders, which combined with MAR0 measures the contribution to the MOC of deep water below

5200 m including the AABW. There are again four landers in this sub-array; two at the site of WB2 and two at the site of WB4.

On Di382, the number of MicroCATs on WB1 was reduced from 15 to 4.

In addition to the moorings listed above, the western boundary sub-array also contains three full depth moorings and two landers from the University of Miami, that were serviced on cruise AB1209 on the R/V Endeavor. WB0 comprises three 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 16 MicroCATs, 6 current meters and an ADCP. 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 MicroCATs and provides the thermal-wind shear across the full width of the boundary currents including any recirculation.

3.3 Results and Data Policy

All data and data products from this programme are freely available. The NERC data policy may be found at http://www.bodc.ac.uk/projects/uk/rapid/data_policy/. Access to data and data products can be obtained via http://www.noc.soton.ac.uk/rapidmoc/ (or alternatively http://www.rapid.ac.uk/rapidmoc) and http://www.rsmas.miami.edu/users/mocha/index.htm). Data may also be obtained directly from http://www.bodc.ac.uk/.

4 Computing and Fitted Instrumentation

Zoltan Nemeth, Darren Rayner and David Smeed

4.1 RVS LEVEL C System

Level C - The level C system is a Sun Solaris 10 UNIX Workstation `discovery1`, also known as ABCGATE. The RVS software suite is available on this machine. This suite of software allows the processing, editing and viewing of all data within the RVS data files. This system also has monitors that allow us to ensure that the level C is receiving data from the level B.

4.2 Ifremer Techsas System

The Ifremer data logging system is the system that will eventually replace the existing Level A and B systems while for the most part the Level C will remain as the main system for outputting, viewing and editing the acquired data.

The Techsas software is installed on an industrial based system with a high level of redundancy. The operating system is Red Hat Enterprise Linux Edition Release 3. The system itself logs data on to a RAID 0 disk mirror and is also backed up from the Level C using a 200GB / 400GB LTO 2 Tape Drive. The Techsas interface displays the status of all incoming data streams and provides alerts if the incoming data is lost. The ability exists to broadcast live data across the network via NMEA.

The storage method used for data storage is NetCDF (binary) and also pseudo-NMEA (ASCII). At present there are some issues on some data streams with file consistency between the local and network data sets for the ASCII files. NetCDF is used as the preferred data type as it does not suffer from this issue.

Both Techsas loggers were attached to separate UPS backup devices. Also connected to the KVM switcher.

The Techsas data logging system was used to log the following instruments:

1. Trimble GPS 4000 DS Surveyor (converted to RVS format as `gps_4000`)
2. Chernikeef EM speed log (converted to RVS format as `log_chf`)
3. Ships Gyrocompass (converted to RVS format as `gyro`)
4. Simrad EA500 Precision Echo Sounder `ea500`
5. NMFD Surface-water and Meteorology `surfmet` instrument suite
6. ASHTECH ADU-5 Attitude Determination Unit `gps_ash`
7. NMFD Winch Cable Logging And Monitoring CLAM `winch`
8. Fugro Seastar 9200 G2 XP Differential `gps_g2`
9. Sea-Bird SBE45 MicroTSG

4.3 Fugro Seastar DGPS Receiver

The Fugro Seastar G2 is a Glonass and GPS receiver that is used to provide 10 cm accuracy and also receives differential from the Fugro differential system. This signal is then buffered out to multiple systems including the Trimble 4000 DS. The Seastar was purchased as an upgrade to the old Seastar and G12 combination. The system is designed to cope wit the future expected solar activity that is expected to disable part of the existing GPS network. The system is also capable of receiving corrections via internet if necessary.

4.4 Trimble 4000 DS Surveyor

The Trimble 4000DS is a single antenna survey-quality advanced GPS receiver with a main-masthead antenna. It uses differential corrections from the Fugro Seastar unit to produce high quality differential GPS (DGPS) fixes. It is used as the data source for Navigation on the ships display system (SSDS). This antenna is directly on top of the mast and suffers from negligible interference from other items on the mast. It is also almost directly at the centre point of the ship making it an ideal navigation system.

4.5 Ashtech ADU-5

This is a four antenna GPS system that can produce attitude data from the relative positions of each antenna and is used to correct the VMADCP for ship motion. Two antennae are on the Bridge Top and two on the boat deck. The ADU-5 forms part of the `bestnav` system which is an assembly of multiple GPS signals including the `gyronmea` and `emlog` stream in order to calculate the best possible position, speed heading pitch and roll of the ship. The Ashtech is not as reliable as the Fugro Seastar G2 and the 4000DS mainly due to its low position on the ship it is hard for this system to maintain locks on satellites when the ship is maneuvering and the bridge and main mast come into its direct line of sight with the satellites.

4.6 Gyronmea

The Gyronmea is a file that receives its data from the Ships gyro compass located on the bridge. There are two such Gyros on the bridge and we are able to use either one of them as a source of heading. The selected Gyro is logged by the TECHSAS system and is used as part of the bestnav calculation.

4.7 RDI 75 kHz Vessel Mounted ADCP

The RDI Ocean Surveyor was setup by the science party at the start of the cruise with a bottom track and water track file that is included with the dataset. The configuration was changed when we left the shelf and went to deeper water. The Ocean surveyors are fed with data from the ships GPS, Gyro and ADU systems in order so that the system can calculate true speeds and direction of the currents below the ship.

4.8 Chernikeef EM log

The Chernikeef EM log is a 2-axis electromagnetic water speed log. It measures both longitudinal (forward-aft) and transverse (port starboard) ships water sped.The EM log was not calibrated prior to the cruise and was reading at 0.0 knots when alongside.

4.9 Simrad EA500 Precision Echo Sounder (PES)

The PES system was used throughout the cruise, with a variation between use of the Fish and use of the hull transducer. The fish is more accurate than the hull transducer as it is capable of being deployed deeper and is also decoupled from the noise of the ship.

The PES fish was inspected at the start of the cruise. The fairings and clips were replaced where necessary.

4.10 Surfmet System

This is the NMFD surface water and meteorology instrument suite. The surface water component consists of a flow through system with a pumped pickup at approximately 5 m depth. Non-Toxic flow is approximately 25 litres per minute whilst fluorometer and transmissometer flow is approximately 1.4 l/min. Flow to instruments is degassed using a debubbler with 40 l/min inflow and 10 l/min waste flow. During this cruise, the inlet to the debubbler was lowered to between 10 and 15 l/min in order to allow more pressure to another water sampling system. This could have had an effect on the amount of bubbles that built up in the system

The meteorology component consists of a suite of sensors mounted on the foremast at a height of approximately 10 m above the waterline. Parameters measured are wind speed and direction, air temperature, humidity and atmospheric pressure. There is also a pair of optical sensors mounted on gimbals on each side of the ship. These measure total irradiance (TIR) and photo-synthetically active radiation (PAR).

The non-toxic system was enabled as soon as we were far enough away from land. It is also used as a coolant for the container labs. Completely new fluorometer, transmissometer, TSG layout being trialled during the previous cruises. It has proved to be more consistent and accumulating less air bubbles than before. Both transmissometer and fluorometer are mounted in the vertical orientation and the addition of a bleed valve to help remove trapped air from the system. The flow rates and other information labels were added to help identify the direction of flow and the recommended flow rates in each part of the system.

Because the relatively high sea water temperature, the transmissometer optics and the fluorimeter were cleaned once a week. The SBE45 unit was cleaned prior to sailing and not cleaned again during the trip to preserve calibration.

Surfmet rvs stream is the raw data captured from the TECHSAS System

The `temp_h`, `temp_m` and `cond` data in the Surfmet file is a direct copy of the Sea-Bird data however it can be delayed in time. For that reason, always use the data from the Sea-Bird instead of the surfmet for TSG calibrations.

These files contains:

`temp_h` (Housing Temperature from the SBE45 in the wet lab)
`temp_m` (Marine Temperature from the Hull intake)
`cond` (Conductivity from the SBE45 in the wet lab)
`trans` (Raw Voltage from Transmissometer)
`fluo` (Raw Voltage from Fluorometer)

Speed (Wind Speed from Gill Windsonic Anemometer)
Direct (Wind Direction from Gill Windsonic Anemometer)
Airtemp (Air Temperature from Vaisala HMP45A)
Humid (Air Temperature from Vaisala HMP45A)

Pressure (Air Pressure from Vaisala PTB100)
PPAR (Photosynthetic Active Radiation from SKE510 PAR Sensor on PORT Gimbal)
SPAR (Photosynthetic Active Radiation from SKE510 PAR Sensor on STBD Gimbal)
PTIR (Total Incidental Radiation from CM6B TIR Sensor on PORT Gimbal)
STIR (Total Incidental Radiation from CM6B TIR Sensor on STBD Gimbal)

Sea-Bird is the raw log of the SBE45 and SBE38 through the SBE45 Junction Box and contains:

`temp_h` (Housing Temperature of SBE45 TSG)
`temp_m` (Remote or Marine Temperature from Inlet pipe)
`cond`(Conductivity in SBE45 TSG)
`salin` (Calculated Salinity from Instrument)
`sndspeed` (Calculated Sound Velocity from Instrument)

4.11 Network Services

Networking worked well throughout the cruise despite a few hiccups with one of the wireless access points on the Forecastle Deck.

4.12 Data Storage

DISCOFS is an advanced Network Attached Storage device. All scientific cruise data was stored on this device under the `Disco_Cruises/D382` folder and organised with a standard template of folders

All CTD, ADCP and LADCP data was backed up to DISCOFS on acquisition.

4.13 Data Backups

Backups of the Level C data were done twice daily as a tar file to LTO tape. Alternating between the standard backup below and a full /rvs backup.

The LTO2 system was backed up on a daily basis in a rolling 2 tape system. Level C Data backup to tape. Using LTO tape on odd, even day schedule. `DiscoFS` only seems to recognise two external USB hard disks and it doesn't seem to matter which two USB ports.

4.14 Scientific computing and data archive

The Linux workstation, Oceanus, was used for scientific processing and archiving of data. Each of the scientific staff used a Mac to connect to Oceanus via the ships Ethernet or WiFi. The following disks were virtually mounted on Oceanus to enable access to the data on the ships systems:

- CTD directory on the DISCOFS server at `/noc/users/pstar/CTD`
- ADCP (75 kHz) PC at `/noc/users/pstar/adcp75`
- Techsas at `/noc/users/pstar/NetCDF`

Matlab version R2009a was installed on Oceanus and the `mstar` suite of Matlab routines was used to import and process data. Necessary packages for RAPID processing in Matlab are the signal processing, statistics and mapping toolboxes.

There was one power cut during the cruise on 31st October last 40 minutes form 08:01UTC and the workstation had to be restarted when power was restored. Oceanus was connected to UPS following this incident.

On previous cruises problems have been encountered when connecting external hard drives to a Linux workstation and so backups were made to disks connected to a Mac. Backups were made twice daily to one of two external hard drives. The `rsync` command was used to synchronise directories on Oceanus with directories on the external drives and to create a backup of files changed or deleted since the last backup using that disk. A logfile detailing the backup was stored on Oceanus in the directory `/noc/users/pstar/cruise/backup_logs`, where a copy of the backup script was also kept.

Samba was started on Oceanus to enable read-only access to the files on the local network.

4.15 The RAPID iPad

Di382 saw the first trial of an iPad for mooring operations. There were two main aims of using an iPad: to provide navigation and bathymetry data directly to the aft deck and to complete electronic copies of the mooring logsheets.

Firstly, in previous cruises, it had been necessary for those overseeing deployment of moorings to communicate via radio to the main lab for navigation and bathymetry data. With the use of the iPad, this information was directly available on the aft deck allowing better decision making and communication *in situ*. This information was available via Matlab and via a web application developed on Di382, as described below. This was a very successful use of the iPad.

Secondly, in previous cruises, scanned copies of hand-written logsheets had been included in the cruise report. This rendered them unsearchable in the document and, sometimes, difficult to read. Electronic logsheets were used on the iPad on Di382, as described below. While the finished product was excellent, the software used suffered frequent crashes and the iPad's inaccurate timekeeping was an issue. In future cruises, it is hoped that software will have improved and that Apple will addressed the problem of setting the time accurately on the iPad.

Displaying Navigation Data Using Matlab

The iPad was also used to give more information to the person completing the logsheet on the back deck. An iPad app called Matlab Mobile allows the iPad to link to a Matlab session running on another computer via a local network–in this case a wireless repeater in the hanger allowed the iPad to connect to the ships network, and therefore Matlab session running on the Oceanus workstation. Matlab connector needs to be installed on the host machine and started with the command `connector on`. The iPad app then connects to the host machine by entering the IP address and password if required.

Commands can be run from the iPad Matlab Mobile command line, and a figure window displayed on the host machine is displayed on the iPad. We combined this with the Rapid WIDGIT Matlab scripts to display the waypoint for anchor drop in real-time whilst on the back deck. Unfortunately the Matlab Mobile app does not work well with GUIs and as such some of the information displayed in a normal Rapid WIDGIT window such as the distance and time to target could not be displayed. A couple of Matlab scripts were written that could be run from the Matlab Mobile command line to retrieve this data:

The script, `here.m`, returns the current position, time, uncorrected depth and corrected depth. The script, `there.m`, works when Rapid WIDGIT is running with a waypoint set. It returns the distance to the waypoint, the time to the waypoint, the current speed (as an average of the last 10 minutes to remove spiking), and the ETA in a more easily readable format. there can be called as a function with an input argument of speed e.g. there(10) calculates the time to the waypoint assuming a fixed speed of 10 knots.

Displaying and accessing navigation information over the ships LAN

Making use of the WiFi network on *RRS Discovery* it is possible to access information in most parts of the ship including the aft deck. Navigation and underway data could be viewed in using the Labview Dashboard app for iOS and Android. The apps access data streamed on `ivs.discovery.local`. This is particularly useful for obtaining the correct time, for example when measuring the range to a mooring.

To aid deployment of moorings a webpage was created showing the distance and time of the ship from the intended mooring locations, water depth and other navigation information. This enabled scientists on the aft deck to better judge the approach to mooring location and the time of anchor drops. A Matlab program on Oceanus created plots saved as PNG files that were displayed on the webpages. The webserver was setup on a Mac as this had PHP installed which enables automatic reloading of web pages. In the future it would be more straightforward to have PHP installed on Oceanus so that it won't be necessary to copy files form one machine to another. The Matlab scripts and instructions for setting up a Webserver are in the directory `rapid_widgit_lite`.

Mooring Logsheets

On Di382, mooring logsheets were completed on the iPad rather than a paper printout. Below are summarised the steps required to get the logsheets ready and onto the iPad.

1. Logsheet drawn up in MS Word using the mooring diagram as reference
2. Include a table for recording acoustic release interrogation
3. Save (Print) to PDF
4. Open PDF in Adobe Acrobat Professional and add in mooring diagram page, and a notes page
5. Click "Run Form Field Recognition" under the Forms menu
6. Edit any unnecessary fields or insert missing fields ensuring that each has a different name to those already in the document. NB: if multiple fields have the same name, then these will update together if you enter anything in one of them–this can be useful, but not really desired for the logsheets.
7. For recovery logsheets checkboxes were inserted next to the instrument serial numbers so a simple tick could be recorded when checking the serial number.
8. Save the modified PDF and transfer to the iPad
9. For this trip we were using the iPad application "PDFpen" to complete the logsheets, as not only does this allow the use of forms in pdfs, it is also compatible with the TextExpander application. TextExpander allows shortcut text abbreviations to be typed into the compatible application, which then expand into their full format equivalent. For this trip we setup `tttt` to expand to

the current time of the iPad (set to GMT), `dddd` to expand to the current date, and `aaa` and `aar` to expand to "Arm and Arm", and "Arm and Release" respectively for use when ranging/firing acoustic releases.

10. The form is completed in PDFpen by clicking into form fields and then entering text, or if need be a text box can be added for extra comments. The check boxes are simply ticked or unticked, and a line drawing tool can be used for annotations on the logsheet and mooring diagram.

Problems

The iPad time cannot be set accurately as there is no option for adjusting the seconds. Whilst this may not be a significant problem for normal use it means that care must be taken when recording times for triangulations and anchor drops if the ship is moving. The offset from GMT was recorded on logsheets. The iPad showed drifts of between 20 and 40 seconds regularly.

PDFpen (version 1.3.2) frequently crashed and closed the open logsheet losing any data not saved. This tended to happen if editing a form field that had already been completed and then the text deleted. The subsequent text entry would crash on the third character being entered. To counter the potential loss of data, the forms were frequently saved (by returning to the documents panel within PDFpen). However if this saving was attempted too quickly after text were entered, then that would not be saved instead it was found to be best to wait a short while (5-10 seconds) before attempting to save.

The battery life of the iPad was not as good as hoped and a long day of mooring operations would mean that the iPad had to be plugged in to a socket in the hanger to charge. Its possible the weakness of the wireless network was causing the power to drain faster as the iPad negotiated with the wireless router more frequently, but generally it was sufficient and it was only on long days that it became a problem.

4.16 Updates to Rapid WIDGIT

The zoom operations were modified in the Rapid WIDGIT code as it would frequently zoom to a different area than the one in the display and the user would then have to pan back to the area they were looking at. The code was changed so that instead of using the Matlab zoom functions, the axes limits were adjusted by a factor of two centred on the mid-point of the chart window.

The swath data collected on JC064 at the MAR0 site were included in the bathymetry files that Rapid WIDGIT displays. It is a relatively small area, but when zooming in to the MAR0 site it is now visible.

5 Underway Data Processing and Calibration

Charlotte Mielke, Rafael Jaume-Catany, Alex Clarke and Ben Moat

5.1 Navigation

RRS Discovery has three navigation systems: GPS 4000, GPS Fugro and Ashtech. High quality navigation data is essential for making accurate underway measurements of meteorological parameters. The ships location is necessary to orient measurements in space, while the ships speed and heading are necessary to create absolute measurements of ocean currents and winds that are measured relative to the ships motion.

Navigation data was logged at 1 Hz to the TECHSAS data system. The script `mday_00_get_all.m` creates the files

`gp4_di382_dDDD_raw.nc` (GPS 4000),
`pos_di382_dDDD_raw.nc` (GPS Fugro) and
`ash_di382_dDDD_raw.nc` (ashtech),

where DDD is the julian day of the year. It is then cleaned using the script, `mday_00_clean_all.m`, to create the corresponding `*_edit.nc` files. The edit files for the GPS 4000 and GPS Fugro are then looked at using the `mplxyed` script, plotting latitude and longitude to check there were no anomalies in the position, and finally these files are renamed as `gp4_di382_dDDD.nc` and `pos_di382_dDDD.nc`. The script `mapend.m` appends these files daily to `gp4_di382_01.nc` and `pos_di382_01.nc`.

After transferring the heading data from the TECHSAS system to `data/nav/ash` and `data/nav/gyros`, `mgyr_01` is run to remove data that is not monotonic in time. Subsequently, the raw data files are inspected and, if need be, edited with `mplxyed`. Then `mash_01` and `mash_02` are run to create the output files. The two scripts clean the data, merge gyro and ashtech data and calculate a smoothed ashtech−gyro correction. The resulting output files, `ash_di382_d<jday>.nc` are then merged to a single output file `ash_di382_01.nc` by using `mapend`. As input, `mapend` requires a text file listing all the individual files to be merged. In this case, the text file can easily be created by typing

```
ls -1 ash_di382_d???.nc > apend.txt
```

in the `data/ash` directory. Afterwards, `mapend` is called as

```
mapend('ash_di382_01.nc','ash_di382_01','f','apend.txt','/','r');
```

Accuracy of the GPS systems

GPS data from the Ashtech, Fugro and GPS 4000 systems were analysed from day 281 (whilst stationed in port at Southampton) to determine their accuracy. The mean latitude/longitude was calculated and taken away from each data point for

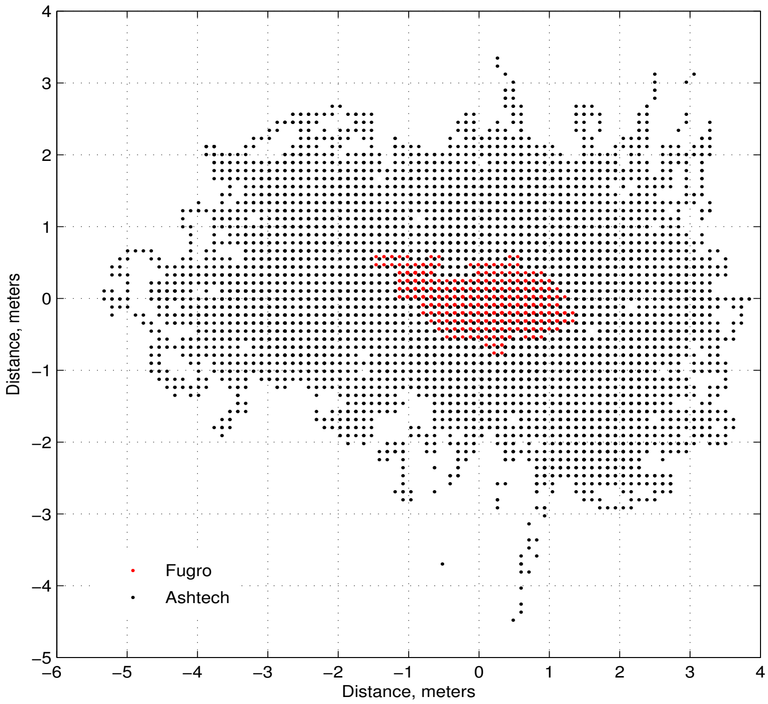


Figure 4: Variation of the Fugro and Ashtech GPS systems whilst in port on day 281. GP4 is not plotted as it is much worse. The standard deviations are: Ashtech(x)=1.717m, Ashtech(y)=1.029m, Fugro(x)=0.688m, Fugro(y)=0.218m, GP4(x)=14.9m, GP4(y)=10.9m

that day. This change in latitude/longitude was converted to a distance in meters and plotted. The standard deviation was deduced for each system. From the results shown in Figure 4, it is clear that the Fugro GPS system is superior to both the Ashtech and the GPS 4000 systems. The GPS 4000 system is not plotted it was shown to be much worse than the other two.

5.2 Bathymetry

A Simrad EA500 hydrographic echosounder is used to obtain bathymetry data throughout the duration of the cruise. A transducer is mounted on the ship's hull, transmitting at 12 kHz. Despite the moorings transducers operating at 10 kHz, the echosounder was occasionally disabled when communicating with moorings on station, hence some gaps appear in the bathymetry data.

RRS Discovery also has a precision echosounding transducer (PES) mounted on a Fish (shown in Figure 5). However, it was inoperable for the first half of the cruise due to broken brackets on the fairing. A fix was implemented and, on the morning of day 314, the fish was deployed, greatly improving bathymetry data for the rest of the cruise. Note that the fish was not used whilst entering port.

The data were gathered assuming a constant sound speed of 1500 m/s and data

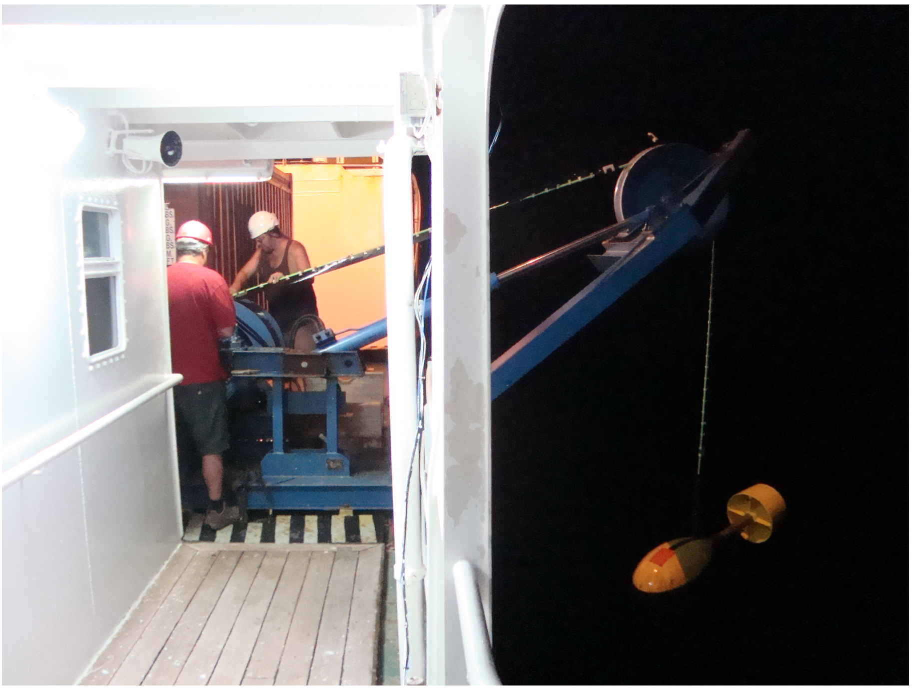


Figure 5: The FISH being deployed on the Port side.

was saved to the TECHSAS data system throughout the cruise.

The Matlab script mday_00_get_all.m collects the previous day's data from the TECHSAS system, copying it across to Oceanus in the file sim_di382_dDDD_raw.nc, where DDD is the Julian day of the year. The script, mday_00_clean_all.m, is then run which removes drop outs and unacceptable readings, creating a file

sim_d382_dDDD_edit.nc.

This file was then looked at using the mplxyed command, where further inconsistencies in the data could be removed by hand on the plot. The hard copy from the live print out was often useful to refer to when cleaning up the data. When finished the output is saved and renamed as sim_d382_dDDD.nc.

The script mmerge_sim_nav_01.m combines navigation data from GPS Fugro file (pos_di382_dDDD.nc) with the bathymetry data. It creates the file

sim_di382_dDDD_merged.nc,

which contains the latitude and longitude with the depth. The script also uses the Carter tables to correct the error on the depth due to sound speed variations underwater. Finally, the merged files are appended together in the file sim_di382_01.nc, using the script mapend.m.

Figure 6 shows the bathymetry data during the steam from Southampton to EBH1.

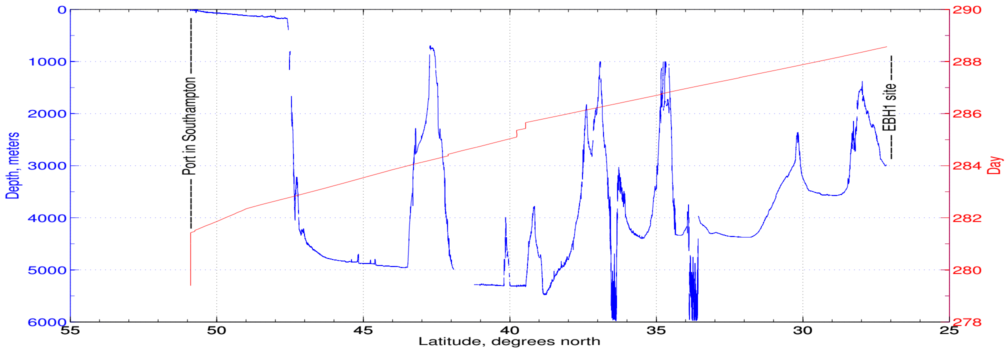


Figure 6: Bathymetry data during the steam from the port of Southampton (50.89 N, 1.40 W) to the site of EBH1 (27.14 N, 15.38 W)

Bathymetry problems

When weather and sea conditions worsened, the data from the EA500 often became unreliable, registering a scatter of more than several thousand meters or having drop outs, and thus making detection of the sea bed impossible. This lead to some sections of bathymetry data being removed, and some sections with large errors on them. On days 311, 310 and 309, large scatters were present. On days 308, 307, 306, 305 and most of 304, no useful data were available. This was directly related to bad weather during these days. On day 305 from 8:00:59 to 8:44:36 the ship suffered a blackout, and so no data is available during this time. During the steam from the mid-Atlantic ridge to Nassau, the echo-sounder had its minimum sea floor depth set at 3000 m. Therefore all data up to 3000 meters was disregarded. This was fixed upon leaving Nassau.

5.3 VMADCP Processing

There are two vessel-mounted Acoustic Doppler Current Profilers (ADCPs) onboard *RRS Discovery* but only the 75 kHz instrument was operational during this cruise. The instrument has a 30-degree beam angle and can either run in narrow-band or broad-band mode. Data were logged on a PC using the software package VmDas. The data were

`cruise/data/vmadcp/di382_os75/rawdata`.

The recording was stopped and restarted once a day. The instrument was configured to sample over two second intervals, with 65 bins each of 16 m distance and a blank distance of 8 m. For most of the cruise, the instrument was run in narrow-band mode and with bottom tracking off. Configuration files for the VMADCP are included in Appendix B.

The final processing was done using the CODAS (Common Ocean Data Access System) suite developed by the University of Hawaii. The individual steps are described in the following sections.

Extracting the data and creating the necessary folders

First, all data of a sequence are moved into a folder `rawdata<sn>`, where `<sn>` denotes the sequence number. Next, a processing directory is created by running

```
adcptree.py di382<sn>nbenx --datatype enx
```

from the `di382_os75` directory. This creates a directory `di382<sn>nbenx` and all the necessary subfolders. A documentation file is also copied to this directory: `adcp_processing.html`.

Initial processing

The initial processing is done by running

```
quick_adcp.py --cntfile q_py<sn>.cnt
```

from the directory `di382<sn>nbenx`. The script, `quick_adcp.py`, is a wrapper that combines several processing steps. In essence, it loads the data into the directory tree, applies some editing and makes an estimate of the water track and, if available, bottom track calibrations. Before running `quick_adcp.py`, it is necessary to create the control file `q_py<sn>.cnt` (Appendix C). Here, only the line

```
--pingtype nb/bb
```

needed to be modified, depending on whether the instrument was running in narrow-band or broad-band mode. If the line

```
--auto
```

is not included, the user will be prompted before each step.

Manual editing with gautoedit

Manual editing was done with the help of gautoedit. To run gautoedit, it is necessary to go to the edit directory, open Matlab and type `codaspaths`. This adds the required paths. gautoedit is started by typing `gautoedit`. In gautoedit, it is possible to look at the data and manually remove bad profiles and bins. Not much editing was needed for most data on this cruise. All edits are applied by running

```
quick_adcp.py --cntfile q_pyedit.cnt
```

from within `di382<sn>nbenx`.

	Amplitude			Phase		
Day	Mean	Median	Std	Mean	Median	Std
08/10/12	0.9953	0.9955	0.0016	−3.4411	−3.4452	0.0789
21/10/12	1.0002	1.0001	0.0010	−3.3944	−3.3751	0.1278

Table 1: Bottom track calibration

Time-dependent heading correction

The first heading correction that needs to be applied is the time-dependent correction of the gyro with a secondary heading source, in this case the Ashtech ADU2 unit. This is done by running `make_g_minus_a(75,<sn>,'enx')` in Matlab. Here, 75 denotes the instrument. Before running `make_g_minus_a`, it is necessary to make sure that an appended heading file that covers the time period in question is available. The rotation angles can be found in `edit/di382<sn>nnx.rot`, and the order of magnitude is typically 1° or less.

Subsequently, `rotate rotate.tmp` is run from a command line within

`di382<sn>nbenx/cal/rotate`.

The file `rotate.tmp` has to be modified to contain the line

`time_angle_file:  ../../edit/di382<sn>nnx.rot`.

The rotation is then applied by running `quick_adcp.py --cntfile ../q_pytvrot.cnt`. The results of the correction can be assessed by having a look at the `*.out` file in either `cal/botmtrk` or `cal/watertrk`.

Fix to `agetmat.m`

The application of the time-dependent heading correction at first caused an error message from `agetmat.m`. The problem was fixed by transposing `corr_heading` in line 836 within the function `get_corrheading` in `agetmat.m`.

Constant heading correction

The second heading correction is a constant correction. It is applied by running `quick_adcp.py --cntfilfe ../q_pyrot.cnt` from within `di382<sn>nbenx`. The angle and phase for the final rotation have to be specified in this file. For this cruise, bottom track data could only be acquired on the first day and on the day we left Santa Cruz.

With this information (Table 1), the following constant rotation was included in `../q_pyrot.cnt`:

```
--rotate_angle -3.42
--rotate_amp 1.00.
```

Creating the output files

After the processing is done, the output data are converted to *.nc files. This is done by running mcod_01_di346 and mcod_02_di346. The first command creates a file os75_di382<sn>nnx.nc that contains the ship's position and speed and the measured velocities. The second command creates a file os75_di382<sn>nnx_spd.nc, which contains the same variables as os75_di382<sn>nnx.nc plus the scalar water speed and the ship speed.

Using mapend, output files are then merged into a single file, os75_di382_nnx_spd.nc. The first sequence was excluded from the merging as the instrument was running in broadband mode and the file has a different depth axis. The list of files to be appended can be created by typing

```
ls -1 di382???nbenx/os75_di382???nnx_spd.nc > apend_adcp.txt
```

in the di382_os75 directory. mapend is then called as

```
mapend('os75_di382_nnx_spd.nc','os75_di382_nnx_spd','f',...
                'apend_adcp.txt','/','r').
```

Missing heading information

After a power failure on 31/10/12, heading information was no longer coming through to VmDAS. This resulted in missing heading information in the .ENX files. For these days, the processing was done using the .ENS files instead.

For the processing of .ENS files, a few things need to be changed. First, adcptree.py must be run with the option --datatype ens. In q_py.cnt, the lines --datafile_glob *.ENX and --datatype enx must be changed to reflect that .ENS files are used instead of .ENX. Also, the heading alignment of the transducer needs to be known in order to process .ENS files, and it is specified by adding a line --ens_halign 0 has to be added to q_py.cnt. Afterwards, processing could be continued as usual.

The connection was repaired on 06/11/12, and the .ENX files were again used for processing after this date.

Final results and gaps in the data

The most notable gap in the data is from 29/10 to 02/11, due to bad weather, the ADCP was not able to record any good data. All data gaps are summarized in Table 2.

5.4 TSG

During Di382 the near sea surface temperature and salinity were measured all along *RRS Discovery*'s track (Figure 7). The near surface temperature was measured

Time period (jday)	Reason for missing data
288.8 – 289.4	ADCP stopped.
291.3 – 294.5	In port at Santa Cruz.
295.7 – 296.3	Output .ENX and .ENS files not written (reason unknown).
303.4 – 307.5	Bad weather.
310.6 – 311.4	Fixing of missing heading data problem (Section 5.3).
311.7 – 312.5	Output .ENX and .ENS files not written (reason unknown).

Table 2: Missing ADCP data

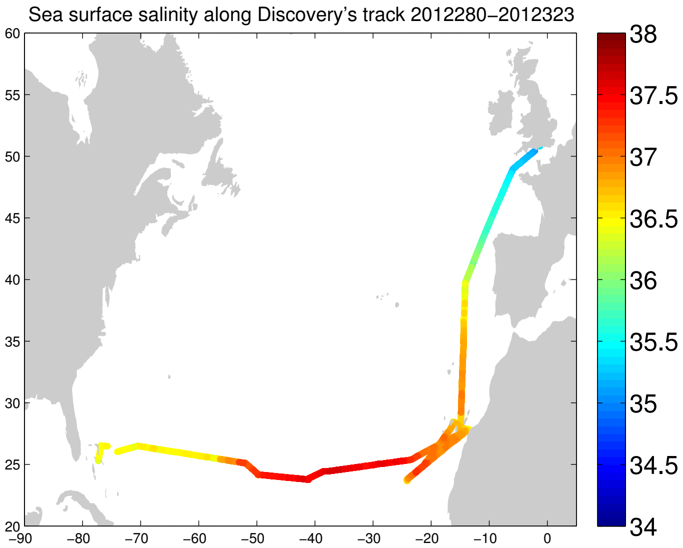


Figure 7: Sea surface salinity measured all along *RRS Discovery*'s track from Southampton (UK) down to the Canary Islands (Spain) to Freeport (The Bahamas)

using a SBE38 probe, located in the forward hold on the starboard side, providing temperature measurements at depths between 6 m and 7 m. Hereafter this temperature will be referred to as remote temperature (`temp_r`) or as sea surface temperature (SST).

The seawater inflow in this ship was located at 0.5 m below the hull (refer to Cunningham (2009) to see a picture). This pumped water is known as the non-toxic supply and was pumped to the wet lab. In the wet lab the non-toxic water passed through an SBE45 MicroTSG to measure the housing temperature or temperature of the water on board (`temp_h`) and the salinity (`tsg_psal`).

To avoid contamination of the non-toxic supply system, the non-toxic water was stopped before any port call. During this cruise, *RRS Discovery* stopped in three different ports. Hence three continuous TSG transects were recorded (Figure 7). Dates (in julian days) of the those three TSG transects were as follow: 1) from 280 to 292 (Southampton-Tenerife); 2) from 295-321 (Tenerife-Nassau): 3) from 322 to 329 (Nassau-Freeport).

During this cruise salinity samples of non-toxic water were collected from the supply in the wet lab every four hours between 8 am and 6 pm (ship time). Samples were kept in individual glass bottles of 200 ml in crates of 24 bottles. When the

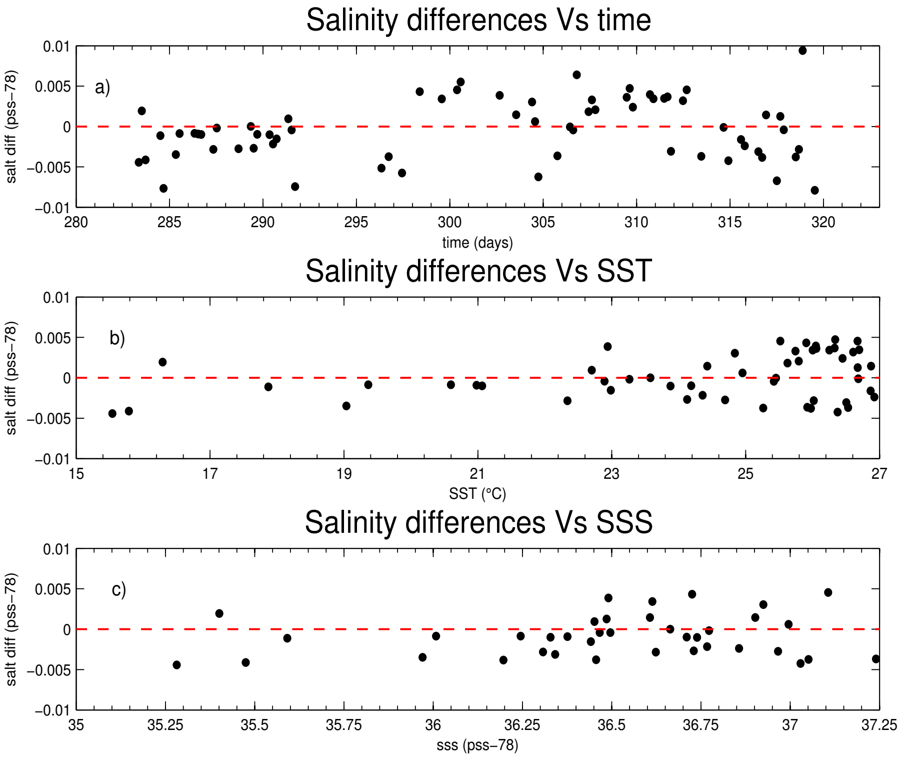


Figure 8: Salinity differences (bottle minus TSG) vs. (a) time, (b) SST, (c) SSS

crate was full, it was kept in the CT lab for 24 hours at constant temperature (∼20 °C) before measuring the salinity with the salinometer. At the end of the cruise, 99 bottles of sea water had been collected and analysed. In addition to the standard `.csv` output of the Autosal, the time in seconds since the start of the year were manually recorded for each sample. These data are read into `mstar` format using `mtsg_01.m`.

As it can be seen in Figure 8 (a), `salt_diff` was generally around zero. The TSG data were stable during all of the transect, therefore it was not necessary to apply any calibration. The `temp_r` was compared to the temperature measured by the CTD (Figure 9) and was stable throughout the cruise with the temperature differences between `temp_r` and `ctd_temp` were generally bellow 0.025°C. Comparing `temp_diff` obtained from all the CTD casts, only the cast 6 showed a larger `temp_diff` (above 0.25 °C and bellow 0.3 °C).

5.5 MET: surfmet, surflight and surftsg

The surface meteorological conditions were measured throughout the cruise. A brief discussion of the performance of the meteorological sensors is given in this section. Figure 10 shows time series of the meteorological data. The *RRS Discovery* was instrumented with a variety of meteorological sensors to measure; air temperature and humidity, atmospheric pressure, short wave radiation, and wind speed and direction. These are logged as part of the SURFMET system. The meteorological instruments were mounted on the ship foremast in order to obtain the best ex-

Instrument	Calibration Y=C0+C1X+C2X2	Serial No.	Sensor location	parameter accuracy
SBE45 micro TSG	calibration applied by SBE45	231	Water bottle annex	Temperature: 0.002 °C conductivity: 0.0003 mS/cm salinity: 0.005 psu
SBE38 Remote temperature	calibration applied by SBE38	416	Remote Temperature	temperature:± 0.001 °C
Wetlabs Fluorometer	15.0*(X-0.064) Not applied.	WS3S-134	Water bottle annex	
Wetlabs Trasmissometer	Tr = (Vsig - Vdark) / (Vref - Vdark) Vdark = 0.06, Vair = 4.766, Vref=4.658 Not applied	CST-112R	Water bottle annex	
Barometer PTB100A	c0=800, c1=52	F4740025	foremast	± 0.25 hPa
Viasala HMP45A temperature humidity	c0=-40, c1=100 c1=100	B4950011	foremast	temperature: ± 0.2 °C at 20°C humidity: ± 1% at 20°C
PAR Skye energy sensor (400–700nm)	c1=1/1.053 c1=1/1.121	28556 28559	foremast PORT STBD	± 2%
TIR Kipp and Zonen CMB6 (335 to 2200nm)	c1=1/0.976 c1=1/1.194	962301 47462	foremast PORT STBD	0.14×10^{-6} V/W/m^2
wind speed Gill wind sonic	speed: c1=50/5 direction: c1=360/5	71123	foremast PORT	speed: ± 2% at 12 m/s direction: ± 3°at 20 m/s

Table 3: Instrumentation aboard *RRS Discovery* and calibrations applied.

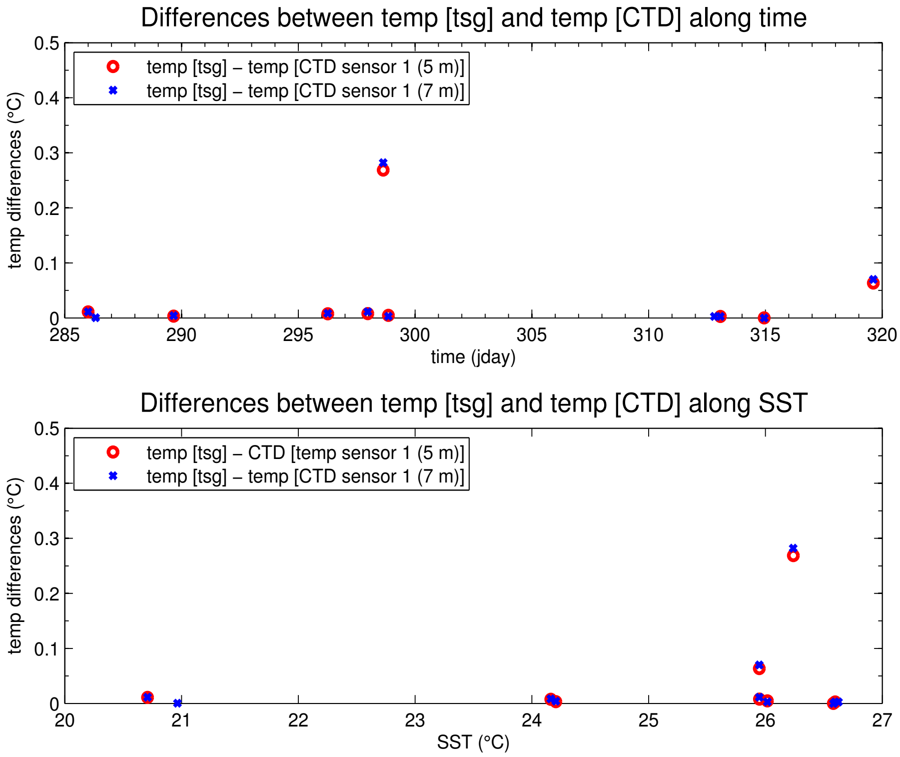


Figure 9: Sea surface temperature differences (TSGCTD)

posure. The heights of the instruments above the foremast platform were: Gill WindSonic anemometer, 1.85 m; Vaisala air temperature and humidity 1.38 m and the irradiance sensors 1.38 m. The foremast platform was 16.16m above the sea surface. Files were transferred from TECHSAS to Oceanus on a daily basis, using the script `mday_00_get_all.m`. The raw SURFMET data files have names of the form `met_di382_dnnn_raw.nc`, where `nnn` represents the day number. These were copied to `met_di382_dnnn_edit.nc` for editing. The Vaisala air temperature and humidity sensor was located on the port side of the foremast platform. The sensor performed well throughout the cruise. As the ship had only one Vaisala, no conclusions about instrument accuracy can be made. The Gill Windsonic was located on the foremast platform and functioned well throughout the cruise. Again only data from one anemometer was logged so no comparisons with other anemometers could be made.

True wind calculation

When the wind speed is measured from a ship during its sailing, it is necessary consider the sailing speed to get the true wind speed. The true wind was calculated using the true wind subroutine described in Cunningham (2012). The input data required is sourced from the following shipboard instruments whose output was logged in the Techsas system:

- GPS position - GPS Fugro
- Ship's heading - Ships gyro corrected using the Ashtech attitude sensors.

- Measured wind speed and direction - Anemometer readings from the SurfMet instruments

Light

The ship carried two total irradiance sensors, one (PTIR) on the port side of the foremast platform and the other (STIR) on the starboard. A comparison of the TIR short-wave sensors showed that the sensors were in good agreement with a daily mean difference in the measured short-wave values of 4.68 W/m^2 (standard deviation 28.3W/m^2). In addition to the TIR sensors the ship carried two PAR sensors, which measured down-welling radiation in the wavelength ranges given in Table 3. The two PAR sensors agreed well with a daily mean difference in the measured short-wave values of 1.65 W/m^2 (standard deviation 9.8W/m2). It is worth noting that the irradiance sensors need a calibration to be applied to the raw data stream, rather than being applied by the instruments themselves.

Surftsg

Although the `surftsg` data stream was processed all along the cruise Di382, these were not used. Besides transmisivity, all the other parameters are the same as in the TSG data stream. From 10th or 12th November (julian days 315 and 320) the transmissometer showed values of 4.61 V. No further investigation was followed.

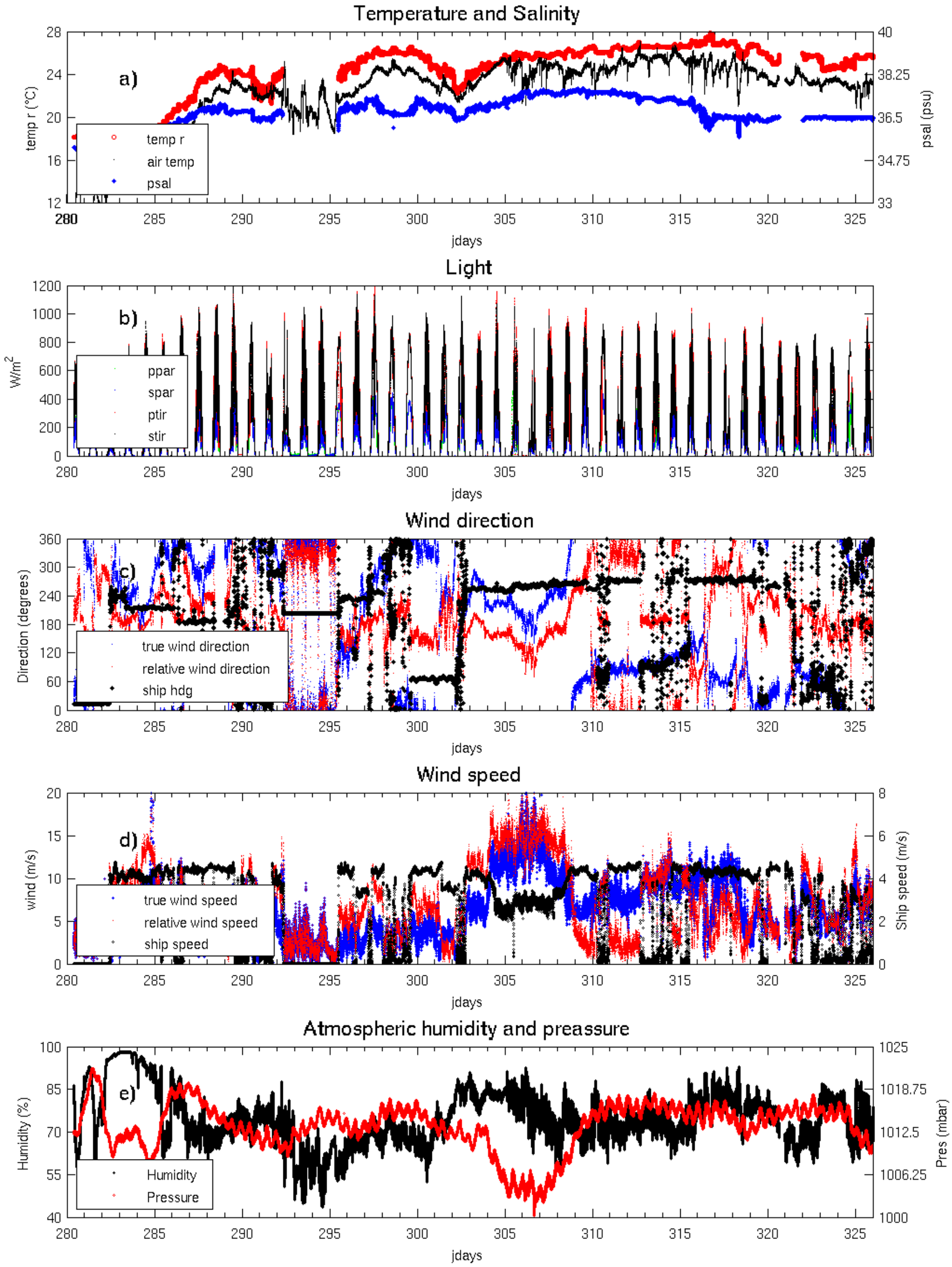


Figure 10: Meteorological parameters measured during the cruise Di382

6 Lowered CTD Operations

Jeff Benson and Paul Provost

6.1 CTD system configuration

1. One CTD system was prepared, with a second system available if required. The first water sampling arrangement was a BAS 24-way stainless steel frame system (s/n S0140171), and the initial sensor configuration was as follows:

   Sea-Bird 9plus underwater unit, s/n 09P-46253-0869 Sea-Bird 3P temperature sensor, s/n 03P-5494, Frequency 0 (primary) Sea-Bird 4C conductivity sensor, s/n 04C-3698, Frequency 1 (primary) Digiquartz temperature compensated pressure sensor, s/n 100898, Frequency 2 Sea-Bird 3P temperature sensor, s/n 03P-5495, Frequency 3 (secondary) Sea-Bird 4C conductivity sensor, s/n 04C-3874, Frequency 4 (secondary) Sea-Bird 5T submersible pump, s/n 05T-3085, (primary) Sea-Bird 5T submersible pump, s/n 05T-3088, (secondary) Sea-Bird 32 Carousel 24 position pylon, s/n 32-19817-0243 Sea-Bird 11plus deck unit, s/n 11P-34173-0676

2. The auxiliary input initial sensor configuration was as follows: Benthos PSAA-916T altimeter, s/n 47597 (V2)

3. Additional instruments:

   Ocean Test Equipment 10L ES-110B water samplers, s/ns 1A through 12A IOS/NOCS 10 kHz beacon, s/n B3

4. Sea-Bird 9plus configuration file `D382_0869_NMEA.xmlcon` was used for all stainless steel frame CTD casts.

5. The second water sampling arrangement was a NOC/Zubkov 24-way stainless steel frame system (s/n 75313), and the initial sensor configuration was as follows:

   Sea-Bird 9plus underwater unit, s/n 09P-34173-0758 Sea-Bird 3P temperature sensor, s/n 03P-4116, Frequency 0 (primary) Sea-Bird 4C conductivity sensor, s/n 04C-2841, Frequency 1 (primary) Digiquartz temperature compensated pressure sensor, s/n 90074, Frequency 2 Sea-Bird 3P temperature sensor, s/n 03P-4872, Frequency 3 (secondary) Sea-Bird 4C conductivity sensor, s/n 04C-3258, Frequency 4 (secondary) Sea-Bird 5T submersible pump, s/n 05T-3090, (primary) Sea-Bird 5T submersible pump, s/n 05T-, (secondary) Sea-Bird 32 Carousel 24 position pylon, s/n 32-53766-0722 Sea-Bird 11plus deck unit, s/n 11P-24680-0589

6. Additional instruments:

   Ocean Test Equipment 10L ES-110B water samplers, s/ns 13A through 24A IOS/NOCS 10 kHz beacon, s/n B6

7. Sea-Bird 9plus configuration file `D382_0758_NMEA.xmlcon` was used for all other stainless steel frame CTD casts.

6.2 Other instruments

1. Autosal salinometer. Two salinometers were configured for salinity analysis, and the instrument details are as below:

   Guildline Autosal 8400B, s/n 60839, installed in Constant Temperature Laboratory as the primary instrument, bath temperature set point 21C.

   Guildline Autosal 8400B, s/n 68958, installed in Constant Temperature Laboratory as the secondary instrument, bath temperature set point 21C.

Cast	Date	Time hh:mm (GMT)	Lat (°N)	Long (°W)	Max CTD depth (dbar)	Max CTD depth (m)
1	12/10/2012	5:19	39.758	-14.114	5111	5012
2	12/10/2012	12:06	39.459	-14.145	5111	5012
3	15/10/2012	19:46	27.126	-15.403	3046	3004
4	22/10/2012	10:14	26.195	-19.324	3762	3704
5	24/10/2012	3:36	23.801	-24.137	4687	4607
6	24/10/2012	19:33	23.689	-24.134	5104	5012
7	24/10/2012	0:31	23.693	-24.137	3557	3505
8	07/11/2012	23:59	24.200	-49.768	5209	5114
9	08/11/2012	6:12	24.204	-49.766	5208	5113
10	10/11/2012	3:09	25.115	-51.993	5623	5515
11	14/11/2012	19:48	26.499	-70.560	5572	5465
12	18/11/2012	4:36	26.477	-75.851	4739	4657
13	18/11/2012	20:40	26.477	-75.752	4681	4600
14	19/11/2012	1:26	26.474	-75.764	3554	3501
15	20/11/2012	4:20	26.517	-76.700	3862	3802
16	21/11/2012	4:28	26.491	-76.666	4670	4589
17	22/11/2012	0:42	26.486	-76.6731	4673	4592
18	23/11/2012	14:14	27.108	-76.617	4065	4000

Table 4: Deployment information for CTD stations. Positions and times are given when the CTD is at the bottom of the cast.

7 CTD Data Processing

Ben Moat

A total of 18 CTD casts were performed to calibrate the MicroCats and test the acoustic releases. The stations are summarised in Table 4. The variables and units were selected as: time, depth, pressure (dbar), temperature (°C), conductivity (S/m), scan and altimeter. The preferred units for conductivity are mS/m, but the first cast was inadvertently set up to use S/m and was left in these units for the rest of the cruise. The raw data files (`ctd_di382_nnn.bl` and `ctd_di382_nnn.hex`, where `nnn` is the CTD cast number) are converted with Sea-Bird processing software to `ctd_di382_nnn.cnv`, `ctd_di382_nnn.ros` and `ctd_di382_nnn_ctm.cnv`. The data in `ctd_di382_nnn_ctm.cnv` are corrected for cell thermal mass effects using an adaptive filter with `alpha = 0.03` and `tau = 7.0`.

Both conductivity sensors were stable throughout the cruise. However, the difference between the two temperature sensors was about 0.001 to 0.002 °C high in the lowest 2000 m of the casts. This led to a 0.003 offset between the two salinity measurements. In order to identify which of the two sensors was offset the secondary temperature sensor `temp2` was swapped before cast 15. Comparisons of temperature measured from both sensors during cast 15 showed that sensor 1 was the more accurate and was selected as the primary sensor. This new sensor remained on the CTD for casts 15–18.

Attempts to use MicroCAT measurements to discern the better CTD tempera-

date	crate	CTD Number	start offset	mid offset	end offset	comments
21-Oct-12	97-120	TSG1	0	6.00E-06	1.80E-05	P153
21-Oct-12	10	CTD1/2	1.80E-05	2.40E-05	5.20E-05	P153
1-Nov-12	49-72	TSG2	-6.00E-06	-2.00E-06	8.00E-06	P153
1-Nov-12	18	CTD2/3/4	8.00E-06	1.00E-06	-9.00E-06	P153
1-Nov-12	22	CTD4/5/6	-9.00E-06	6.00E-06	1.30E-05	P153
12-Nov-12	1	TSG3	-2.50E-05	1.30E-05	7.00E-06	P153
12-Nov-12	11	CTD6/7/8	7.00E-06	6.00E-06	1.60E-05	P153
12-Nov-12	19	CTD8/9/10	1.60E-05	6.00E-06	1.80E-05	P153
19-Nov-12	21	CTD10/11	-6.30E-05	-3.60E-05	-4.10E-05	P153
19-Nov-12	17	CTD11/12	-1.30E-05	-1.50E-05	-6.00E-06	P153
19-Nov-12	901	TSG4	-6.00E-06	9.00E-05	6.10E-05	P153
19-Nov-12	12	CTD13/14	-5.20E-05	1.20E-05	2.50E-05	P153
23-Nov-12	12	CTD15/16	-1.31E-04	-7.20E-05	-3.30E-05	P153
23-Nov-12	17	CTD17	-2.80E-05	/	-1.00E-05	P153

Table 5: Salinometer offset across each crate of samples. The offset applied is measured minus known conductivity of standard seawater.

ture sensor proved unsuccessful. While the MicroCATs are less accurate than the CTD, it was hoped that the higher precision from multiple instruments on each cast would be useful. It was concluded that the cell thermal mass lag in the MicroCATs rendered them not useful for this purpose.

During upcast at CTD station 10 the temperature sensor (`temp1`) reported intermittent measurements at a depth of around 3000 m. The cable to the temperature sensor was replaced before station 11 and performed well thereafter.

Salinometry

A guideline Autosal 8400B Salinometer (s/n: 60839) was used for salinity measurements. A total of 194 salinity samples were taken to calibrate the conductivity sensors on the CTD. The Salinometer was located in the constant temperature laboratory, with the bath temperature set at 21 °C. The ambient air temperature was checked every 4 hours during daylight and varied from 19 to 20 °C. A bespoke Labview was used for recording the conductivity values.

The Salinometer was calibrated against seawater standard before and after each CTD/TSG crate was analyzed. A further standard was run half way through the crate. Standard seawater batch P153 (2K15=1.99958, salinity=34.992) was used throughout the cruise. Table 5 shows the change in the measured conductivity and the known conductivity of the standard seawater sample for each crate.

The processing of salinity data proceeds as follows. Conductivity data from the salinometer are entered into excel files and transferred to the Oceanus in `/ctd/-BOTTLE_SALTS/` as comma-separated value files. The first column of the data must be `ctdnnn_bot`, where `nnn` is the station number (e.g. 001 or 002) and `bot` is the sample number (e.g. 325). This allows for the data for two CTD casts to be saved on the same excel spreadsheet. The last column is entered by hand: it contains

CTD no	start offset	end offset	offset applied
1	2.40E-05	5.20E-05	3.80E-05
2	8.00E-06	1.00E-06	4.50E-06
3	1.00E-05	-9.00E-06	-4.00E-06
4	-9.00E-06	6.00E-06	-1.50E-06
5	6.00E-06	1.30E-05	9.50E-06
6	7.00E-06	6.00E-06	6.50E-06
7	6.00E-06	1.60E-05	1.10E-05
8	1.60E-05	6.00E-06	1.10E-05
9	6.00E-06	1.80E-05	1.20E-05
10	-3.60E-05	-4.10E-05	-3.85E-05
11	-3.60E-05	-4.10E-05	-3.85E-05
12	-1.30E-05	-6.00E-06	-1.13E-05
13	-5.20E-05	1.20E-05	1.20E-05
14	1.20E-05	2.50E-05	1.85E-05
15	-1.31E-04	-7.20E-05	-1.02E-04
16	-7.20E-05	-2.20E-05	-5.25E-05
17	-2.80E-05	-1.00E-05	-1.90E-05

Table 6: Salinometer offset for each CTD cast. The offset applied is measured minus known conductivity. No bottles were processed from cast 18.

the CTD cast followed by the bottle location on the frame (e.g. 105 for bottle in firing position 5 on cast 1). The CSV file contains the conductivity measurement of the standard sea water, which is used to measure the instrument drift. Instrument drift is defined as the difference between the measured standard conductivity and the known conductivity of the standard seawater. This offset is defined in Table 6 and is applied to the conductivities of each cast before the salinity was calculated. The CTD casts were split across crates, which proved problematic in deciding the offset, which should be applied to the measured sample conductivities. This is not recommended for future cruises.

CTD processing and calibration

The CTD casts were processed with `mexec` routines written by Brian King. These routines are higher-level processing programs that depend on the `mstar` library. `mstar` is a replacement for PSTAR, runs in MATLAB and uses NetCDF as its native format. The base directory for CTD processing on Oceanus is `cruise/data/ctd/`. The `mexec` routines were run in the order given in Appendix B.2.

The CTD conductivity measurements were calibrated against bottle samples measured using a Salinometer. Trends with pressure and time were observed in the differences between the measured conductivities (sensor 1 and sensor 2) and the bottle conductivity. Figure 11 shows the steady increase in time of the CTD conductivity relative to bottle conductivity for sensor 1 and sensor 2. A linear regression was fitted through the more stable periods of each sensor, i.e. seven measurements the period between sample 40 and 50, and the data between 6 and 13 where excluded from the regression. The difference between the two regressions

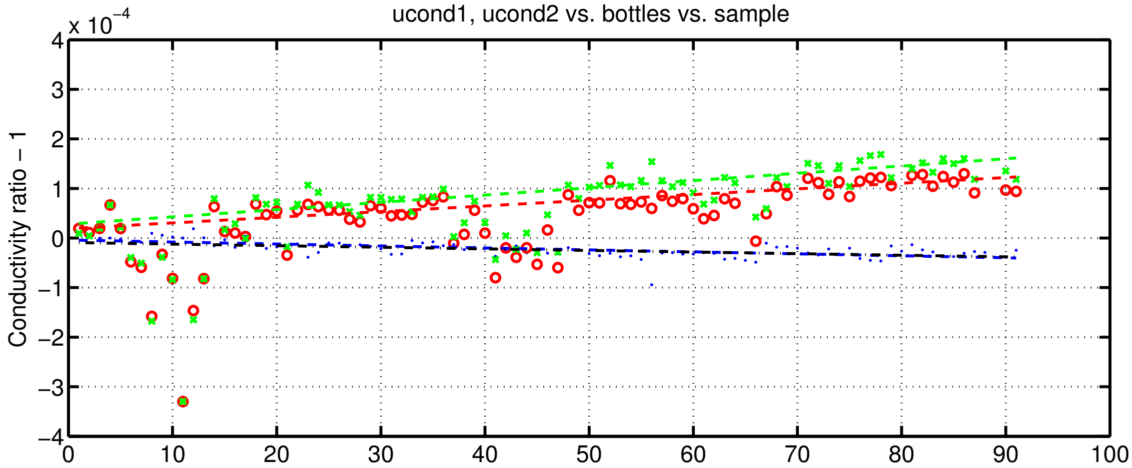


Figure 11: Conductivity ratio between `cond1` and bottle salinities (green), conductivity ratio between `cond2` and bottle salinities (red) and conductivity ratio between `cond1` and `cond2` (blue). All ratios have had 1 subtracted due to the small scaling around unity. The green and red dashed lines are based on regions where the Autosal was stable: sample numbers 1:3, 18:36, 48:60, 68:88. This was decided to be representative of the real drift of the CTD sensors. The blue dashed line is a fit to the drift between the two CTD sensors. The black dashed line is the difference between the green and red lines. The black and blue lines overlying one another gives confidence to the fact that the real drift of the CTD sensors has been captured.

agrees well with the drift between the two conductivity sensors (blue lines) giving us confidence in using a time dependent calibration to correct the conductivity.

A multiplicative conductivity correction for the time drift of the two sensors was derived. This was applied to both conductivity sensors for each station using `ctd_calibrate_di382`. The correction was applied to the 24 Hz file and the salinities were recalculated. After this time drift correction was applied a correction for pressure was not required. The time drift correction applied as single multiplicative factor for each station. The calibration lowered the conductivity by 8.6914E-06 for the primary sensor for each successive station. The calibration lowered the conductivity by 1.11259E-05 for the secondary sensor for each successive station.

8 Mooring Operations

Rob McLachlan

The mooring operations carried out can be split in to three sections:

1. Winch deployments
2. Hand deployments
3. Recoveries

8.1 Winch deployments

This method uses the double barrel winch system; this allows the wires/ropes to pass around the double barrels four times before either going round a diverter sheave and on to a reeling winch or directly on to one of the reeling winches. The reeling winches store the wires/ropes under a constant, relatively low tension. The wires/ropes are wound on to the winch prior to deployment ensuring all the shackles, links and joins are wrapped in canvas or similar. The start of the wire is passed through the scrolling of the reeling winch, around the double barrel four times, under a deck sheave and finally through a block hanging from one of the aft cranes. From here the wire/rope is connected in to whatever is at the top of the mooring. Deployment starts when the run in length has been determined taking into account the prevailing weather, surface currents and previous experience. It is normal to start deployments with the vessel moving ahead at between 0.5 and 1.5 knots, this allows the deployment to start without too much outboard tension and gets things underway steadily. The speed can be increased when necessary. When deploying large buoys and packages the second aft crane can be used to pick this up using a release hook and deployed over the aft ensuring that there is enough slack in the wire/rope from the winch to prevent snatching. Connecting buoyancy packages, such as packs of glass spheres, and instrumentation requires the use of a deck stopper to transfer the load from the winch to the deck so that the buoyancy/instrument can be shackled in line and seized using cable ties. The load is then transferred back to the winch and deployment commences. Attaching instruments that clamp on to the wire does not require the use of the deck stopper and can be done while the wire is under tension. The mooring deployment continues as described, stopping off to deck to connect buoyancy and instrumentation and clamping on instrumentation as required until the bottom of the last wire is reached, this is then stopped off to the deck and the releases, chain, shock rope (if used) and anchor is connected in. The load is then transferred to a slip rope; this is a length of rope attached to an eye bolt in the deck and then a few turns taken around it and a link on the chain. When the deployment position is reached the anchor is lifted over the aft using a release hook in the aft crane or attached to a wire from a suitable deck winch, the slip rope is then used to transfer the load to the anchor by slipping out slowly, the anchor is lowered in to the sea and then released. The ship then repositions and the release deck unit can be used in conjunction with a transducer to communicate with the releases and confirm that the mooring is descending and reaches the bottom.

8.2 Hand deployments

This method does not require the use of the winch due to the short lengths and relative lightness of the mooring components. This type of deployment is normally reserved for the shorter polyester rope moorings and the Landers. For the polyester rope moorings the ropes are coiled in to baskets ensuring that both ends of the rope are accessible. For Lander deployments the ropes are coiled on the deck due to the very short lengths. The buoyancy, instrumentation and ropes are then all shackled together and seized with cable ties. Any clamp on instrumentation is then clamped on. The mooring is then shackled in to the releases and finally the anchor, or if it has a Lander frame then this is shackled in. One of the aft cranes is the attached to the anchor/Lander frame with the release hook ready for deployment. Deployment starts when the run in length has been determined taking into account the prevailing weather, surface currents and previous experience. It is normal to start deployments with the vessel moving ahead at around 0.5 knots, this allows the deployment to start without too much outboard tension and gets things underway steadily. The speed can be increased when necessary. The mooring deployment starts by lowering buoyancy/instrumentation in to the water by two or more people and then feeding out the rope as required, this continues until all of the buoyancy and instrumentation is deployed. When the deployment position is reached the anchor/Lander frame is then lifted over and lowered in to the sea and the released. The ship then repositions and the release deck unit can be used in conjunction with a transducer to communicate with the releases and confirm that the mooring is descending and reaches the bottom.

8.3 Recoveries

Before the recovery is attempted the deck and associated machinery needs to be ready for such operations; a recovery line needs to be attached to the double barrel winch system, through a block on the aft crane and round to the starboard side from where recoveries will be attempted. A deck stopper needs to be ready. Any tools need to be at hand. Recovery of a mooring starts with attempting to communicate with the releases using the deck unit and the transducer. Once communication has been established the release command can be sent and the mooring released from its anchor. As the mooring begins to surface the lay of the mooring on the surface can be established, this is particularly important for the longer moorings and often requires that all of the mooring is on the surface before a decision is made to move in for recovery. Once the decision has been made to move in the ship creeps towards the mooring aiming for the top recovery float in such a way that the mooring can be streamed aft of the vessel once the recovery float and line has been secured to the vessel. As the ship approaches the recovery float, ensuring that the starboard side is lined up with the float, a grapnel is thrown out in an attempt to hook the recovery line/rope. Once hooked, the line and buoy are hauled on board by hand, the buoy is removed and the recovery line is attached to the line that has been routed from the winch. The vessel then repositions so that the mooring is streaming aft, at the same time the mooring is being slowly hauled on board using the winch. Once everyone is happy that the mooring is streaming aft, that the tension is fine and that the vessel is moving at the correct speed then the mooring recovery can commence by hauling in on the winch. Stopping off to the deck stopper is required to transfer the load of the mooring from the winch to the deck in order to remove buoyancy packages and instrumentation. Clamp on instrumentation can be removed while the tension is still on the mooring without the need to stop off to deck. Often, for large buoyancy spheres or for the recovery of the Landers, the crane can be used to slew these items in board.

9 Mooring Instrumentation and Data Processing

Darren Rayner, Alex Clarke and David Smeed

9.1 MicroCATs

A total of 131 Sea-Bird SMP-37/IMP-37 MicroCAT CTDs were recovered from 16 moorings. The two instrument types (SMP/IMP) differ in their communication modes for programming and data retrieval being serial and inductive respectively. These are pumped CTDs with a temperature specification (initial accuracy: stability: resolution) of 2 m°C: 0.02 m°C/month: 0.01 m°C; conductivity specification 0.003 mS/cm: 0.003 mS/cm/month: 0.0001 mS/cm and; Pressure specification of 0.1% full-scale:0.05% of full scale range per year:0.002% of full scale range. Almost all of them are rated for use at 7000 m but 4 are rated to 3500 m only. The CTD instruments are fitted with one of three types of pressure sensor: Druck; Paine and; Kistler. The pressure sensors differ in their characteristics and the order of quality is Kistler, Druck and Paine, where the Paine is close to the specification above but typically has worse stability than quoted. The full scale for pressure is also different for the three pressure sensors but is around 7000 dbar.

Each instrument on recovery is downloaded using Sea-Bird Seaterm software appropriate to the firmware version of the SMPs. The IMPs (S/N less than 7000) are downloaded in HEX using our own software that allows multiple downloading of IMP instruments and is considerably quicker than the Sea-Bird software: the HEX files are subsequently converted to ascii format.

Subsequent to data download the instruments are then prepared for calibration. Calibration consists of lowering the instruments with the shipboard CTD. A comparison is then made between the microCATS and the shipboard CTD, using data from five minute stops on the CTD upcast, made at 12 depths throughout the water column. This provides a post mooring deployment calibration of each MicroCAT CTD sensor. The same calibration procedure is adopted for instruments to be deployed. By this method we obtain *in situ* pre and post deployment calibrations that can correct for sensor drift during their deployment. The pre deployment calibration also serves as a function test of the instrument. During the cruise 156 microCATS were lowered on 13 CTD casts.

For mooring deployments the microCATS sample once every 60 minutes and for calibration cast once every 10 seconds (their highest sampling rate).

Raw ASCII microCAT data are collected together on Oceanus for subsequent processing.

Processing

The RAPID-MOC/MOCHA project uses instruments from a number of different manufacturers and measurements utilised by three science teams within the project. At the outset we adopted a common data format, to which we ensure all instrument data conform. The format is ascii and is referred to as RODB and the processing software is MATLAB. The programmes utilised are:

- `mc_call_2_d382.m` : Performs stage 1 processing, converting microCAT raw ascii data to the common RODB format.
- `microcat_raw2use_003.m` : Performs stage 2 processing, eliminating data at mooring launch and recovery; interpolates data gaps; saves file; creates diagnostic plots.
- `mc_call_caldip_d382_v3.m` : Plots all microCAT data from one CTD cast with the CTD data. Used during the cruise for a function check of the micoCATS, and a qualitative assessment of sensor performance and post cruise provides quantified calibration information.

Calibration Dips

A Matlab program `m_caldip_check_d382` was written during the cruise to provide a quick quantitative comparison of MicroCAT cal-dip data with the Sea-Bird 911 data from the CTD. Data obtained during the middle part of the deepest bottle stop was used. For each instrument differences of conductivity, temperature and pressure between the instrument and the CTD sensor were calculated. Typically there were between 20 and 100 samples depending on whether acoustic releases were tested during the bottle stop. The mean and standard deviation of the differences for each instrument are then presented in a table.

Between 12 and 18 MicroCATs were deployed on each CTD cast. Outliers for each cast were identified as being those MicroCATs for which the mean difference from the CTD differed from the average the mean difference for instruments on that cast by more than 2.32 standard deviations of the mean differences (For a normal distribution 98% of samples lie within 2.32 standard deviations of the mean). Similarly instruments with unusually high variability were also identified by the comparing the standard deviation for each instrument with the distribution of standard deviations for that cast.

MicroCAT problems

In addition to the MicroCATs that were deemed to have calibration offsets that were too large [[details in the calibration dip section]] there were some other problems encountered with the MicroCATs.

A new version of the SeaTerm V2 software that was installed on the new download laptops has a different process for converting `.xml` files to the required `.cnv` files. Now the output variables need to be selected, along with the units, and the order in which they are written to the file also needs to be specified. These settings can be saved as a default to future use with the software, but for reference the order should be: Temperature in TS-90°C, Conductivity in S/m, Pressure in dbar, Time in "Time, Instrument (seconds)". This will then match the previous format and the stage 1 routines can handle these datafiles.

Serial number 3270 exhibited a very large over-reading of pressure on the pre-deployment cal-dip (1600-2000 dbar over-reading). This instrument was fine on it's last dip aboard cruise RB1201 (where it was dipped but not deployed) so it has drifted a lot since then. The last calibration was in January 2012 following a pressure sensor upgrade. Sea-Bird were contacted and they suspect there is a drift in the slope of the pressure calibration and as such the pressure sensor needs to be replaced.

Serial number 5246 was likewise reading incorrectly for pressure (up to 80 dbar at 3700 m). This instrument has never performed within specification since the pressure sensor was replaced in 2010. Sea-Bird were contacted and they are to replace the pressure sensor under warranty.

3258 flooded on EBH4. The bulkhead connector was broken and appears to be the source of the flooding.

The data record from serial number 5485 recovered from MAR1 exhibits a sudden drop in conductivity of about 7 mS/cm. This is typically symptomatic of something falling into the conductivity cell, but this instrument should have been deployed with the cell opening pointing down as it has a bleed hole to allow air to escape the other end. Therefore it's not clear if it is fouling that has caused the problem. The conductivity sensor was also under-reading on the post recovery cal-dip. The cell was attempted to be cleaned and re-dipped but it again was under-reading. This instrument needs further examination.

Serial number 4799 has a faulty pump as evidenced by the slow response of the conductivity sensor on cal-dips. This needs to be repaired.

MicroCAT serial number 6333 had some random data in the middle of the record where it appears that the instrument failed to write to the memory but increased the sample number count. There is therefore approximately 4.5 hours of data missing. On resumption after the missing data, the sampling timebase also changes, with the data prior to the gap being collected on 1 second past the hour (and 1 second past 30 minutes), but the data after the gap was collected on 34 seconds past the hour (and 34 seconds past 30 minutes). This instrument also caused problems after the cal-dip where it got into a command state where it would not communicate properly. Commands could be entered if they were typed sufficiently quickly after waking the instrument with the return key, but if not then they were not recognized. Although there were no indications of a flat battery from the DS reply the batteries were changed and this seems to have fixed the problem of the communication. However this instrument again collected a period of bad data where it again seems not to have written to the memory but incremented the sample count. This instrument needs further investigation.

9.2 Bottom Pressure Recorders

Bottom pressure recorders (BPR's) are deployed on landers (see figure 12), which sit on the sea floor directly attached to the anchor frame itself. They record the pressure and temperature once every 30 minutes throughout their lifetime. Due to their weight, 8-10 glass buoyancy spheres are usually placed directly above the BPR's. Enough buoyancy redundancy is given such that if any part of the mooring

Di382	Inst code	Number	Directory
InterOcean S4	302	3	s4
Aanderaa RCM11	310	8	rcm
RDI ADCP	324	1	adcp
Seabird Microcat	337	131	microcat
Sontek Argonaut	366	6	arg
Nortek Aquadop	370	23	nor
Seabird Seagauge	465	18	seaguage
	Total	190	

Table 7: Summary of moored instrumentation on Di382.

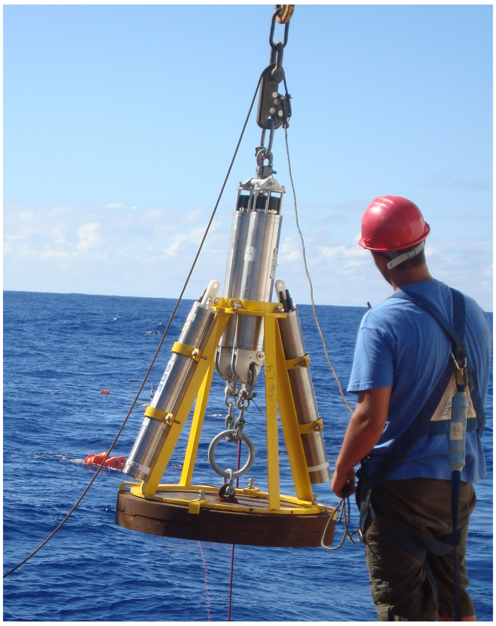


Figure 12: Lander WB4_L9 being deployed from the aft deck.

should break, or if a number of glass spheres implode (up to a certain limit), there is still enough buoyancy left to float the mooring to the surface. BPR's are deployed in pairs, which not only gives the extra data, but more importantly gives redundancy if one should fail or flood. During this cruise the BPR on EB1L7 (serial number 0061) flooded. RAPID uses the Sea-Bird SBE26 Seagauge and/or the Sea-Bird SBE53 BPR to measure bottom pressure and temperature. The data is processed in three stages.

Stage 0

The raw data is downloaded from the BPR using Sea-Bird's software and saved as `.hex` file. These are converted to `.tid` files using the same software. After downloading the files are transferred to the seagauge directory in `/raw/d382` under files names based on the serial number of the BPR recovered. An info.dat file is also created which contains information about the moorings location, the start and end times, and serial numbers.

Stage 1

The code `seagauge2rdb_003.m` looks at the `info.dat` file and converts the `ASCII .tid` file to RODB format. The units are converted from psi to dbar, the median temperature and pressure are calculated, and if there is a set clock offset from GMT recorded, this is applied as well. There is an option to correct for wrapped data, however this was not necessary on Di382 cruise. A file, `stage1_log`, is created which records the options chosen by the processing operator when running this code. The code is located in

`/data/exec/d382/stage1/bpr/seagauge2rdb_003.m`.

Output files are saved in `data/moor/proc/(mooring I.D)/seagauge/` with file names ending in `.raw`. A postscript figure is also created of the raw data, under the filename ending in `.raw.eps`.

Stage 2

The BPR's pressure measurements have a drift associated with them over their lifetime, usually of an exponential-linear nature. Stage 2 consists of removing these drifts and correcting the linear clock offset in the data. The code `seagauge_processing_d382_003.m` is run (which also calls `purge_bp_003.m`), which first corrects the clock drift, and then temporarily applies a 2 day low pass filter to remove daily tides. A straight linear fit is calculated of the form,

$$g(t) = a_3(t - t_1) + a_4 \tag{1}$$

and an exponential plus linear fit is calculated of the form,

$$f(t) = a_1\Big(\ 1 - exp[-a_2(t - t_1)]\Big)\ + g(t) \tag{2}$$

With the daily tides removed the user can check the exponential-linear fit by eye to ensure it is sensible. The linear fit is not used. By taking the inverse of the decay rate a_2, we get the decay scale, which typically has the value of tens of days. At this stage two figures are saved; the first is with the raw temperature and pressure data, with the file ending in `.use.1.eps`. The second figure (ending in `.use.2.eps`) shows three plots of the data with the 2 day low pass filter applied. The first plot is of the pressure with exponential-linear fit, the second plot is of the pressure with this exponential-linear drift subtracted, and the third plot is of the temperature. The BPR data is then saved with the exponential-linear drift subtracted (but without the two day low pass filter) as a file ending in `.use`.

Stage 3

The final stage of BPR processing uses the code `bp_stage3_d382.m`. This removes daily, fortnightly and monthly tides. The file `stage3_log` keeps a track of the parameters used, and the final output file saved ends in `.seagauge`.

BPR problems

SBE26 serial number 393 would not communicate. This instrument was loaded at NOCS prior to the cruise, so this needs further investigation. SBE53 serial number 0061 flooded on EB1L7 and needs returning to Sea-Bird for repair. Serial number 0064 recovered from EBH1L7 was found to have a time offset of 1 hour, 1 minute and 7 seconds form GMT, but when comparing with the data from 0060 on the same mooring it is evident that serial number 0064 had the time incorrectly set by 1 hour on the deployment cruise. This offset is entered in the `clock_offset.dat` file in the cruise raw data directory and corrected during processing. The BPR records from WBAL2 showed two clear jumps where the mooring moved slightly downslope. This was probably caused by an anchor that is slightly lighter than that required for the strong currents at this site.

Lander mechanical problems

We nearly lost the lander frame and BPRs from the recovered WBAL2 as the releases almost slipped out of the frame on recovery. It looks like corrosion of the clamps through contact with the stainless bolts has caused the tension to drop off and allow the releases to move slightly. This is the shallowest lander site in relatively fast flowing warm water and so corrosion is probably fast than at other lander sites. There was also strong evidence of crevice corrosion on the acoustic releases recovered from the EBH4L2 lander where the clamps were tight against the release pressure housing. In light of the losses of the lander frames from MAR0 and MAR1L6 and the two corrosion problems detailed above, the lander designs needs revision.

9.3 Current Meter and ADCP Processing

All current meters recovered on this cruise were processed as per previous cruises using the Matlab stage 1 and stage 2 processing routines. A total of 40 current meters were recovered, consisting of seven Aanderaa RCM11s, six Sontek Argonaut MDs, three InterOcean S4s and 24 Nortek Aquadopps. A numer of these had short records due to a combination of premature battery depletion and beam failures causing the currents data to be invalid. Full details of instrument record lengths are shown in Table 14

Beam failures were limited to the Sontek Argonaut MDs, with four out of six having a beam failure during the deployment period. As this is sometimes not obvious from the output velocity plots from the stage 2 processing (especially when viewing the filtered data) the stage 2 routine was modified to also produce plots of the diagnostic data available to highlight periods of invalid data. The diagnostic information available is the `u`, `v` and `w` velocity component standard deviation, along with the signal strength, noise level and resultant signal to noise ratio for each of the three beams. These plots are now automatically saved to the same output directory as the `.use` data files and `.use.eps` graphics files.

Two of the S4s recovered on this trip (serial numbers 35612572 from MAR1 and 35612571 from MAR2) were incorrectly setup to only log channel 6 rather than channels 2, 3, 4, 5 and 6. This can be caused by the instrument being setup via a terminal and the command CA2,3,4,5,6 being instead entered as CA23456. There are therefore no heading, conductivity or temperature measurements from these instruments. The VB routines used to download and convert the S4 data were modified so that it would be able to handle instances of varying numbers of ancillary channels, and this updated set of routines were recompiled to create `S4download_V3.exe` and installed on the instrument download laptops.

Current meter problems

Sontek Argonaut MD serial number D332 not only had a beam failure after 8 days of the deployment, it also had a constant temperature reading of -10°C indicating that the temperature sensor is faulty. This could have a knock on effect on the speed of sound calculation as the instrument uses the measured temperature to calculate the speed of sound, however this should be corrected in the stage 3 processing.

Beam failures also occurred in Sontek serial numbers D273 (from EB1), D278 (from EBH5) and D295 (from MAR1).

Several of the Sonteks also stopped early due to flat batteries. The battery endurance calculations suggest this shouldn't have been a problem for the sampling setup we have been using, but with the new switch to an 18-month service interval, the sampling frequency has also been reduced to allow the sampling to continue for longer.

The battery in RCM11 serial number 303 depleted approximately 13 days early. As with the Sonteks, the sampling frequency of the RCM11s has now been reduced as the project moves to an 18-month service interval.

The data from RCM11 serial number 305 needed a lot of manual editing towards the end of the record where it was missing the reference channel reading at the start of each sample. The instrument also stopped early, which after consultation with Aanderraa has been diagnosed as likely being due to a flat battery. Initially it looked like a different problem as the number of words on the DSU was seen to visibly drop when the DSU Reader cable was connected, leading us to think that a memory pointer had been changed, but Aanderaa suggested that it was the battery causing the problem.

The S4 recovered from MAR2 (serial number 35612571) has a faulty pressure sensor.

Several of the Nortek current meters appear to have not had the pressure sensor correctly zeroed during setup. This can at worst lead to zeroes throughout the timeseries as the instrument doesn't reach the depth range that the sensor thinks is zero, but more commonly the pressure is simply offset from what it should be. Each affected current meter can be corrected by using the pressure record of MicroCAT CTDs that were deployed at the same nominal depth, but for those on WBH2 there are not always corresponding MicroCATs so the correct pressure needs to be worked out using the length of rope between the different instruments and using that as an additional offset.

Nortek serial number 5963 had a corroded bulkhead connector pin which had snapped off and become stuck in the bulkhead connector. This instrument needed to be downloaded using the end cap from another instrument.

9.4 WBP1 PIES

A recovered lander frame was modified to fit a PIES so that it could be deployed at the new WBP1 site approximately 40 nautical miles to the north of WB2.

The PIES was setup with the following parameters for deployment in 4100 m of water.

```
Serial Number: 136
Mission Statement: WBP1 deployed 2012 from Disco's Last Dance Di382.
Travel Time Measurements: 24 pings every 60 minutes
Pressure and Temperature measured every 60 minutes
Pressure & temperature frequency file disabled
Telemetry data file enabled
Estimated Water Depth: 4100 meters
Acoustic Lockout: 4.92 seconds
Acoustic output set at 191 dB
Current Time: Fri Nov 23 10:24:51 2012
Release Time: Fri Nov 22 02:00:00 2019

Commands: CLEAR  76
          TELEM  65
          XPND   69
          BEACON 73
          RELEASE 8
```

Testing during setup confirmed the correct operation of the pressure sensor and responses to the XPND, BEACON and RELEASE commands. There was difficulty in getting the instrument to acknowledge the CLEAR command as seen when trying to switch off the BEACON mode. Following deployment the instrument was monitored to the seabed by ranging in the XPND mode. However no further tests could be conducted as a final CTD was taking place and the pinger had not been removed from the frame. The CLEAR command again could not be acknowledged but it is unclear whether this was due to interference from the pinger, or the same problem experienced in the lab prior to deployment. If in the future the data telemetry option is required then it would be wise to do this without putting the instrument into any other command mode as the CLEAR may still not be able to be acknowledged. This may also be important for when attempting recovery as the RELEASE command may not be able to be received if in another mode than cannot be cancelled until the instrument reaches midnight.

10 Float and Drifter Deployments

Rafael Jaume-Catany

10.1 Argo float deployments

The international Argo project consists of an array of about 3000 floats distributed all around the global ocean. Argo floats profile every ten days and provide observations of temperature, conductivity and pressure in the water column, from the surface down to 2000 m. The spatial resolution of the array depends on the number of the number of the floats which are operational at any given time. At the moment the spatial resolution of the array is estimated to be about 3 degrees (`http://www.argo.ucsd.edu/`http://www.argo.ucsd.edu/). As part of the UK's commitment to the Argo programme, five floats were deployed during Di382 (Table 8). The choice of the deployment location was made looking at the largest gaps of floats near by the scheduled ship's transect.

Before each float was deployed, this was connected to a serial port of a laptop using the communication cables supplied by the fabricant. Then the recommended pre-deployment test was run using TeraTerm (baud rate: 9600, 8 data bits, no parity, 1 stop bit). To complete the pre-deployment test takes between 15 and 20 min. This test includes a full check of, and if necessary, adjustment of float time (one float had a year set to 1972), satellite transmission, pump inflation, pressure test, battery voltage, internal vacuum, pneumatic and CTD test.

At least one hour before the deployment time, each float was activated by rubbing a magnet on the reset space located by one sticker on the hull of the float. Placing a transmission detector within 5 cm of the aerial, six Argos transmissions, eight seconds apart, are heard upon activation. After a few minutes (up to 12 minutes) the float will start beeping with a repetition period of about 40 seconds. Each float was deployed within one hour from the activation time. The deployment was performed by two scientists lowering the float from the starboard quarter. To lower the float gently into the water a rope passed through the white ring on the top of the float was used. Ship speed was about 1 knot.

After each deployment, confirmation emails were sent to the relevant project handlers at the BODC, Met Office and the National Oceanography Centre.

APEX Argo floats					
Argo ID	Date	jday	time	lat	lon
4882	14/10/2012	288	09:05	32.1653	-14.6515
4881	22/10/2012	296	12:45	26.1942	-19.3247
5014	31/10/2012	305	12:03	25.3820	-23.5422
5013	10/11/2012	315	20:00	25.2141	-53.4887
5012	13/11/2012	318	21:00	25.9417	-62.9697

Table 8: Argo floats deployments

Met Office drifters					
Argos S/N	910180	022040	912280	919170	912120
day	14/10/2012	22/10/2012	31/10/2012	10/11/2012	12/11/2012
Lat	32.299	26.196	25.382	25.214	25.9417
Lon	-14.640	-19.323	-23.542	-53.489	-62.9697

Table 9: SVP Met Office drifters deployment

Salinity drifters deployments			
Argos ID	Deployment time	Lat	Lon
36323	12:15:35	24.450	-37.700
36326	12:47:40	24.450	-37.804
36433	13:17:00	24.450	-37.899
36243	13:48:30	24.450	-38.002
36430	14:19:45	24.450	-38.103
36244	14:47:30	24.450	-38.194
36373	15:18:30	24.450	-38.296
36363	15:49:34	24.440	-38.399
36245	16:19:30	24.450	-38.500

Table 10: SVP with salinity sensor for the SPURS project

10.2 Surface Velocity Profiler

The Surface Velocity Profiler (SVP) is a drifting buoy specifically designed to track ocean currents at a fixed depth of 15 meters. The key elements of the SVP include the surface float which contains the telemetry system and sensors necessary to retrieve and transmit the required data and the drogue that it is designed to hold the SVP in place on the ocean surface.

During the Di382, five SVPs for the Met office (UK) were deployed in five different locations (Table 9). The locations of the deployment were the same as the Argo floats. The deployment procedure was very simple and the only important consideration was to activate the drifter removing the ON/OFF magnet between 10 and 30 minutes past the hour. The deployment was performed by two scientists.

After each deployment the relevant project handlers at the Met Office were contacted. The drifters were all confirmed to be operational.

10.3 Salinity drifter

Salinity Processes in the Upper Ocean Regional Study (SPURS) is a US-European project that seeks to understand the main processes controlling the upper ocean salinity budget with new salinity sampling tools. Nine SVP drifters specially equipped with a sensor to measure the sea surface salinity (SSS) were deployed on this cruise. The deployment of these drifters was done in a region requested by the SPURS project (Figure 10). Drifters were contained in a cardboard box and they were deployed in their box from the aft deck of *RRS Discovery*. It was necessary to remove two rubber plugs and an activation magnet from the floats prior to deployment.

11 RAPID and TEOS-10

Charlotte Mielke

The International Thermodynamic Equation of Seawater, 2010 (TEOS-10) (IOC & IAPSO, 2010) replaces the old equation of seawater, EOS-80. The basis of the description is a Gibbs function formulation, where the Gibbs function is a function of Absolute Salinity, temperature and pressure. The use of Absolute Salinity instead of Practical Salinity is one of the major differences between TEOS-10 and EOS-80. Another difference that is relevant here is the use of Conservative Temperature instead of potential temperature. More information about TEOS-10 can be found at `www.teos-10.org`.

Absolute Salinity is defined as the mass fraction of dissolved materials in seawater and has units of g/kg, so unlike Practical Salinity, it is given in SI units. But the main reason for using Absolute Salinity is that thermodynamic properties, for example density, directly depend on Absolute Salinity, but not Practical Salinity. In this way, Absolute Salinity is the more natural quantity. Also, the use of Absolute Salinity makes it possible to take spatial variations in seawater composition into account. This has a non-negligible influence on the calculation of density gradients and thereby on the calculation of ocean velocities.

Furthermore, the use of theoretical relations such as the ideal-solution law and the Debye–Hückel limiting law as well as new, more accurate measurements such as the temperatures of maximum density has improved the calculation of sea water density, especially for seawater at high pressures and low temperature.

In the following, we want to investigate how the use of the new toolbox affects the calculation of geostrophic velocities and thereby mass transports in the RAPID framework.

11.1 MOC timeseries

First, we calculate an MOC timeseries from the an eastern and a western boundary profile using a simple box model for the calculation of the internal transport. In the old version, geostrophic velocity is calculated using the function `geo_vel`. In the new version, dynamic height is calculated using `gsw_geo_dyn_height`. Afterwards, `gsw_geostrophic_velocity` is used to calculate the geostrophic velocity. Western Boundary Wedge, Gulf Stream and Ekman transport are added subsequently. Below the depth of the RAPID array (4820m), a time-invariant AABW profile is used. A barotropic correction is then applied to ensure mass balance.

In this simple calculation, the difference in overturning between the old and the new approach has a mean of 0.48 Sv and a standard deviation of 0.05 Sv (Figures 13 and 14). Note that there is a gap in the data due to a combination of dead batteries and a collapsed mooring in the west. To further examine the differences in mid-ocean transport, we estimate the transports in depth classes: thermocline recirculation ($0 - 800$ m), intermediate water ($800 - 1100$ m), upper North Atlantic deep water (UNADW, $1100 - 3000$m) and lower North Atlantic deep water ($3000 - 5000$ m).

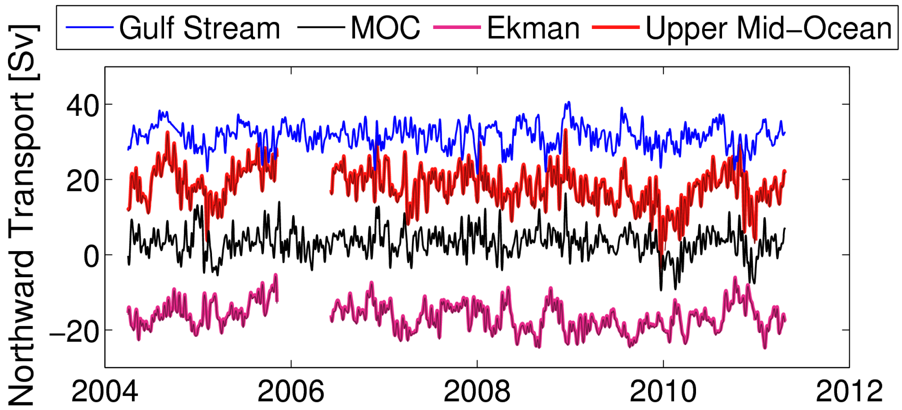


Figure 13: Gulf Stream, Ekman transport, upper mid-ocean transport and MOC timeseries from the box model calculation. Gulf Stream and Ekman transport timeseries are the same for both cases. For the upper mid-ocean transport and the MOC, results from the old toolbox are plotted in light and bold, while results from the new toolbox are dark and thin.

	old	TEOS-10	difference
Thermocline recirculation (0 – 800m)	−17.53	−17.13	−0.41
Intermediate water (800 – 1100m)	0.41	0.50	−0.09
UNADW (1100 – 3000m)	−11.07	−10.72	−0.36
LNADW (3000 – 5000m)	−7.04	−7.71	0.67

Table 11: Mean mid-ocean layer transports in the old and the new toolbox. Data are in Sverdrup.

In the upper 3000 m, transports are larger for the old toolbox, while the transport of LNADW is larger in the new toolbox.

11.2 Antarctic Bottom Water

In the above calculation of the Overturning, a time-invariant profile is used for the Antarctic Bottom Water, as it lies below the depth of the RAPID array. In the following, we therefore estimate the deep transports from five hydrographic sections (1982, 1992, 1998, 2004 and 2010) to investigate the effects of the new toolbox.

Transports are calculated from the geostrophic velocity between station pairs, where the geostrophic velocity is calculated as in Section 11.1. Following Frajka-Williams et al. (2011), 4100dbar is chosen as the level of no motion, and the deep transport is calculated between 70.5°W and 49°W and below 4100dbar (Table 12 and Figure 15).

It should be noted that the transport estimate is very sensitive to the choice of the western limit of the integration. For example, if 71.0°W is chosen as the western limit instead of 70.5°W, the old toolbox yields only 3.28 Sv, whereas the deep transport amounts to 4.38 Sv for 71.5°W as the western limit. This may explain the discrepancies between the results presented here and the results found by Frajka-

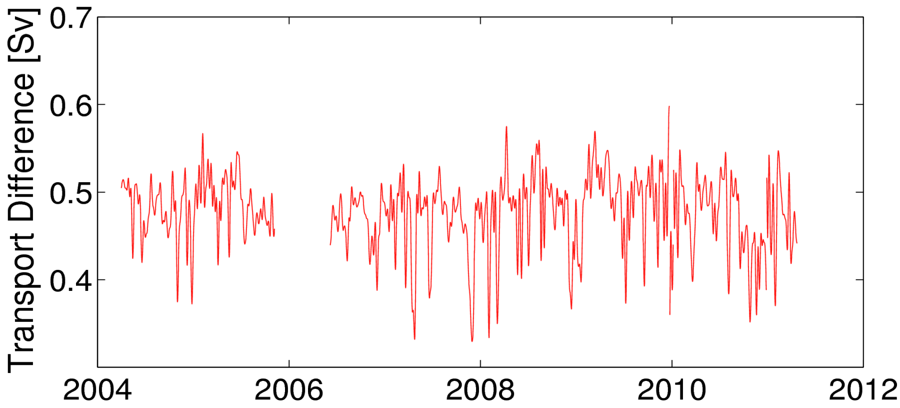


Figure 14: Difference in the calculated MOC timeseries (old−new, equal to the difference in upper mid-ocean transports).

	1981	1992	1998	2004	2010
old method	3.90	2.8	2.25	2.03	2.69
TEOS-10	4.29	3.16	2.57	2.36	2.99

Table 12: Deep transport estimates from hydrographic sections. Transports are calculated as the zonal integral between 70.5°W and 49°W and below 4100dbar. Data are in Sv.

Williams et al. (2011), where each section is interpolated on a fine longitudinal and pressure grid before the calculation. As the purpose here is to compare the old to the new seawater toolbox rather than getting a very accurate estimate of the deep transports, no such steps were taken here.

The new toolbox yields larger deep ocean transports for all hydrographic sections, with an average difference of 0.34 Sv, in agreement with the finding in Section 11.1, where we also found larger transports for the deeper layers.

From the deep transport profiles obtained using TEOS-10, we have calculated a mean vertical profile, which was then smoothed using the moving average filter provided by the Matlab function `smooth` with a span of 30 (Figure 16). The mass transport of the smoothed profile is 3.45 Sv, and the profile has been saved as

`cruise/TEOS-10/DATA/aabw_profile.mat`

.

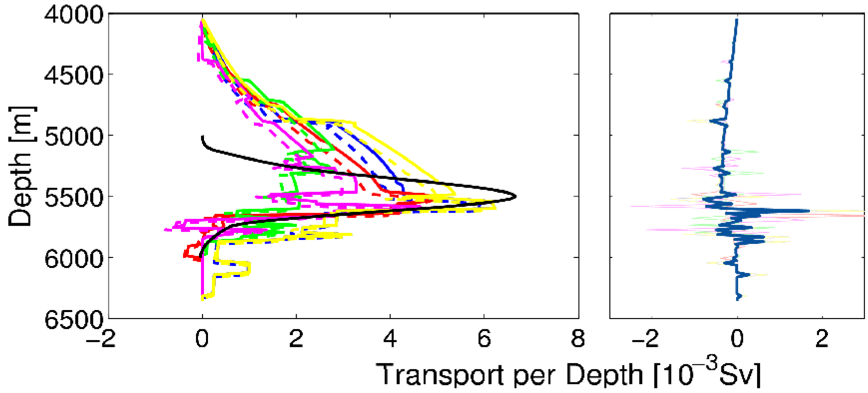


Figure 15: Left: Deep transport profiles from hydrographic sections, calculated using the old method (dashed) and TEOS-10 (solid). Profiles for the same year are in the same color (1982: blue), 1992: red, 1998: green, 2004: magenta, 2010: yellow). For comparison, the time-invariant AABW profile used in the box model calculations is also plotted. Right: Mean difference between the deep transport profiles. Individual differences are plotted faintly.

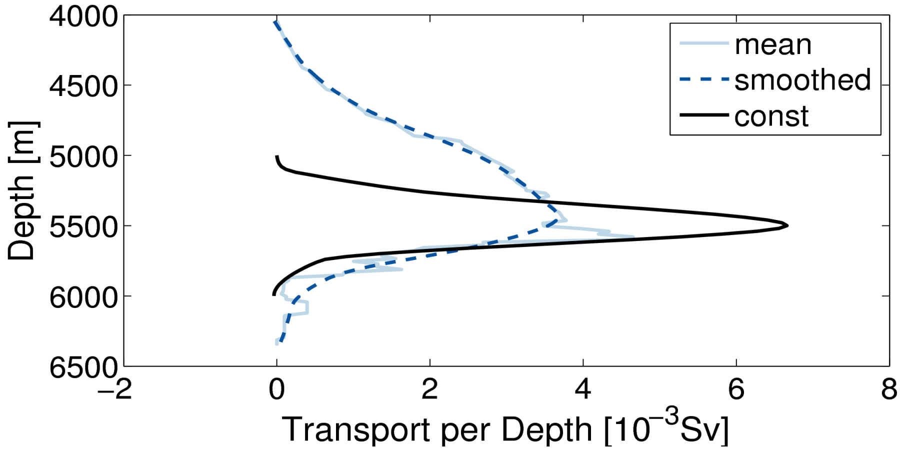


Figure 16: Mean deep transport profiles from hydrographic sections calculated with TEOS-10, as-is (light blue, solid) and smoothed (dark blue, dashed). For comparison, the time-invariant AABW profile used in the box model calculations is also plotted (black).

12 Triangulation of Deployed Moorings

David Smeed

In some cases the positions of deployed moorings were checked by obtaining acoustic ranges from a transducer deployed over the side of the ship. Attempts to use the ships transducer to communicate with the mooring acoustic releases were not successful. Matlab scripts used to determine positions were updated during the cruise to make use of the `m_map` Matlab toolbox routines `m_idist` and `m_fdist` to calculate distances between points on an ellipsoidal earth. When three or more ranges were available the `Anchor5.m` program solves a least squares problem to determine a position for the mooring anchor, along with an error estimate. The routine `Triangle5.m` provides a graphical representation of the information from the ranges only. A further routine `plan_triangle.m` was used to select positions to be used for triangulation.

To obtain accurate ranges it is important to deploy the transducer at the same depth each time particularly when taking a range close to the mooring.

The results are listed in Section 12.1.

12.1 Triangulation of non-retrieved moorings

MAR1L6

The Di359 cruise report listed a triangulated position of: 24.2038°N 49.7279°W, with a corrected water depth of 5222 m. During Di382 two ranges were made to the mooring these were not sufficient for a full triangulation but are consistent with the above location a best estimate being: 24.204°N 49.727°W.

MAR0

The JC064 cruise report gives an anchor drop position of 25.1047°N 52.0102°W with corrected water depth of 5529 m. During Di382 five ranges were made to the mooring. These suggested a corrected water depth of not more than 5500 m. Using the swath data from JC064 and the acoustic ranges from Di382 best estimate of the position is 25.1042°N 52.0092°W. This is located near the top of a hillock of the order of 50 m high and 200 m across.

13 Details of Instruments on Lowered CTDs

David Smeed

Cast	Date	Microcat serial numbers																	
1	12/10/12	3207	3214	3247	3251	3252	3253	3255	3270	3484	5766	5772	6829						
			T					T	P			c							
2	12/10/12	3212	3216	3256	3264	3277	5765	5777	6817	6818	6819	6823	6831						
					C		C												
3	15/10/12	3213	3220	3249	3893	3912	4066	4710	4712	4713	4718	4720	6331	6816					
4	22/10/12	3257	3259	3271	3916	4184	4462	4464	4466	4473	4474	5238	5246						
								C					P						
5	24/10/12	3215	3224	3230	3232	3234	3244	3265	3905	3907	6799	6800	6801	6802					
6	24/10/12	3229	3268	3900	3913	4178	5241	5242	6127	6322	6832	6841	7300						
						C,P	T	p	T	C									
7	24/10/12	3891	4060	4062	5244	5245	5247	5484	5486	5789	6113	6804	6805						
		No data																	
8	7/11/12	3222	3225	3254	3266	3281	3901	3904	4461	4468	6112	6798	6811	6815	6833	6834	6838	6839	7681
						C,P	T		C										
10	10/11/12	3284	3903	3910	4708	4717	4721	4797	4799	4800	5485	5784	5788	5978	6324	6807	6809	6812	
11	14/11/12	3919	3932	4306	5240	5485	5767	5778	5783	6119	6120	6128	6321	6335	6806	6813	6830	7723	
		C				C							P	C			P		
12	18/11/12	3248	3902	4068	4072	4180	4471	4472	5768	5773	5782	6121	6123	6820	7363	7468			
			P						T						T				
13	18/11/12	3911	3931	5779	5786	5787	6124	6137	6320	6323	6325	6326	6827	6840	7362	7470			
				C									P			P			
14	19/11/12	4068	4070	4071	4072														
16	21/11/12	3209	3483	3933	3934	4307	5762	5763	5780	5781	5785	6333	6821	6822	6828				
										C									
17	21/11/12	3928	4305	4470	4475	4719	5239	5243	6115	6116	6117	6824	6825	7361					
										P									

14 Instrument Record Lengths

David Smeed

Mooring	Nominal Depth (m)	Inst Code	S/N	Mean Pres. (dbar)	Start Date	End Date	No Records	Comments
ebh5_7_201131	100	337	3223	127.4	11/09/2011	28/10/2012	19814	
	175	337	3228	192.9	11/09/2011	28/10/2012	19814	
	250	337	3269	271.3	11/09/2011	28/10/2012	19814	
	450	310	305	466.4	11/09/2011	23/08/2012	16656	Battery failure
	750	366	278	755.5	11/09/2011	28/09/2012	18371	Beam failure + Battery failure 28/9/12
	950	366	322	974.5	11/09/2011	28/10/2012	19814	
ebh4_9_201129	325	337	3233	314.4	11/09/2011	28/10/2012	19812	
	400	337	3258					instrument flooded
	500	337	3254	514.0	11/09/2011	28/10/2012	19813	
	600	337	3219	610.1	11/09/2011	28/10/2012	19813	
	700	337	3221	705.4	11/09/2011	28/10/2012	19813	
	800	337	3222	812.2	11/09/2011	28/10/2012	19813	
ebh4l2_2_201110	1009	465	002	1028.0	12/01/2011	28/10/2012	31418	
	1009	465	004	1027.4	12/01/2011	28/10/2012	31418	
ebh3_8_201128	900	337	3907	891.7	12/09/2011	17/10/2012	19236	
	1000	337	6802	999.4	12/09/2011	17/10/2012	19236	
	1100	337	6801	1107.7	12/09/2011	17/10/2012	19236	
	1200	337	6800	1220.5	12/09/2011	17/10/2012	19236	
	1300	366	298	1319.9	12/09/2011	17/10/2012	19236	
	1400	337	6799	1424.3	12/09/2011	17/10/2012	19236	
ebh2_8_201127	1600	337	3230	1617.2	12/09/2011	16/10/2012	19192	
	1800	337	3224	1830.2	12/09/2011	16/10/2012	19192	

	1900	366	332	1971.4	12/09/2011	20/09/2011	27912	20 min. samp. , Beam Filaure then battery failure 4/10/12
	2000	337	3265	2037.6	12/09/2011	16/10/2012	19192	
ebh1_8_201124a	2500	337	3215	2488.4	13/09/2011	06/10/2011	1101	
	2900	310	301	2937.4	13/09/2011	06/10/2011	1100	
	3000	337	3244	3040.6	13/09/2011	06/10/2011	1101	
ebh1_8_201124b	2500	337	3215	2480.8	06/10/2012	15/10/2012	17992	
	2900	310	301	2937.4	06/10/2012	08/10/2012	17656	Battery failure
	3000	337	3244	3038.4	06/10/2012	15/10/2012	17992	
ebh1l7_7_201125a	5096	465	060	3059.7	10/01/2011	06/10/2011	12904	
	5096	465	064	3059.4	10/01/2011	06/10/2011	12902	
ebh1l7_7_201125b	5096	465	060	3059.7	07/10/2011	15/10/2012	17946	
	5096	465	064	3059.4	07/10/2011	15/10/2012	17944	
ebhi_8_201132	3500	337	3232	3490.6	15/09/2011	23/10/2012	19383	
	4000	337	3234	4035.8	15/09/2011	23/10/2012	19383	
	4400	310	302	4465.6	15/09/2011	23/10/2012	19383	
	4500	337	3905	4575.7	15/09/2011	23/10/2012	19383	
eb1_10_201122	50	337	5486	14.6	17/09/2011	24/10/2012	19335	
	105	337	3891	68.4	17/09/2011	24/10/2012	19335	
	175	337	5484	140.8	17/09/2011	24/10/2012	19335	
	250	337	6804	216.7	17/09/2011	24/10/2012	19335	
	325	337	6805	293.1	17/09/2011	24/10/2012	19335	
	400	337	5789	391.5	17/09/2011	24/10/2012	19335	
	600	337	5247	575.4	17/09/2011	24/10/2012	19335	
	800	337	5245	772.1	17/09/2011	24/10/2012	19335	
	1000	337	6113	966.8	17/09/2011	24/10/2012	19335	
	1200	337	5244	1178.8	17/09/2011	24/10/2012	19335	
	1500	366	273	1483.5	17/09/2011	29/07/2012	16125	Beam failure + Battery failure 18/8/2012
	1600	337	6814	1578.2	17/09/2011	24/10/2012	19335	
	2000	337	3206	1993.9	17/09/2011	24/10/2012	19335	

	2500	337	6114	2492.9	17/09/2011	24/10/2012	19335	
	3000	337	3266	3018.0	17/09/2011	24/10/2012	19335	
	3500	337	6811	3535.7	17/09/2011	24/10/2012	19335	
	4000	337	6815	4053.2	17/09/2011	24/10/2012	19335	
	4500	337	4549	4506.5	17/09/2011	24/10/2012	19335	
	4990	310	303	5084.5	17/09/2011	11/10/2012	18737	Battery failed
	5000	337	3225	5095.3	17/09/2011	24/10/2012	19335	
eb1l7_7_201102	5100	465	054	5201.7	06/01/2011	24/10/2012	31516	
	5100	465	061					Flooded
mar3_8_201137	2500	337	5776	2511.9	21/09/2011	05/11/2012	19716	
	3000	337	5774	3022.5	21/09/2011	05/11/2012	19716	
	3500	337	6835	3527.1	21/09/2011	05/11/2012	19716	
	4000	337	6810	4048.1	21/09/2011	05/11/2012	19716	
	4500	337	6836	4565.5	21/09/2011	05/11/2012	19716	
	5000	337	5770	5083.5	21/09/2011	05/11/2012	19716	
	5000	302	35612568	5090.0	21/09/2011	05/11/2012	19716	
mar3l6_6_201031	5050	465	062	5140.5	01/10/2011	05/11/2012	32342	
	5050	465	394	5141.9	01/01/2011	05/11/2012	32343	
mar2_8_201136	1100	337	3931	1128.7	25/09/2011	07/11/2012	19626	
	1400	337	3911	1428.6	25/09/2011	07/11/2012	19626	
	1600	337	6115	1615.0	25/09/2011	07/11/2012	19626	
	1800	337	6116	1816.2	25/09/2011	07/11/2012	19626	
	2250	337	6117	2280.0	25/09/2011	07/11/2012	19626	
	2750	337	3928	2817.9	25/09/2011	07/11/2012	19626	
	3257	337	5243	3321.1	25/09/2011	07/11/2012	19626	
	3750	337	5239	3833.5	25/09/2011	07/11/2012	19626	
	4250	337	5778	4357.1	25/09/2011	07/11/2012	19626	
	4750	337	6119	4849.4	25/09/2011	07/11/2012	19626	
	5150	302	35612571		25/09/2011	07/11/2012	19626	Pres. Sens fail. + No setup for C and T
	5160	337	6120	5260.7	25/09/2011	07/11/2012	19626	

mar1_8_201134	50	337	6335	41.0	25/09/2011	08/11/2012	19666	
	100	337	6321	83.7	25/09/2011	08/11/2012	19668	
	175	337	6324	171.6	25/09/2011	08/11/2012	19668	
	250	337	4721	252.1	25/09/2011	08/11/2012	19668	
	325	337	5485	331.1	25/09/2011	08/11/2012	19668	
	400	337	6806	409.7	25/09/2011	08/11/2012	19668	
	600	337	6807	608.7	25/09/2011	08/11/2012	19668	
	800	337	4717	811.6	25/09/2011	08/11/2012	19668	
	1000	337	6809	1012.2	25/09/2011	08/11/2012	19668	
	1200	337	4708	1217.3	25/09/2011	08/11/2012	19668	
	1500	366	295	1514.5	25/09/2011	11/12/2011	19668	Beam failure
	1600	337	5784	1641.2	25/09/2011	08/11/2012	19668	
	2000	337	6812	2034.4	25/09/2011	08/11/2012	19668	
	2500	337	3932	2566.4	25/09/2011	08/11/2012	19668	
	3000	337	6813	3082.4	25/09/2011	08/11/2012	19668	
	3500	337	3919	3561.4	25/09/2011	08/11/2012	19668	
	4000	337	7723	4131.7	25/09/2011	08/11/2012	19668	
	4500	337	5783	4645.9	25/09/2011	08/11/2012	19668	
	5000	302	35612572	5172.2	25/09/2011	08/11/2012	19669	Not setup for C and T
	5000	337	6830	5150.7	25/09/2011	08/11/2012	19668	
mar1l6_6_201027								Mooring not recovered
mar0_5_201133								Mooring not recovered
wb6_6_201201	5100	337	5240	5170.4	19/02/2012	14/11/2012	12938	
	5200	337	6128	5272.7	19/02/2012	14/11/2012	12938	
	5300	337	5767	5392.9	19/02/2012	14/11/2012	12938	
	5400	368	6747	5543.1	19/02/2012	14/11/2012	12938	
	5400	337	7361	5502.2	19/02/2012	14/11/2012	12938	
	5495	337	4306	5597.0	19/02/2012	14/11/2012	12938	
	5500	465	390	5611.2	19/02/2012	14/11/2012	12924	
	5500	465	040	5608.9	19/02/2012	14/11/2012	12937	
wb4_9_201202	50	337	4071	60.9	24/02/2012	18/11/2012	12852	

	100	310	445	109.2	24/02/2012	18/11/2012	12853	
	100	337	4070	113.1	24/02/2012	18/11/2012	12852	
	250	337	5787	251.7	24/02/2012	18/11/2012	12852	
	400	370	5963	412.4	24/02/2012	18/11/2012	12851	
	400	337	5779	407.2	24/02/2012	18/11/2012	12852	
	600	337	5786	607.9	24/02/2012	18/11/2012	12852	
	800	370	6751	-	24/02/2012	18/11/2012	12852	No pressure
	800	337	6827	808.6	24/02/2012	18/11/2012	12852	
	1000	337	7362	1006.2	24/02/2012	18/11/2012	12852	
	1200	370	6743	18.1	24/02/2012	18/11/2012	12852	large pressure offset
	1200	337	7470	1216.4	24/02/2012	18/11/2012	12852	
	1500	370	9406	1508.2	24/02/2012	18/11/2012	12852	
	1600	337	6840	1611.5	24/02/2012	18/11/2012	12852	
	2000	370	9439	2029.5	24/02/2012	18/11/2012	12852	
	2000	337	6124	2012.5	24/02/2012	18/11/2012	12852	
	2500	337	6326	2532.5	24/02/2012	18/11/2012	12852	
	3000	370	9433	3068.9	24/02/2012	18/11/2012	12852	
	3000	337	6325	3046.5	24/02/2012	18/11/2012	12852	
	3500	337	6323	3556.5	24/02/2012	18/11/2012	12852	
	4000	370	9420	4076.4	24/02/2012	18/11/2012	12852	
	4000	337	6320	4072.1	24/02/2012	18/11/2012	12852	
	4500	337	6137	4569.1	24/02/2012	18/11/2012	12852	
	4630	370	5885	4700.1	24/02/2012	18/11/2012	12852	
wb4l7_7_201120	4700	465	014	4831.0	23/04/2011	18/11/2012	27573	
	4700	465	057	4830.0	23/04/2011	18/11/2012	27573	
wb2_10_201205	50	337	5781	58.4	28/02/2012	20/11/2012	12750	
	100	310	448	119.7	28/02/2012	20/11/2012	12750	
	100	337	5780	115.9	28/02/2012	20/11/2012	12750	
	175	310	449	189.9	28/02/2012	20/11/2012	12750	
	175	337	6821	179.2	28/02/2012	20/11/2012	12750	
	325	337	6822	331.3	28/02/2012	20/11/2012	12750	

	400	370	6753	-	28/02/2012	20/11/2012	12750	no pressure
	400	337	3933	419.1	28/02/2012	20/11/2012	12750	
	500	337	5763	505.1	28/02/2012	20/11/2012	12750	
	700	337	4307	707.7	28/02/2012	20/11/2012	12750	
	800	370	6119	818.7	28/02/2012	20/11/2012	12750	
	900	337	4470	908.8	28/02/2012	20/11/2012	12750	
	1100	337	5762	1114.4	28/02/2012	20/11/2012	12750	
	1200	370	5884	1221.4	28/02/2012	20/11/2012	12750	
	1300	337	3209	1314.6	28/02/2012	20/11/2012	12750	
	1500	370	6176	1537.5	28/02/2012	20/11/2012	12750	
	1500	337	6333	1520.2	28/02/2012	20/11/2012	12741	Bad data for few hours in middle and at end of record
	1700	337	5785	1724.1	28/02/2012	20/11/2012	12750	
	1900	337	3934	1926.3	28/02/2012	20/11/2012	12750	
	2050	370	5967	2103.5	28/02/2012	20/11/2012	12750	
	2300	337	4475	2335.3	28/02/2012	20/11/2012	12750	
	2800	337	4719	2844.7	28/02/2012	20/11/2012	12750	
	3000	370	9266	3071.0	28/02/2012	20/11/2012	12750	
	3300	337	3483	3338.4	28/02/2012	20/11/2012	12750	
	3850	337	6828	3911.2	28/02/2012	20/11/2012	12750	
wb2l_7_201119	3885	465	055	3956.2	28/04/2011	20/11/2012	27453	
	3885	465	056	3955.8	28/04/2011	20/11/2012	27453	
wbh2_6_201204	1500	370	9402	1334.6	26/02/2012	21/11/2012	12891	
	2200	370	9427	2066.7	26/02/2012	21/11/2012	12891	
	3000	370	9444	2902.4	26/02/2012	21/11/2012	12891	
	3800	370	6132	3822.6	26/02/2012	21/11/2012	12891	
	3800	337	6825	3767.4	26/02/2012	21/11/2012	12891	
	4300	337	6824	4334.5	26/02/2012	21/11/2012	12891	
	4700	370	5879	4704.3	26/02/2012	21/11/2012	12891	
	4780	337	4305	4760.6	26/02/2012	21/11/2012	12891	
wb1_9_201208	50	337	6123	54.9	29/02/2012	17/11/2012	12564	

	100	370	9409	105.2	29/02/2012	17/11/2012	12564	
	100	337	6121	104.9	29/02/2012	17/11/2012	12564	
	175	337	4072	178.3	29/02/2012	17/11/2012	12564	
	250	337	6820	262.2	29/02/2012	17/11/2012	12564	
	325	337	4180	336.3	29/02/2012	17/11/2012	12564	
	400	377	5773	414.0	29/02/2012	17/11/2012	12564	
	400	370	5890	419.2	29/02/2012	17/11/2012	12564	
	500	337	3248	514.9	29/02/2012	17/11/2012	12564	
	600	337	3902	617.4	29/02/2012	17/11/2012	12564	
	700	337	4472	718.4	29/02/2012	17/11/2012	12564	
	800	370	5897	-	29/02/2012	17/11/2012	12564	No pressure
	800	337	5768	831.0	29/02/2012	17/11/2012	12564	
	900	337	5782	930.0	29/02/2012	17/11/2012	12564	
	1000	337	4068	1032.3	29/02/2012	17/11/2012	12564	
	1000	337	4471	1132.9	29/02/2012	17/11/2012	12564	
	1200	370	5889	1247.3	29/02/2012	17/11/2012	12564	Seems to have c. 20db error in pressure
	1200	337	7468	1239.3	29/02/2012	17/11/2012	12564	
	1350	337	7363	1356.5	29/02/2012	17/11/2012	12564	
wbal2_2_201121	495	465	417	522.7	30/04/2011	21/11/2012	27410	Lander moved due to currents
	495	465	039	523.3	30/04/2011	21/11/2012	27410	data needs correction for pressure jump
wbadcp_9_201206	614	324	5817	597.6(m)	28/02/2012	21/11/2012	6402	No correction for soundspeed

15 Lost or Damaged Instruments and Hardware

Darren Rayner

Mooring	Equipment damages	Equipment lost	Details
WB1	2 x SBE37 MicroCATs - Conductivity guard missing from each		Likely strumming of mooring shaking out bolts
MAR3	4 x 17" glass spheres		Implosion of 4 out of 8 from deepest buoyancy package
MAR1L6		1 x 12" glass, 8 x 17" glass, 1 x Billings float, 1 x Argos beacon, 1 x light, 2 x SeaBird SBE53 BPRs, 1 x Ixsea AR861 acoustic release, 1 x Ixsea RT661 acoustic release	Mooring not recoverable. Likely double implosion of glass buoyancy packages
MAR0		1 x 12" glass, 12 x 17" glass, 1 x Billings float, 1 x Argos beacon, 1 x light, 2 x SeaBird SBE53 BPRs, 2 x Ixsea AR861 acoustic release, 5 x SBE37 MicroCATs	Mooring not recoverable. Likely implosion of deepest buoyancy package with sympathetic implosions meaning all 8 failed
WB6	2 x 17" glass	1 x Billings float, 1 x Argos beacon, 1 x Light	Implosion of glass and Billings float. Billings float implosion shattered mast and caused loss of beacons
EBH4	1 x SBE37 MicroCAT		Flooded. Bulkhead connector missing.
EB1L7	1 x Billings float, 1 x SBE53 BPR		Implosion of Billings float. Flooding of BPR
EB1		1 x mini-Trimsyn	Missing from pick up line. Assumed pull off by wave motion as top of mooring was too shallow.

WB2	1 x Ixsea Oceano AR861 acoustic release	Corosion of top ring above transducer cage. Ring completely missing and clearly caused by mismatch of touching metals as part of release construction.
WB4	1 x Nortek Aquadopp current meter	Corossion of 1 pin in bulkhead connector plug.
WBH2	2 x 17" glass	Implosion of 2 out of 5 of the deepest buoyancy package.

16 Mooring Deployment Table

Mooring	UKORS No.	Latitude °N	Longitude °W	Fallback (m)	Depth (m)	date	Duration	Argos ID	A/R 1	A/R 2
EBH1	2012/30	27°13.34’	15°25.36’		3039	16/10/12	0:25	121992	1351	251
EBH1L9	2012/31	27°12.73’	15°24.17’		3015	16/10/12	0:05	121991	265	347
EBH2	2012/32	27°36.65’	14°12.74’		2020	16/10/12	0:15	121990	1346	1534
EBH3	2012/33	27°48.74’	13°44.71’	94	1423	17/10/12	1:24	121989	825	1345
EBHi	2012/35	24°55.97’	21°16.39’		4495	23/10/12	0:32	53157	1533	1348
EB1L9	2012/36	23°47.93’	24°06.69’	112	5097	24/10/12	0:04	93792	1353	368
EB1	2012/37	23°45.27’	24°09.39’	361	5097	25/10/12	4:01	82952, 60211	1535	1536
EBH4L4	2012/38	27°52.31’	13°30.89’	93	1009	28/10/12	0:09	46501	908	1242
EBH4	2012/39	27°51.06’	13°32.42’	155	1057	28/10/12	1:23	121996	246	1354
MAR3	2012/40	23°52.21’	41°05.40’		5056	05/11/12	1:40	46491	824	925
MAR3L8	2012/41	23°51.39’	41°05.93’		5055	05/11/12	0:06	46492	927	907
MAR1	2012/43	24°09.91’	49°45.02’	423	5212	08/11/12	4:08	121988, 82895	1200	319
MAR1L8	2012/44	24°11.72’	49°42.84’		5222	09/11/12	0:05	121997	822	1203
MAR2	2012/45	24°10.66’	49°45.77’		5214	09/11/12	1:11	53153	264	1197
MAR0	2012/46	25°06.68’	52°01.03’		5489	10/11/12	0:17	121933	923	249
WB6	2012/47	26°29.65’	70°31.36’		5497	14/11/12	0:15	121994	819	281
WB1	2012/48	26°30.60’	76°49.09’	78	1369	17/11/12	2:30	46493, 42145	1201	1194
WB4L9	2012/49	26°28.38’	75°42.30’	236	4691	18/11/12	0:04	53130	322	256
WB4	2012/50	26°28.74’	75°42.25’	345	4695	19/11/12	5:15	53218, 111853	910	316
WB2	2012/51	26°30.98’	76°44.32’	264	3920	20/11/12	3:58	46499, 22442	917	323
WB2L9	2012/52	26°30.43’	76°44.43’	-250	3889	20/11/12	0:04	121995	928	920
WBH2	2012/53	26°29.14’	76°37.76		4714	22/11/12	02:44	46485	827	687
WBADCP	2012/54	26°31.51	76°52.06’		615	22/11/12	00:03	46494	906	497
WBAL4	2012/55	26°31.48’	76°52.56’		493	22/11/12	00:06	111852	1195	320
WBP1	2012/56	27°06.10’	76°36.71’		4102	23/11/12	00.01	n/a	n/a	n/a
NOG	2012/42	23°46.25’	24°05.92’		4241	05/11/12	1:19	n/a	1350	n/a

17 Mooring Recovery Table

Mooring Name	Sequential Mooring Number	UKORS Mooring Number	Deployment Cruise	Lat (°N)	Lon (°W)	Deployment Date	Recovery Date
EBH1	8	2011/24	JC064	27°08.61’	15°22.66’	06/10/11	15/10/12
EBH1L7	7	2011/05-25	D359	27°16.61’	15°24.94’	10/01/11	15/10/12
EBH2	8	2011/27	JC064	27°36.88’	14°12.65’	12/09/11	16/10/12
EBH3	8	2011/38	JC064	27°48.30’	13°44.81’	12/09/11	17/10/12
EBHi	8	2011/32	JC064	24°55.98’	21°16.39’	15/09/11	23/10/12
EB1	10	2011/22	JC064	23°45.46’	24°09.31’	17/09/11	24/10/12
EB1L7	7	2011/02	JC064	23°48.05’	24°06.69’	06/01/11	24/10/12
EBH4L2	2	2011/10	D359	27°52.30’	13°30.81’	12/01/11	28/10/12
EBH4	9	2011/29	JC064	27°51.01’	13°32.45’	11/09/11	28/10/12
EBH5	7	2011/31	JC064	27°50.56’	13°32.65’	11/09/11	28/10/12
MAR3L6	6	2010/27	D359	23°51.76’	41°05.76’	31/12/10	05/11/12
MAR3	8	2011/37	JC064	23°48.42’	41°05.90’	21/09/11	05/11/12
NOGST			JC064	23°46.26’	41°05.93’	22/09/11	05/11/12
MAR2	8	2011/36	JC064	24°11.10’	49°45.39’	25/09/11	07/11/12
MAR1L6	6	2010/27	D359	24°12.23’	49°43.68’	25/12/10	LOST
MAR1	8	2011/34	JC064	24°09.93’	49°45.00’	25/09/11	08/11/12
MAR0	5	2011/33	JC064	25°06.28’	52°00.61’	26/09/11	LOST
WB6	6	2012/01	RB1201	26°29.70’	70°31.34’	17/02/12	14/11/12
WB1	9	2012/08	RB1201	26°29.97’	76°44.82’	28/02/12	17/11/12
WB4	9	2012/02	RB1201	26°28.71’	75°41.98’	23/02/12	18/11/12
WB4L7	7	2011/20	KN200-4	26°29.20’	75°48.44’	23/04/11	18/11/12
WB2	10	2015/05	RB1201	26°30.72’	76°43.98’	27/02/12	20/11/12
WB2L7	7	2011/19	KN200-4	26°30.50’	76°44.60’	28/04/11	20/11/12
WBH2	6	2012/04	RB1201	26°28.91’	76°37.44’	25/02/12	21/11/12
WBAL2	2	2011/21	KN200-4	26°31.57’	76°52.55’	30/04/11	21/11/12
WBADCP	9	2012/06	RB1201	26°31.49’	76°52.08’	27/02/12	21/11/12

18 Acoustic Release Summary

Serial No	Type	Previous Location	Current Location	Deployed	Serviced	New Batts	Bench tested	Wire tested	Depth tested
1353	AR861	NOC	EB1L9	24/10/12	YES	YES	YES	YES	5000
265	AR861	NOC	EBH1L9	16/10/12	YES	YES	YES	YES	5000
1347	AR861	NOC	EBH1L9	16/10/12	YES	YES	YES	YES	5000
368	AR861	NOC	EB1L9	24/10/12	YES	YES	YES	YES	5000
246	AR861	NOC	EBH4	28/10/12	YES	YES	YES	YES	5000
1354	AR861	NOC	EBH4	28/10/12	YES	YES	YES	YES	5000
1535	AR861	NOC	EB1	25/10/12	YES	YES	YES	YES	5000
1533	AR861	NOC	ENHI	23/10/12	YES	YES	YES	YES	5000
1348	AR861	NOC	EBHI	23/10/12	YES	YES	YES	YES	5000
1351	AR861	NOC	EBH1	16/10/12	YES	YES	YES	YES	5000
251	AR861	NOC	EBH1	16/10/12	YES	YES	YES	YES	5000
1536	AR861	NOC	EB1	25/10/12	YES	YES	YES	YES	5000
320	AR861	EBH3L1	WBAL4		YES	YES	YES	YES	3000
1350	AR861	EBH3L1	NOG	05/11/12	YES	YES	YES	YES	3000
1345	AR861	NOC	EBH3	17/10/12	YES	YES	YES	YES	3000
1346	AR861	NOC	EBH2	16/10/12	YES	YES	YES	YES	3000
825	AR861	NOC	EBH3	17/10/12	YES	YES	YES	YES	3000
907	AR861	NOC	MAR3L8	05/11/12	YES	YES	YES	YES	5000
1534	AR861	NOC	EBH2	16/10/12	YES	YES	YES	YES	3000
824	AR861	EBH1L7	MAR3	05/11/12	YES	YES	YES	YES	5000
281	AR861	EBH1L7	WB6	14/11/12	YES	YES	YES	YES	5600
827	AR861	EBH1	WBH2	19/11/12	YES	YES	YES	YES	5600
1200	AR861	EBH1	MAR1	08/11/12	YES	YES	YES	YES	5000
1242	AR861	EBH2	EBH4L4	28/10/12	YES	YES	YES	YES	5000
927	AR861	EBH2	MAR3L8	05/11/12	YES	YES	YES	YES	5000

925	AR861	EBH3	MAR3	05/11/12	YES	YES	YES	YES	5000
908	AR861	EBH3	EBH4L4	28/10/12	YES	YES	YES	YES	5000
819	AR861	EBHI	DISCO		YES	YES	YES	YES	5600
923	AR861	EBHI	MAR0	10/11/12	YES	YES	YES	YES	5600
319	AR861	EB1L7	MAR1	08/11/12	YES	YES	YES	YES	5000
924	AR861	EB1L7	DISCO	CORRODED					
1203	AR861	EB1	MAR1L8	09/11/12	YES	YES	YES	YES	5000
1197	AR861	EB1	MAR2	09/11/12	YES	YES	YES	YES	5000
249	AR861	EBH5	MAR0	10/11/12	YES	YES	YES	YES	5600
256	AR861	EBH5	WB4L9	19/11/12	YES	YES	YES	YES	5000
323	AR861	EBH4L2	WB2		YES	YES	YES	YES	5000
687	AR861	EBH4L2	WBH2	19/11/12	YES	YES	YES	YES	5600
264	AR861	EBH4	MAR2	09/11/12	YES	YES	YES	YES	5000
906	AR861	EBH4	WBADCP	22/11/12	YES	YES	YES	YES	5000
917	AR861	MAR3	WB2		YES	YES	YES	YES	5000
322	AR861	MAR3	WB4L9	19/11/12	YES	YES	YES	YES	5000
497	AR861	MAR3L6	WBADCP	22/11/12	YES	YES	YES	YES	5000
1195	AR861	MAR3L6	WBAL4		YES	YES	YES	YES	5000
822	AR861	NOG	MAR1L8	09/11/12	YES	YES	YES	YES	5000
928	AR861	MAR2	WB2L9		YES	YES	YES	YES	5400
1194	AR861	MAR2	WB1		YES	YES	YES	YES	5400
920	AR861	MAR1	WB2L9		YES	YES	YES	YES	5400
316	AR861	MAR1	WB4		YES	YES	YES	YES	5400
163	RT661	MAR1L6	MAR1L6	N/R					
1196	AR861	MAR1L6	MAR1L6	N/R					
826	AR861	MAR0	MAR0	N/R					
1199	AR861	MAR0	MAR0	N/R					
1201	AR861	WB6	WB1		YES	YES	YES	YES	5400
910	AR861	WB6	WB4		YES	YES	YES	YES	5400

1464	AR861	WBADCP	DISCO
821	AR861	WBADCP	DISCO
1461	AR861	WB1	DISCO
823	AR861	WB1	DISCO
1406	AR861	WB2	DISCO
324	AR861	WB2	DISCO
918	AR861	WB2L7	DISCO
916	AR861	WB2L7	DISCO
1465	AR861	WB4	DISCO
1463	AR861	WB4	DISCO
1349	AR861	WB4L7	DISCO
358	AR861	WB4L7	DISCO
1352	AR861	WBAL2	DISCO
364	AR861	WBAL2	DISCO
216	RT661	WBH2	DISCO
1405	AR861	WBH2	DISCO

19 RAPID mooring and hydrographic cruises

Gerard McCarthy

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-04	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-04	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-05	Service and redeployment of 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-05	Service and redeployment of UK and US Western Boundary Moorings and Western Boundary Time Series (WBTS) hydrography 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-05	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 05	Emergency recovery of drifting WB1 mooring	No report published

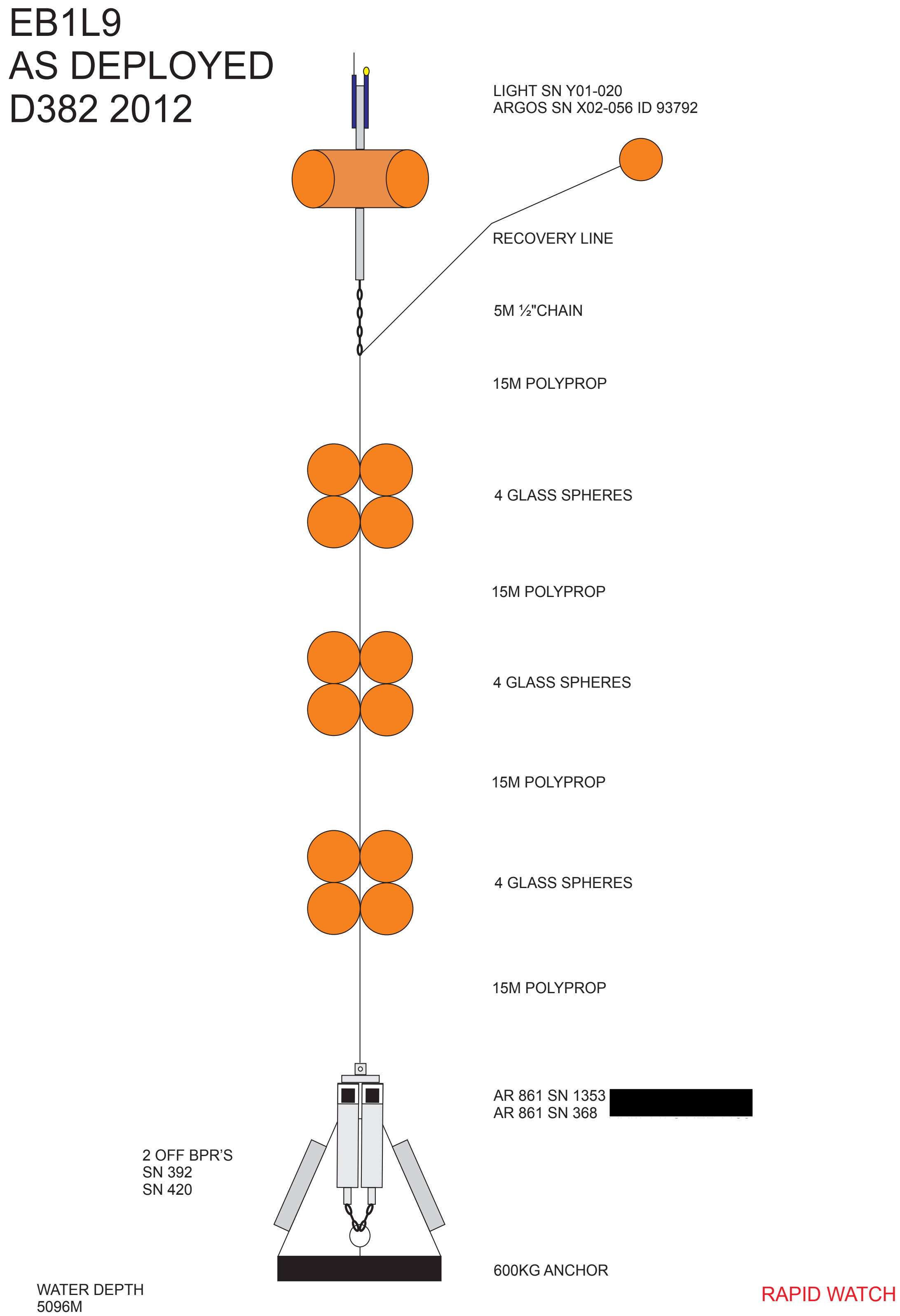
RB0602	RV Ronald H. Brown	Mar-06	Service and redeployment of UK Western Boundary moorings and WBTS hydrography section	RV Ronald H. Brown Cruise RB0602 and RRS Discovery Cruise D304. National Oceanography Centre Southampton Cruise Report, No. 16, 2007
D304	RRS Discovery	May - Jun 2006	Service and redeployment of Eastern Boundary and Mid-Atlantic Ridge moorings	RV Ronald H. Brown Cruise RB0602 and RRS Discovery Cruise D304. National Oceanography Centre Southampton Cruise Report, No. 16, 2007
P343	RV Poseidon	Oct 06	Service and redeployment of key Eastern Boundary moorings	RS Poseidon Cruises P343 and P345. National Oceanography Centre Southampton Cruise Report No. 28, 2008.
P345	RV Poseidon	Dec 06	Emergency redeployment of EB1 and EB2 following problems on P343	RS Poseidon Cruises 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 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 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 Eastern Boundary and Mid-Atlantic Ridge moorings	RRS Discovery Cruise D324, National Oceanography Centre,Southampton Cruise Report, No 34
SJ0803	RV Seward Johnson	Apr-08	Service and redeployment of the Western Boundary moorings	RV Seward Johnson Cruise SJ0803, National Oceanography Centre,Southampton Cruise Report, No 37
D334	RRS Discovery	Oct-Nov 2008	Service and redeployment of the Eastern Boundary and Mid-Atlantic Ridge moorings	RRS Discovery D344, National Oceanography Centre, Southampton, Cruise Report No. 38, 2009

RB0901	RV Ronald H. Brown	April - May 2009	Service and redeployment of the UK and US Western Boundary moorings and WBTS hydrography 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 Cruise, D334, 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 hydrography section	No cruise report to be published
OC459-1	RV Oceanus	Apr-10	Service and redeployment of the Western Boundary moorings	RV Oceanus Cruise OC459-1, National Oceanography Centre, Cruise Report, No. 1, 2011
D359	RRS Discovery	Dec 2010 - Jan 2011	Service and redeployment of the Eastern Boundary and Mid-Atlantic Ridge moorings	National Oceanography Centre, Cruise Report No. 09, 2012
KN200-4	RV Knorr	April 2011 - May 2011	Recovery and redeployment of US Western Boundary moorings, and WBTS hydrography section	National Oceanography Centre, Cruise Report No. 07, 2012
JC064	RRS James Cook	September 2011 - October 2011	Service and redeployment of the Eastern Boundary and Mid-Atlantic Ridge moorings	National Oceanography Centre, Cruise Report No. 14, 2012
RB1201	RV Ronald H Brown	February 2012	Recovery and redeployment of UK Western Boundary moorings, and WBTS hydrography section	National Oceanography Centre, Cruise Report No. 19, 2012

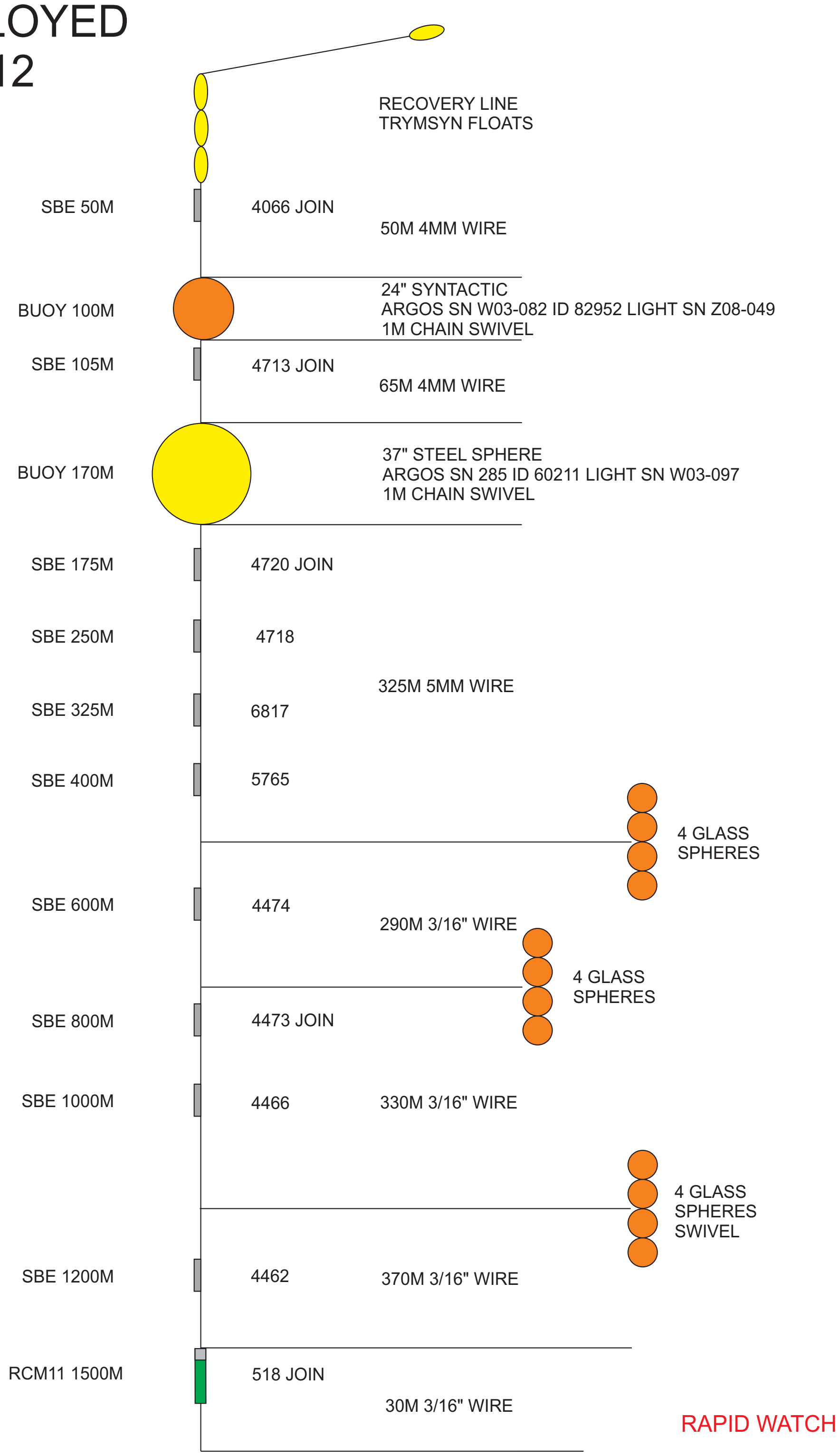
AB1209	RV Endeavor	September 2012 - October 2012	Recovery and redeployment of US Western Boundary moorings and WBTS hydrography section	R/V Endeavor Cruise EN-517 Cruise Report
Di382	RRS Discovery	October - November 2012	Recovery and redeployment of full RAPID array	This Report

20 Deployed Mooring Diagrams

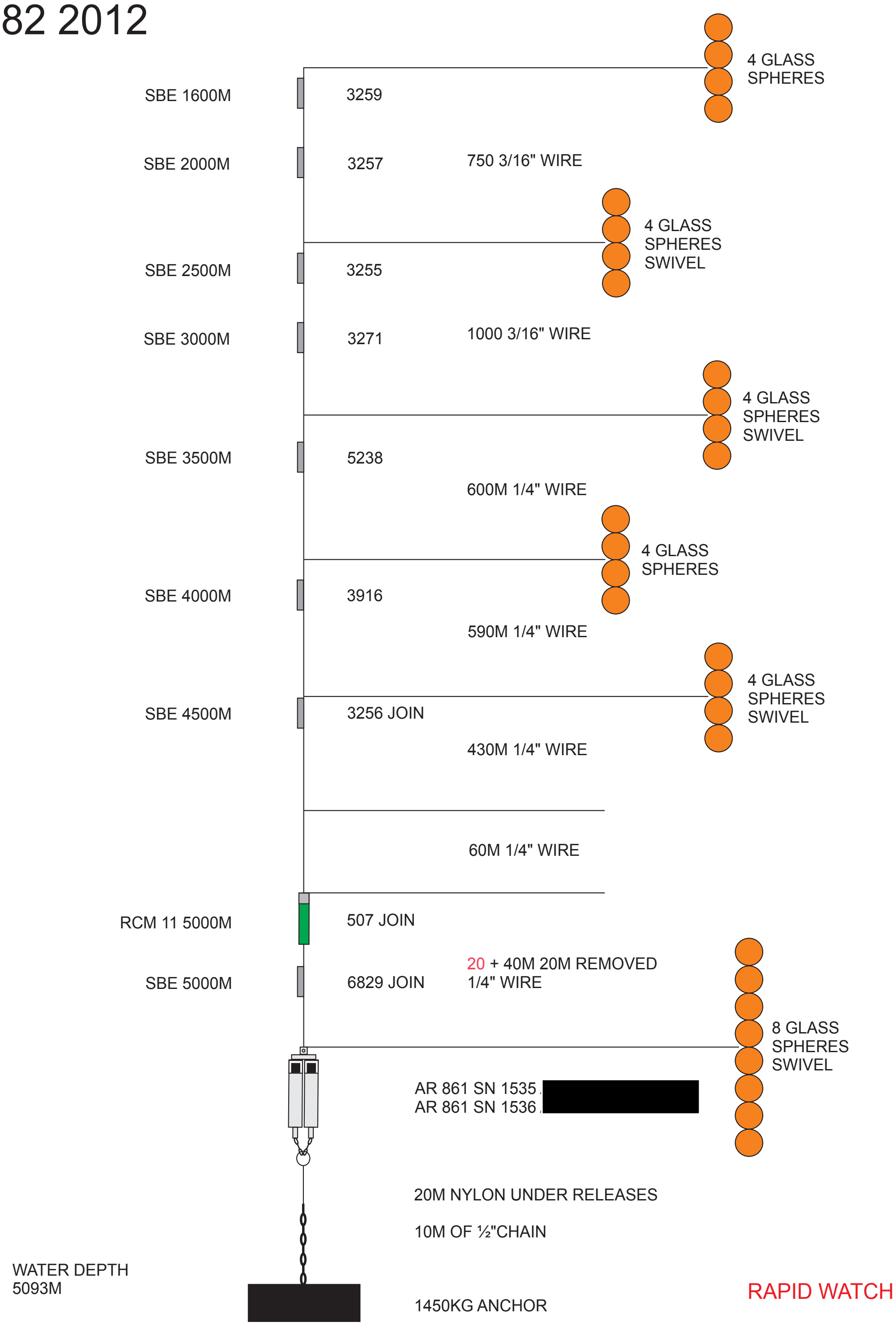
Rob McLachlan



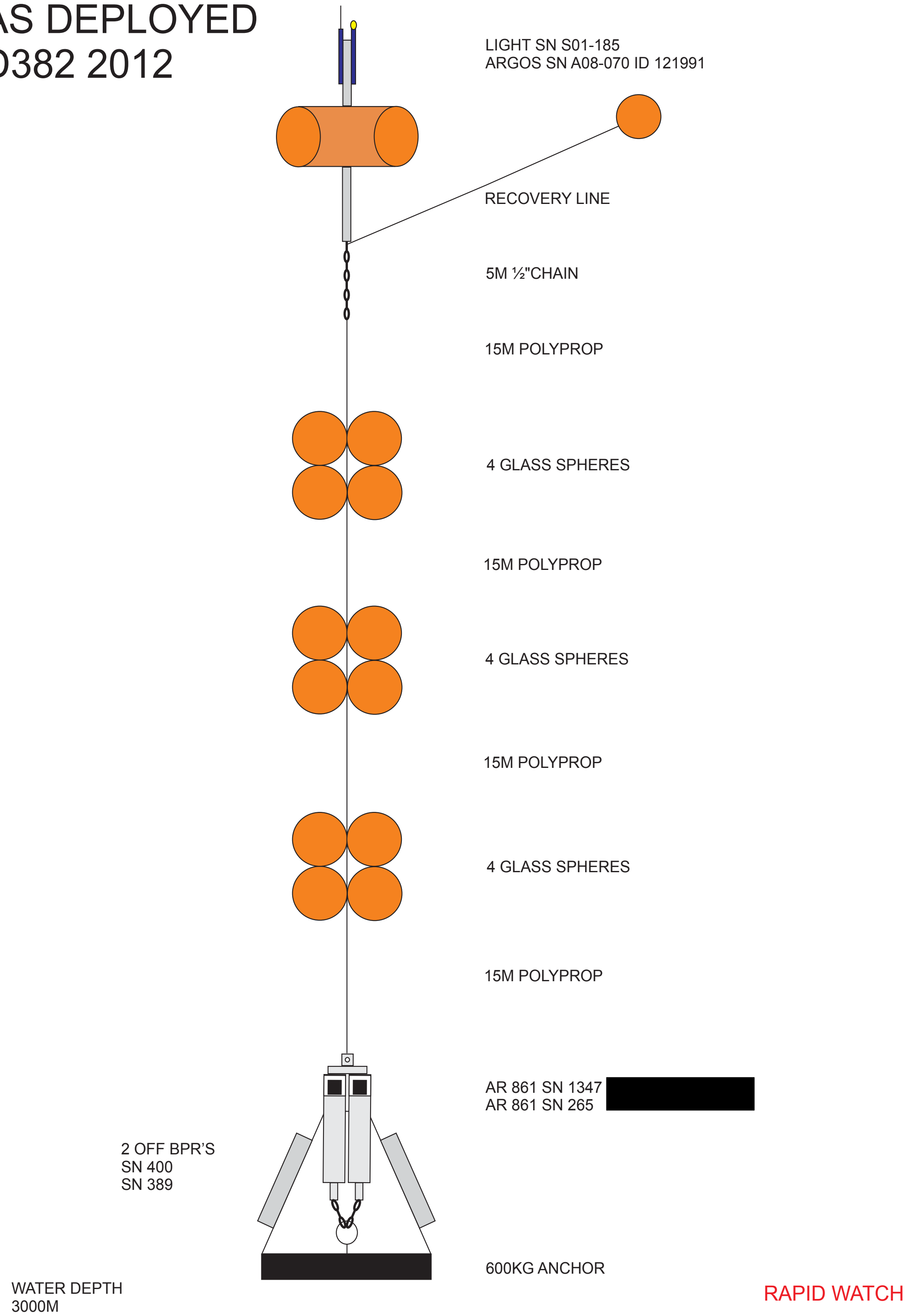
EB 1
AS DEPLOYED
D382 2012

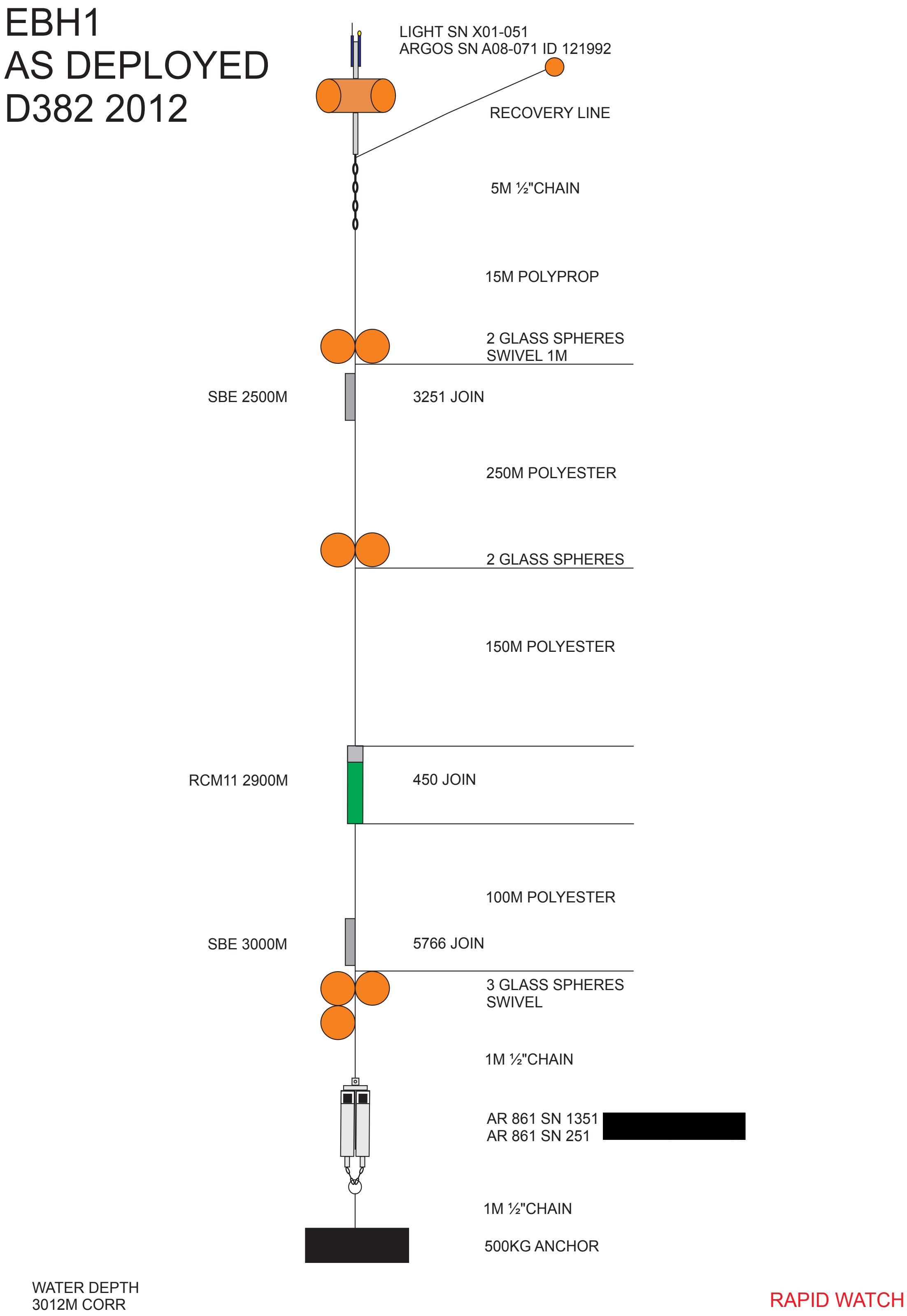


EB 1
AS DEPLOYED
D382 2012

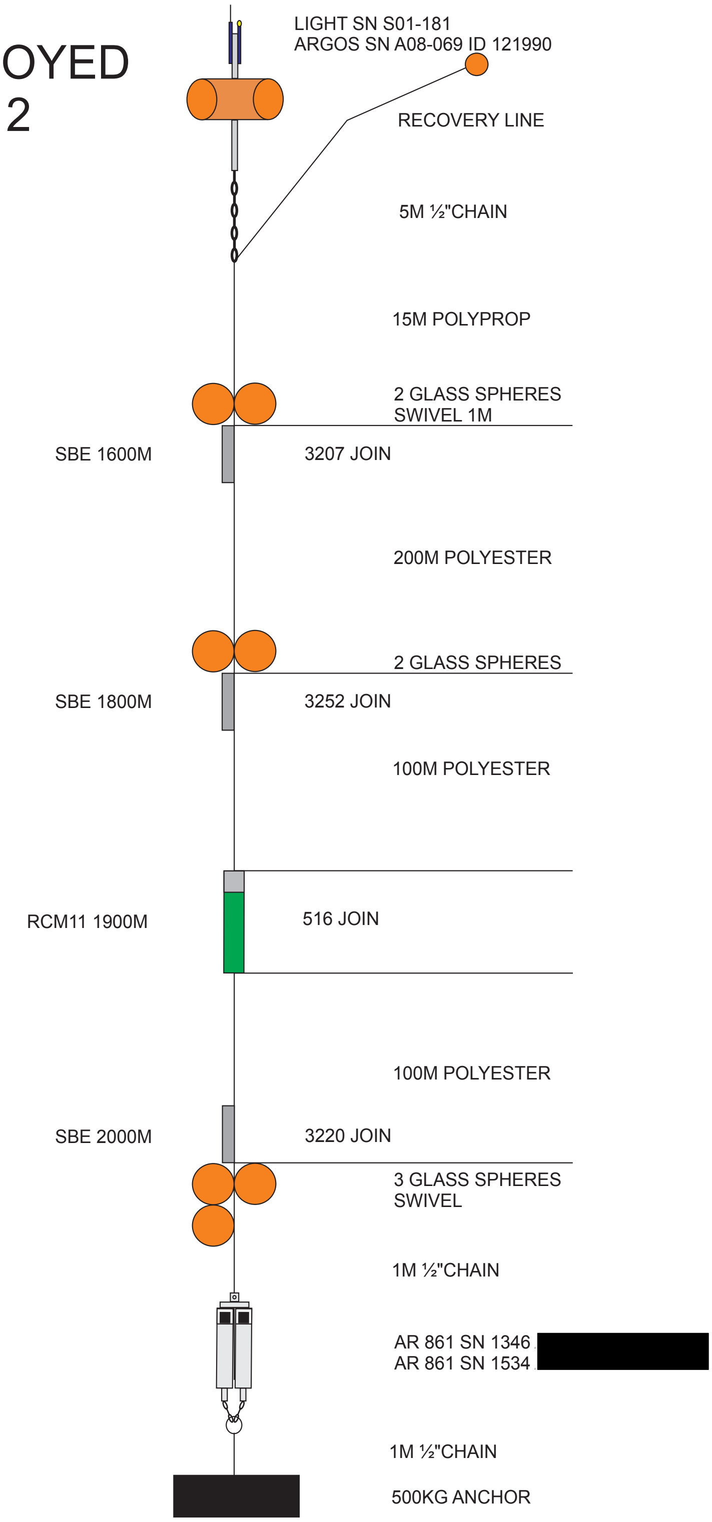


EBH1L9
AS DEPLOYED
D382 2012




EBH1
AS DEPLOYED
D382 2012
LIGHT SN X01-051
ARGOS SN A08-071 ID 121992
RECOVERY LINE
5M ½"CHAIN
15M POLYPROP
2 GLASS SPHERES
SWIVEL 1M
SBE 2500M
3251 JOIN
250M POLYESTER
2 GLASS SPHERES
150M POLYESTER
RCM11 2900M
450 JOIN
100M POLYESTER
SBE 3000M
5766 JOIN
3 GLASS SPHERES
SWIVEL
1M ½"CHAIN
AR 861 SN 1351
AR 861 SN 251 [redacted]
1M ½"CHAIN
500KG ANCHOR
WATER DEPTH
3012M CORR
RAPID WATCH

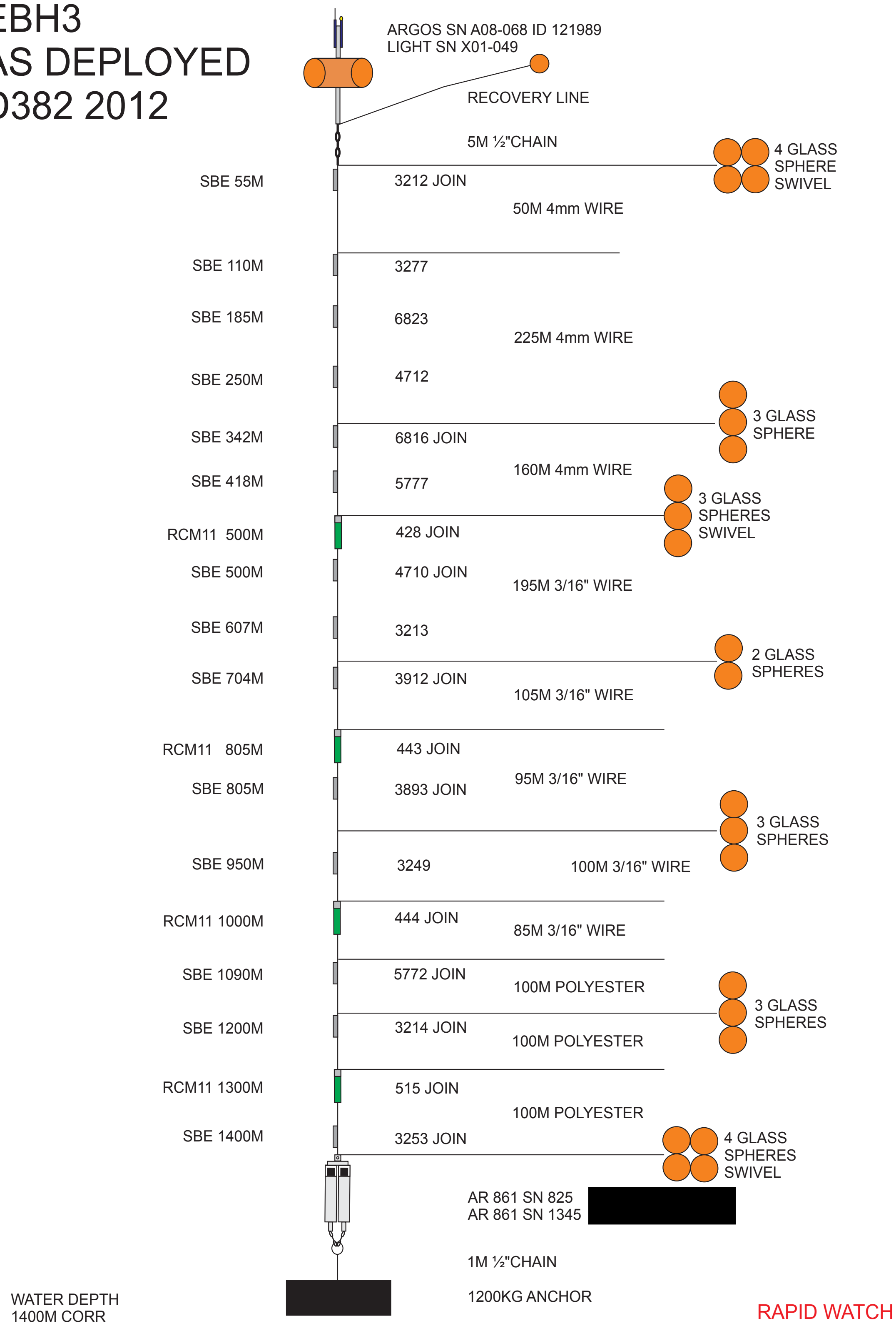
EBH2
AS DEPLOYED
D382 2012



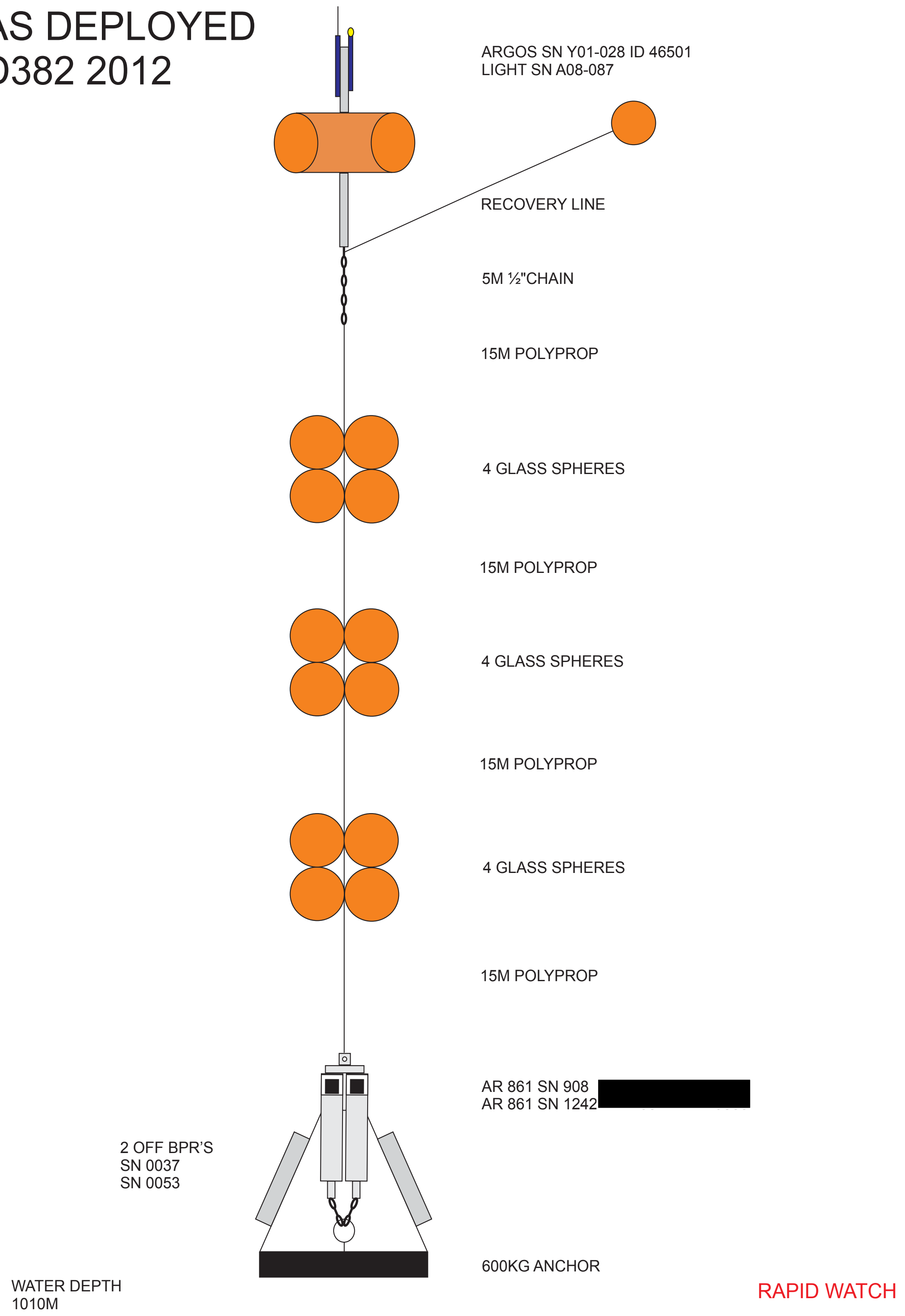
WATER DEPTH
2023M CORR

RAPID WATCH

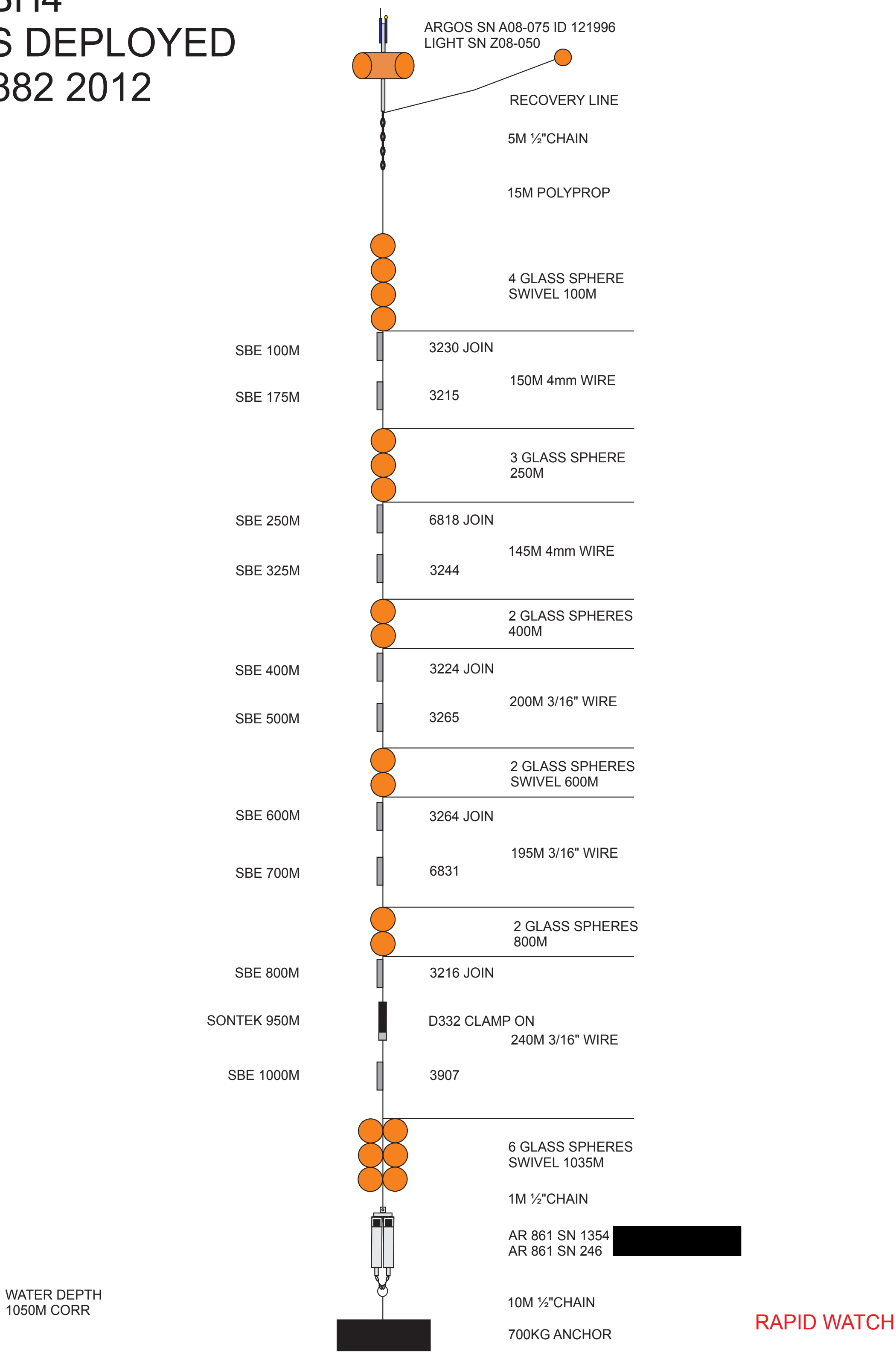
EBH3
AS DEPLOYED
D382 2012



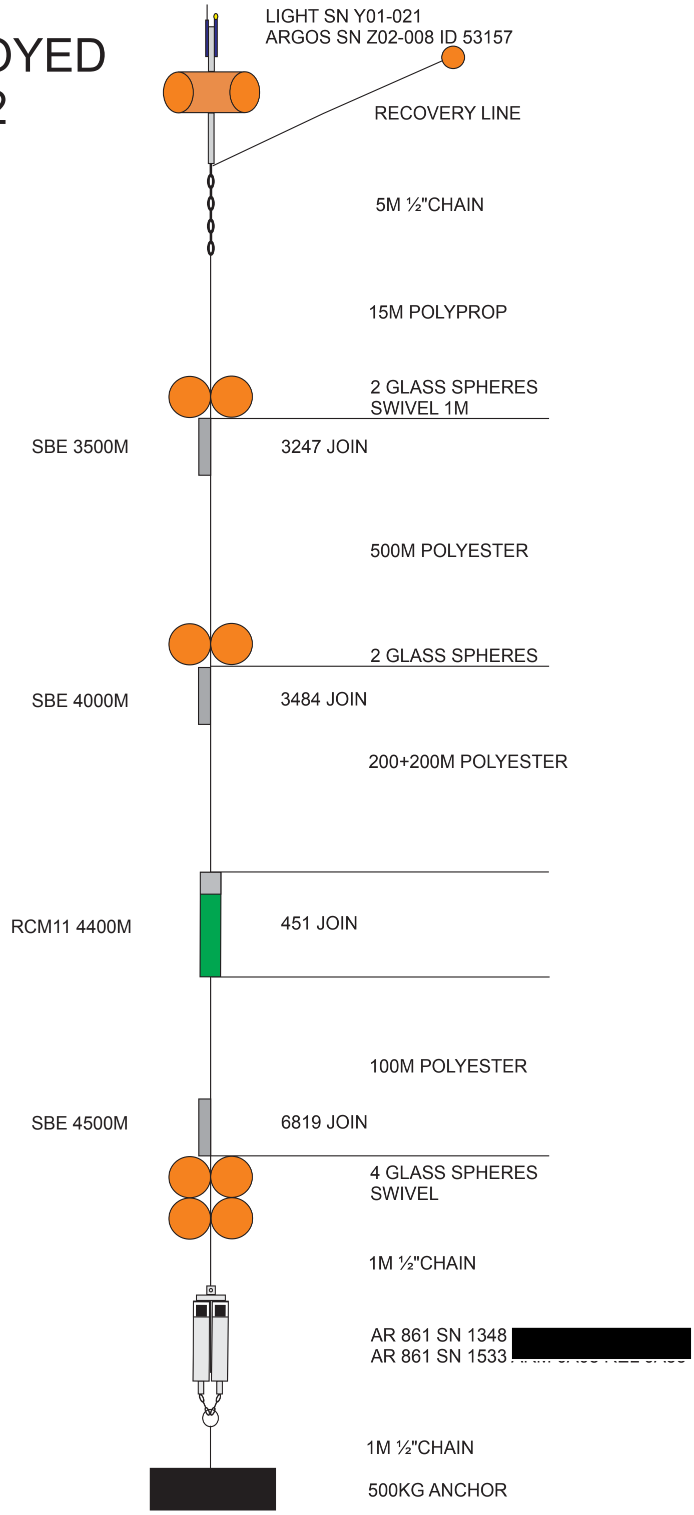
EBH4L4
AS DEPLOYED
D382 2012



EBH4
AS DEPLOYED
D382 2012



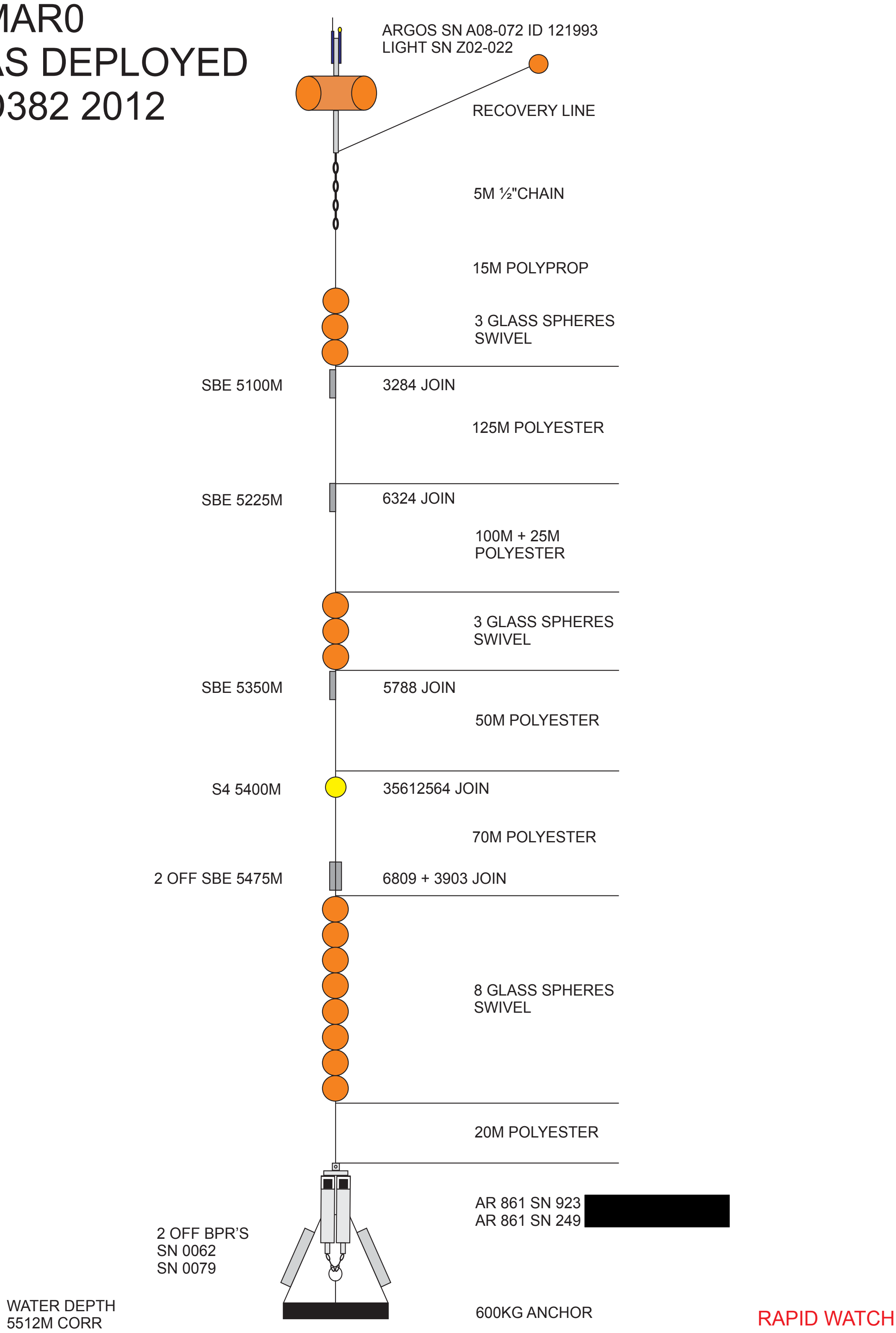
EBHi
AS DEPLOYED
D382 2012



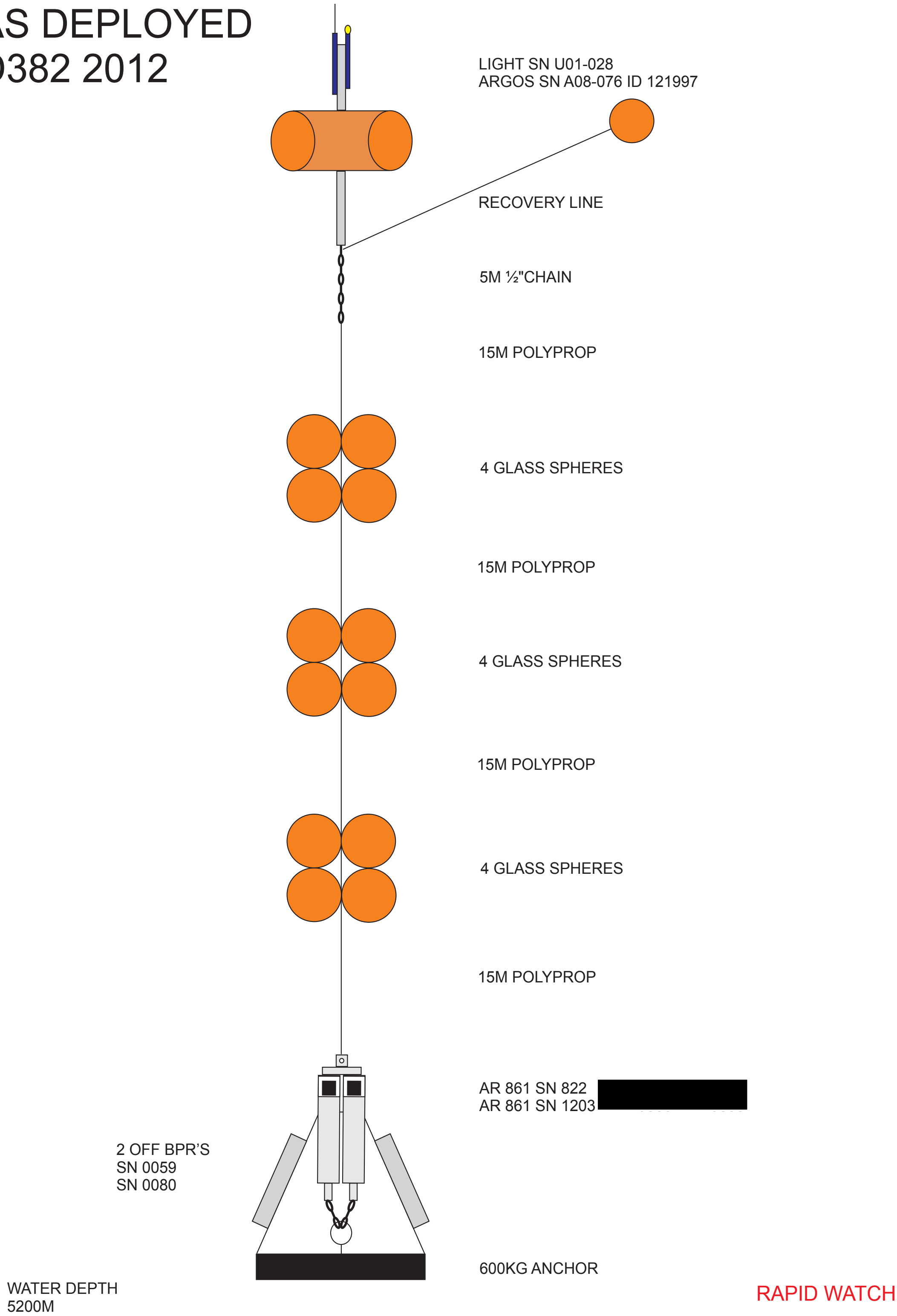
WATER DEPTH
4505M CORR

RAPID WATCH

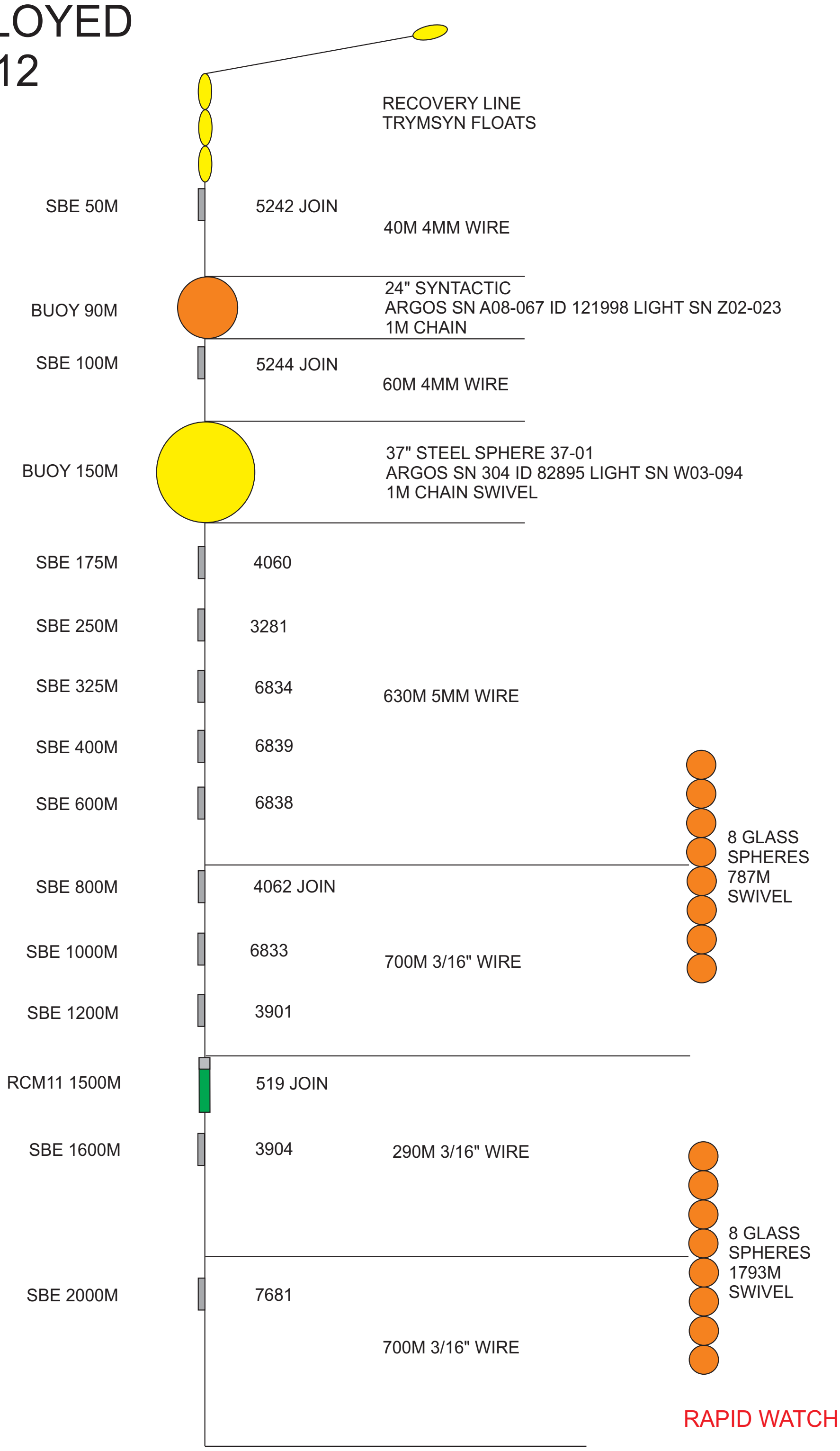
MAR0
AS DEPLOYED
D382 2012



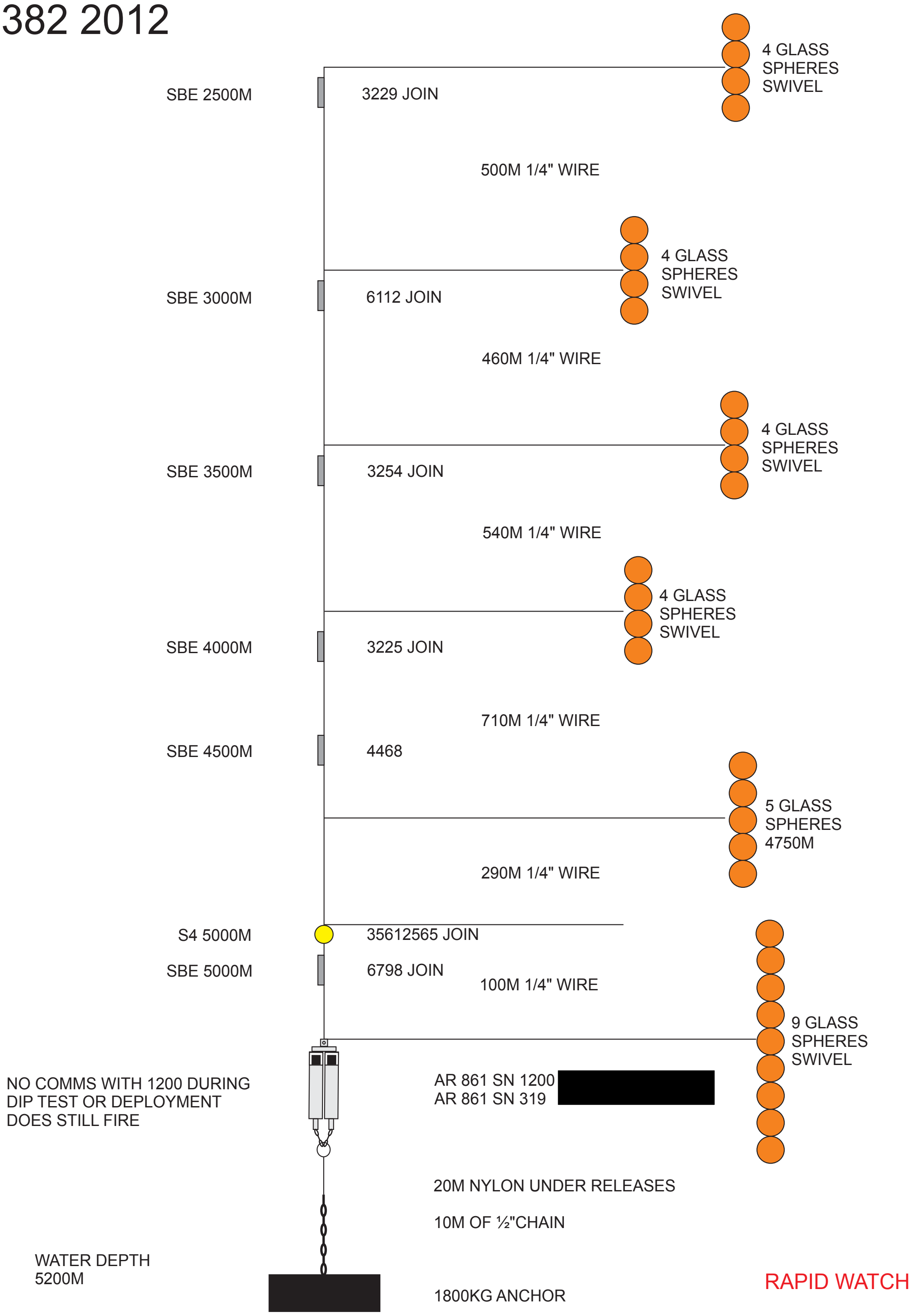
MAR1L8
AS DEPLOYED
D382 2012



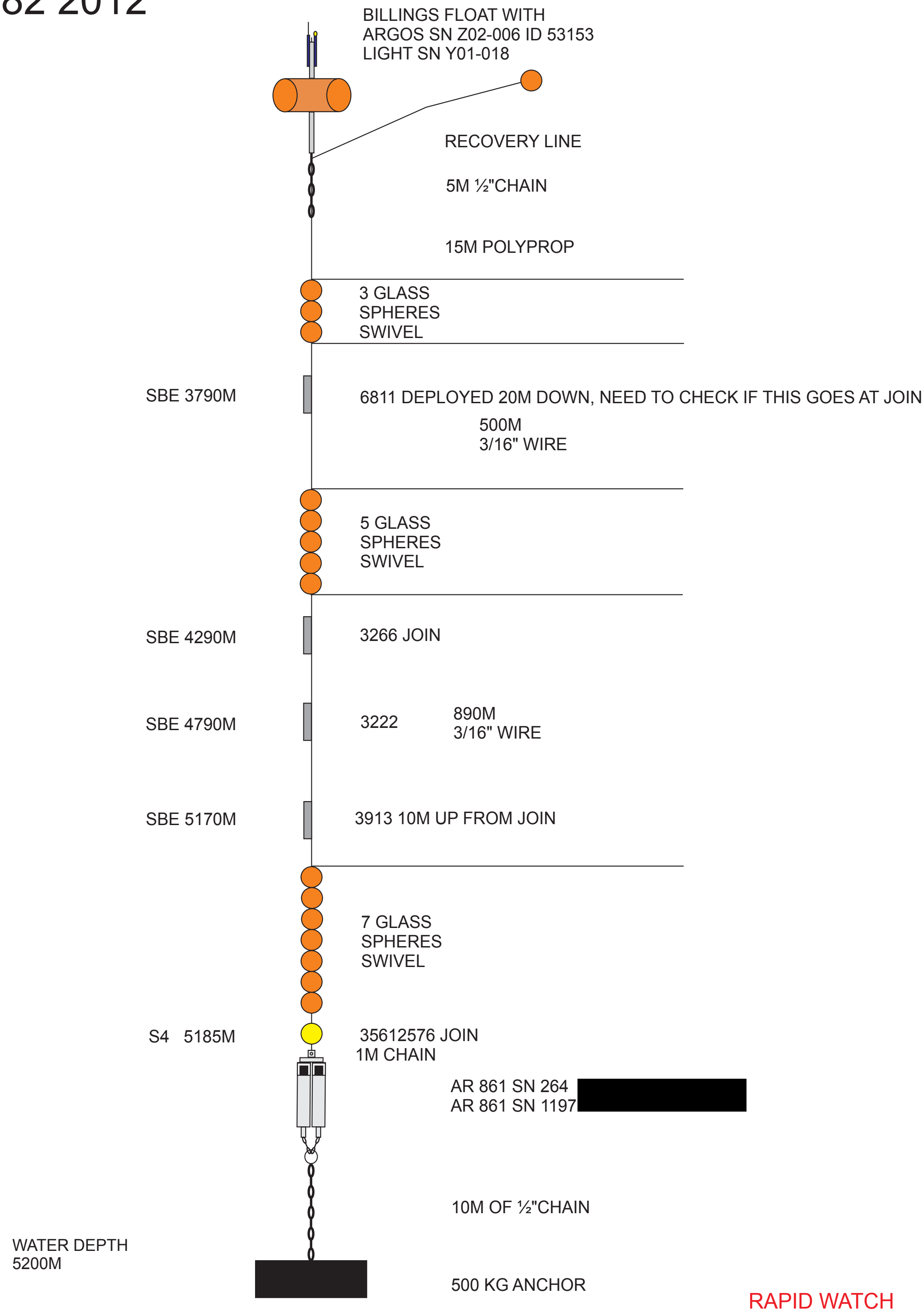
MAR 1
AS DEPLOYED
D382 2012



MAR 1
AS DEPLOYED
D382 2012

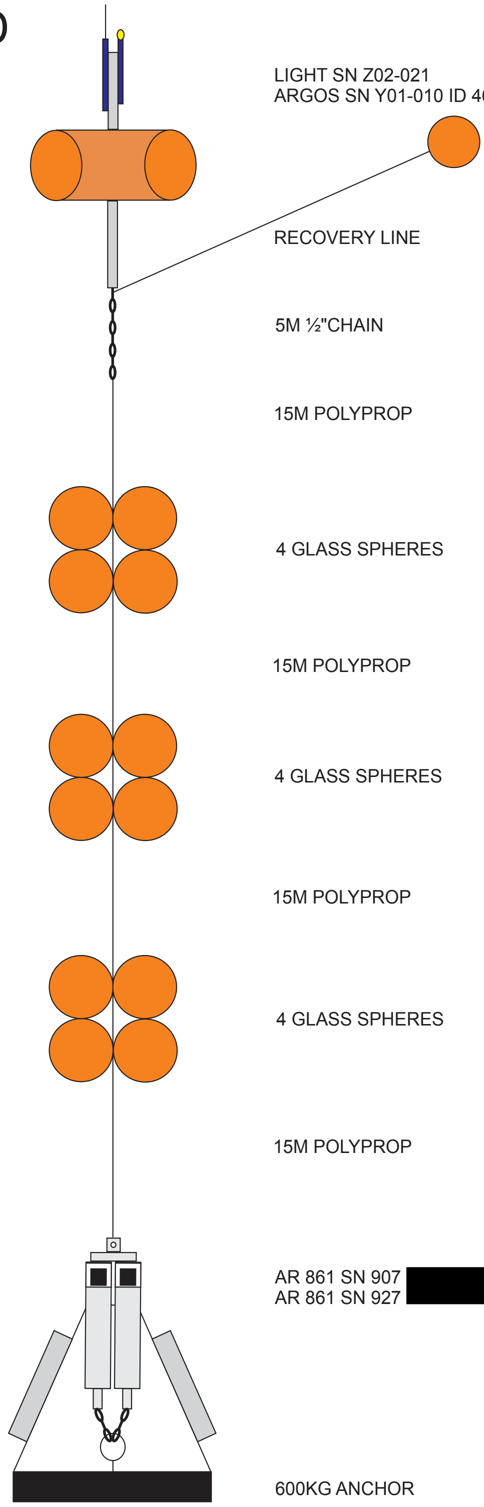


MAR 2
AS DEPLOYED
D382 2012

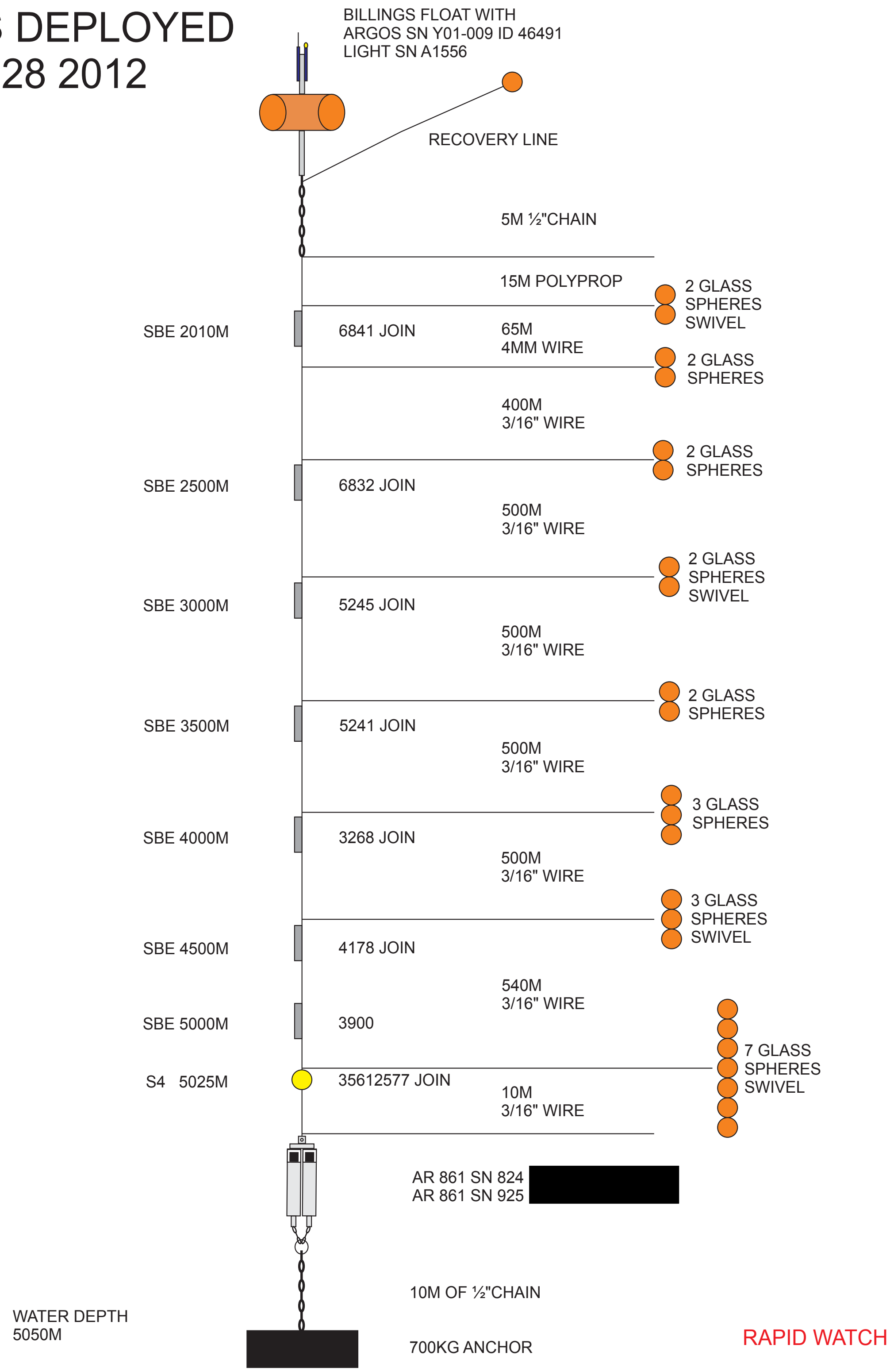


RAPID WATCH

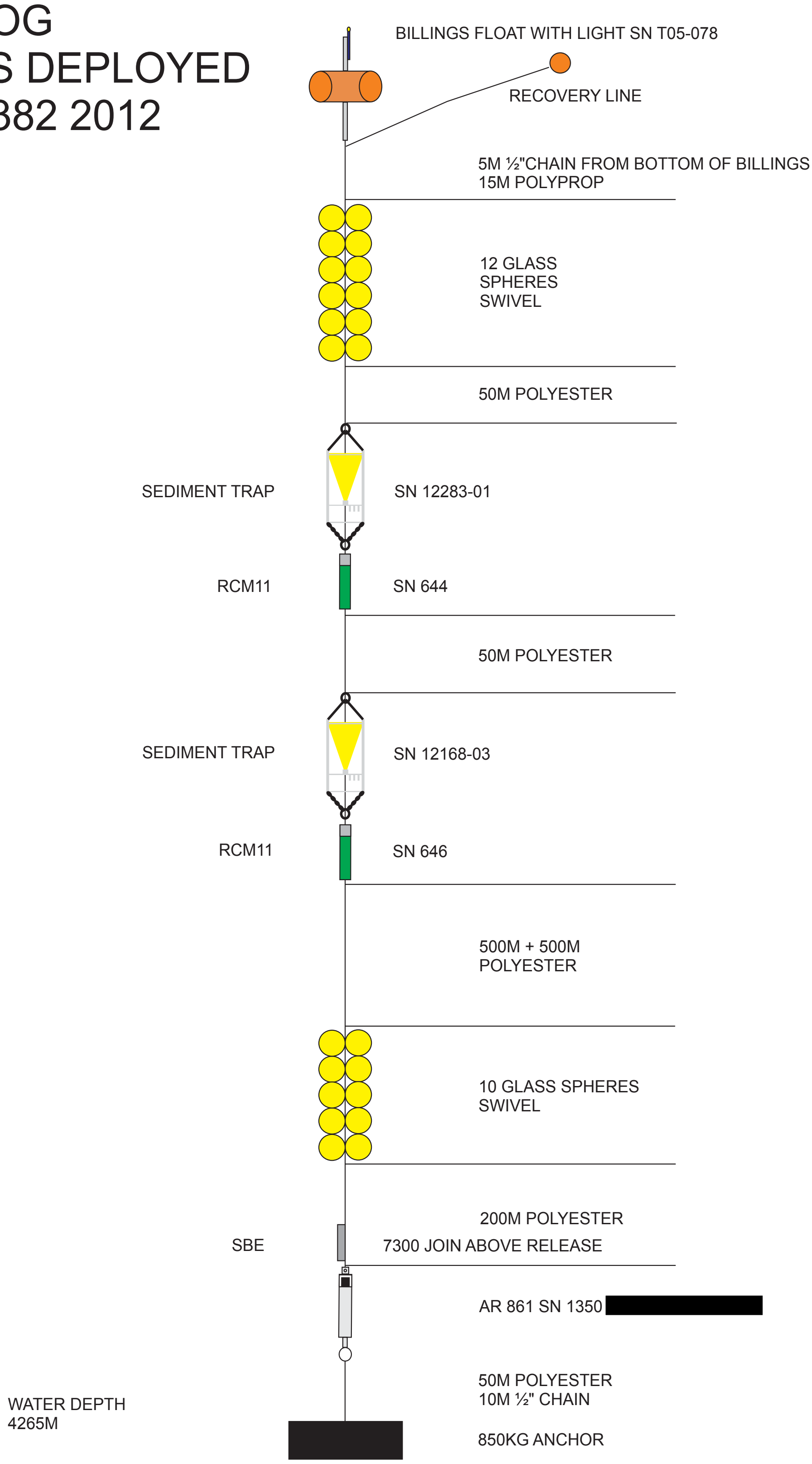
MAR3L8
AS DEPLOYED
D382 2012



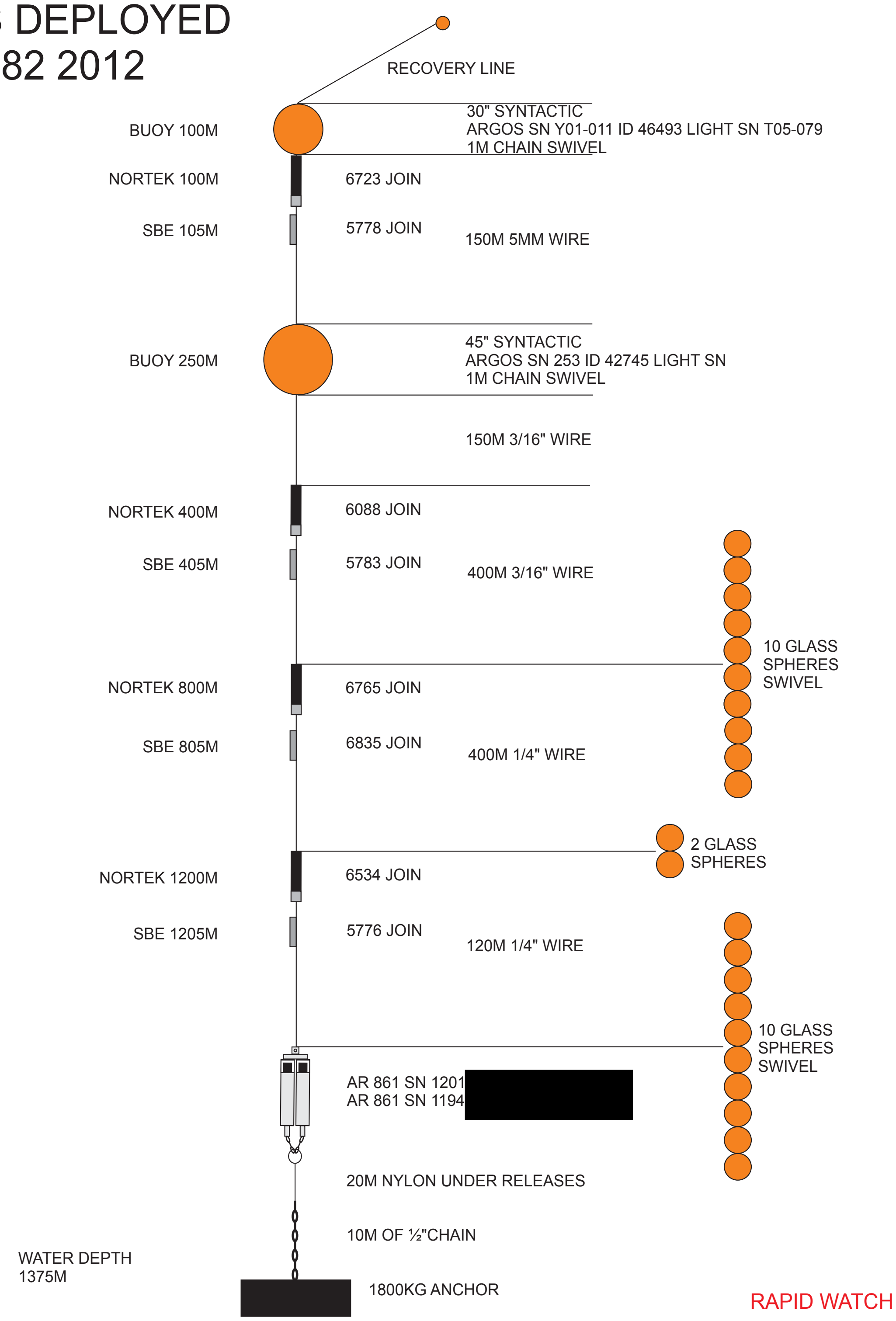
MAR 3
AS DEPLOYED
D328 2012



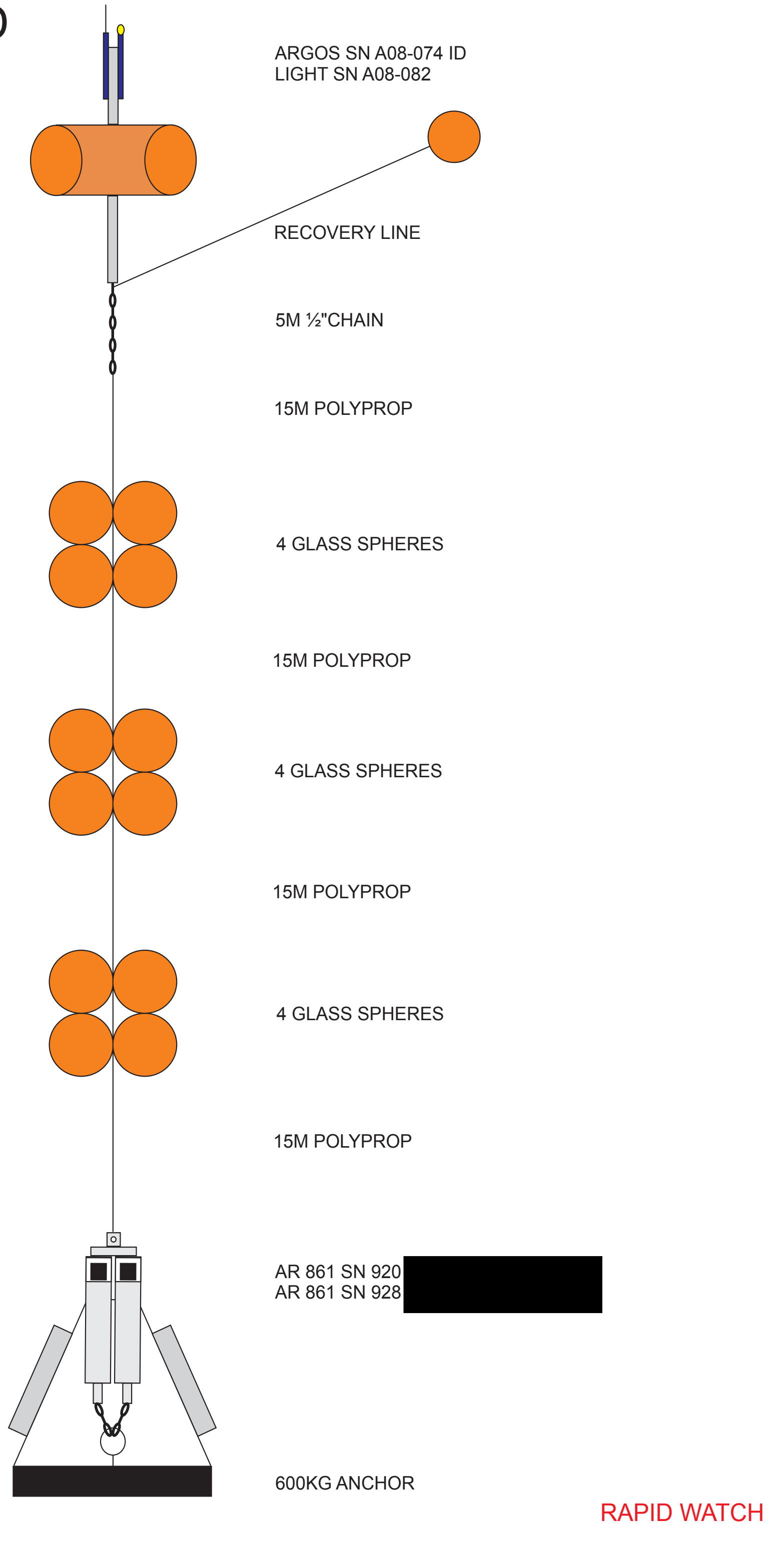
NOG
AS DEPLOYED
D382 2012



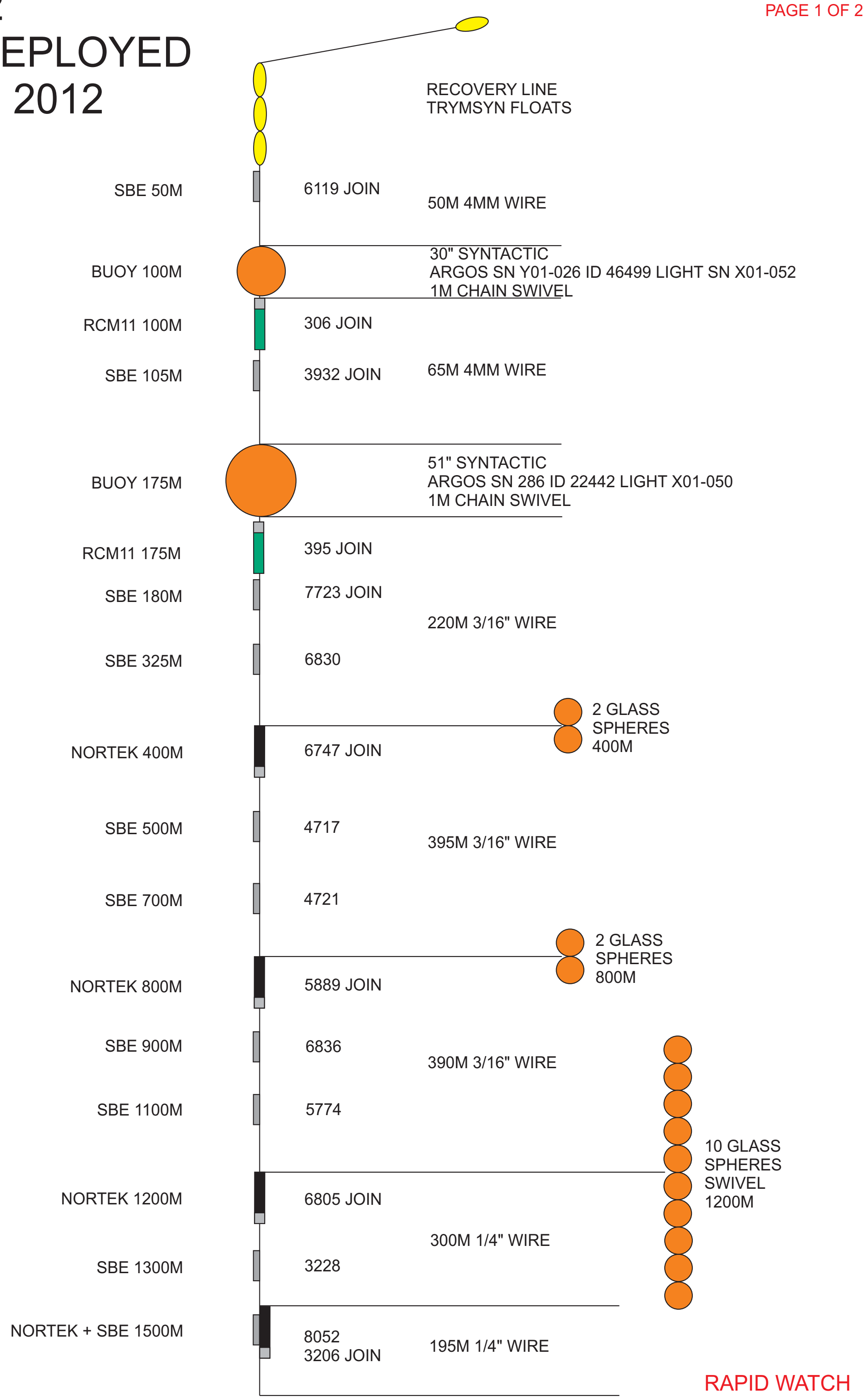
WB 1
AS DEPLOYED
D382 2012



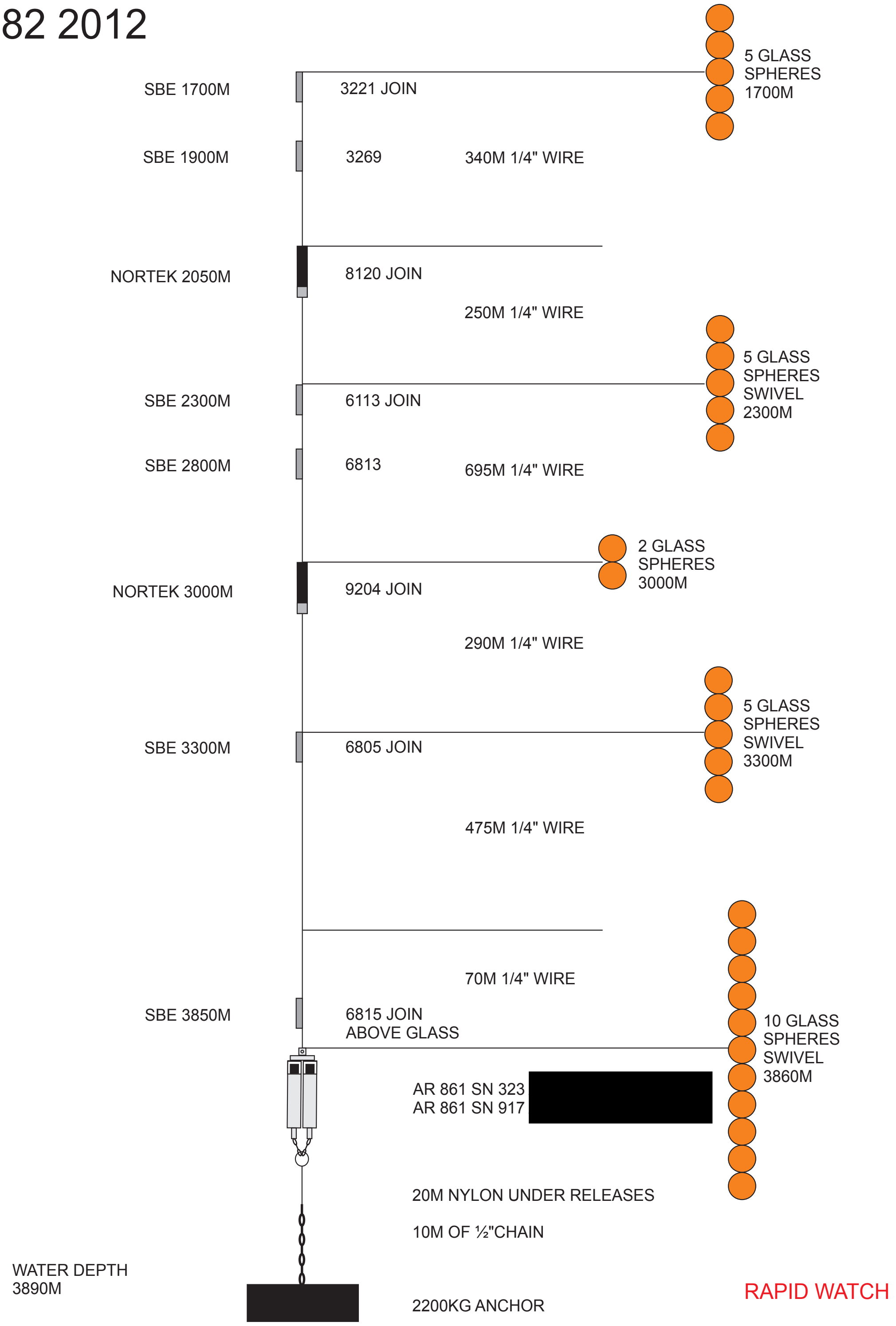
WB2L9
AS DEPLOYED
D382 2012



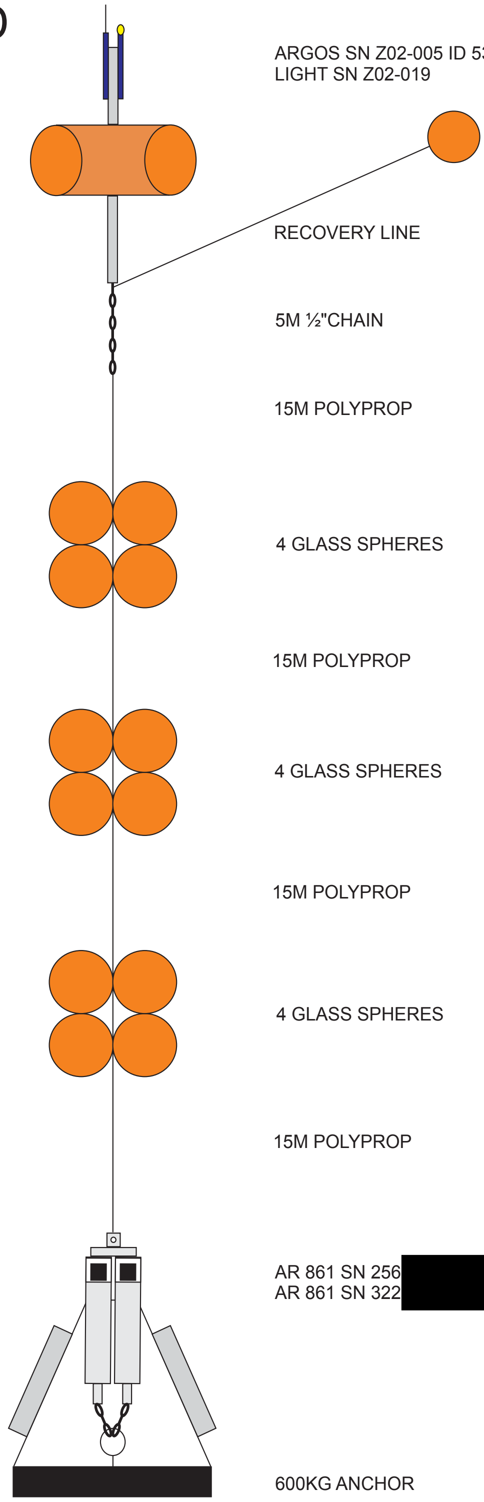
WB 2
AS DEPLOYED
D382 2012



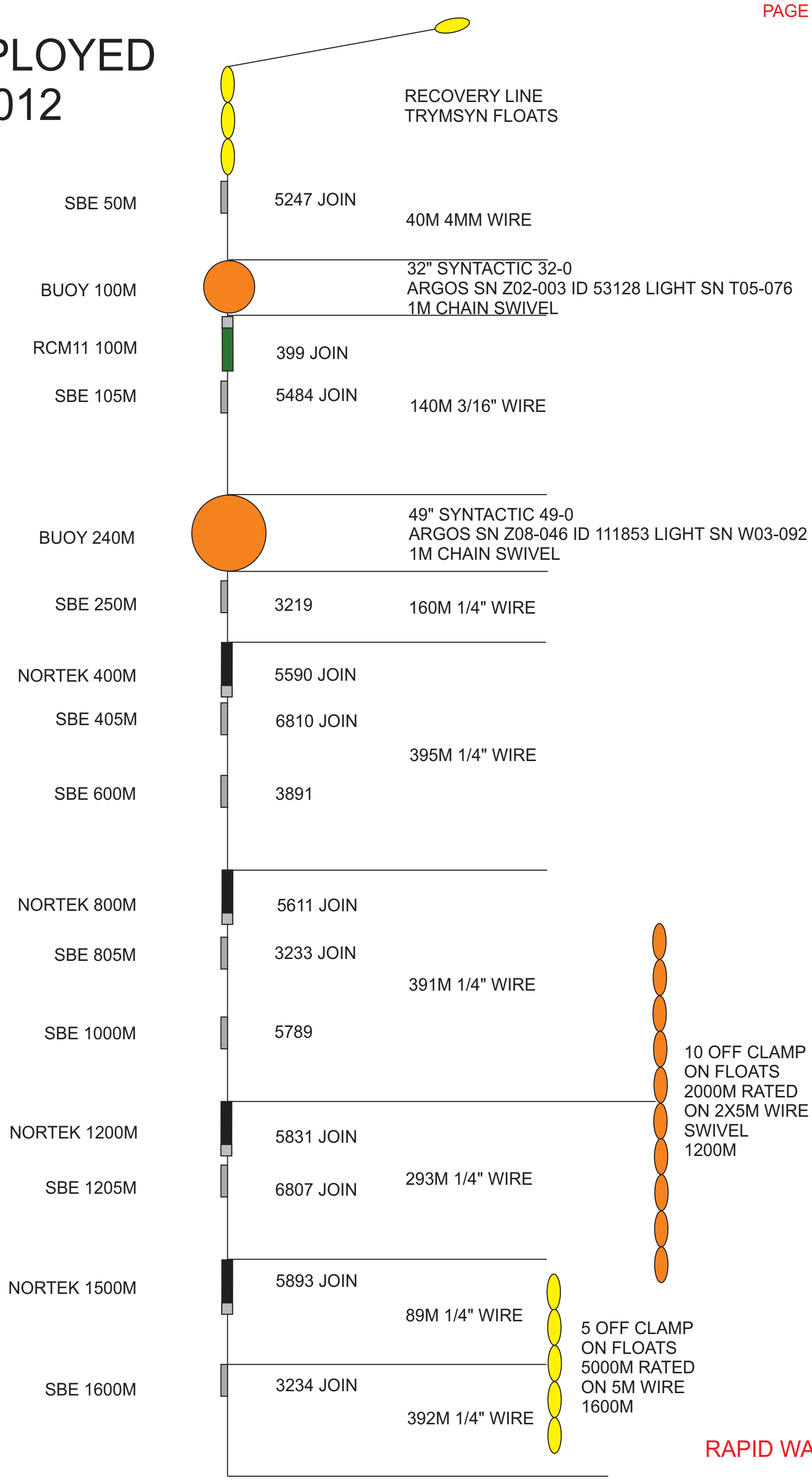
WB 2
AS DEPLOYED
D382 2012



WB4L9
AS DEPLOYED
D382 2012

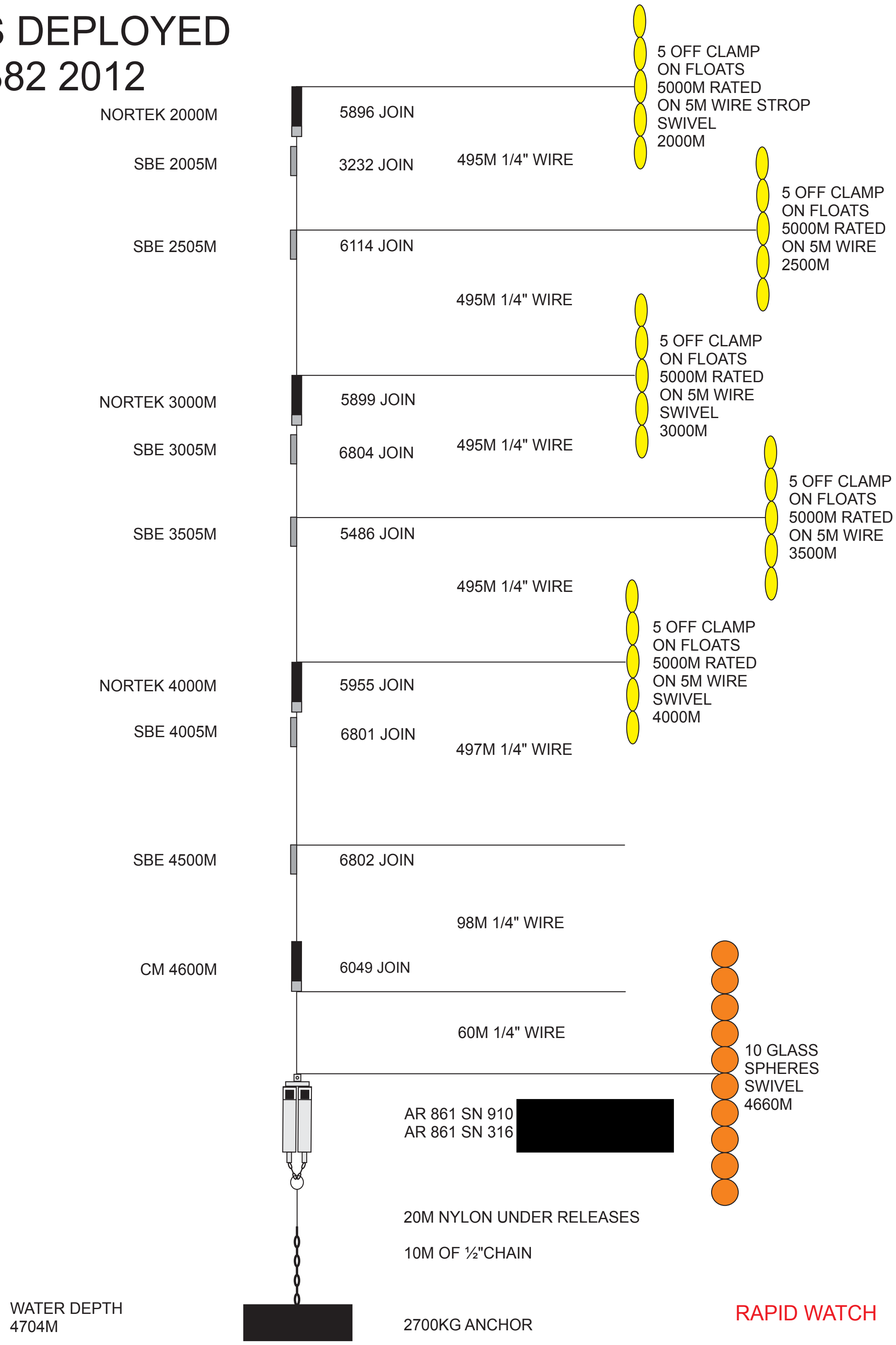


WB 4
AS DEPLOYED
D382 2012

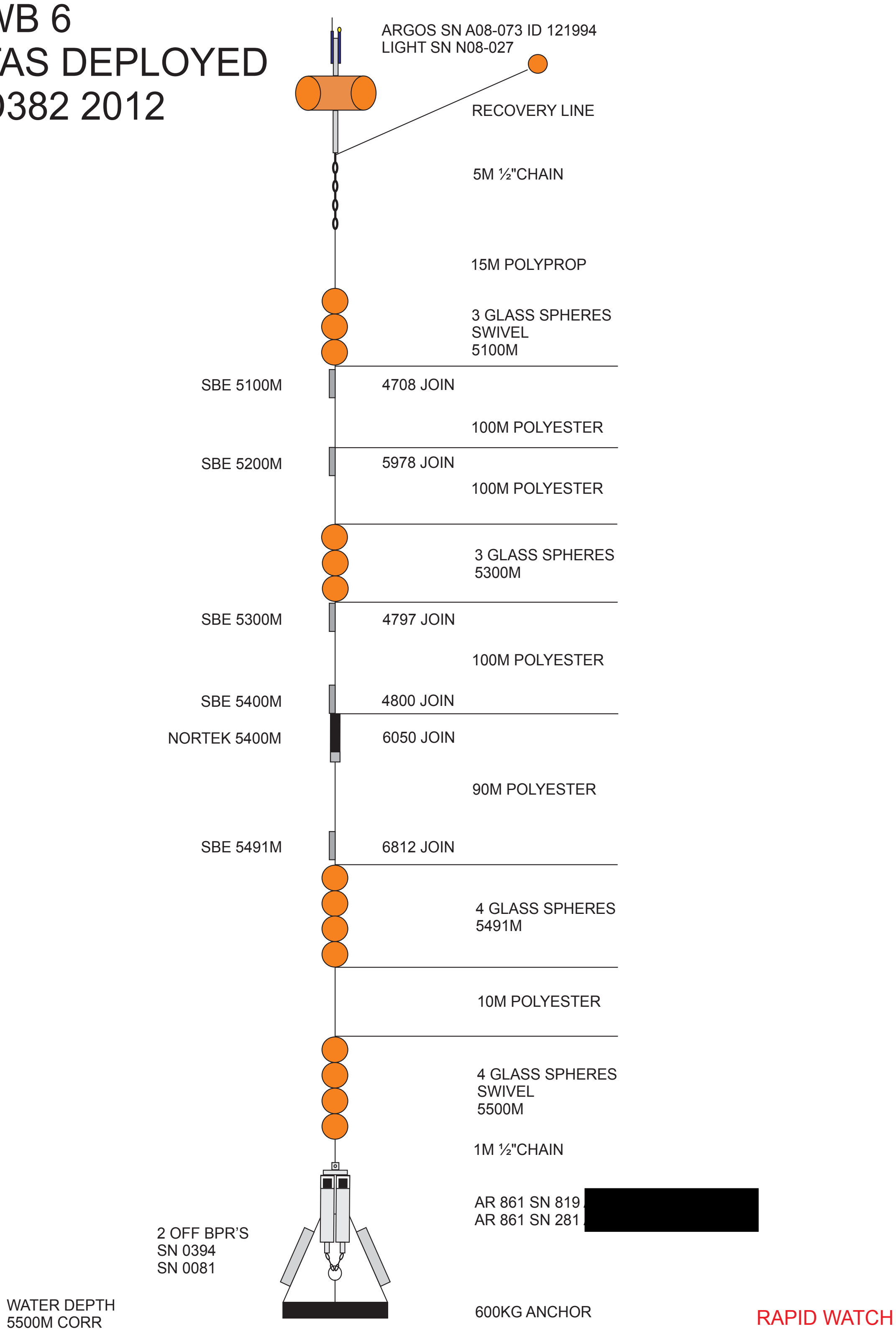


RAPID WATCH

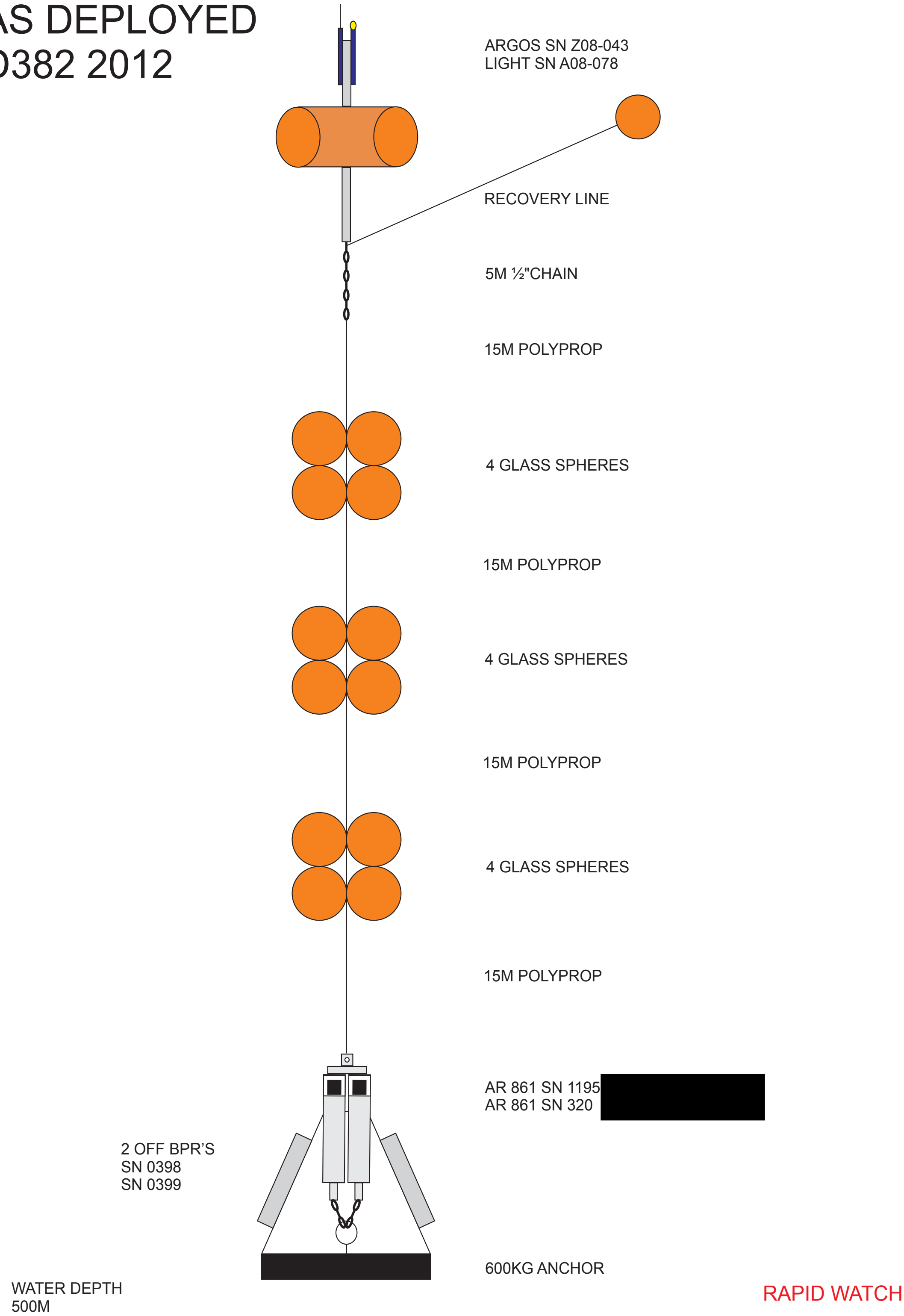
WB 4
AS DEPLOYED
D382 2012



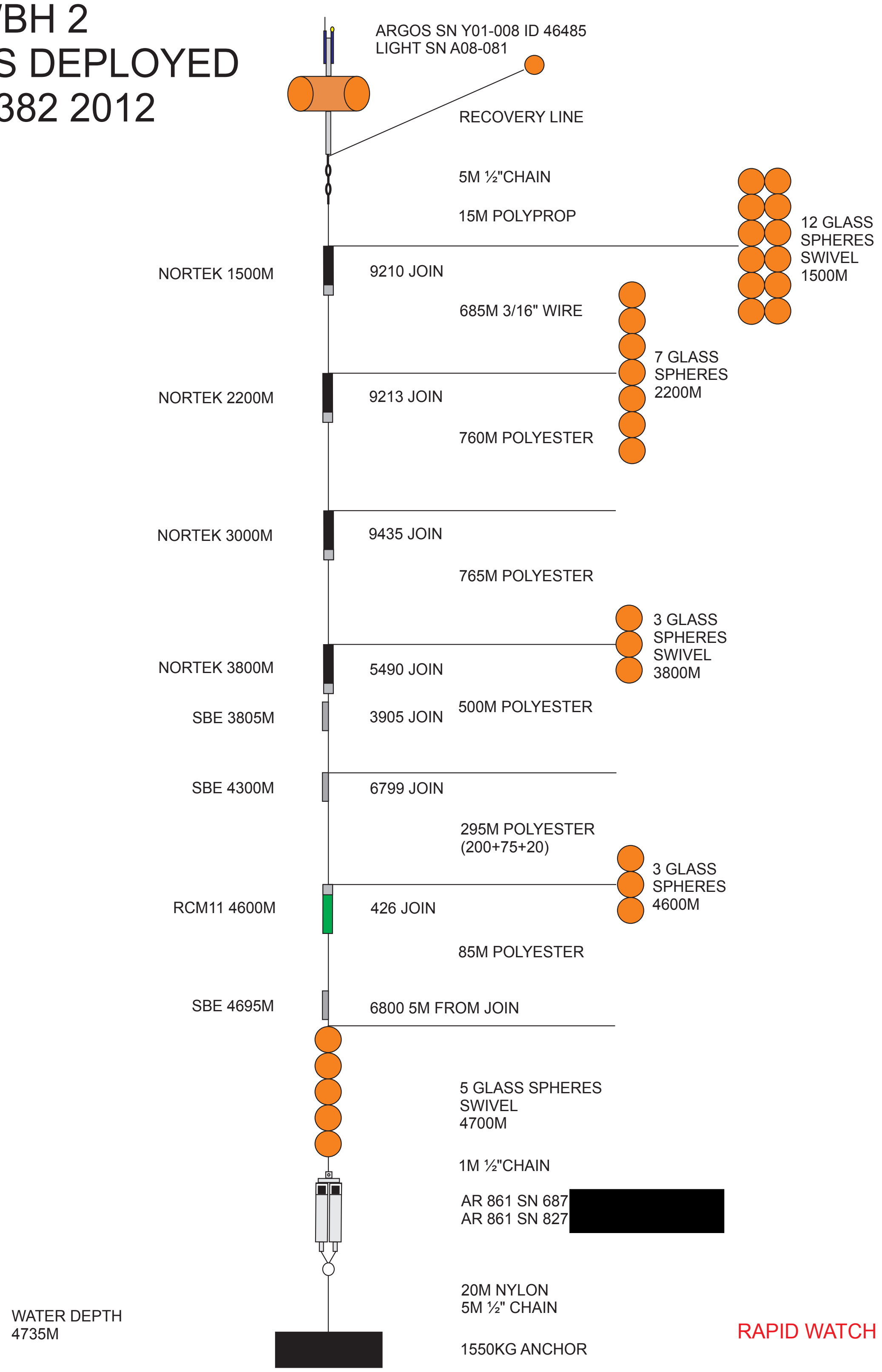
WB 6
TAS DEPLOYED
D382 2012



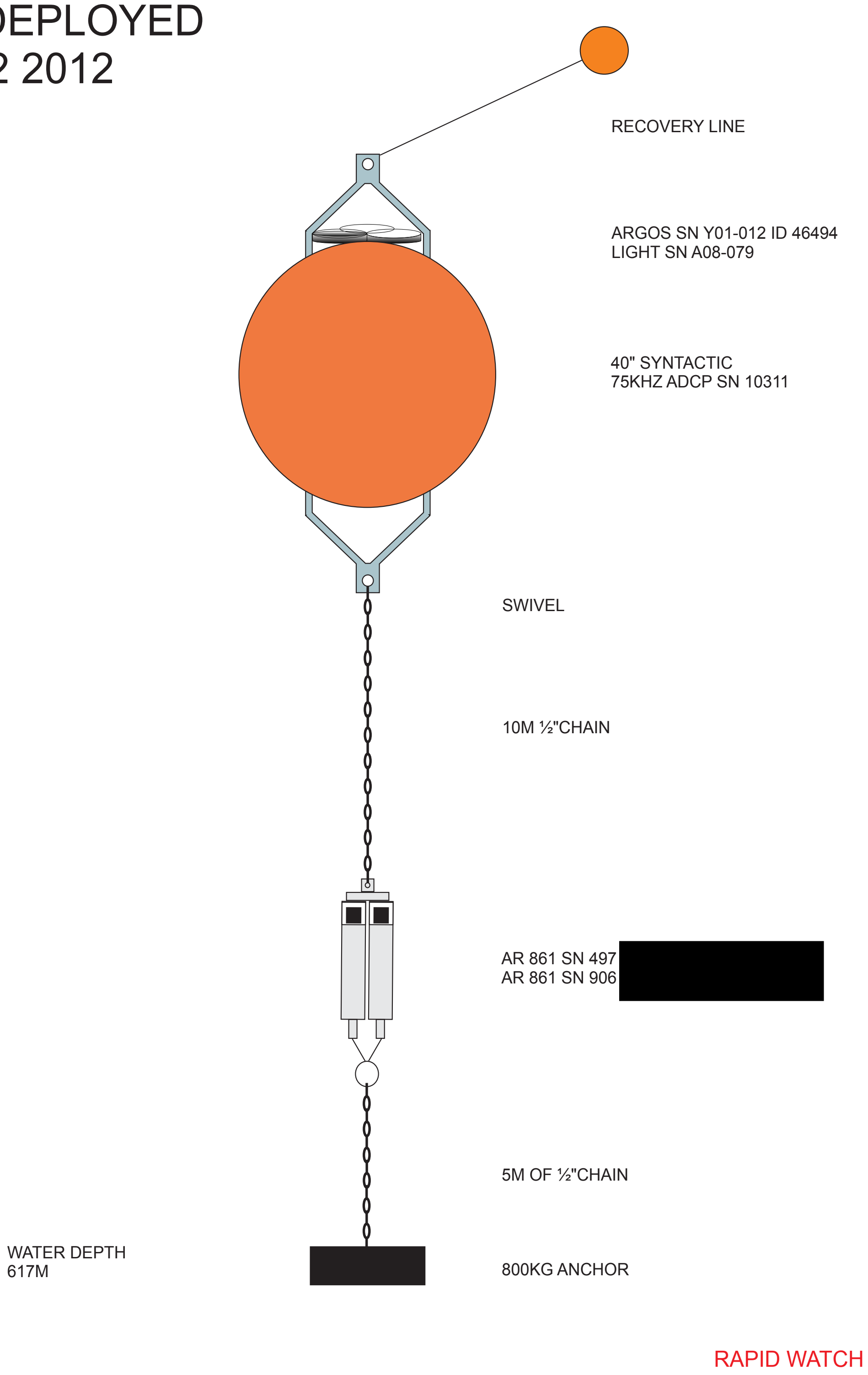
WBAL4
AS DEPLOYED
D382 2012



WBH 2
AS DEPLOYED
D382 2012



WB ADCP
AS DEPLOYED
D382 2012



21 Mooring Recovery Logsheets

RAPID-WATCH MOORING LOGSHEET **RECOVERY**

Mooring **EB1L7** Cruise **D382**

NB: all times recorded in GMT

Date 24/10/12 **Site arrival time** 07:05:46

Time of first ranging 07:06

ITEM	SER NO		COMMENT	TIME
Recovery line	n/a		surfaced approx 08:30-08:35	09:05:40
Billings Float	n/a		billings imploded	
with Light				
and Argos Beacon				
4 x 17" glass	n/a		orange	09:01:59
4 x 17" glass	n/a		yellow	09:05:20
BPR	0002	☐	0054	
BPR	0061	✔		
Acoustic Release #1	319	✔		
Acoustic Release #2	924	✔		09:09:14

Ascent Rate 60 m min

Ranging

Time	Range 1	Range 2	Command/comment
07:06:05	898	716	Arm + Arm
07:07	5124	5125	Arm + Arm
07:07:29	-	5122	Arm + Arm
07:08:45	5119	5118	Arm + Release, ok
07:10:14	5048	5039	
07:11:14	4990	-	60 m min
07:12:14	5118	4923	

RAPID-WATCH MOORING LOGSHEET **RECOVERY**

Mooring **EB1** Cruise **D382**

NB: all times recorded in GMT

Date 24/10/12 **Site arrival time** 09:48:44

Time of first ranging 09:50

ITEM	SER NO	COMMENT	TIME
Recovery line	n/a	port side pick up, hooked 11:36:21	11:39:33
3 x Mini-Trimsyns	n/a		
MicroCAT	5486 ☑	banged and fouled	11:39:46
24" syntactic float	n/a	wire parted, 2nd grapple needed	12:34:27
with Light		second hook 12:27:56	
and Argos Beacon			
Swivel	n/a		
MicroCAT	3891 ☑		
37" steel sphere	n/a		12:41:55
with light			
and Argos Beacon			
Swivel	n/a	Hauling two wires	
MicroCAT	5484 ☑		
MicroCAT	6804 ☑		12:50:43
MicroCAT	6805 ☑		12:56:48
MicroCAT	5789 ☑		
4 x 17" glass	n/a		12:59:43
MicroCAT	5247 ☑	Wire cut. Hauling two wires	12:57:09
4 x 17" glass	n/a		~~12:59:48~~
MicroCAT	5245 ☑		13:11:55
MicroCAT	6113 ☑		13:15:33
4 x 17" glass	n/a		13:28:58
Swivel	n/a		
MicroCAT	5244 ☑	Anode corroded	
Sontek	D273 ☑	annoid coroded	13:49:07
4 x 17" glass	n/a		
MicroCAT	6814 ☑	Split wire	
MicroCAT	3206 ☑		
4 x 17" glass	n/a		13:52:13
Swivel	n/a		
MicroCAT	6114 ☑		14:18:29
MicroCAT	3266 ☑		14:26:13
4 x 17" glass	n/a		14:31:00
Swivel	n/a	hange of drum hauling again at 14:47:22	
MicroCAT	6811 ☑		14:47:58

4 x 17" glass	n/a			14:53:53
MicroCAT	6815	✔		14:58:13
4 x 17" glass	n/a			15:04:37
Swivel	n/a			
MicroCAT	4549	✔		15:05:37
RCM11	303	✔		15:22:55
MicroCAT	3225	✔		15:23:30
8 x 17" glass	n/a			15:26:12
Swivel	n/a			
Acoustic Release #1	1203	✔		15:27:19
Acoustic Release #2	1197	✔		15:27:22

Ascent Rate ___________

RAPID-WATCH MOORING LOGSHEET **RECOVERY**

Mooring **EBH1** Cruise **D382**

NB: all times recorded in GMT

Date 15/10/12 **Site arrival time** 13:50

Time of first ranging 13:50

ITEM	SER NO		COMMENT	TIME
Recovery line	n/a		surfaced 14:30	15:21:47
Billings Float	n/a		slight tangle with pickup line	15:28:35
with Light				
~~and Argos Beacon~~				
2 x 17" glass	n/a			
Swivel	n/a			15:35
MicroCAT	3215	✔		15:35
2 x 17" glass	n/a			15:42:17
RCM11	301	✔		15:47:58
MicroCAT	3244	✔		
3 x 17" glass	n/a		four glass not three	15:51
Swivel	n/a			
Acoustic Release #1	1200	✔		15:51
Acoustic Release #2	827	✔		15:51

Ascent Rate 80m/min

Ranging

Time	Range 1	Range 2	Command/comment
13:50	3022		Arm + Arm
13:52	3020	3020	Arm + Release sn1200
13:53	none	2930	
13:54	none	2849	eta 14:30

RAPID-WATCH MOORING LOGSHEET **RECOVERY**

Mooring **EBH1L7** Cruise **D382**

NB: all times recorded in GMT

Date 15/10/12 **Site arrival time** 16:15:21

Time of first ranging 16:16:03

ITEM	SER NO		COMMENT	TIME
Recovery line	n/a		on surface 16:56:01	17:06:56
Billings Float	n/a		subsurface beneath middle buoyancy	17:11:14
with Light				
and Argos Beacon				
4 x 17" glass	n/a		3 glass	17:10:29
4 x 17" glass	n/a		3 glass	17:14:37
BPR	0064	✔	extra 3 glass	17:17:18
BPR	0060	✔		17:19:31
Acoustic Release #1	824	✔		
Acoustic Release #2	281	✔		

Ascent Rate 80 m/min

Ranging

Time	Range 1	Range 2	Command/comment
16:15:24	-	3017	Arm + Arm
16:16:12	-	3018	Arm + Arm
16:17:16	3019	3018	ok
16:18:23	2944	2936	
16:19:23	2865	2855	80 m/min
			eta 16.55

RAPID-WATCH MOORING LOGSHEET **RECOVERY**

Mooring **EBH2** Cruise **D382**

NB: all times recorded in GMT

Date 16/10/12 **Site arrival time** 1536

Time of first ranging 15.39

ITEM	SER NO		COMMENT	TIME
Recovery line	n/a			16:22:45
Billings Float	n/a			16:24:21
with Light				
and Argos Beacon			no argos beacon	16:26:50
2 x 17" glass	n/a		tangled	16:27:21
Swivel	n/a			
MicroCAT	3230	✔		16:28:57
2 x 17" glass	n/a			
MicroCAT	3224	✔		
Sontek	D332	✔	rusty anode	16:38:44
MicroCAT	3265	✔		
3 x 17" glass	n/a			16:41:06
Swivel	n/a			
Acoustic Release #1	1242	✔		16:41:24
Acoustic Release #2	927	✔		16:41:27

Ascent Rate 65 m/min

3 cable setup

RAPID-WATCH MOORING LOGSHEET **RECOVERY**

Mooring **EBH3** Cruise **D382**

NB: all times recorded in GMT

Date 17/10/12 **Site arrival time** overnight

Time of first ranging 07:46:21

ITEM	SER NO		COMMENT	TIME
Recovery line	n/a		surface 08:09	08:52:29
Billings Float	n/a			08:56:49
with Light				
~~and Argos Beacon~~			no Argos	
2 x Mini-Trimsyn	n/a			08:59:45
MicroCAT	3907	✔		
2 x Mini Trimsyn	n/a			09:04:19
MicroCAT	6802	✔		
2 x Mini Trimsyn	n/a			09:08:51
MicroCAT	6801	✔		09:10:01
2 x Mini Trimsyn	b/a			09:13:11
MicroCAT	6800	✔		09:14:32
Sontek	D298	✔		09:17:13
MicroCAT	6799	✔	growth on cat and rope	09:21:11
3 x 17" glass	n/a			
Swivel	n/a			
Acoustic Release #1	925	✔	growth on releases	
Acoustic Release #2	908	✔		

Ascent Rate 50 m/ min

hooked 08:51

RAPID-WATCH MOORING LOGSHEET **RECOVERY**

Mooring **EBH4** Cruise **D382**

NB: all times recorded in GMT

Date 28/10/12 **Site arrival time** 08:30

Time of first ranging 08:34

ITEM	SER NO		COMMENT	TIME
Recovery line	n/a		spotted 08:42	09:11:55
Billings Float	n/a		whole mooring on surface 08:50	09:18
with Light				
and Argos Beacon				
1 x 17” glass	n/a			09:19
Swivel	n/a			
MicroCAT	3233	☑		09:22:39
MicroCAT	3258	✔	flooded. end cap missing	09:24:59
2 x 17” glass	n/a		end cap recovered here. slid down wire	09:27
MicroCAT	3254	☑		09:29
MicroCAT	3219	☑		09:31
MicroCAT	3221	☑		09:33
2 x 17” glass	n/a			09:34
MicroCAT	3222	☑		09:38:39
4 x 17” glass	n/a			
Swivel	n/a			
Acoustic Release #1	264	☑		
Acoustic Release #2	906	☑		09:44:09

Ascent Rate n/a

RAPID-WATCH MOORING LOGSHEET **RECOVERY**

Mooring **EBH4L2** Cruise **D382**

NB: all times recorded in GMT

Date 28/10/12 **Site arrival time** 06:39:53

Time of first ranging 06:42

ITEM	SER NO		COMMENT	TIME
Recovery line	n/a		surfaced 06:59	06:15:31
Billings Float	n/a		fouling	06:19:46
with Light				
and Argos Beacon			argos upside down	
4 x 17” glass	n/a		surfaced before billings	06:22:20
4 x 17” glass	n/a			06:25:49
BPR	0397	☐	0002	
BPR	0054	☐	0004	
Acoustic Release #1	323	☑		
Acoustic Release #2	687	☑		06:28:47

Ascent Rate 65 m min

Ranging

Time	Range 1	Range 2	Command/comment
06:42:04	-	1144	Arm + Arm 323
6:43:16	-	1148	Arm + Arm 687
6:44:54	1152	1152	Arm + Release 323
			release ok
6:45:53	1104	1090	
6:46:51	1039	1033	

RAPID-WATCH MOORING LOGSHEET **RECOVERY**

Mooring **EBH5** Cruise **D382**

NB: all times recorded in GMT

Date 28/10/12 **Site arrival time** 10:14:04

Time of first ranging 10:14:23

ITEM	SER NO		COMMENT	TIME
Recovery line	n/a		sighted 10:54, grappled 11:22:49	11:22
Billings Float	n/a		fouling	11:25:24
with Light				
and Argos Beacon				
MicroCAT	3223	☑		11:32:25
2 x 17" glass	n/a			11:34:41
Swivel	n/a			
MicroCAT	3228	☑		11:35:50
MicroCAT	3269	☑		11:38:23
2 x 17" glass	n/a			11:42:38
RCM11	305	☑		11:44:02
2 x 17" glass	n/a			11:49:41
Sontek	D278		tick	11:52:39
Sontek	D322	☑		11:56:05
5 x 17" glass	n/a			11:59:34
Swivel	n/a			"
Acoustic Release #1	249	☐		"
Acoustic Release #2	256	☐		"

Ascent Rate n/a

RAPID-WATCH MOORING LOGSHEET **RECOVERY**

Mooring **EBHi** Cruise **D382**

NB: all times recorded in GMT

Date 23/10/12 **Site arrival time** overnight

Time of first ranging 06:07

ITEM	SER NO		COMMENT	TIME
Recovery line	n/a		first float 07:13:58	07:42:31
Billings Float	n/a		tangled w first buoyancy	07:48:34
with Light			light working and helpful fr spotting	
~~and Argos Beacon~~			no argos	
2 x 17" glass	n/a			07:52:54
Swivel	n/a			
MicroCAT	3232	✔		07:54:44
2 x 17" glass	n/a			08:04:36
MicroCAT	3234	✔		08:06:48
RCM11	302	✔		
MicroCAT	3905	✔		08:18:39
4 x 17" glass	n/a			
Swivel	n/a			
Acoustic Release #1	819	✔		
Acoustic Release #2	923	✔		

Ascent Rate 80 m min

Ranging

Time	Range 1	Range 2	Command/comment
06:17	4589	4589	Arm + Arm
06:18:53	4555	4555	Arm + Release
06:19:13	4488	4478	
06:20:11	4408	4398	80 m min
			eta 0705

RAPID-WATCH MOORING LOGSHEET **RECOVERY**

Mooring **MAR0** Cruise **D382**

NB: all times recorded in GMT

Date 10/11/12 **Site arrival time** 08:20

Time of first ranging 08:20

ITEM	SER NO	COMMENT	TIME
Recovery line	n/a		
Billings Float	n/a	LOST	
with Light	Y01-017	Communications intermittent	
and Argos Beacon	X02-055	Tried firing from three different	
2 x 17" glass	n/a	locations	
Swivel	n/a	Both releases returned 'release ok'	
MicroCAT	5764	on a number of occasions	
MicroCAT	5771	However the mooring didn't leave	
2 x 17" glass	n/a	the seabed	
Swivel	n/a	Suspected implosion	
MicroCAT	4715		
S4	35612578		
MicroCAT	4711		
MicroCAT	4709		
8 x 17" glass	n/a		
BPR	0032		
BPR	0418		
Acoustic Release #1	826		
Acoustic Release #2	1199		

Ascent Rate ____________

Ranging

Time	Range 1	Range 2	Command/comment
08:15:44	-	-	Arm + Arm
08:16:40	-	5507	
08:17:38	-	-	Arm + Arm
08:18:19	-	-	Arm + Arm
08:19:13	-	-	
08:20:25	-	12437	Arm + Arm
08:21:11	-	-	
08:21:55	5515	-	
08:23:23	5515	-	Arm + Release,m
08:24:10	-	5516	no answer
08:25:17	-	5164	
08:26:01	-	5517	release ok
08:27:02	-	-	
08:27:41	3641	-	
08:28:40	-	-	
08:29:23	-	5514	no answer
08:30:04	-	-	
08:32:59	5480	-	transducer deeper
08:33:33	5480	13070	
08:34:20	5480	5480	
	4849	13070	-
08:36:32	5477		-
08:37:27	5479	5479	release ok
08:37:59	5477	13587	-
08:38:53	-	5477	-
08:39:58	-	-	
08:41:48	5476	5475	ok
08:42:19	5477	-	-
08:42:46	5477	5478	-
08:43:34	5478	4683	-
08:44:11	-	13055	-
08:45:11	5477	13075	-
08:46:35			ok
08:46:48	5476	5474	ok
08:47:23	5474	12994	-

Ranging

Time	Range 1	Range 2	Command/comment
0904	5437	5436	Release OK
0905	-	13448	-
0906	-	13492	-
0907	-	5438	Release OK
0908	5440	5440	Release OK
0909	5440	-	-
0909	5440	5439	-
1147	7290	-	-
1148	-	-	-
1149	5472	-	Release OK
1150	-	-	-
1151	-	-	-
1152	-	-	-
1153	8122	-	-
1154	-	-	
1210	-	-	
1211	-	-	
1212	5426	-	
1213	-	-	
1214	-	5426	Release OK
1215	5265	-	
1215	5428		
1216	5425	5425	

RAPID-WATCH MOORING LOGSHEET **RECOVERY**

Mooring **MAR1L6** Cruise **D382**

NB: all times recorded in GMT

Date 08/11/12 **Site arrival time** overnight

Time of first ranging 09:33

ITEM	SER NO		COMMENT	TIME
Recovery line	n/a			
Billings Float	n/a		NOT RECOVERED	
with Light	Y01-022	☐	Communications good	
and Argos Beacon	X02-054	☐	Releases OK	
4 x 17" glass	n/a		Likely implosion of glass	
4 x 17" glass	n/a		Retried in evening: same response	
BPR	0028	☐		
BPR	0063	☐		
Acoustic Release #1	163	☐		
Acoustic Release #2	1196	☐		

Ascent Rate ____________

Ranging

Time	Range 1	Range 2	Command/comment
09:33:19	9753	6426	Arm + Arm
09:33:45	1480	7546	Arm + Arm
09:39:13	3427		release ok
09:40:11	6439		no answer
09:41:11	5481	6439	release ok
09:42:09	6440		
09:43:58	6437	6388	release ok
09:44:44	6428	6427	release ok
09:45:56	8685	6754	
09:46:46	5162	1459	
	6395	6393	
09:48:22	4646		
10:17:08	5217	5217	Arm + Arm not fired
10:18:15	5218	5215	Arm + Release
10:19:07	5114	5215	
10:20:04	5217	5216	
10:21:15	-	5216	release ok. second release
10:22:06	5216	5216	vertical, good battery, not releasing

RAPID-WATCH MOORING LOGSHEET **RECOVERY**

Mooring **MAR1** Cruise **D382**

NB: all times recorded in GMT

Date 08/11/12 **Site arrival time** 11:00

Time of first ranging 11:04

ITEM	**SER NO**		**COMMENT**	**TIME**
Recovery line	n/a		spotted by bridge shortly after firing	
3 x Mini-Trimsyn	n/a			12:54:14
MicroCAT	6835	✔	6335, not 6835	12:56:00
24" syntactic float	n/a			
with Light	T05-079	☐		
and Argos Beacon	Y01-008	☐		
MicroCAT	6321	✔		13:00:40
37" Steel Sphere	n/a			
with Light	W03-094	✔		13:03:00
and Argos Beacon	304	✔		
Swivel	n/a			
MicroCAT	6324	✔		13:08:40
MicroCAT	4721	✔		13:09:49
MicroCAT	5485	✔		13:15:35
MicroCAT	6806	✔	ge tangle after microcat, cut and reattach	13:17:21
MicroCAT	6807	✔		13:26:03
8 x 17" glass	n/a			13:29:25
Swivel	n/a			
MicroCAT	4717	✔		13:29:46
MicroCAT	6809	✔		13:36:35
MicroCAT	4708	✔		13:40:12
Sontek	D295	✔		13:46:46
MicroCAT	5784	✔		13:48:03
8 x 17" glass	n/a			13:56:01
Swivel	n/a			
MicroCAT	6812	✔		13:58:36
4 x 17" glass	n/a			14:06:48
Swivel	n/a			
MicroCAT	3932	✔		14:07:53
4 x 17" glass	n/a		tangled	14:18:35
Swivel	n/a			
MicroCAT	6813	✔		14:18:43
4 x 17" glass	n/a			15:21:03
Swivel	n/a			
MicroCAT	3919	✔		15:31:28
4 x 17" glass	n/a			

Swivel	n/a			
MicroCAT	7723	✔		14:55:21
MicroCAT	5783	✔		15:54:17
5 x 17" glass	n/a		tangled	15:23:57
Swivel	n/a			
S4	35612572	✔		16:04:47
MicroCAT	6830	✔		16:08:27
9 x 17" glass	n/a			16:10:22
Swivel	n/a			
Acoustic Release #1	920	✔		16:10:42
Acoustic Release #2	316	✔		

Ascent Rate n/a

Ranging

Time	Range 1	Range 2	Command/comment
11:04:31	-	-	Arm + Arm
11:05:07	-	8613	
11:06:14	6519	5157	
11:06:41	-	-	
11:07:56	-	-	Arm + Release
11:08:47	-	-	
11:09:56	-	-	
11:12:30	-		
11:12:46	4787		
11:14:33	-		spotted by bridge

RAPID-WATCH MOORING LOGSHEET **RECOVERY**

Mooring **MAR2** Cruise **D382**

NB: all times recorded in GMT

Date 07/11/12 **Site arrival time** 17:45

Time of first ranging 17:46:27

ITEM	SER NO		COMMENT	TIME
Recovery line	n/a		surfaced 1809, hooked 19:29:31	19:33:58
Billings float	n/a			
with Light		☑		
and Argos Beacon		☑		
4 x 17" glass	n/a			19:30:46
Swivel	n/a			
MicroCAT	3931	☑		
MicroCAT	3911	☑		19:45:39
MicroCAT	6115	☑		19:50:12
4 x 17" glass	n/a			19:54:12
Swivel	n/a			
MicroCAT	6116	☑		19:56:06
3 x 17" glass	n/a			
Swivel	n/a			
MicroCAT	6117	☑		20:05:00
3 x 17" glass	n/a			20:13:48
Swivel	n/a			
MicroCAT	3928	☑		20:21:36
MicroCAT	5243	☑		20:29:26
3 x 17" glass	n/a			
Swivel	n/a			
MicroCAT	5239	☑		20:40
3 x 17" glass	n/a		21:20:20 last thing on deck	
Swivel	n/a			
MicroCAT	5778	☑	21:19:45	
MicroCAT	6119	☑	tangled	20:36
4 x 17" glass	n/a			
S4	35612571	☑		21:09:41
MicroCAT	6120	☑		
5 x 17" glass	n/a			
Swivel	n/a			
Acoustic Release #1				21:06:47
Acoustic Release #2				

Ascent Rate 60 m min major tangling for second year running

Ranging

Time	Range 1	Range 2	Command/comment
17:46:41	-	4204	Arm + Arm
17:48:10	-	-	
17:48:37	-	5348	Arm + Arm
17:49:39	9572	-	
17:51:21			Arm + Release
17:52:13	-	-	
17:53:48	4974	4962	
		top	surfaced 18:09:26
		+700 m	18:20:06
		+450	18:35:01
		+500	

RAPID-WATCH MOORING LOGSHEET **RECOVERY**

Mooring **MAR3** Cruise **D382**

NB: all times recorded in GMT

Date 05/11/12 **Site arrival time** 09:38

Time of first ranging 09:38

ITEM	SER NO		COMMENT	TIME
Recovery line	n/a		spotted 10:25	12:13:12
Billings float	n/a			12:17:29
with Light				
and Argos Beacon				
2 x 17" glass	n/a			12:18:31
Swivel	n/a			
MicroCAT	5776	✔		12:17:35
3 x 17" glass	n/a			
Swivel	n/a			
MicroCAT	5774	✔		12:34:00
3 x 17" glass	n/a			12:45:50
Swivel	n/a			
MicroCAT	6835	✔		12:46:54
3 x 17" glass	n/a			12:57:22
Swivel	n/a			12:57:19
MicroCAT	6810	✔		12:57:15
3 x 17" glass	n/a			13:04:55
Swivel	n/a			13:04:55
MicroCAT	6836	✔		13:06:40
MicroCAT	5770	✔		13:14:39
8 x 17" glass	n/a		4 spheres imploaded, 4 ok	13:16:20
Swivel	n/a			
S4	35612568	✔		13:17:58
Acoustic Release #1	917	✔		13:21:11
Acoustic Release #2	322	✔		13:21:14

Ascent Rate 60 m min

grapple slipped on first pass
had to go round again
bottom two packs not on surface
suspected implosion

RAPID-WATCH MOORING LOGSHEET **RECOVERY**

Mooring **MAR3L6** Cruise **D382**

NB: all times recorded in GMT

Date 05/11/12 **Site arrival time** 07:00

Time of first ranging 07:47

ITEM	SER NO		COMMENT	TIME
Recovery line	n/a		surfaced 09:07:10 vhf heard first chan 72	09:22:54
Billings Float	n/a			09:26:14
with Light				
and Argos Beacon				
4 x 17" glass	n/a		time is the same as billings	
4 x 17" glass	n/a			
BPR	0394	✔		
BPR	0062	✔		
Acoustic Release #1	497	✔		
Acoustic Release #2	1195	✔		09:31:12

Ascent Rate 80 m min

Ranging

Time	Range 1	Range 2	Command/comment
07:47:45	-	5055	Arm + Arm
07:48:45	-	5054	Arm + Arm
07:50:58	5053	5052	Arm + Release, Release ok
07:52:02	-	-	
07:53:33	4884	4875	
07:54:31	-	4798	80 m min

RAPID-WATCH MOORING LOGSHEET **RECOVERY**

Mooring **NOG** Cruise **D382**

NB: all times recorded in GMT

Date 05/11/12 **Site arrival time** 17:21

Time of first ranging 17:21

ITEM	SER NO		COMMENT	TIME
Recovery line	n/a		grappled 18:43:05	
Billings Float	n/a			18:50:02
with Light	T05-078	✔		
12 x 17" glass	n/a			
Swivel	n/a			
Sediment Trap	12168-02	✔		19:00:38
Nortek	8100	✔		19:04:18
Sediment Trap	12168-04	✔		19:08:25
Nortek	8092	✔		19:11:49
10 x 17" glass	n/a			19:32:35
Acoustic Release #1	822	✔		19:37:23

Ascent Rate 60 m min

mooring came up much faster than anticipated
surfaced at 18:15

RAPID-WATCH MOORING LOGSHEET **RECOVERY**

Mooring **WB1** Cruise **D382**

NB: all times recorded in GMT

Date 17/11/12 **Site arrival time** 1300

Time of first ranging 1303

ITEM	SER NO		COMMENT	TIME
1 x Trimsyn pick up float				14:28:13
3 Trymsyn floats				14:27:59
SBE37 MicoCAT	6123	✔	heavy fouling	14:28:02
30" SYNTACTIC				14:24:32
ARGOS				
Light				
swivel				
Nortek	9409	✔		14:24:26
SBE37 MicoCAT	6121	✔		14:24:23
SBE37 MicoCAT	4072	✔		14:20:12
45" syntactic			hooked 14:03:09	14:10:28
ARGOS				
LIGHT				
swivel				
SBE37 MicoCAT	6820	✔		14:31:35
SBE37 MicoCAT	4180	✔	no guard	14:32:28
Nortek	5890	✔		14:35:01
SBE37 MicoCAT	5773	✔		
SBE37 MicoCAT	3248	✔		14:39:50
SBE37 MicoCAT	3902	✔	no guard	14:42:21
SBE37 MicoCAT	4472	✔		14:45:25
10 x 17" glass spheres				14:51:20
SWIVEL				
Nortek	5897	✔		
SBE37 MicoCAT	5768	✔		15:01:15
SBE37 MicoCAT	5782	✔		15:03:59
SBE37 MicoCAT	4471	✔	15:08 after 4068 on mooring	15:06:31
SBE37 MicoCAT	4068	✔	1506 before 4471 on mooring	
2 x 17" glass				15:11:51
Nortek	5889	✔	15:11	
SBE37 MicoCAT	7468	✔		15:14:08
SBE37 MicoCAT	7363	✔		15:17:13
10 x 17" glass				
SWIVEL				
Acoustic release #1	823	✔		15:17:34
Acoustic release #2	1461	✔		

Ascent Rate n/a

Time at end of recovery 15:17

Ranging

Time	Range 1	Range 2	Command/comment
13:03:47		1629	Arm + Arm
13:04:04	1630	1630	Arm + Arm
13:05:10	1632	1631	Arm + Release no answer
13:05:56	748	1569	no answer
13:06:30	1513	1503	coming up

RAPID-WATCH MOORING LOGSHEET **RECOVERY**

Mooring **WB2L7** Cruise **D382**

NB: all times recorded in GMT

Date 20/11/12 **Site arrival time** 20:30

Time of first ranging 20:33

ITEM	SER NO	COMMENT	TIME
1 x Trymsyn pickup float		surf. 2123. hooked 21:47:04	22:14:50
Billings float			22:04:53
ARGOS			
LIGHT			
4 x 17" glass			21:59:37
4 x 17" glass			21:54:48
4 x 17" glass			
BPR #1 in tripod	0055 ☑		
BPR #2 in tripod	0056 ☑		
Release #1 in tripod		916	
Release #2 in tripod		918	22:19:50

Ascent Rate 85 m min

Time at end of recovery 22:19:55

Ranging

Time	Range 1	Range 2	Command/comment
2033	3080	3942	Arm + Arm
2036	3938	3939	Arm + Arm
2038	3937	-	Arm + Release
2038	3896	7263	release ok
2039	3811		85 m min

RAPID-WATCH MOORING LOGSHEET **RECOVERY**

Mooring **WB2** Cruise **D382**

NB: all times recorded in GMT

Date 20/11/12 **Site arrival time** overnight

Time of first ranging 11:06

ITEM	SER NO	COMMENT	TIME
1 x Trymsyn pickup float		spotted some way off. both lights on	12:31
3 x Trymsyn floats			12:40:35
SBE 37 MicroCAT	5781 ✔		12:40
30" SYNTACTIC			
ARGOS		sn y01-026 id 46499	
Light		sn x01-052	
swivel			
RCM11	448 ✔		12:47
SBE 37 MicroCAT	5780 ✔		12:49:54
51" syntactic			12:52:36
ARGOS		sn 286 id 22442	
Light		x01-050	
swivel			
RCM11	449 ✔		12:52:45
SBE 37 MicroCAT	6821 ✔		12:52:48
SBE 37 MicroCAT	6822 ✔		13:04:09
2 x 17" glass			
Nortek	6753 ✔		13:06:17
SBE37 MicroCAT	3933 ✔		13:09:06
SBE 37 MicroCAT	5763 ✔		13:11:08
SBE 37 MicroCAT	4307 ✔		13:15:49
2 x 17" glass			13:18:26
Nortek	6119 ✔		13:18:23
SBE 37 MicroCAT	4470 ✔		13:23:12
SBE 37 MicroCAT	5762 ✔		13:26:30
10 x 17" glass			13:29:22
Swivel			
Nortek	5884 ✔		13:31:28
SBE 37 MicroCAT	3209 ✔		13:34:45
Nortek	6176 ✔		13:38:46
MicroCAT	6333 ✔		13:38:43
5 x 17" glass			13:44:06
SBE 37 MicroCAT	5785 ✔		13:44:03
SBE 37 MicroCAT	3934 ✔		13:49:40
Nortek	5967 ✔		13:54:00

5 x 17" glass			13:59:33
Swivel			
SBE 37 MicroCAT	4475		14:00:19
SBE 37 MicroCAT	4719		14:11:12
2 x 17" glass spheres			
Nortek	9266		14:15:26
5 x 17" glass spheres			14:23:43
swivel			
SBE 37 MicroCAT	3483	slipped down wire	14:30:37
SBE 37 MicroCAT	6828	correct place - 14:36	
10 x 17" glass spheres			14:36
Swivel			
Release #1	324		14:36:04
Release #2	1406	damaged-top ring gone. this is the one that re	

Ascent Rate n/a
Time at end of recovery 14:36

Ranging

Time	Range 1	Range 2	Command/comment
11:16:56	-	-	
11:17:41	5393	3969	Arm + Arm
11:18:28		462	
11:18:49	3968	3968	
11:20:48	-	-	Arm + Release
11:21:36	3909	3897	-
11:22:26	-	3756	release ok

RAPID-WATCH MOORING LOGSHEET **RECOVERY**

Mooring **WB4L7** Cruise **D382**

NB: all times recorded in GMT

Date 18/11/12 **Site arrival time** overnight

Time of first ranging 10:30:32

ITEM	SER NO		COMMENT	TIME
1 x Trymsyn pickup float			surfaced 11:27:23, hooked 11:47:19	11:52:17
Billings float				
ARGOS				
LIGHT				
4 x 17" glass			large tangle, came up in one clump	12:08:11
4 x 17" glass				11:52:24
4 x 17" glass				12:10:04
BPR #1 in tripod	0057	✔		
BPR #2 in tripod	0014	✔		
Release #1 in tripod	1349	✔		
Release #2 in tripod	358	✔		12:14:13

Ascent Rate 82 m/min

Time at end of recovery 12:14:18

Ranging

Time	Range 1	Range 2	Command/comment
10:30:27	7606	4778	0924 Arm + Arm
10:30:53	4789	4789	
10:32:18	4788	4788	0924 Arm + Release
			release ok
10:32:55	4757	4746	
10:33:56	4675	4664	

RAPID-WATCH MOORING LOGSHEET **RECOVERY**

Mooring **WB4** Cruise **D382**

NB: all times recorded in GMT

Date 18/11/12 **Site arrival time** 13:20

Time of first ranging 13:20

ITEM	SER NO		COMMENT	TIME
1 x Trimsyn pickup float			spotted instantly, hooked 14:00:00	14:00:12
3 TRYMSYN floats				14:10:42
MicroCAT	4071	✔	heavy fouling	14:11:24
32" syntactic				14:17:22
with Argos beacon			arial broken	
and light			y01-023	
Swivel				
RCM11	445	✔		14:18:40
MicroCAT	4070	✔		14:23:48
49" syntactic				14:27:19
with Argos beacon			z08-046	
and light			z02-018	
swivel				
MicroCAT	5787	✔		14:34:22
Nortek	5963	✔		14:37:31
MicroCAT	5779	✔		14:37:36
MicroCAT	5786	✔		14:44:22
Nortek	6751	✔		14:47:51
MicroCAT	6827	✔		14:47:54
MicroCAT	7362	✔		14:54:36
10 x Orange CF-16s			tangled	14:58:22
Nortek	6743	✔		14:59:02
MicroCAT	7470	✔		14:59:14
Nortek	9406	✔		15:16:51
5 x yellow CF-16s				15:21:01
MicroCAT	6840	✔		15:23:47
5 x yellow CF-16s				15:30:30
Swivel				
Nortek	9439	✔		15:30:46
MicroCAT	6124	✔	changed drum	16:00:00
5 x yellow CF-16s				
MicroCAT	6326	✔		16:04:00
5 x yellow CF-16s				

Swivel				
Nortek	9433	☑		16:14:17
MicroCAT	6325	☑		16:15:40
5 x yellow CF-16s				
MicroCAT	6323	☑		16:23:13
5 x yellow CF-16s				16:35:49
Swivel				
Nortek	9420	☑		16:36:04
MicroCAT	6320	☑		16:38:51
MicroCAT	6137	☑		16:48:41
Nortek	5885	☑		16:52:41
10x glass spheres				16:55:44
Swivel				
Acoustic release #1	1465	☑		16:55:46
Acoustic release #2	1463	☑		16:55:48

Ascent Rate n/a

Time at end of recovery 16:57:53 ipad time: plus 55 sec.

Ranging

Time	Range 1	Range 2	Command/comment
13:20:42	-	4213	Arm + Arm
13:21:27	1046	2296	Arm + Arm
13:22:03	4770	4241	
13:22:58	-	-	
13:23:33	-	1577	
13:26:05	4748	4747	
13:27:24	4745	4745	Arm + Release -
13:28:07	4676	4657	rel ok

Mooring **WB6** Cruise **D382**

NB: all times recorded in GMT

Date 14/11/12 **Site arrival time** 13:25

Time of first ranging 13:26

ITEM	SER NO		COMMENT	TIME
1 x Trymsyn pickup float	12" glass,		surfaced 14:47	
Billings float	not trimsyn		billings not on surface. tangled	lost
Argos			so hooked with pole	lost
Light				lost
3 x 17" glass				15:22:00
Swivel				
SBE MicroCAT	5240	✔		15:25:22
SBE MicroCAT	6128	✔		15:31:14
2 x 17" glass			imploded	15:33:45
SBE MicroCAT	5767	✔	tangled with imploded glass	15:33:48
Nortek	6747	✔		15:39:45
SBE MicroCAT	7361	✔	above nortek	15:39:49
SBE MicroCAT	4306	✔		15:42
8 x 17" glass				15:46:04
Swivel				
BPR #1 on tripod	0390	✔		15:47
BPR #2 on tripod	0040	✔		15:47
Release #1 in tripod	1201	✔		15:47
Release #2 in tripod	910	✔		15:47

Ascent Rate 60m/min iPad time = GMT + 48 secs.

Time at end of recovery 15:47

13:26:15			1201 Arm + Arm
13:26:50			
13:27			
13:28:25			910 Arm + Arm
13:29:02			
13:30:45	5409		
13:31:15			
13:31:53			
			1201 Arm + Arm
13:32:40		5411	
13:33:26			1201 Arm + Release
13:34:07			
13:34:47			
13:35:26			
13:36:04			
13:37:00			901 Arm + Arm
13:37:36			
13:38:11			
13:39:12	4996		
13:39:52		4886	
13:40:53	4828		eta approx 14:50 gmt

RAPID-WATCH MOORING LOGSHEET **RECOVERY**

Mooring **WBADCP** Cruise **D382**

NB: all times recorded in GMT

Date 21/11/12 **Site arrival time** 17:55

Time of first ranging ___________

ITEM	SER NO	COMMENT	TIME
1 x 12" glass pickup float			18:11:26
ADCP in 40 " syntactic	5817 ☑	tangled and upside down	18:15:38
with Argos beacon			
and light			
swivel			
Acoustic Release #1	1464		
Acoustic Release #2	821		18:26:42

Ascent Rate 40 m min

Time at end of recovery 18:26:42

Ranging

Time	Range 1	Range 2	Command/comment
17.41	932	933	Arm + Release; Release OK

RAPID-WATCH MOORING LOGSHEET **RECOVERY**

Mooring **WBAL2** Cruise **D382**

NB: all times recorded in GMT

Date 21/11/12 **Site arrival time** 19:05

Time of first ranging 19.07

ITEM	SER NO	COMMENT	TIME
1 x Trymsyn pick up float			14:42
Billings float			
ARGOS		Y01-012	
LIGHT		Y01-016	
4 x 17" glass			14:53
4 x 17" glass			
4 x 17" glass			
BPR #1 in tripod	417 ✔		20:03:56
BPR #2 in tripod	0039 ✔		20:04:01
Release #1 in tripod		1352	20:04:14
Release #2 in tripod	Text	364	20:04:17

tripot almost lost with BPRs

Ascent Rate indeterminate

Time at end of recovery 20:04

Ranging

Time	Range 1	Range 2	Command/comment
19:07:36	-	678	arm+arm 1352
19:08:01	679	681	
19:08:55	690	691	arm+arm ok
19:09:25	694	695	ok
19:09:50	696	696	ok
19:10:20	-	687	ok
19:11:00	682	682	ok
19:11:55	-	680	364 arm+arm
19:12:35	682	684	
19:13:15	684	683	364 arm+release ok
19:13:45	681	671	ok
19:14:20	678	676	ok
19:15:20	650	647	1352 arm+diag vertical 8.6 v

RAPID-WATCH MOORING LOGSHEET **RECOVERY**

Mooring **WBH2** Cruise **D382**

NB: all times recorded in GMT

Date 21 nov 2012 **Site arrival time** overnight

Time of first ranging 12.27

ITEM	SER NO		COMMENT	TIME
1 x Trymsyn pickup float	n/a			14.08
Billings float	n/a			
ARGOS			z08-043 111852	14:14:03
Light			z08-047	
12x 17" glass	n/a			14:18:09
Swivel	n/a			
Nortek	9402	✔		14:23:58
7 x 17" glass	n/a			14:38:08
Nortek	9427	✔	tangled in glass	14:38:20
Nortek	9444	✔		14:54:28
3 x 17" glass	n/a			
Swivel	n/a			
Nortek	6132	✔		15:09:57
MicroCAT	6825	✔	tangled in glass	15:10:10
MicroCAT	6824	✔		15:22:54
3 x 17" glass	n/a			15:28:46
Nortek	5879	✔	tangled in glass	15:28:39
MicroCAT	4305	✔		15:34:35
5 x 17" glass	n/a		2 glass imploded	15:35:23
Swivel	n/a			
Release #1	1405	✔		15:35:49
Release #2	216	✔		15:35:52

Ascent Rate 100m/min

Time at end of recovery 15.35

Ranging

Time	Range 1	Range 2	Command/comment
12:27:08	-	4803	
12:27:47	-	-	
12:28:32	4804	-	
12:30:19	-	4804	Arm + Release, no ans
12:31:23	-	-	
12:32:08	-	9128	-
12:33:03	-		
12:34:48	-		
12:36:16	4264	-	
12:36:52	1953	4188	
12:37:50	3811		
12:39:42	-		
12:42:20	3674	3674	
12:43:39	3540	3530	

22 Mooring Deployment Logsheets

RAPID-WATCH MOORING LOGSHEET **DEPLOYMENT**

Mooring **EB1L9** Cruise **D382**

NB: all times recorded in GMT

Date 24/10/12

Setup distance 1 cable

Start time 16:35

Site arrival time 16:33:53

End time 16:40:27

Start Position

Latitude 23.80 **Longitude** -24.11

ITEM	SER NO	COMMENT	TIME
Recovery line	n/a		16:35:01
Billings Float	n/a		16:36:30
with Light	y01-020		
and Argos Beacon		Beacon ID =93792	
3 x 17" glass	n/a		16:37:19
3 x 17" glass	n/a		16:37:55
3 x 17" glass	n/a		16:38:52
BPR	392		
BPR	420		
Acoustic Release #1	1353	Record codes below	
Acoustic Release #2	368	Record codes below	
300kg Anchor	n/a		16:40:27

Release #1 arm code
Release #1 release code
Release #2 arm code
Release #2 release code
[redacted]

Argos beacon #1 ID 93792

lander obs goin down

Anchor Drop Position

Latitude 23.7998 **Longitude** -24.1119

Uncorrected water depth 5053 (at anchor launch)

Corrected water depth 5096 (at anchor launch)

RAPID-WATCH MOORING LOGSHEET **DEPLOYMENT**

setup distance increased due to advice from bridge re. .3/.4 knot following current

Mooring **EB1**

Cruise **D382**

NB: all times recorded in GMT

Date 25/10/12

Site arrival time 07:26:01

Setup distance 5.5 nm

Start time 07:37:56

End time 11:38:44

Start Position

Latitude 23.6647 **Longitude** -24.1389

ITEM	SER NO	COMMENT	TIME
Recovery line	n/a		07:37:49
~~3 x~~ Mini-Trimsyns	n/a	2 trimsyn	
MicroCAT	4066		
24" syntactic float	n/a		07:42:35
with Light	208-049	on and working	
and Argos Beacon	W03-082	Beacon ID =82952	
Swivel	n/a		
MicroCAT	4713		07:44:39
37" steel sphere	n/a		07:51:53
with light	W03-097	on and working	
and Argos Beacon	285	Beacon ID = 60211	
Swivel	n/a		
MicroCAT	4720		07:53:19
MicroCAT	4718	speed up to 1 knot	07:57:19
MicroCAT	6817		08:01:25
MicroCAT	5765		08:05:58
4 x 17" glass	n/a		08:11:37
MicroCAT	4474		08:15:59
4 x 17" glass	n/a		08:24:37
MicroCAT	4473		08:26:46
MicroCAT	4466	fell over on deck	08:33:48
4 x 17" glass	n/a		08:39:48
Swivel			
MicroCAT	4462		08:42:58
RCM11	518		08:52:55
4 x 17" glass	n/a		08:55:55
MicroCAT	3259		08:58:54
MicroCAT	3257		09:06
4 x 17" glass	n/a		09:14:14
Swivel			
MicroCAT	3255		09:19:22
MicroCAT	3271	3.4 miles to run	09:28:54
4 x 17" glass	n/a		09:36:37
Swivel			
MicroCAT	5238	3.0 miles to run	09:42:14

4 x 17" glass	n/a		09:51:49
MicroCAT	3916	2.7 miles to run	09:55:12
4 x 17" glass	n/a		10:08:06
Swivel			
MicroCAT	3256		10:09:28
RCM11	507		10:28:36
MicroCAT	6829		10:29:51
8 x 17" glass	n/a	rem 20 m wire	
Swivel	n/a		
Acoustic Release #1	1535	Record codes below	10:40:01
Acoustic Release #2	1536	Record codes below	
1450kg Anchor	n/a	starting towing 10:55, 1.5 nm to go	11:38:44

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

ipad has a +16 sec time offset today

Anchor Drop Position
Latitude 23.7574 **Longitude** -24.1581
Uncorrected water depth 5053 (at anchor launch)
Corrected water depth 5096 (at anchor launch)

RAPID-WATCH MOORING LOGSHEET **DEPLOYMENT**

Mooring **EBH1L9** Cruise **D382**

NB: all times recorded in GMT

Date 16/10/12 **Site arrival time** 07:55:54

Setup distance 3 cables

Start time 08:09:44 **End time** 08:14:28

Start Position

Latitude 27.2116 **Longitude** -15.4038

ITEM	SER NO	COMMENT	TIME
Recovery line	n/a		08:09:51
Billings Float	n/a		08:10:38
with Light	S01-185		
and Argos Beacon	A08-070	Beacon ID =	
3 x 17" glass	n/a		08:11:21
3 x 17" glass	n/a		08:11:48
3 x 17" glass	n/a	4 glass	08:12:26
BPR	0389		
BPR	400		
Acoustic Release #1	265	Record codes below	
Acoustic Release #2	347	Record codes below	
300kg Anchor	n/a		08:14:28

Release #1 arm code [redacted]

Release #1 release code [redacted]

Release #2 arm code [redacted]

Release #2 release code [redacted]

Argos beacon #1 ID 121991

readjusting to 1.5 cables

Anchor Drop Position

Latitude 27.2122 **Longitude** -15.4029

Uncorrected water depth 3011.5 (at anchor launch)

Corrected water depth 3014.6 (at anchor launch)

RAPID-WATCH MOORING LOGSHEET **DEPLOYMENT**

Mooring **EBH1** Cruise **D382**

NB: all times recorded in GMT

Date 16/10/12 **Site arrival time** 06:38:23

Setup distance 4 cables

Start time 06:43:04 **End time** 07.15

Start Position

Latitude 27.2145 **Longitude** -15.4306

ITEM	SER NO	COMMENT	TIME
Recovery line	n/a		06:50:48
Billings Float	n/a		06:51:36
with Light		on and flashing	
and Argos Beacon	a08-071	Beacon ID =121992	
2 x 17" glass	n/a		06:52:12
Swivel	n/a		
MicroCAT	3251		06:52:48
2 x 17" glass	n/a		07:00:22
RCM11	450		07:04:12
MicroCAT	5766		07:06:40
3 x 17" glass	n/a		
Swivel	n/a		
Acoustic Release #1	1351	Record codes below	07.15.23
Acoustic Release #2	251	Record codes below	
500kg Anchor	n/a		

Release #1 arm code [redacted]
Release #1 release code [redacted]
Release #2 arm code [redacted]
Release #2 release code [redacted]
Argos beacon #1 ID 121992

overrunning the waypoint for depth

Anchor Drop Position

Latitude 27.2224 **Longitude** -15.4227

Uncorrected water depth 3035.5 (at anchor launch)

Corrected water depth 3038.9 (at anchor launch)

RAPID-WATCH MOORING LOGSHEET **DEPLOYMENT**

Mooring **EBH2** Cruise **D382**

NB: all times recorded in GMT

Date 16/10/12 **Site arrival time** 16:55:42

Setup distance 3 cables

Start time 17:16:39 **End time** 17:31:06

Start Position

Latitude 27.6094 **Longitude** -14.2126

ITEM	SER NO	COMMENT	TIME
Recovery line	n/a		17:16:35
Billings Float	n/a		17:17:31
with Light	s01-181		
and Argos Beacon	a08-069	Beacon ID =	
2 x 17" glass	n/a		17:18
Swivel	n/a		
MicroCAT	3207		
2 x 17" glass	n/a	mcat 3252 after glass	17:24:50
RCM11	516		17:27:02
MicroCAT	3220		
3 x 17" glass	n/a		
Swivel	n/a		
Acoustic Release #1	1346	Record codes below	
Acoustic Release #2	1534	Record codes below	
500kg Anchor	n/a		17:31:06

Release #1 arm code [redacted]
Release #1 release code [redacted]
Release #2 arm code [redacted]
Release #2 release code [redacted]
Argos beacon #1 ID 121990

Anchor Drop Position

Latitude 27.6109 **Longitude** -14.2123

Uncorrected water depth 2020 (at anchor launch)
Corrected water depth 2020 (at anchor launch)

RAPID-WATCH MOORING LOGSHEET **DEPLOYMENT**

Mooring **EBH3** Cruise **D382**

NB: all times recorded in GMT

Date 17/10/12 **Site arrival time** 13:00

Setup distance 1.5 nm

Start time 13:43:41 **End time** 15:07

Start Position

Latitude 27.7841 **Longitude** -13.7549

ITEM	SER NO	COMMENT	TIME
Recovery line	n/a		13:43:47
Billings Float	n/a		
with Light	X01-049		
and Argos Beacon	A08-068	Beacon ID =	
4 x 17" glass	n/a		
Swivel	n/a		
MicroCAT	3212		13:44:27
MicroCAT	3277		13:48:06
MicroCAT	6823		13:50:44
MicroCAT	4712		13:53:09
3 x 17" glass	n/a		
MicroCAT	6816		13:58:46
MicroCAT	5777		14:01:30
3 x 17" glass	n/a	rcm 428	14:17:54
RCM11	443	mcat 4710	
MicroCAT	3912	mcat 3213	
MicroCAT	3893		
2 x 17" glass	n/a		
MicroCAT	3249	mark measured as deploying	14:33:07
RCM11	444		14:36:27
MicroCAT	5772	winding on polyester	
3 x 17" glass	n/a		
MicroCAT	3214		14:54:28
RCM11	515		14:58:28
MicroCAT	3253		
4 x 17" glass	n/a		
Swivel	n/a		
Acoustic Release #1	825	Record codes below	
Acoustic Release #2	1345	Record codes below	
500kg Anchor	n/a		15:07:17

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

[redacted]

Argos beacon #1 ID 121989

Anchor Drop Position
Latitude 27.81321 **Longitude** -13.74465

Uncorrected water depth 1422 (at anchor launch)
Corrected water depth 1424 (at anchor launch)

RAPID-WATCH MOORING LOGSHEET **DEPLOYMENT**

Mooring **EBH4L4** Cruise **D382**

NB: all times recorded in GMT

Date 28/10/12

Setup distance 1cable

Start time 07:52:59

Site arrival time 07:47:56

End time 08:01:38

Start Position

Latitude 27.8716 **Longitude** -13.5149

ITEM	SER NO	COMMENT	TIME
Recovery line	n/a		07:52:33
Billings Float	n/a		07:53:12
with Light	A08-087		
and Argos Beacon	Y01-028	Beacon ID =	
3 x 17" glass	n/a	4 glass	07:53:46
3 x 17" glass	n/a	4 glass	07:54:45
3 x 17" glass	n/a	4 glass	07:55:00
BPR	0037		
BPR	0053		
Acoustic Release #1	908	Record codes below	
Acoustic Release #2	1242	Record codes below	
300kg Anchor	n/a		08:01:38

Release #1 arm code
Release #1 release code
Release #2 arm code
Release #2 release code [redacted]
Argos beacon #1 ID 46501

ipad +4 secs
also adjusted fr clock change
automatically

Anchor Drop Position

Latitude 27.8720 **Longitude** -13.5140

Uncorrected water depth 1004.5 (at anchor launch)

Corrected water depth 1008.5 (at anchor launch)

RAPID-WATCH MOORING LOGSHEET **DEPLOYMENT**

Mooring **EBH4** Cruise **D382**

NB: all times recorded in GMT

Date 28/10/12

Setup distance 1.2 nm

Start time 12:53:11

Site arrival time 12:44:17

End time 14:15:42

Start Position

Latitude 27.8709 **Longitude** -13.5454

ITEM	SER NO	COMMENT	TIME
Recovery line	n/a		12:52:58
Billings Float	n/a		12:53:27
with Light	Z08-050		
and Argos Beacon	A08-075	Beacon ID =	
4 x 17" glass	n/a		
Swivel	n/a		
MicroCAT	3230		12:54
MicroCAT	3215		12:57:06
3 x 17" glass	n/a		13:01:37
MicroCAT	6818		13:03:23
MicroCAT	3244		13:06:30
2 x 17" glass	n/a		13:10:59
MicroCAT	3224		13:12:05
MicroCAT	3265		13:16:47
2 x 17" glass	n/a		13:21:32
MicroCAT	3264		13:22:38
MicroCAT	6831		13:27:02
2 x 17" glass	n/a		
MicroCAT	3216		
MicroCAT	3907	sontek d332, pointing down, at 13:41:35	13:44:32
6 x 17" glass	n/a		13:50:06
Swivel	n/a	towing from 13:58:18	
Acoustic Release #1	246	Record codes below	13:55:14
Acoustic Release #2	1354	Record codes below	
700kg Anchor	n/a		14:15:42

Release #1 arm code
Release #1 release code
Release #2 arm code
Release #2 release code
[redacted]

Argos beacon #1 ID 121996

Anchor Drop Position

Latitude 27.8495 **Longitude** -13.5405

Uncorrected water depth 1053 (at anchor launch)

Corrected water depth: 1056.5

RAPID-WATCH MOORING LOGSHEET **DEPLOYMENT**

Mooring **EBHi** Cruise **D382**

NB: all times recorded in GMT

Date 23/10/12 **Site arrival time** 08:42:30

Setup distance 5 cables

Start time 08:42 **End time** 09:15:16

Start Position

Latitude 24.93667 **Longitude** -21.26390

ITEM	SER NO	COMMENT	TIME
Recovery line	n/a		08:43:41
Billings Float	n/a		
with Light	tY01-021		
and Argos Beacon	202-008	Beacon ID = 53157	
2 x 17" glass	n/a		08:44:11
Swivel	n/a		
MicroCAT	3247		08:44:26
2 x 17" glass	n/a		08:58:37
MicroCAT	3484		08:58:58
RCM11	451		09:07:55
MicroCAT	6819		09:10:08
4 x 17" glass	n/a		
Swivel	n/a		
Acoustic Release #1	1533	Record codes below	
Acoustic Release #2	1348	Record codes below	
500kg Anchor	n/a		09:15:16

Release #1 arm code [redacted]
Release #1 release code
Release #2 arm code
Release #2 release code
Argos beacon #1 ID 53157

Anchor Drop Position

Latitude 24.93288 **Longitude** -21.27319

Uncorrected water depth 4469 (at anchor launch)

Corrected water depth 4495 (at anchor launch)

RAPID-WATCH MOORING LOGSHEET **DEPLOYMENT**

Mooring **MAR0** Cruise **D382**

NB: all times recorded in GMT

Date 10/11/12 **Site arrival time** 10:10

Setup distance 3 cables

Start time 11:13:22 **End time** 11:30:17

Start Position

Latitude 25.1131 **Longitude** -52.0207

ITEM	SER NO	COMMENT	TIME
Recovery line	n/a		11:13:59
Billings Float	n/a		
with Light	Z02-022		
and Argos Beacon	A08-072	Beacon ID =121993	
~~2 x~~ 17” glass	n/a	3 glass	
Swivel			
MicroCAT	3284		11:20:43
MicroCAT	6324		
~~2 x~~ 17” glass	n/a	3 glass	11:22:52
MicroCAT	5788		
S4	35612564		11:24:21
MicroCAT	6809		11:25:52
MicroCAT	3903		
8 x 17” glass	n/a		11:26:43
SBE26 BPR	62		
SBE53 BPR	79		
Acoustic Release #1	923	Record codes below	
Acoustic Release #2	249	Record codes below	
600kg Anchor	n/a	descending 90 m min	11:30:17

Release #1 arm code [redacted] ipad plus 40 seconds

Release #1 release code

Release #2 arm code

Release #2 release code

Argos beacon #1 ID 121993

Anchor Drop Position

Latitude 25.1113 **Longitude** -52.0171

Uncorrected water depth 5430 (at anchor launch)

Corrected water depth 5489 (at anchor launch)

RAPID-WATCH MOORING LOGSHEET **DEPLOYMENT**

Mooring **MAR1L8** Cruise **D382**

NB: all times recorded in GMT

Date 09/11/12 **Site arrival time** overnight

Setup distance 1 cable

Start time 09:14:24 **End time** 09:23:04

Start Position

Latitude 24.1957 **Longitude** -49.7158

ITEM	SER NO	COMMENT	TIME
Recovery line	n/a		09:18:43
Billings Float	n/a		09:19:20
with Light	U01-078	on and flashing	
and Argos Beacon	A08-078	Beacon ID =on	
3 x 17" glass	n/a		09:20:09
3 x 17" glass	n/a		09:20:31
3 x 17" glass	n/a		09:21:07
BPR	0059		
BPR	0080		
Acoustic Release #1	822	Record codes below	
Acoustic Release #2	1203	Record codes below	
300kg Anchor	n/a	corrected 09:22:26	09:23:04

Release #1 arm code [redacted]
Release #1 release code [redacted]
Release #2 arm code [redacted]
Release #2 release code [redacted]
Argos beacon #1 ID 121997

Anchor Drop Position

Latitude 24.1953 **Longitude** -49.7140

Uncorrected water depth ________ (at anchor launch)
Corrected water depth 5221.5 (at anchor launch)

RAPID-WATCH MOORING LOGSHEET **DEPLOYMENT**

Mooring **MAR1** Cruise **D382**

NB: all times recorded in GMT

Date 8/11/2012 **Site arrival time** 16:08

Setup distance 5 miles

Start time 17:27 **End time** 21:35:27

Start Position

Latitude 24.1697 **Longitude** -49.8420

ITEM	SER NO	COMMENT	TIME
Recovery line	n/a		17:27
3 x Mini-Trimsyn	n/a		17:27
MicroCAT			17:27
24" syntactic float	n/a		17:30
with Light	Z02-023		
and Argos Beacon	A08-067	Beacon ID = 121988	
Swivel	n/a		
MicroCAT	5244		17:31
37" Steel Sphere			17:38:08
with Light	w03/094		
and Argos Beacon		Beacon ID = 82895	
Swivel	n/a		
MicroCAT	4060		17:41:42
MicroCAT	3281		17:45:22
MicroCAT	6834		17:48:55
MicroCAT	6839		17:52:51
MicroCAT	6838		17:58:51
8 x 17" glass	n/a		
Swivel	n/a		
MicroCAT	4062		
MicroCAT	6833		18:10:16
MicroCAT	3901		18:16:10
RCM11	519		18:31:07
MicroCAT	3904		18:34:37
8 x 17" glass	n/a		18:42:21
Swivel	n/a		
MicroCAT	7681		18:47:44
4 x 17" glass	n/a		
Swivel	n/a		
MicroCAT	3229		19:01:09
4 x 17" glass	n/a		19:13:18
Swivel	n/a		19:13:25
MicroCAT	6112	speed up	19:14:17
4 x 17" glass	n/a		19:25:26
Swivel	n/a		19:25:31

MicroCAT	3254		19:27:01
4 x 17" glass	n/a		19:38:39
Swivel	n/a		
MicroCAT	3225		19:39:37
MicroCAT	4468		19:50:53
5 x 17" glass	n/a		19:58:16
Swivel	n/a		
S4	35612565		20:14:11
MicroCAT	6798		
9 x 17" glass	n/a		20:22:54
Swivel	n/a		
Acoustic Release #1	1200	Record codes below	20:23:11
Acoustic Release #2	319	Record codes below	20:23:16
1800kg Anchor	n/a		21:35:27

Release #1 arm code
Release #1 release code
Release #2 arm code
Release #2 release code
[redacted]
Argos beacon #1 ID 121988
Argos beacon #2 ID 82895

Anchor Drop Position
Latitude 24.16529 N **Longitude** 49.74643 W

Uncorrected water depth 5162 (at anchor launch)
Corrected water depth 5212 (at anchor launch)

Time is 32 seconds off GMT.

RAPID-WATCH MOORING LOGSHEET **DEPLOYMENT**

Mooring **MAR2** Cruise **D382**

NB: all times recorded in GMT

Date 09:25:17

Site arrival time 10:08

Setup distance 15 cables

Start time 10:08

End time 11:29:22

Start Position

Latitude 24.1838 **Longitude** -49.7891

ITEM	SER NO	COMMENT	TIME
Recovery line	n/a		10:08:13
Billings float	n/a		10:08:33
with Light	Y01-018	on	
and Argos Beacon	z02-066	Beacon ID =on	
3 x 17” glass	n/a		10:09
Swivel	n/a		
MicroCAT	6811	20 m below join	10:10:52
5 x 17” glass	n/a		10:25:07
Swivel	n/a		
MicroCAT	3266		10:26:22
MicroCAT	3222		10:37:57
MicroCAT	3913		10:48:43
7 x 17” glass	n/a		10:55:40
Swivel	n/a		
S4	35612576		10:56:31
Acoustic Release #1	264	Record codes below	11:01:41
Acoustic Release #2	1197	Record codes below	
500kg Anchor	n/a	corrected 11:28:45	11:29:22

Release #1 arm code [redacted]
Release #1 release code
Release #2 arm code
Release #2 release code
Argos beacon #1 ID 53153

Anchor Drop Position

Latitude 24.1777 **Longitude** -49.7629

Uncorrected water depth ______ (at anchor launch)

Corrected water depth 5214 (at anchor launch)

RAPID-WATCH MOORING LOGSHEET **DEPLOYMENT**

Mooring **MAR3L8** Cruise **D382**

NB: all times recorded in GMT

Date 05/11/12

Setup distance 2 cables

Start time 16:01:49

Site arrival time 16:01:17

End time 16:08:09

Start Position

Latitude 23.8564 **Longitude** -41.1002

ITEM	SER NO	COMMENT	TIME
Recovery line	n/a		16:02:14
Billings Float	n/a		
with Light	z02-021		
and Argos Beacon	y01-010	Beacon ID =	
3 x 17” glass	n/a		16:05:26
3 x 17” glass	n/a		16:05:29
3 x 17” glass	n/a		16:05:32
BPR	0029		
BPR	0031		
Acoustic Release #1	927	Record codes below	
Acoustic Release #2	907	Record codes below	
300kg Anchor	n/a		16:08:09

obs going down

Release #1 arm code [redacted]
Release #1 release code [redacted]
Release #2 arm code [redacted]
Release #2 release code [redacted]
Argos beacon #1 ID 46492

Anchor Drop Position

Latitude 23.8565N **Longitude** 41.0988W

Uncorrected water depth 5014 (at anchor launch)
Corrected water depth 5055 (at anchor launch)

RAPID-WATCH MOORING LOGSHEET **DEPLOYMENT**

Mooring **MAR3** Cruise **D382**

NB: all times recorded in GMT

Date 05/11/12 **Site arrival time** 13:49:27

Setup distance 2.5 nm

Start time 13:53:21 **End time** 15:33:58

Start Position

Latitude 23.8629 **Longitude** -41.1383

ITEM	SER NO	COMMENT	TIME
Recovery line	n/a		13:53:06
Billings float	n/a		13:54:10
with Light	a1556		
and Argos Beacon	Y01-009	Beacon ID =46491	
2 x 17" glass	n/a		
Swivel	n/a		
MicroCAT	6841		13:54:19
2 x 17" glass	n/a		13:58:00
2 x 17" glass	n/a		
MicroCAT	6832		14:08:58
2 x 17" glass	n/a		14:18:14
Swivel	n/a		
MicroCAT	5245		14:19:46
2 x 17" glass	n/a		14:31:15
MicroCAT	5241		14:32:40
3 x 17" glass	n/a		14:42:51
MicroCAT	3268		14:44:30
Swivel	n/a		
S4 3xglass			14:56:42
MicroCAT	4178		14:58:01
MicroCAT	3900		15:09:38
7 x 17" glass	n/a		15:17:18
Swivel	n/a		
S4	35612577	s4 went in above glass	15:15:51
Acoustic Release #1	824	Record codes below	15:24:38
Acoustic Release #2	925	Record codes below	15:24:41
700kg Anchor	n/a		15:33:58

Release #1 arm code
Release #1 release code
Release #2 arm code
Release #2 release code
[redacted] ipad plus 30 sec

Argos beacon #1 ID 46491

Anchor Drop Position

Latitude 23.8701 **Longitude** -41.090

Uncorrected water depth 5015 (at anchor launch)
Corrected water depth 5056 (at anchor launch)

RAPID-WATCH MOORING LOGSHEET **DEPLOYMENT**

Mooring **NOG** Cruise **D382**

NB: all times recorded in GMT

Date 05/11/12

Site arrival time 20:17:48

Setup distance 1.5 nm

Start time 20:17:45

End time 21:36

Start Position

Latitude 23.7707 **Longitude** -41.1261

ITEM	SER NO	COMMENT	TIME
Recovery line	n/a		20:17:32
Billings Float	n/a		
with Light		light on	
12 x 17" glass	n/a		20:18:44
Swivel	n/a		
Sediment Trap	12283-01		20:24:41
~~Nortek~~ rcm11	644		
Sediment Trap	12168-03		20:31:33
~~Nortek~~ rcm11	646		
MicroCAT	7300		
10 x 17" glass	n/a		20:55:16
Acoustic Release #1	1350		21:02:56
Anchor	n/a		21:36:17

Release #1 arm code [redacted]

Release #1 release code

Anchor Drop Position

Latitude 23.7709N **Longitude** 41.0987W

Uncorrected water depth 4220 (at anchor launch)

Corrected water depth 4241 (at anchor launch)

RAPID-WATCH MOORING LOGSHEET **DEPLOYMENT**

Mooring **WB1** Cruise **D382**

NB: all times recorded in GMT

Date 17/11/12 **Site arrival time** 16:55:43

Setup distance 3.5 nm

Start time 16:56:08 **End time** 19:39:19

Start Position

Latitude 26.4577 **Longitude** -76.8613

ITEM	SER NO	COMMENT	TIME
Recovery line	n/a		16:59:06
30” syntactic float	n/a		16:59:10
with light	t05-079		
and Argos Beacon	46493	Beacon ID =46493	
Swivel	n/a		
Nortek	6723		16:59:20
MicroCAT	5778		16:59:27
45” syntactic float	n/a		17:12:03
with light	hol-009		
and Argos Beacon	253	Beacon ID = 42145	
Swivel	n/a		
Nortek	6088		17:32:21
MicroCAT	5783		17:35:23
10 x 17” glass	n/a		17:50:59
Swivel			
Nortek	6765		18:00:31
MicroCAT	6835		18:00:35
2 x 17” glass	n/a		18:16:29
Nortek	6534		18:16:38
MicroCAT	5776		18:16:41
10 x 17” glass	n/a		18:26:36
Swivel	n/a		
Acoustic Release #1	1201	Record codes below	18:26:45
Acoustic Release #2	1194	Record codes below	18:26:48
1800kg Anchor	n/a	started towing at 18:29:37	19:39:19

Release #1 arm code
Release #1 release code
Release #2 arm code
Release #2 release code [redacted]
Argos beacon #1 ID 46493
Argos beacon #2 ID 42145

ipad time plus 55 secs

Anchor Drop Position

Latitude	26.5104	**Longitude**	-76.8172

Uncorrected water depth	1354.5	(at anchor launch)
Corrected water depth	1363.0	(at anchor launch)

RAPID-WATCH MOORING LOGSHEET **DEPLOYMENT**

Mooring **WB2L9** Cruise **D382**

NB: all times recorded in GMT

Date 20/11/12

Setup distance 1 cable

Site arrival time 22:30

Start time 23:19 **End time** 23:23

Start Position

Latitude 26.5048 **Longitude** -76.7416

ITEM	SER NO	COMMENT	TIME
Recovery line	n/a		23:19:34
Billings Float	n/a		
with Light	a08-082	light on	
and Argos Beacon	a08-074	Beacon ID = 121995	
4 x 17” glass	n/a		
4 x 17” glass	n/a		23:19:51
4 x 17” glass	n/a		23:20:24
BPR	0002		
BPR	0060		
Acoustic Release #1	928	Record codes below	
Acoustic Release #2	920	Record codes below	23:23:32
600kg Anchor	n/a		23:23

Release #1 arm code
Release #1 release code
Release #2 arm code
Release #2 release code
[redacted]

Argos beacon #1 ID 121995

Anchor Drop Position

Latitude 26.5053 **Longitude** -76.7418

Uncorrected water depth 3851 (at anchor launch)

Corrected water depth 3870 (at anchor launch)

RAPID-WATCH MOORING LOGSHEET **DEPLOYMENT**

Mooring **WB2** Cruise **D382**

NB: all times recorded in GMT

Date 20/11/12 **Site arrival time** 16:00

Setup distance 6 miles

Start time 16:00 **End time** 20:00

Start Position

Latitude 26.4195 **Longitude** -76.7000

ITEM	SER NO	COMMENT	TIME
Recovery line	n/a		
3 x Mini-Trimsyn			16:02
MicroCAT	6119		16:02
30" syntactic float	n/a		16:07:20
with light	x01-052		
and Argos Beacon	y01-026	Beacon ID =46499	
Swivel	n/a		
RCM11	306		16:07:24
MicroCAT	3932		16:09:18
51" syntactic float	n/a		16:30:00
with light	x01-050		
and Argos Beacon	286	Beacon ID =22442	
Swivel	n/a		
RCM11	395		16:30:06
MicroCAT	7723	more like 10m below rather than 5	16:33:39
MicroCAT	6830		16:37:38
2 x 17" glass	n/a		16:44:00
Nortek	6747		16:44:07
MicroCAT	4717		16:48:10
MicroCAT	4721		16:53:19
2 x 17" glass	n/a		
Nortek	5889		16:58:25
MicroCAT	6836		17:01:40
MicroCAT	5774		17:06:16
10 x 17" glass	n/a		17:14:39
Swivel	n/a		17:14:45
Nortek	6805		17:14:55
MicroCAT	3228		17:17:59
Nortek	8052		17:25:33
MicroCAT	3206		17:25:43
5 x 17" glass	n/a		17:33:10
MicroCAT	3221		17:33:14
MicroCAT	3269		17:38:02
Nortek	8120		17:43:29
5 x 17" glass	n/a		

Swivel	n/a		
MicroCAT	6113		17:52:29
MicroCAT	6813		18:03:17
2 x 17” glass	n/a		18:09:51
Nortek	9204		18:10:02
5 x 17” glass	n/a		
MicroCAT	6805		18:19:21
MicroCAT	6815		18:37:52
10 x 17” glass	n/a		18:46
Swivel	n/a		
Acoustic Release #1	917	Record codes below	
Acoustic Release #2	323	Record codes below	20:00:00
2200kg Anchor	n/a	towing at 18:50	

Release #1 arm code [redacted]
Release #1 release code [redacted]
Release #2 arm code [redacted]
Release #2 release code [redacted]
Argos beacon #1 ID 46499
Argos beacon #2 ID 22442

0.5 knot running with ship S-N est. time of 4 hours based on RB1201
Mooring completed in 2.75 hrs hence long tow

ipad minus 10 secs

Anchor Drop Position
Latitude 26.5185 **Longitude** -76.7398

Uncorrected water depth 3811 (at anchor launch)
Corrected water depth 3829 (at anchor launch)

RAPID-WATCH MOORING LOGSHEET **DEPLOYMENT**

Mooring **WB4L9** Cruise **D382**

NB: all times recorded in GMT

Date 18/11/2012

Setup distance 1 cable

Start time 17.32

Site arrival time 17.32

End time 17:36:48

Start Position

Latitude 26.4735 **Longitude** -75.7031

ITEM	SER NO	COMMENT	TIME
Recovery line	n/a		17:32:12
Billings Float	n/a		
with Light	z02-019		17:32:35
and Argos Beacon		Beacon ID = z02-005	
4 x 17” glass	n/a		17:33:20
4 x 17” glass	n/a		17:34:03
4 x 17” glass	n/a		17:34:31
BPR	5336763-00		
BPR	5356939-005		
Acoustic Release #1	322	Record codes below	
Acoustic Release #2	256	Record codes below	
600kg Anchor	n/a		17:36:48

Release #1 arm code [redacted]

Release #1 release code

Release #2 arm code

Release #2 release code

Argos beacon #1 ID

ipad plus 55 sec

Anchor Drop Position

Latitude 26.4736 **Longitude** -75.7027

Uncorrected water depth 4656 (at anchor launch)

Corrected water depth 4691 (at anchor launch)

RAPID-WATCH MOORING LOGSHEET **DEPLOYMENT**

Mooring **WB4** Cruise **D382**

NB: all times recorded in GMT

Date 19/11/2012 **Site arrival time** overnight

Setup distance 4.5 miles

Start time 12:05:51 **End time** 17:23:11

Start Position

Latitude 26.4005 **Longitude** -75.6844

ITEM	SER NO	COMMENT	TIME
Recovery line	n/a		12:07:31
3 x Mini-Trimsyn		w03-092	12:07:34
MicroCAT	5247		12:07:39
32" syntactic float	n/a		12:16:21
with light	t05-076		
and Argos Beacon	z02-003	Beacon ID = 53128	
Swivel	n/a		
RCM11	399		12:16:26
MicroCAT	5484	moved down a few meters	12:18:06
49" syntactic float	n/a		12:35:40
with light		argos beacon id: 111853	
and Argos Beacon	z08-046	Beacon ID =	
Swivel	n/a		12:38:59
MicroCAT	3219		12:38:59
Nortek	5590		12:51:28
MicroCAT	6810		12:51:32
MicroCAT	3891		13:00:15
Nortek	5611		13:10:59
MicroCAT	3233		13:11:06
MicroCAT	5789		13:18:18
10 x Orange CF-16s	n/a		13:34:52
Swivel	n/a		
Nortek	5831		13:40:30
MicroCAT	6807		13:40:34
Nortek	5893		13:52:11
5 x Yellow CF-16s	n/a		13:59:12
MicroCAT	3234		14:01:05
5 x Yellow CF-16s	n/a		14:13:31
Swivel	n/a		
Nortek	5896	14:17:00	
MicroCAT	3232		14:17:05
5 x Yellow CF-16s	n/a		14:33:27
MicroCAT	6114		14:34:53
5 x Yellow CF-16s	n/a	slowing down ship because problems	15:05:46
Swivel	n/a	with crane need fixing.	

crane problems resolved 15:02

Nortek	5899		15:09:29
MicroCAT	6804		15:09:36
5 x Yellow CF-16s	n/a		15:24:08
Swivel	n/a	+ another microcat: 5486	15:25:46
Nortek	5955	rugby floats before	15:42:59
MicroCAT	6801	taped up wire after mc - split in plastic.	15:43:04
MicroCAT	6802		16:10:39
Nortek	6049	taking out 60m, replacing it with a 20m a	16:24:09
10 x 17” glass	n/a		
Swivel	n/a		
Acoustic Release #1	910	Record codes below	17:00
Acoustic Release #2	316	Record codes below	
2700kg Anchor	n/a		17:23:11

Release #1 arm code [redacted]
Release #1 release code [redacted]
Release #2 arm code [redacted]
Release #2 release code [redacted]
Argos beacon #1 ID 53128
Argos beacon #2 ID 111853

ipad = gmt + 61 seconds

Anchor Drop Position
Latitude 26.4819 **Longitude** -75.7028

Uncorrected water depth 4659 (at anchor launch)
Corrected water depth 4695 (at anchor launch)

RAPID-WATCH MOORING LOGSHEET **DEPLOYMENT**

Mooring **WB6** Cruise **D382**

NB: all times recorded in GMT

Date 14/11/12

Setup distance 3 cables

Start time 16:20:46

Site arrival time 16:18:41

End time 16:35:15

Start Position

Latitude 26.4906 **Longitude** -70.5238

ITEM	SER NO	COMMENT	TIME
Recovery line	n/a		16:20:51
Billings Float	n/a		
with Light	n08-027		
and Argos Beacon	a08-073	Beacon ID =	
3 x 17" glass	n/a		16:22:07
Swivel			
MicroCAT	4708		16:22:28
MicroCAT	5978		16:26:08
2 x 17" glass	n/a		
MicroCAT	4797		16:28
Nortek	6050		16:30:31
MicroCAT	4800		16:30:38
MicroCAT	6812		16:32:44
8 x 17" glass	n/a		16:33:08
SBE26 BPR	0394		
SBE53 BPR	0081		
Acoustic Release #1	819	Record codes below	
Acoustic Release #2	281	Record codes below	
600kg Anchor	n/a		16:35:15

Release #1 arm code
Release #1 release code
Release #2 arm code
Release #2 release code [redacted]
Argos beacon #1 ID 121994

ipad plus 48 seconds

descending 60 m min

Anchor Drop Position

Latitude 26.4942 **Longitude** -70.5226

Uncorrected water depth 5437 (at anchor launch)

Corrected water depth 5497 (at anchor launch)

RAPID-WATCH MOORING LOGSHEET **DEPLOYMENT**

Mooring **WBADCP** Cruise **D382**

NB: all times recorded in GMT

Date 22/11/12

Site arrival time 21:00

Setup distance 1 cable

Start time 21:04

End time 21:07:52

Start Position

Latitude 26.5249 **Longitude** -76.8675

ITEM	SER NO	COMMENT	TIME
Recovery line	n/a		
ADCP in float	10311	not released brought against ship	21:04:29
with Light	a08079		
and Argos Beacon	y01-012	Beacon ID = 46494	
Swivel	n/a		
Acoustic Release #1	906	Record codes below	
Acoustic Release #2	497	Record codes below	
800kg Anchor	n/a		21:07:52

Release #1 arm code [redacted]
Release #1 release code
Release #2 arm code
Release #2 release code
Argos beacon #1 ID 46494

Anchor Drop Position

Latitude 26.5251 **Longitude** -76.8676

Uncorrected water depth 606 (at anchor launch)

Corrected water depth 615 (at anchor launch)

RAPID-WATCH MOORING LOGSHEET **DEPLOYMENT**

Mooring **WBAL4** Cruise **D382**

NB: all times recorded in GMT

Date 22/11/12

Setup distance 1 cable

Start time 21.35

Site arrival time 21.30

End time 21.41.36

Start Position

Latitude 26.5247 **Longitude** -76.8761

ITEM	SER NO	COMMENT	TIME
Recovery line	n/a		21:35:02
Billings Float	n/a		
with Light	a08-078		
and Argos Beacon	z08-045	Beacon ID =111852	
4 x 17" glass	n/a		
4 x 17" glass	n/a		
4 x 17" glass	n/a		
BPR			
BPR			
Acoustic Release #1	1195	Record codes below	
Acoustic Release #2	320	Record codes below	
600kg Anchor	n/a		21.41.36

Release #1 arm code [redacted]
Release #1 release code
Release #2 arm code
Release #2 release code
Argos beacon #1 ID 111852

Anchor Drop Position

Latitude 26.5247 **Longitude** -76.8760

Uncorrected water depth 485 (at anchor launch)

Corrected water depth 493 (at anchor launch)

RAPID-WATCH MOORING LOGSHEET **DEPLOYMENT**

Mooring **WBH2** Cruise **D382**

NB: all times recorded in GMT

Date 22/11/12

Site arrival time 12:04:37

Setup distance 3 miles

Start time 12:05:46

End time ______

Start Position

Latitude 26.4338 **Longitude** -76.6019

ITEM	SER NO	COMMENT	TIME
Recovery line	n/a		12:06:05
Billings Float	n/a		12:06:59
with Light	a08-081		
and Argos Beacon	y08-081	Beacon ID = 46485	
12 x 17” glass	n/a		12:09:53
Swivel	n/a		
Nortek	9210		12:13:01
7 x 17” glass	n/a		12:28:47
Nortek	9213		12:30:00
Nortek	9435		12:51:00
3 x 17” glass	n/a		13:08:58
Swivel			
Nortek	5490		13:09:04
MicroCAT	3905		13:12:00
MicroCAT	6799	13:55:00	
3 x 17” glass	n/a	14:03:40	
RCM11	426	14:03:46	
MicroCAT	6800		14:06:46
5 x 17” glass			14:09:04
Acoustic Release #1	827	Record codes below	14:21:25
Acoustic Release #2	687	Record codes below	14:21:29
1550kg Anchor	n/a	towing at 14:10:15	14:50:07

Release #1 arm code [redacted]

Release #1 release code [redacted]

Release #2 arm code [redacted]

Release #2 release code [redacted]

Argos beacon #1 ID 46485

Anchor Drop Position

Latitude 26.4857 **Longitude** -76.6293

Uncorrected water depth 4678 (at anchor launch)

Corrected water depth 4714.3 (at anchor launch)

Appendices

A Configuration of Sea-Bird 911 CTD

```
Stainless CTD frame:

Date: 10/09/2012

Instrument configuration file:
C:\Program Files\Sea-Bird\SeasaveV7\D382\D382_0869_NMEA.xmlcon

Configuration report for SBE 911plus/917plus CTD
------------------------------------------------

Frequency channels suppressed : 0
Voltage words suppressed      : 2
Computer interface            : RS-232C
Deck unit                     : SBE11plus Firmware Version >= 5.0
Scans to average              : 1
NMEA position data added      : Yes
NMEA depth data added         : No
NMEA time added               : No
NMEA device connected to      : deck unit
Surface PAR voltage added     : No
Scan time added               : Yes

1) Frequency 0, Temperature

   Serial number : 03P-5494
   Calibrated on : 9 May 2012
   G             : 4.32432899e-003
   H             : 6.26209304e-004
   I             : 1.95955803e-005
   J             : 1.51713616e-006
   F0            : 1000.000
   Slope         : 1.00000000
   Offset        : 0.0000

2) Frequency 1, Conductivity

   Serial number : 04C-3698
   Calibrated on : 8 May 2012
   G             : -1.01569849e+001
   H             : 1.43967267e+000
   I             : -3.44059820e-003
```

```
J              : 3.39351246e-004
CTcor          : 3.2500e-006
CPcor          : -9.57000000e-008
Slope          : 1.00000000
Offset         : 0.00000
```

3) Frequency 2, Pressure, Digiquartz with TC

```
Serial number : 100898
Calibrated on : 6 January 2012
C1             : -4.405863e+004
C2             : -6.206030e-002
C3             : 1.337540e-002
D1             : 3.669100e-002
D2             : 0.000000e+000
T1             : 2.990734e+001
T2             : -3.493620e-004
T3             : 4.061200e-006
T4             : 3.043880e-009
T5             : 0.000000e+000
Slope          : 0.99995000
Offset         : -1.59900
AD590M         : 1.288520e-002
AD590B         : -8.271930e+000
```

4) Frequency 3, Temperature, 2

```
Serial number : 03P-5495
Calibrated on : 6 July 2012
G              : 4.38224268e-003
H              : 6.31026077e-004
I              : 2.02985691e-005
J              : 1.58183621e-006
F0             : 1000.000
Slope          : 1.00000000
Offset         : 0.0000
```

5) Frequency 4, Conductivity, 2

```
Serial number : 04C-3874
Calibrated on : 12 July 2012
G              : -1.05030174e+001
H              : 1.38921915e+000
I              : -1.00129763e-003
J              : 1.37088089e-004
CTcor          : 3.2500e-006
CPcor          : -9.57000000e-008
```

```
   Slope          : 1.00000000
   Offset         : 0.00000

6) A/D voltage 0, Free

7) A/D voltage 1, Free

8) A/D voltage 2, Altimeter

   Serial number : 47597
   Calibrated on : 10 March 2010
   Scale factor  : 15.000
   Offset        : 0.000

9) A/D voltage 3, Free

Scan length                  : 35


Spare Stainless CTD frame:
```

B VmDas control files

B.1 Bottom Track Off

```
;--------------------------------------------------------------------------------\
; ADCP Command File for use with VmDas software.
;
; ADCP type:     75 Khz Ocean Surveyor
; Setup name:    default
; Setup type:    Low resolution, long range profile(narrowband)
;
; NOTE:  Any line beginning with a semicolon in the first
;        column is treated as a comment and is ignored by
;        the VmDas software.
;
; NOTE:  This file is best viewed with a fixed-point font (e.g. courier).
; Modified Last: 27October2008
;--------------------------------------------------------------------------------/

; Restore factory default settings in the ADCP
cr1

; set the data collection baud rate to 38400 bps,
; no parity, one stop bit, 8 data bits
; NOTE:  VmDas sends baud rate change command after all other commands in
; this file, so that it is not made permanent by a CK command.
cb611

; Set for narrowband single-ping profile mode (NP), fifty (NN) 16 meter bins (NS),
; 8 meter blanking distance (NF)
WP0
NP00001
NN065
NS1600
NF0800

; DISABLE single-ping bottom track (BP),
; Set maximum bottom search depth to 1200 meters (BX)
BP000
BX12000

; output velocity, correlation, echo intensity, percent good
ND111100000

; One and a half seconds between bottom and water pings
TP000200
```

```
; Three seconds between ensembles
; Since VmDas uses manual pinging, TE is ignored by the ADCP.
; You must set the time between ensemble in the VmDas Communication options
TE00000150

; Set to calculate speed-of-sound, no depth sensor, external synchro heading
; sensor, no pitch or roll being used, no salinity sensor, use internal transducer
; temperature sensor
EZ1020001

; Output beam data (rotations are done in software)
EX00000

; Set transducer misalignment (hundredths of degrees)
EA00000

; Set transducer depth (decimeters); Correct for Discovery
ED00053

; Set Salinity (ppt) Is the tranducer really seawater? Maybe should be 0?
ES35

; save this setup to non-volatile memory in the ADCP
CK
```

B.2 Bottom Track On

```
;--------------------------------------------------------------------------------\
; ADCP Command File for use with VmDas software.
;
; ADCP type:     75 Khz Ocean Surveyor
; Setup name:    default
; Setup type:    Low resolution, long range profile(narrowband)
;
; NOTE:  Any line beginning with a semicolon in the first
;        column is treated as a comment and is ignored by
;        the VmDas software.
;
; NOTE:  This file is best viewed with a fixed-point font (e.g. courier).
; Modified Last: 27October2008
;-------------------------------------------------------------------------------/

; Restore factory default settings in the ADCP
cr1

; set the data collection baud rate to 38400 bps,
; no parity, one stop bit, 8 data bits
; NOTE:  VmDas sends baud rate change command after all other commands in
; this file, so that it is not made permanent by a CK command.
cb611

; Set for narrowband single-ping profile mode (NP), sixty five (NN) 16 meter bins (
; 8 meter blanking distance (NF)
WP0
NP00001
NN065
NS1600
NF0800

; ENABLE single-ping bottom track (BP),
; Set maximum bottom search depth to 1200 meters (BX)
BP001
BX12000

; output velocity, correlation, echo intensity, percent good
ND111100000

; One and a half seconds between bottom and water pings
TP000200

; Three seconds between ensembles
; Since VmDas uses manual pinging, TE is ignored by the ADCP.
```

```
; You must set the time between ensemble in the VmDas Communication options
TE00000150

; Set to calculate speed-of-sound, no depth sensor, external synchro heading
; sensor, no pitch or roll being used, no salinity sensor, use internal transducer
; temperature sensor
EZ1020001

; Output beam data (rotations are done in software)
EX00000

; Set transducer misalignment (hundredths of degrees)
EA00000

; Set transducer depth (decimeters); Correct for Discovery
ED00053

; Set Salinity (ppt) Is the tranducer really seawater? Maybe should be 0?
ES35

; save this setup to non-volatile memory in the ADCP
CK
```

C quick_adcp.py control files

q_py<sn>.cnt

The line `--pingtype nb` needs to be modified depending on whether the instrument is running in narrowband (`nb`) or broadband (`bb`) mode.

```
--yearbase 2012
--dbname di382<sn>nnx
--datadir /local/users/pstar/cruise/data/vmadcp/di382_os75/rawdata003
--datafile_glob *.ENX
--instname os75
--instclass os
--datatype enx
--auto
--rotate_angle 0.0
--pingtype nb
--ducer_depth 5
```

q_pyedit.cnt

```
#q_pyedit.cnt
##comments follow hash marks; this is a comment line
--yearbase 2012
--steps2rerun apply_edit:navsteps:calib:matfiles
--instname os75
--auto
#end of q_pyedit.cnt
```

q_pytvrot.cnt

```
# q_pyrot.cnt is
## comments follow hash marks; this is a comment line
--yearbase 2012
--steps2rerun navsteps:calib:matfiles
--auto
# end of q_pyrot.cnt
```

q_pyrot.cnt

```
#q_pyrot.cnt
## comments follow hash marks; this is a comment line
--yearbase 2012
--rotate_angle -3.42
--rotate_amp 1.00
--steps2rerun rotate:navsteps:calib:matfiles
--instname os75
--auto
#end of q_pyrot.cnt
```

D Mstar CTD steps

step	script	example infile(s)	example otfiles	comments	requires previous step
1	msam_01	none	sam_di382_016.nc	create empty sam file (eg list of vars is in sam_di82_varlist.csv) variable list file is kept in directory M_TEMPLATES	-
2	mctd_01	ctd_di382_016_ctm.cnv	ctd_di382_016_raw.nc	read in ctd data (may need to be edited for exact ctd file name)	-
3	mctd_02	ctd_di382_016_24hz.nc	ctd_di382_016_24hz.nc	rename SBE variable names	2
4	mctd_03	ctd_di382_016_24hz.nc	ctd_di382_016_1hz.nc ctd_di382_016_psal.nc	average to 1 hz and calculate psal, potemp	3
5	mdcs_01	None	dcs_di382_016.nc	create empty dcs file; this is used to store information about start, bottom and end of good data in ctd file	-
6	mdcs_02	dcs_di382_016.nc	dcs_di382_016.nc	populate dcs file with data to identify bottom of cast	3,5
7	mdcs_03	dcs_di382_016.nc	dcs_di382_016.nc ctd_di382_016_surf.nc	populate dcs file with data to identify start and end of cast	3,6
8	mdcs_04	dcs_di382_016.nc pos_di382_01.nc	dcs_di382_016_pos.nc	merge positions onto ctd start bottom end times (requires nav file)	7 & nav
			dcs_di382_016_pos.nc	apply positions to set of files. Any of this list have positions set if the file exists	
			ctd_di382_016_raw,nc ctd_di382_016_24hz.nc ctd_di382_016_1hz.nc	The list should be extended to include any other chemistry files, and the winch file if it exists	
9	mdcs_05	dcs_di382_016_pos.nc			8

			ctd_di382_016_psal.nc ctd_di382_016_surf.nc ctd_di382_016_2db.nc fir_di382_016_bl.nc fir_di382_016_time.nc fir_di382_016_winch.nc fir_di382_016_ctd.nc sal_di382_016.nc sam_di382_016.nc sam_di382_016_resid.nc dcs_di382_016.nc	It can be used at any time, once step 8 is complete	
10	mctd_04	ctd_di382_016_psal.nc	ctd_di382_016_2db.nc	extract downcast data from psal file using index information in dcs file; sort, interpolate gaps and average to 2db.	4,8
11	mfir_01	ctd_di382_016.bl	fir_di382_016_bl.nc	read in .bl file and create fir file	-
12	mfir_02	fir_di382_016_bl.nc ctd_di382_016_1hz.nc	fir_di382_016_time.nc	merge time from ctd onto fir file using scan number	4,11
13	mfir_03	fir_di382_016_time.nc ctd_di382_016_psal.nc	fir_di382_016_ctd.nc	merge ctd upcast data onto fir file	4,12
14	mfir_04	fir_di382_016_ctd.nc	sam_di382_016.nc	paste ctd fir data into sam file	1,13
15a	mwin_01	techsas_files	win_di382_016.nc	times extracted from start and end of ctd 1hz file, plus 10 minutes at either end	4
15	mwin_03	fir_di382_016_time win_di382_016.nc	fir_di382_016_winch.nc	merge winch wireout onto fir file (only relevant if winch data available)	12 & 15a
16	mwin_04	fir_di382_016_winch.nc	sam_di382_016.nc	paste win fir data into sam file	1,15
17	msal_01	none	sal_di382_016.nc	read in the bottle salinities	-
18	msal_02	sal_di382_016.nc	sam_di382_016.nc	paste sal data into sam file	1,17
19	msam_02	sam_di382_016.nc	sam_di382_016_resid.nc	calculate residuals in sam file	14,18

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