

## Appendix 5: JR152 & JR159 Cruise Report

27/09/06-20/10/06

**David Pond**

### **Introduction**

During the 3 weeks prior to JR161 the JCR was primarily engaged in logistical duties with limited time allocated to science activities. Forty eight hours were allocated to AFI16-16 for larval fish sampling using the RMT8 and neuston net. A further 6 days were allocated to mooring deployments, the western core box and acoustic calibrations. A PCO<sub>2</sub> analyser was also operated during this leg of the cruise. Sea conditions were generally rough during the 3 weeks and science time was lost from all science activities.

### **Non-toxic pumped seawater sampling**

**David Pond**

During passage from Montivideo samples were taken from the ships non-toxic pumped seawater supply. Large volume filtrations 100-125 litres were taken for PCB analysis and smaller volume filtrations taken for stable isotope (<sup>13</sup>C and <sup>15</sup>N) and fatty acid analysis (Table1).

Details of samples taken form the non-toxic pumped sea water filtrations for fatty acid, stable isotope and PCB analysis.

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DP Event	Date	Time (ship)	Lat	Long	N° carbouys	Salinity	Temp	Fluor.
PCB1	29/09/2006	20:25	40 02.50	56 04.43	4	-	-	-
PCB2	30/11/2006	05:11	41 44.65	56 17.02	5	34.04	5.15	1.00
PCB3	30/11/2006	10:30	42 52.58	56 25.50	5	34.02	7.29	0.43
PCB4	30/09/2006	16:10	44 03.52	56 34.57	5	34.00	7.31	0.40
PCB5	30/11/2006	22:11	45 19.41	56 44.53	5	34.07	7.43	0.65
PCB6	01/11/2006	04:11	46 31.85	56 54.32	4	34.03	7.18	1.58
PCB7	01/10/2006	01:12	47 40.68	57 03.79	4	34.03	5.7	0.47
PCB8	01/10/2006	16:00	48 50.87	57 13.47	5	34.02	5.61	0.41
PCB9	13/10/2006	10:20	53 19 60	39 35 11	5	33.92	0.58	0.36

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## ***Report on pCO<sub>2</sub> activities***

***Nick Hardman-Mountford , Elizabeth Jones***

### ***Introduction***

This report describes the implementation of pCO<sub>2</sub> (partial pressure of carbon dioxide) monitoring on James Clark Ross (JCR) during cruise JR152/159 during 3-21 October 2006. A Natural Environment Research Council (NERC) Capital Equipment Grant to CASIX covered the provision and temporary installation of the pCO<sub>2</sub> system on JCR. The pCO<sub>2</sub> system was built by the engineering company Dartcom. Participation in the cruise was through an Antarctic Funding Initiative (AFI) Collaborative Gearing Scheme (CGS) bid (CGS8/28). This funded sending Nick Hardman-Mountford (CASIX-PML, pCO<sub>2</sub> instrument expert) and Elizabeth Jones (CASIX-UEA, pCO<sub>2</sub> researcher) on the first scientific voyage of JCR with this instrument, with the aims of a) providing validation data for British Antarctic Survey (BAS) modeling activities over the long-term, b) tailoring the system to JCR for use in specific Southern Ocean conditions (e.g. large diatoms, sea ice), c) to train BAS and shipside in the necessary procedures for future near-autonomous operation.

Expectations prior to departure were that PML would install the instrument in Immingham prior to the ship's departure south. BAS would ensure the necessary NMEA and ancillary data streams were output to the instrument and that e-mail communications for the instrument were established. It was also intended that the instrument would run with basic shipside support (Deck Engineer) on the leg south to gain important data from the Atlantic Ocean. Mark Preston (BAS) would then take over science support of the instrument at first port of embarkation for scientific personnel.

The instrument was successfully installed in Immingham, although the NMEA/ancillary data streams and e-mail communications were not working adequately on departure from Immingham. Jeremy Robst (BAS) endeavoured to implement these during the leg south (departure 4<sup>th</sup> Sep 2006) but these were not implemented by the time of a major incident with the instrument on the 22<sup>nd</sup> Sep, at which point the instrument was turned off to await repair in Stanley. Therefore, the repair of the instrument has become the primary goal of this trip. The prior stated aims have also all been achieved as best possible.

### ***Summary of problems and actions taken to recover system performance***

#### **Flooding of valve tray gas loop**

##### **Initial assessment**

Analysis of the data file from the leg south showed a short-lived spike in pCO<sub>2</sub> on 12 Sep, coinciding with a quick clean of the equilibrator by the Deck Engineer. This in itself may not be indicative of a problem. On 14<sup>th</sup> Sep humidity in the equilibrator cycle began to increase and reached 100% on 15<sup>th</sup> Sep. This would have triggered an alarm, but no metatext record is entered for this event. pCO<sub>2</sub> values were reduced due

to the high humidity. The software was closed and restarted on 21<sup>st</sup> Sep although the reasons for this are not specified. The high humidity and low pCO<sub>2</sub> continued until 22<sup>nd</sup> Sep when another quick clean took place. Both pCO<sub>2</sub> and pressure values jumped at this point, 10-fold in the case of pCO<sub>2</sub>. At this point Dartcom were contacted and the system turned off. The changes in the equilibrator cycle were reflected in the other cycles to a lesser degree.

Initial inspection of the valve tray showed water had got into the valve tray via the equilibrator-in gas line. The marine air and equilibrator pumps were still working. Attempts to blow out some of the water through the V3 vent valve were initially unsuccessful, suggesting this valve could be stuck. However, it continued to make the right noises when turned on and off and further attempts showed this valve to be working properly. All the other valves were working properly.

### **Causes**

Water in the valve tray was fresh, not saline, so the flooding appears to have happened when the equilibrator was filled up for cleaning. Inspection of data for the leg south showed problems to have occurred following cleaning of the equilibrator (12<sup>th</sup> and 22<sup>nd</sup> Sep). This suggests that the equilibrator was overfilled, allowing water to push all the way through the gas lines and explains the high humidity and pCO<sub>2</sub> values on all readings.

### **Actions taken**

To attempt to dry out the valve tray components, the filters and various bits of tubing were disconnected and dried out using a low oven (40-60°C). A peristaltic pump was used to suck water out of the solenoid valve manifold, humidity sensor housings, LICOR and other sections of the gas loop, until thoroughly dry. A hairdryer was used to dry the humidity sensor.

Following this action, the LICOR was still not providing absorption output values so, in reference to the manual, the optical bench was taken apart for cleaning. The interior was covered in dry salts so was cleaned with a 50% ethanol solution, clean cotton swabs and lens tissues. This was not entirely effective, although it allowed some tarnishing of the gold and scratches (presumably from dried salts) to be identified. A second clean with a high-grade solvent cleaner (designed for electronic systems) improved the reflectivity of the gold tube, source and receptor ends.

Once all components were cleaned and dry, tubing was refitted. For the most part existing tubing and collars/clamps were reused, although a new length was required between the Swagelok T-piece and the input air filter, as this had been damaged during removal. Some new collars and clamps were also fitted. The tray was pressurized to 1.6 bar using the nitrogen standard and left overnight with the input pressure turned off. Reduction in pressure was negligible. Joints were also tested with Snoop and no leaks were found.

Recalibration of the LICOR was undertaken using software provided by LICOR. The zero for CO<sub>2</sub> was calculated using the nitrogen standard and the span gas used for CO<sub>2</sub> was the 450ppm standard as this gave the least variable reading (actual value used was 449.03ppm, as provided by UEA calibration of gases). The nitrogen gas was also

used to zero the H<sub>2</sub>O channel but marine air had to be used as the span gas because this allowed a positive dew point to be entered (the LICOR calibration software can only take positive dewpoints although the LICOR itself can read negative dewpoints). Dewpoints were calculated from relative humidity and temperature in the loop using the Magnus formulae (obtained from UK National Physical Laboratory website [http://www.npl.co.uk/thermal/faqs\\_humidity.html#dewpoint](http://www.npl.co.uk/thermal/faqs_humidity.html#dewpoint)). Recalibration was attempted after both the initial and second cleans.

Overnight operation of the LICOR following the initial clean showed an increasing trend in pCO<sub>2</sub> although H<sub>2</sub>O values remained stable. The low LICOR pressure values also showed an increasing trend. The second clean and recalibration appeared to reduce the high frequency variability on the pCO<sub>2</sub> readings but did not fix the increasing trend in pCO<sub>2</sub> or pressure. Breathing into the valve tray and around joints produced no CO<sub>2</sub> spikes, suggesting no leaks in the tray.

Ultimately, the problem with the LICOR could not be solved during the cruise. However, post-processing corrections applied to data collected between leaving KEP (9 Oct) and arrival in Stanley (20 Oct) may provide useable data for some of this period (data from after the 18<sup>th</sup> Oct appears to be best). Dartcom/PML have provided a replacement LICOR and filters, sent out with personnel for the next leg (JR161).

Swagelok taps were sent out from PML and UEA to be fitted to the gas lines in the top of the equilibrator. These will be closed during future cleaning to prevent water getting through the lines.

Dartcom are looking into a retrospective modification to the dryer design, allowing a flood reservoir to be fitted to the input gas lines.

The cleaning schedule has been amended to avoid this problem reoccurring.

## **Flow and LICOR pressure readings**

### **Initial assessment**

In addition to the other LICOR and valve tray problems, barometric pressure readings from the LICOR and flow meter readings were found to be extremely low (2-300mb and 3-7 sccm, respectively) when the system was restarted in Stanley.

### **Causes**

These problems were probably caused by over-pressurisation of the valve tray, although the point at which this occurred is not apparent from the data files.

### **Actions taken**

Mark Preston replaced the flow meter with a new unit provided by Dartcom. The LICOR was replaced with a new unit provided by Dartcom/PML on return to Stanley.

### **Final state**

Flow meter working properly.

### **Low 250 ppm CO<sub>2</sub> standard**

#### **Initial assessment**

The regulator on the 250ppm cylinder showed only 100 bar remaining, i.e. 100 bar had been used. The other two cylinders had used 10-20 bar each. This suggests a leak but no leak was identified on the cylinder or regulator. The pressure in this cylinder did not drop significantly during the cruise.

#### **Causes**

The cause of this problem is uncertain, but was probably a leak that has been fixed.

#### **Actions taken**

The cylinder and regulator were tested for leaks. No further actions were taken with respect to the fitting. Replacement standards for all gases were ordered from PML to be sent from the UK on RRS Ernest Shackleton and then transferred to JCR. If these are not required they can be returned to PML for use on other pCO<sub>2</sub> systems or retained by BAS for next season (to be discussed).

### **Final state**

The regulator and cylinder appear to be functioning properly, but need to be monitored.

### **Lack of NMEA/Ancillary data stream**

#### **Initial assessment**

Jeremy Robst (IT support) was aware of the need to provide an NMEA/ancillary data feed to the pCO<sub>2</sub> system but had not been able to implement this during the leg south. He logged a metatext message that these were 'to do' on 3<sup>rd</sup> Sep. Jeremy was not aware that underway NMEA (including GPS) and ancillary data were required during the leg south, so these were not logged by the ship. Therefore no ancillary data concurrent with pCO<sub>2</sub> data exists prior to this cruise.

#### **Causes**

During the cruise, attempts to provide the NMEA and ancillary data strings were held up because BAS data output strings do not normally have a check sum term.

#### **Actions taken**

Contact with Dartcom established the checksum was needed. This was then implemented by Jeremy Robst for the BAS strings.

The GPS string coordinates need the number of satellites to be output for the data to be logged in preference to the Iridium, when Iridium is showing zero.

## **Final state**

GPS co-ordinates, ancillary data and some NMEA data are now being received by the pCO<sub>2</sub> system and logged, where appropriate.

## **Lack of e-mail communications**

### **Initial assessment**

Attempts during the leg south to e-mail data from the pCO<sub>2</sub> system via the ship's mailserver were unsuccessful. Jeremy Robst was not able to fix this prior to this cruise. During the cruise it was found that the pCO<sub>2</sub> system would e-mail only the first address of the three listed, that it would do this for every record rather than waiting for a buffer to fill up and that attempts to change the mailserver or input a new DNS server would hang the system.

### **Causes**

The probable cause of the mail only being sent to the first address was identified as being the structure of the e-mail addresses. All three e-mail addresses were surrounded by angle brackets and separated by semi-colons, as follows:

```
<pco2@pml.ac.uk;colin@dartcom.co.uk;jpro@bas.ac.uk>
```

The BAS sendmail system interprets this as an attempt to use a routing address format. When sending multiple addresses BAS use the format:

```
<pco2@pml.ac.uk> , <colin@dartcom.co.uk> , <jpro@bas.ac.uk>
```

Note the angle brackets are around individual addresses, not the whole list. Also, addresses are separated by a comma, according to the RFC, but most e-mail systems accept either a comma or semicolon, including BAS systems. Section 3.4 of RFC2822 has details (<http://www.faqs.org/rfcs/rfc2822.html>).

### **Actions taken**

Dartcom were contacted with these details to determine any changes to the source code that were necessary. This is not straightforward because the routine used by Dartcom has been used successfully for many other applications over many years.

An interim solution was provided by Jeremy Robst: the pCO<sub>2</sub> system sends an e-mail to a single onboard e-mail address which then concatenates the mime output into one file and sends it out to other e-mail recipients every 6 hours.

## **Final state**

The interim on-board system is working properly. A software upgrade by Dartcom is pending.

## **Dryer blockage**

### **Initial assessment**

During testing of the valve tray, it was noticed that the marine air line was blocked.

### **Causes and actions taken**

This was initially thought to be caused by the input filter to the line being frozen, so this was defrosted and an inverted funnel fitted to the input to prevent water accumulating at the narrow aperture of the filter input. However, this was found not to be the cause of the problem. The blockage was then traced to the dryer. Turning off the dryer for a while released the blockage and quite a bit of water was pumped from the dryer reservoir. It appears that the dryer was frozen, perhaps from being left in cooling mode when the pCO<sub>2</sub> system control screen was changed from automatic to manual operation. Gas lines were disconnected from the dryer and all water was removed from the dryer before turning the dryer back on. The dryer gradually reduced the humidity of the marine air and equilibrators gases, but with a much lower efficiency than before. Rebooting the live pCO<sub>2</sub> software fixed this problem and caused the dryer to work efficiently again.

The problem repeated on 18<sup>th</sup> Oct during normal operation. The marine air lines into and then out from the dryer were systematically disconnected to check that this was where the blockage could be found. The system was then powered down, the equilibrators in and out gas lines to/from the dryer were disconnected (to prevent any water ingress when the dryer was turned off) and the whole system was left to stand for 2 hours, allowing time for the dryer to thaw out. The system was then powered up and the dryer pump operated in manual mode to empty the water reservoirs (although nothing was found in these). Finally, when satisfied that there was no water in the dryer, all the gas lines to the dryer were reconnected and the system switched back to automatic operation. This procedure should be followed if the problem recurs.

### **Final state**

The dryer is working properly.

While continued running in manual mode for testing the system may have caused the dryer to freeze up the first time, this is not certain and was certainly not the case the second time. Prolonged system testing is unusual away from Dartcom, however, modifications to the control system are required so that the dryer is not left either cooling or turned off for prolonged periods, e.g. while systems are being tested. The former could cause freezing and the latter could allow water ingress to the valve tray.

### **Other activities**

During the cruise, Mark Preston was trained in the day-to-day scientific support of the instrument, including equilibrators cleaning procedures.

Elizabeth Jones supplemented the pCO<sub>2</sub> data obtained with water samples for dissolved inorganic carbon (DIC) and total alkalinity (TA). These were taken from the ship's non-toxic underway seawater supply and fixed with mercuric chloride for analysis back at UEA. Samples were taken coincident with CTD stations in the

western core box and every 6 hours along the transect from South Georgia to Stanley, with a higher frequency of every 3 hours in the vicinity of the Polar Front.

Remote sensing support was provided to the cruise by the NERC Earth Observation Data Service (NEODAS), hosted at PML. Composites of SST and chlorophyll data from satellite were provided every 2-3 days (see Fig. 1). Cloud covered much of the area of work, but information on the position of the Polar Front and areas of bloom developed off South Georgia was useful.

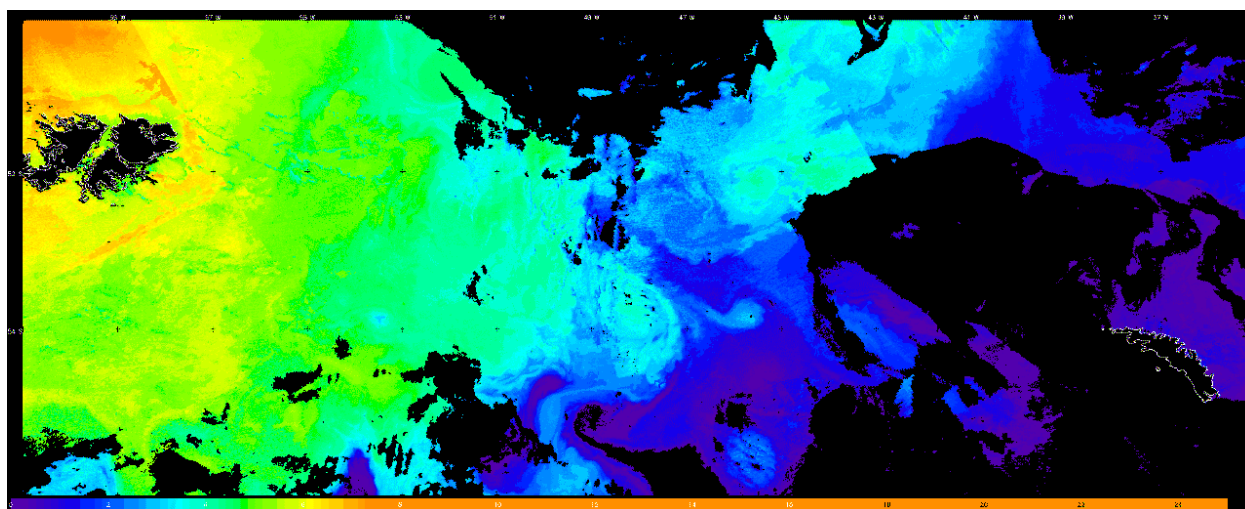


Fig. 1. SST composite from MODIS Aqua for the period 26 Sep to 2 Oct 2006, showing the position of the Polar Front between the Falklands (left) and South Georgia (right). Provided by NEODAS.

## ***Lessons learned***

### **Communication is the key to successful operations.**

Breakdown in communication at a number of points, both technical and personal, have been behind a number of the problems encountered. If near-real time (NRT) e-mail communications between the pCO<sub>2</sub> system and Dartcom/PML had been established on departure from Immingham, the water ingress problems could have been spotted earlier and the severe damage to the system potentially avoided. A gap in the communication of the need for ship's underway data logging meant that valuable data collected by the pCO<sub>2</sub> instrument on the leg south cannot be processed to the highest possible standards. Conversely, good communications between the ship, PML and Dartcom during this cruise have allowed for many of the problems encountered to be adequately dealt with and repairs made where necessary. Good communications between the ship and Dartcom/PML, by telephone and e-mail, must be maintained if this trial is to succeed.

### **Training of pCO<sub>2</sub> system operators is essential.**

Another contributing factor to the problems encountered has been the lack of adequate training so far. This was looked into and accepted as not feasible before the cruise, but must be prioritised for the future. Simon Wright (shipside, Deck Engineer) was given very basic level training before departure from Immingham, which he passed on to Doug Trevy (shipside, Deck Engineer) when the crew changed over. Mark Preston



has been trained in operation of the system for this season during this cruise but should attend further training at Dartcom if he is to be responsible for the instrument over future seasons. Ideally, more than one responsible person needs to be trained so operations are not dependent on one person and it would also be useful if both BAS technical personnel and the ship's Deck Engineers could be trained.

### **Appropriate spare parts should be kept on board**

Expense precludes providing a full set of spare parts for each pCO<sub>2</sub> system, but provision of a basic set of Swagelok fittings, tubing, Snoop leak detector, filters and regulator as a minimum has proved useful on this cruise. Spare gas cylinders should also be provided in future (these have been ordered). Other (small) parts can be transported by scientific personnel heading south, as has been undertaken during the changeover between this cruise and JR161.

### **Major risks to the system are water ingress and over-pressurisation.**

These risks are well known and the diagnostic sensors in the tray have worked adequately in alerting to these. These failure modes are the most likely to cause full system shutdown so must be avoided at all costs. Any evidence of these must be treated with the utmost urgency.

### **Southern Ocean specific problems**

So far, the harsh Southern Ocean environment has not caused significant problems for the instrument. The freezing-up of the marine air line may be partly attributable to negative air temperatures, but this has only been a minor issue and appropriate procedures have been established to deal with it. The cruise has not encountered blockage by large diatoms but these may become an issue later in the season. It has also not been exposed to the lowest temperatures or sea ice. Ongoing assessment of these possible issues needs to be undertaken throughout the season.

### **Conclusion**

Despite a difficult start, the operation of the pCO<sub>2</sub> system throughout this cruise has been broadly successful, although with provisos to data quality. Good communication between the ship and PML/Dartcom appear to be the key to successful implementation of the trial throughout the season, so these must be maintained at all times.

## **Gene Flow in Antarctic Fishes (AF16-16):**

**Jenny Rock, Bill Hutchinson (leg 1); Martin Collins, leg 2**

This research examines the influence of oceanographic processes, bathymetry and life history variation on dispersal and gene flow in two Antarctic fishes (*Champscephalus gunnari*, *Notothenia rossii*) that differ in the distribution of eggs and larvae and longevity. Molecular markers (microsatellites and mtDNA) are being used to characterise population structure at both circumpolar and regional geographic scales, which will then be compared with predictions from oceanographic models.

### **Objectives**

Broadly, to quantify the degree of population genetic structuring, larval dispersal, and influence of oceanography on two fish species with contrasting life histories. Specifically for **JR 152**, to sample aggregations of *C. gunnari* and *N. rossii* larvae for genetic analysis to test dispersal patterns predicted by oceanographic modelling.

Sampling will occur:

- a) at a coarse-scale level across the Scotia Sea, including the area between the southern and northern extremes (South Orkneys and South Georgia/Shag Rocks, respectively) and between South Georgia and Shag Rocks themselves;
- b) at a fine-scale level along the coast of South Georgia, e.g. comparing NW with NE waters, and N coast with SW coast.

### **Work at sea to date (20-10-06; end of first leg of cruise)**

To collect larval fish of both species, two types of fishing gear are prepared for use: the Neuston net and RMT8 net. Due to weather conditions and other constraints of sampling time, to date we have been unable to deploy the neuston net. The RMT8 (rigged with paired nets) has been deployed a total of seven times. Six of these deployments involved fishing each of the paired nets sequentially for approximately 30 minutes each at depths ranging from 20-90 m; the 7th deployment had to be aborted due to poor weather after only a few minutes fishing. Deployments were made onto or over shelf waters, generally between 100-250 m, and occurred in two locations: Royal Bay (54.30 S, 36.0 W) and Shag Rocks (53.40 S, 41.0 W).

Due to previously mentioned constraints, nets were deployed at suboptimal times (daylight hours) and due to weather conditions were limited to depths greater than 20 m (which is also considered suboptimal for sampling larval aggregations). Catch was extremely low for larvae, as well as for pelagic crustaceans such as krill and amphipods.

At Royal Bay two larvae were caught at depths of between 30-50 m, both of these were identified as *Chaenocephalus aceratus*. At Shag Rocks 5 larvae and two eggs were caught. One larvae, captured at approximately 30 m depth was identified as the target species *C. gunnari* and measured 33mm total length. Three larvae were identified as putative *Patagonotothen larseni* (these identifications will be confirmed

using molecular methods) with total lengths ranging from 27-33 mm. One larvae was significantly damaged by the net and will be identified by molecular methods, as will the two eggs.

A further 24 h of fishing time remains allocated to JR152 for the second leg of the cruise, to be carried out by Martin Collins.

## Acoustic Report

**Peter Enderlein, Sophie Fielding, Nathan Cunningham, Mark Preston**

### Introduction:

The EK60 has been run routinely on the JCR since 2003. Detailed operating instructions can be found in either the cruise reports of JR96, JR100 and JR116 or within the operating protocols that can be found on the EK60 computing machines. The EK60 was run continuously throughout this cruise with a 2 second ping rate, although logging of the data was not continuous due to network issues and the running of the swath bathymetry system.

### SSU settings

During the passage from Stanley to South Georgia, the swath bathymetry (EM120) system was switched on and run through the SSU grouped with the EA500. The EM120 was set to active, whilst the EA500 was passive and time usage was calculated. The EK60 maintained a 2 second ping rate and was independent of the SSU. Interference from the EM120 is obvious.

During the Western Core Box the EK60 and EA500 were run together through the SSU, the EM120 and ADCP was switched off. Mode was EM EA&EK TO. The EM120 trigger was off. The EA500 was in active mode and set to external trigger by the bridge, the SSU trigger was on and time usage was set to Tx Pulse. The EK60 trigger was on and the time usage was calculated. Ping control by the ER60 software was set to 2 seconds. The bridge was asked to turn off the bridge Doppler logger to prevent shelf interference. All other ships echosounders, apart from the EA500, should be turned off if the Captain is willing.

A new group on the SSU has been established in order to undertake combined EK60, EA500 and ADCP measurements at a frequency acceptable to both the biologists and physicists (note the WCB needs a minimum of a 2 second ping rate for the EK60).

Survey for?	Mode	Group									
		EM120		EA600		EK60		TOPAS		ADCP	
		Trigger	Time usage	Trigger	Time usage	Trigger	Time usage	Trigger	Time usage	Trigger	Time usage
Swath bathymetry	EM&EA EK TO AD	Active, external	Calculated	Passive, external	Calculated	Active, internal, interference	User defined	x	x	Active, internal, interference	User defined
Biology/EK60	EM EK&EA TO AD	Off	x	Active, external	TX pulse	Active, external	Calculated	x	x	x	X
Physics/ADCP	EM EK EA TO AD	Off	Off	Off	Off	Off	Off	x	x	Active, internal	User defined
Biology/physics compromise	EM EA&EK&AD TO	Off	Off	Active, external	Tx Pulse	Active, external	Calculated	x	x	Active&, external	Tx pulse

\* EM = EM120 swath bathymetry, EA = EA500 bathymetry, EK = EK60 biological echosounder, TO = Topas sub bottom profiler, AD = ADCP Acoustic Doppler Current Profiler.

& Check ADCP setup file CX1,3 Bottom tracking mode off

As yet, no method has been created to run the ADCP within the core box survey. However, it should be possible within the new group setting of EM EA&EK&AD TO. There will likely have to be a compromise from the physicists regarding bottom pinging (not necessarily compatible with the SSU), but a dedicated time is required onboard the ship to really establish compatible instruments and correct settings. A recommendation would be to use the ships trials after refit to undertake on-shelf/off-shelf transects in a dedicated time allocation.

### **General narrative:**

The Western Core Box (WCB) acoustic survey was run in the normal west to east direction. W1.1 was started at 08:57 GMT 13 October 2006 at the southern end, all XBTs were successfully undertaken. The sea was calm (!) and there was little dropout on transect W1.1 or W1.2. Immediately after the end of W1.2 transect 3 RMT8 net hauls were undertaken. The first (Event 9), was fished returning back off shelf along the transect W1.2 on small marks between 130 and 150 m. The catch consisted predominantly of salps. The second net (Event 10) was undertaken near the beginning of transect W1.1 on a strong deep scattering layer that was present at the beginning of the WCB survey. The net was fished at a depth of ~265 m and returned with 6 myctophid fish and a few euphausiids – predominantly *Euphausia triacantha*. Unfortunately this sample was disposed of before further investigation could be made. The third net undertaken on the first WCB day (Event 11) was close to the surface between 0 and 20 m, unfortunately the mark originally expected to be fished had disappeared. This net event brought up only a few euphausiids and was not kept. A shallow and a deep CTD were undertaken overnight before the second transect commenced at 09:00 14 October 2006. The weather deteriorated rapidly over the period of W2.1 and W2.2 (far more in keeping with typical WCB weather!) and neither nets or CTDs were undertaken after the transects had finished. At this point, with the weather forecast in hand, it was decided to abort the WCB and run for shelter.

### **EK60 settings and operation:**

#### **Software versions, hardware**

Simrad ER60 v. 2.0

Sonardata Echolog 60 v 4.05

Sonardata Echoview v 4.0.75.6342 Live viewing and processing

HASP Dongle BAS3 licensed for base, bathymetry, analysis export, live viewing, school detection and virtual echogram was used to run the echolog and echoview in live viewing mode. It was intended to use the analogue BAS1 HASP, however it appears that the dongle is slightly damaged and the connection is intermittent. Therefore processing of the WCB data was undertaken using the BAS1 dongle (screwed tightly into a parallel port to get it to work!).

The echosounder pc AP10 and the EK60 workstation 2 are integrated into the ship's LAN. ER60 .raw data files were logged to a Sun workstation jrua, using a Samba connection, which is backed up at regular intervals. Echolog was run on workstation 2 and wrote compressed files also directly to the Sun workstation via a Samba connection.

## Echolog compression settings

Final compression settings used in Echolog for all frequencies:

- 6) Power data only (angle data is still available from the raw files)
- 7) From 0 to 300 m data only (data from deeper is available from the raw files)
- 8) Average samples where both Sv below -100 and TS below -20
- 9) Maximum number of samples to average: 50
- 10) DO NOT use average samples below echosounder detected bottom unless sure of bottom detection

## Data processing

Data processing utilised the WCBtemp.ev template that is on the Echoview workstation. Dropout and interference was removed, data were averaged into 100 sec intervals horizontally and 3 m vertical bins. Krill biomass estimates were calculated assuming a TS of -39 dB per Kg for Antarctic krill (NOTE – this value was not calculated using in situ length data and may be subject to validation). The average biomass for the two transects was calculated to be 25 gm<sup>-2</sup>.

## EK60 (ER60) settings

Variable	38 kHz	120 kHz	200 kHz
Ping interval (per sec)	2	2	2
Salinity (PSU)	34	34	34
Temperature (°C)	1	1	1
Sound velocity (m/s)	1453	1453	1453
Mode	Active	Active	Active
Transducer type	ES38	ES120-7	ES200-7
Transceiver Serial no.	009072033fa5	00907203422d	009072033f91
Transducer depth (m)	0	0	0
Absorption coef. (dB/km)	10.07	26.27	39.8
Pulse length (ms)	1.024	1.024	1.024
Max Power (W)	2000	500	300
2-way beam angle (dB)	-20.70	-20.70	-19.60
Sv transducer gain (dB)	24.07	21.38	22.03
Sa correction (dB)	-0.63	-0.39	-0.31
Angle sensitivity along	22	21	23
Angle sensitivity athwart	22	21	23
3 dB Beam along	-0.02	-0.12	0.17

<b>3 dB Beam athwart</b>	0	-0.07	-0.24
<b>Along offset</b>	6.96	7.48	6.44
<b>Athwart offset</b>	6.88	7.48	6.43

### ***CTD operations***

The CTD was successfully deployed at 2 stations.

### ***Problems:***

During the transect from Stanley to South Georgia the EK60 38 kHz signal was extremely noisy. This feature was also noted during cruise JR129 and was discovered to have been solve by replacing the 38 kHz GPT (Serial No. 00907203400b). This process was undertaken during this cruise also. The serial number of the 38 kz GPT being used during this season is 009072033fa5

Echolog appeared to be extremely temperamental this trip and stalled regularly if used to compress files in real time, although live viewing could be run permanently if no compression was used. Ultimately, Jeremy discovered that there was a problem with new Samba software Ver. 3.0.23c loaded onto the Sun server. Reloading the older version (Ver. 2.2.12) fixed the problem and normal Echolog saving could resume.

Both the EK60 main processor and the EK60 workstation computers were networked differently this cruise – onto a more secure network. There were some teething problems after this that were fixed by Jeremy Robst actually.

A comcontainer.exe error arose on several occasions with the ER60 software, crashing the EK60 echosounder. This seems to arise when there is a conflict between the SSU and the EK60 and requires the power cycling of the EK60 and turning the trigger off on the SSU.

### ***Calibration:***

An acoustic calibration was carried out in Stromness Harbour, South Georgia between the 13 and 14<sup>th</sup> October 2006. Standard EK60 calibration procedures were undertaken for a calibration of each transducer as documented for previous cruises on the 13 October 2006. Each frequency was calibrated (with the other frequencies switched off) with standard copper spheres and a pulse duration of 1.024 ms. All unnecessary ships noise was turned off and ships discharge over the side was ceased. A CTD was conducted prior to the start of the calibration and sound velocity calculated using Francois and Garrison (1989) for the depth of the target (Temperature = 1°C, Salinity = 33.75, Sound velocity = 1453). Slightly different from previous calibrations was the requirement to undertake at least 300 points per calibration (this was to examine the controls on a good calibration). The 120 kHz target appeared to have some noise above it as viewed in the echogram and it was decided to repeat this calibration during the next set of calibrations.

On the 14<sup>th</sup> October a second calibration was undertaken, in a similar manner, but on this occasion all frequencies were left on during calibration (except for the 120 kHz repeat). At a first look it appears that there is little difference between calibration values and that it may be possible to undertake future calibrations within conditions

more similar to survey conditions (i.e. noise left on as well as all transducers left on). During the 38 kHz calibration a tungsten carbide sphere was also hung under the transducers (below the copper sphere). The EK60 settings after calibration are given above, these were implemented on the 14th October 2006.

Calibration details are as follows for each frequency. The following filenames were uploaded as the calibration constants. Cal38khz\_061006\_mod, cal\_07100\_120khzalone\_mod, cal200khz\_20061006\_cal

### 38 kHz calibration

```
# Calibration Version 1.0.0.9
#
# Date: 2006-10-06
#
# Comments:
#
# Reference Target:
# TS -33.80 dB Min. Distance 22.00
m
# TS Deviation 3.0 dB Max. Distance 28.00
m
#
# Transducer: ES38 Serial No. 0090720335
# Frequency 38000 Hz Beamtype
Split
# Gain 24.24 dB Two Way Beam Angle -20.7
dB
# Athw. Angle Sens. 22.00 Along. Angle Sens.
22.00
# Athw. Beam Angle 6.91 deg Along. Beam Angle 6.94
deg
# Athw. Offset Angle 0.03 deg Along. Offset Angle -0.03
deg
# SaCorrection -0.64 dB Depth 0.00
m
#
# Transceiver: GPT 38 kHz 009072033fa5 1 ES38
# Pulse Duration 1.024 ms Sample Interval 0.186
m
# Power 2000 W Receiver Bandwidth 2.43
kHz
#
# Sounder Type:
# EK60 Version ComSounder
#
# TS Detection:
# Min. Value -50.0 dB
# Max. Beam Comp. 6.0 dB Min. Echolength 80
%
# Max. Phase Dev. 8.0 Max. Echolength 180
%
#
# Environment:
# Absorption Coeff. 10.1 dB/km Sound Velocity 1453.0
m/s
#
# Beam Model results:
```



```

#   Transducer Gain      = 24.07 dB           SaCorrection           = -0.63
dB
#   Athw. Beam Angle     = 6.88 deg           Along. Beam Angle       = 6.96
deg
#   Athw. Offset Angle   = 0.00 deg           Along. Offset Angle    =-0.02
deg
#
#   Data deviation from beam model:
#   RMS =      0.14 dB
#   Max =      0.47 dB No. =    129 Athw. = -2.9 deg Along =  0.2
deg
#   Min =     -0.44 dB No. =    147 Athw. =  0.5 deg Along = -4.8
deg
#
#   Data deviation from polynomial model:
#   RMS =      0.10 dB
#   Max =      0.42 dB No. =    129 Athw. = -2.9 deg Along =  0.2
deg
#   Min =     -0.24 dB No. =    229 Athw. =  1.4 deg Along =  2.7
deg
#
#   Data:
#   No.      Time      Distance  TS-c    TS-u      Athw.    Along    Sa
#           [m]       [dB]     [dB]     [deg]    [deg]
# [m2/nm2]
#
  1  19:25:12.35  24.85  -34.22  -34.24     0.03     0.16    3088
  2  19:25:49.35  24.85  -34.14  -34.17    -0.03     0.22    3078
  3  19:26:02.35  24.85  -34.09  -34.20    -0.22     0.35    3093
  4  19:27:33.37  24.86  -34.50  -34.52     0.23    -0.10    2922
  5  19:27:37.38  24.87  -34.56  -34.64     0.35    -0.29    2864
  6  19:27:45.37  24.93  -34.65  -35.08     0.74    -0.61    2679
  7  19:27:47.37  24.94  -34.57  -35.12     0.80    -0.74    2619
  8  19:27:50.38  24.95  -34.49  -35.48     1.06    -0.99    2382
  9  19:27:51.38  24.96  -34.62  -35.66     1.06    -1.06    2275
 10  19:27:58.38  24.98  -34.15  -36.30     1.50    -1.50    1936
 11  19:28:02.38  24.98  -34.14  -36.19     1.50    -1.44    1980
 12  19:28:07.37  25.00  -34.12  -37.62     1.89    -1.95    1403
 13  19:28:15.37  25.02  -34.10  -39.23     2.27    -2.40     958
 14  19:28:16.38  25.03  -34.08  -39.47     2.34    -2.46     902
 15  19:28:25.38  25.04  -34.22  -41.87     2.78    -2.97     530
 16  19:28:30.38  25.03  -33.90  -40.46     2.59    -2.72     717
 17  19:28:47.39  25.01  -34.45  -43.27     3.17    -3.04     379
 18  19:29:11.38  25.17  -34.31  -40.56     2.21    -2.91     708
 19  19:29:22.39  25.14  -34.36  -38.65     1.82    -2.40    1120
 20  19:29:25.38  25.13  -34.63  -38.53     1.76    -2.27    1156
 21  19:29:30.38  25.17  -34.29  -37.64     1.38    -2.27    1387
 22  19:29:36.41  25.22  -33.87  -36.68     0.99    -2.21    1685
 23  19:29:42.40  25.31  -34.61  -36.93     0.48    -2.14    1682
 24  19:29:46.40  25.35  -34.61  -36.71     0.16    -2.08    1712
 25  19:29:50.40  25.38  -34.18  -36.18    -0.22    -2.02    1891
 26  19:29:57.41  25.43  -34.15  -36.48    -0.67    -2.08    1791
 27  19:30:03.40  25.53  -34.14  -36.55    -1.05    -1.95    1757
 28  19:30:09.40  25.58  -33.74  -36.82    -1.50    -2.02    1588
 29  19:30:14.40  25.62  -33.97  -37.79    -1.95    -2.02    1311
 30  19:30:24.40  25.71  -33.97  -38.37    -2.33    -1.89    1141
 31  19:30:25.41  25.72  -33.97  -38.40    -2.40    -1.82    1120
 32  19:30:29.40  25.76  -33.60  -38.92    -2.71    -1.89     966
 33  19:30:35.40  25.80  -33.76  -40.46    -3.23    -1.82     698
 34  19:30:39.40  25.88  -34.04  -41.66    -3.48    -1.89     531
 35  19:30:41.40  25.91  -33.94  -41.91    -3.61    -1.82     490

```

36	19:30:50.41	25.92	-33.65	-42.79	-3.99	-1.63	395
37	19:30:52.41	25.92	-33.62	-43.05	-4.12	-1.44	373
38	19:30:56.40	25.90	-34.09	-44.31	-4.38	-1.12	282
39	19:30:57.41	25.90	-34.25	-44.66	-4.44	-0.99	262
40	19:31:04.41	25.88	-34.40	-46.37	-4.82	-0.55	181
41	19:31:10.40	25.80	-34.65	-46.30	-4.76	-0.48	185
42	19:31:17.40	25.76	-34.04	-43.63	-4.31	-0.48	326
43	19:31:23.40	25.71	-34.23	-42.21	-3.93	-0.48	472
44	19:31:29.40	25.61	-33.74	-40.10	-3.48	-0.61	761
45	19:31:35.40	25.57	-33.52	-38.60	-3.10	-0.61	1062
46	19:31:38.40	25.54	-33.83	-38.17	-2.84	-0.67	1204
47	19:31:42.40	25.50	-34.12	-37.73	-2.59	-0.61	1373
48	19:31:43.40	25.44	-34.16	-37.63	-2.52	-0.67	1437
49	19:31:47.41	25.42	-34.10	-36.99	-2.27	-0.74	1565
50	19:31:53.41	25.38	-33.97	-35.86	-1.76	-0.80	2053
51	19:31:58.41	25.33	-34.36	-35.64	-1.37	-0.80	2237
52	19:32:04.41	25.23	-34.18	-34.99	-0.99	-0.80	2524
53	19:32:11.41	25.18	-34.41	-34.96	-0.61	-0.86	2568
54	19:32:16.41	25.13	-34.28	-34.59	-0.16	-0.80	2909
55	19:32:27.41	25.06	-34.42	-34.95	0.10	-1.06	2653
56	19:32:34.41	25.03	-34.00	-35.09	-0.03	-1.50	2479
57	19:32:47.41	24.96	-34.14	-36.81	-0.16	-2.34	1750
58	19:32:50.42	24.93	-34.25	-37.56	-0.22	-2.59	1501
59	19:32:51.41	24.88	-34.21	-37.85	-0.22	-2.72	1421
60	19:32:58.42	24.85	-33.84	-38.80	-0.29	-3.17	1081
61	19:33:06.41	24.81	-33.85	-40.38	-0.48	-3.61	756
62	19:33:12.41	24.75	-34.23	-41.44	-0.86	-3.74	621
63	19:33:14.41	24.75	-34.43	-42.57	-0.80	-4.00	478
64	19:33:16.42	24.75	-34.58	-44.19	-0.61	-4.38	327
65	19:33:18.42	24.69	-34.44	-44.64	-0.67	-4.51	299
66	19:33:39.42	24.63	-34.34	-44.95	-0.16	-4.64	263
67	19:33:45.42	24.58	-34.84	-45.46	0.23	-4.64	241
68	19:33:56.43	24.49	-34.18	-43.38	0.16	-4.32	393
69	19:34:00.44	24.47	-33.95	-41.33	-0.16	-3.87	616
70	19:34:18.43	24.49	-33.56	-38.70	-0.16	-3.23	1161
71	19:34:28.43	24.56	-34.10	-40.78	0.29	-3.68	729
72	19:34:33.44	24.58	-34.08	-42.05	0.55	-4.00	531
73	19:34:36.43	24.60	-34.55	-43.38	0.74	-4.19	387
74	19:34:38.43	24.61	-34.41	-44.12	0.86	-4.38	323
75	19:34:40.44	24.62	-34.18	-44.87	1.06	-4.57	270
76	19:34:47.44	24.66	-34.42	-44.20	1.31	-4.32	313
77	19:34:53.43	24.68	-34.28	-42.43	1.44	-3.87	494
78	19:34:57.43	24.75	-34.37	-41.67	1.50	-3.61	578
79	19:34:58.44	24.76	-34.42	-41.29	1.50	-3.49	627
80	19:35:04.43	24.80	-34.18	-39.92	1.57	-3.10	839
81	19:35:35.44	24.87	-34.02	-36.37	1.44	-1.70	1926
82	19:35:54.44	24.97	-34.40	-35.38	1.31	-0.61	2416
83	19:36:00.44	25.01	-34.54	-35.45	1.38	-0.16	2315
84	19:36:11.45	25.00	-34.15	-34.85	1.18	0.22	2678
* 85	19:36:20.44	24.94	-35.19	-36.44	1.57	0.29	1943
* 86	19:36:25.45	24.86	-33.24	-35.03	1.89	0.29	2590
87	19:36:31.45	24.82	-34.36	-37.09	2.34	0.29	1618
88	19:36:39.45	24.75	-34.23	-37.90	2.72	0.22	1407
89	19:36:40.45	24.69	-34.31	-38.33	2.85	0.16	1293
90	19:36:43.44	24.68	-33.80	-38.77	3.17	0.16	1120
91	19:36:45.45	24.66	-33.71	-39.11	3.29	0.22	1013
92	19:36:49.44	24.64	-34.09	-40.36	3.55	0.16	771
93	19:36:54.45	24.59	-34.54	-41.52	3.74	0.29	608
94	19:36:57.44	24.56	-34.43	-42.65	4.06	0.22	474
95	19:36:58.44	24.55	-34.62	-43.34	4.19	0.09	409
96	19:37:00.45	24.50	-34.48	-44.03	4.38	0.03	344

97	19:37:41.46	24.47	-34.45	-42.92	4.12	-0.23	427
98	19:37:46.46	24.44	-34.07	-41.79	3.93	-0.35	563
99	19:37:50.45	24.41	-34.69	-42.29	3.87	-0.67	510
100	19:37:56.46	24.32	-34.62	-42.21	3.81	-1.06	539
101	19:38:01.46	24.32	-34.37	-42.93	4.00	-1.31	460
102	19:38:30.47	24.38	-34.79	-43.56	4.00	-1.50	390
103	19:38:58.47	24.31	-34.11	-40.42	3.49	-0.86	790
104	19:39:08.46	24.30	-34.07	-39.58	3.29	-0.61	950
105	19:39:12.48	24.29	-33.76	-38.57	3.10	-0.35	1177
106	19:39:25.47	24.25	-33.96	-36.86	2.34	0.67	1805
107	19:39:26.48	24.25	-33.91	-36.57	2.21	0.73	1927
108	19:39:46.47	24.28	-33.89	-35.78	1.76	0.86	2250
109	19:39:51.47	24.31	-34.24	-35.55	1.38	0.86	2429
110	19:39:57.47	24.41	-34.05	-34.91	0.99	0.86	2821
111	19:40:01.48	24.45	-34.23	-34.95	0.55	1.05	2732
112	19:40:02.47	24.45	-34.14	-34.76	0.48	0.99	2835
113	19:40:07.47	24.49	-34.45	-35.05	0.16	1.05	2668
114	19:40:12.47	24.58	-34.17	-34.81	-0.29	1.05	2895
115	19:40:14.47	24.60	-34.18	-34.79	-0.41	0.99	2854
116	19:40:18.48	24.64	-33.87	-34.81	-0.73	1.12	2773
117	19:40:22.48	24.67	-33.94	-35.24	-1.05	1.18	2443
118	19:40:30.48	24.76	-34.27	-36.16	-1.50	1.18	2083
119	19:40:34.48	24.81	-33.97	-36.51	-1.88	1.18	1864
120	19:40:40.48	24.85	-34.10	-37.65	-2.33	1.24	1403
121	19:40:46.48	24.95	-34.15	-38.75	-2.71	1.31	1128
122	19:40:52.47	25.01	-33.80	-40.05	-3.23	1.44	800
123	19:40:53.48	25.02	-33.96	-40.50	-3.29	1.50	716
124	19:40:56.48	25.04	-34.16	-41.56	-3.55	1.50	563
125	19:41:04.48	25.05	-33.74	-41.27	-3.61	1.44	605
126	19:41:10.48	25.06	-33.84	-39.63	-3.23	0.99	902
127	19:41:12.47	25.06	-34.11	-39.38	-3.10	0.86	974
128	19:41:15.48	25.12	-34.22	-38.56	-2.84	0.61	1180
129	19:41:48.49	25.05	-33.05	-37.42	-2.91	0.16	1486
130	19:41:58.49	25.03	-33.98	-37.45	-2.59	0.16	1425
131	19:42:03.49	24.99	-34.05	-36.74	-2.27	0.16	1745
132	19:42:10.49	24.88	-33.92	-35.65	-1.82	0.09	2306
133	19:42:14.50	24.85	-33.97	-35.05	-1.44	0.03	2511
134	19:42:20.50	24.81	-34.54	-35.07	-0.99	-0.03	2603
*135	19:42:25.65	24.70	-34.95	-35.15	-0.61	-0.03	2689
136	19:42:44.65	24.64	-34.48	-34.50	-0.03	-0.23	2972
137	19:42:51.65	24.59	-34.44	-34.64	-0.22	-0.61	2960
138	19:42:59.65	24.49	-34.40	-35.02	-0.41	-1.06	2670
139	19:43:04.65	24.46	-34.00	-34.98	-0.67	-1.25	2694
140	19:43:09.64	24.43	-34.28	-35.65	-0.73	-1.50	2354
141	19:43:13.65	24.38	-33.90	-35.63	-1.12	-1.50	2450
142	19:43:28.61	24.27	-33.97	-37.46	-1.31	-2.34	1527
143	19:43:31.61	24.26	-33.90	-38.25	-1.24	-2.72	1290
144	19:43:40.61	24.25	-33.96	-39.38	-1.05	-3.17	995
145	19:43:42.61	24.26	-33.92	-39.49	-0.99	-3.23	970
146	19:44:00.61	24.29	-34.21	-42.13	-0.35	-4.00	516
147	19:44:13.61	24.36	-35.17	-46.75	0.48	-4.83	189
148	19:44:47.58	24.23	-33.68	-38.35	-1.50	-2.72	1282
149	19:44:49.58	24.23	-33.88	-38.38	-1.50	-2.65	1273
150	19:45:08.58	24.12	-33.74	-40.12	-1.82	-3.17	862
151	19:45:09.58	24.12	-33.47	-40.15	-1.88	-3.23	847
152	19:45:18.58	24.13	-33.88	-41.20	-1.63	-3.55	676
153	19:45:21.58	24.18	-34.02	-41.77	-1.44	-3.74	608
154	19:45:31.58	24.25	-33.88	-42.80	-1.63	-4.00	453
155	19:45:34.59	24.27	-33.74	-42.65	-1.95	-3.87	461
156	19:45:45.55	24.27	-33.50	-41.58	-2.33	-3.42	592
157	19:45:51.55	24.25	-34.01	-41.66	-2.65	-3.04	588

158	19:45:52.55	24.24	-33.97	-41.62	-2.71	-2.97	594
159	19:45:57.54	24.23	-33.77	-41.29	-2.97	-2.65	651
160	19:46:00.55	24.22	-33.77	-41.16	-3.16	-2.34	679
161	19:46:19.55	24.26	-33.36	-39.35	-3.16	-1.44	996
162	19:46:21.55	24.27	-33.49	-39.06	-3.10	-1.25	1049
163	19:46:50.51	24.47	-33.69	-37.53	-2.65	0.67	1472
164	19:46:51.51	24.46	-33.81	-37.28	-2.52	0.61	1565
165	19:46:55.51	24.43	-34.31	-37.16	-2.27	0.61	1660
166	19:47:02.51	24.32	-34.07	-35.95	-1.82	0.54	2240
167	19:47:11.51	24.31	-34.14	-35.65	-1.56	0.67	2386
168	19:47:22.51	24.44	-34.07	-36.37	-1.50	1.50	1973
169	19:47:23.51	24.45	-33.88	-36.29	-1.44	1.63	2002
170	19:47:27.50	24.47	-33.65	-36.42	-1.37	1.88	1904
171	19:47:33.50	24.50	-34.03	-37.64	-1.31	2.33	1496
172	19:47:40.51	24.60	-33.89	-38.59	-1.12	2.84	1190
173	19:47:45.47	24.64	-33.75	-39.55	-1.05	3.23	928
174	19:47:46.48	24.65	-33.78	-39.73	-0.99	3.29	883
175	19:47:53.48	24.65	-33.78	-41.06	-1.24	3.61	652
176	19:47:56.47	24.64	-33.78	-42.29	-1.50	3.87	495
177	19:48:00.48	24.63	-33.77	-42.92	-1.63	3.99	428
178	19:48:04.47	24.62	-33.95	-44.71	-1.88	4.31	287
179	19:48:05.47	24.62	-33.95	-45.06	-1.95	4.38	263
180	19:48:16.47	24.58	-34.16	-43.60	-2.01	3.93	380
181	19:48:27.47	24.50	-33.94	-43.93	-2.33	3.93	352
182	19:48:28.48	24.49	-33.97	-44.31	-2.40	3.99	318
183	19:48:36.47	24.57	-34.27	-45.24	-2.71	3.99	263
184	19:49:04.44	24.31	-33.74	-41.49	-0.99	3.80	616
185	19:49:10.45	24.27	-33.82	-41.32	-0.61	3.80	636
186	19:49:18.44	24.23	-33.88	-40.12	-0.41	3.48	859
187	19:49:24.45	24.13	-33.97	-39.00	-0.54	3.10	1150
188	19:49:27.44	24.12	-33.81	-38.15	-0.67	2.84	1349
189	19:49:30.45	24.10	-33.69	-37.50	-0.67	2.65	1528
190	19:49:36.45	24.06	-34.15	-36.96	-0.80	2.20	1792
191	19:49:50.45	24.10	-33.68	-37.12	-1.50	2.14	1660
192	19:49:55.41	24.14	-34.05	-38.39	-1.88	2.27	1335
193	19:50:03.41	24.27	-33.76	-39.13	-2.40	2.27	1046
194	19:50:07.40	24.30	-33.85	-40.16	-2.78	2.27	832
195	19:50:08.40	24.30	-33.72	-40.32	-2.84	2.33	803
196	19:50:23.41	24.32	-34.31	-38.49	-2.33	1.69	1266
197	19:50:24.41	24.38	-34.22	-38.05	-2.27	1.56	1407
198	19:50:40.41	24.31	-33.90	-41.93	-3.16	2.59	560
199	19:50:42.40	24.31	-33.64	-42.16	-3.23	2.71	532
200	19:50:53.41	24.32	-33.97	-44.21	-3.55	3.03	339
201	19:51:06.37	24.28	-33.80	-42.07	-3.03	2.84	532
202	19:51:12.37	24.22	-33.83	-40.82	-2.59	2.78	731
203	19:51:16.37	24.13	-34.09	-40.22	-2.27	2.71	864
204	19:51:22.37	24.09	-34.02	-39.32	-1.82	2.71	1015
205	19:51:25.37	24.07	-34.16	-38.90	-1.56	2.65	1138
206	19:51:38.37	23.91	-34.11	-37.52	-0.54	2.52	1549
207	19:51:50.37	23.91	-34.00	-36.66	-0.22	2.27	1885
208	19:51:52.37	23.92	-33.88	-36.11	-0.16	2.08	2143
209	19:51:57.37	23.93	-33.87	-35.59	0.23	1.82	2450
210	19:52:04.35	23.94	-34.24	-35.34	0.67	1.31	2655
211	19:52:40.34	24.20	-34.24	-36.19	0.55	1.88	2188
212	19:52:43.34	24.22	-33.80	-36.35	0.67	2.14	2064
213	19:52:46.35	24.24	-33.96	-36.93	0.67	2.33	1778
214	19:52:51.35	24.28	-33.67	-37.62	0.67	2.71	1486
215	19:52:57.34	24.31	-34.08	-39.43	0.80	3.16	1003
216	19:53:02.34	24.40	-33.70	-40.43	0.93	3.55	801
217	19:53:07.30	24.44	-33.57	-41.57	1.06	3.87	598
218	19:53:09.30	24.45	-33.56	-42.05	1.06	3.99	531

219	19:53:13.31	24.48	-33.31	-43.61	1.31	4.38	372
220	19:53:21.30	24.46	-33.67	-44.15	1.50	4.38	327
221	19:53:22.30	24.45	-33.84	-44.13	1.57	4.31	330
222	19:53:26.31	24.42	-33.82	-44.77	1.89	4.38	290
223	19:53:31.30	24.39	-33.91	-44.59	1.89	4.31	308
224	19:53:36.30	24.31	-33.60	-42.77	1.89	3.93	468
225	19:53:38.30	24.30	-34.00	-42.60	1.82	3.80	479
226	19:53:43.30	24.27	-33.78	-40.79	1.63	3.42	720
227	19:53:48.31	24.23	-33.71	-39.35	1.50	3.03	1029
228	19:53:49.30	24.22	-33.97	-39.53	1.44	3.03	993
229	19:53:54.31	24.13	-34.31	-38.72	1.38	2.65	1226
230	19:54:07.27	24.09	-34.10	-37.75	1.50	2.27	1471
231	19:54:12.27	24.10	-33.81	-37.52	1.89	2.01	1536
232	19:54:15.27	24.10	-33.90	-37.39	2.02	1.76	1573
233	19:54:19.27	24.11	-33.82	-37.57	2.34	1.50	1540
234	19:54:20.27	24.12	-34.16	-37.75	2.34	1.37	1478
235	19:54:27.27	24.11	-34.11	-38.42	2.72	1.18	1239
236	19:54:33.27	24.06	-34.14	-39.72	3.17	1.18	949
237	19:54:38.26	24.02	-34.55	-41.33	3.55	1.12	669
238	19:54:45.26	23.92	-33.97	-42.61	4.06	1.05	480
239	19:54:49.27	23.90	-33.91	-41.86	3.74	1.56	577
240	19:54:53.27	23.92	-34.30	-43.40	4.19	0.99	398
241	19:54:59.27	23.93	-34.41	-44.17	4.38	0.73	344
242	19:55:00.27	23.93	-34.52	-44.75	4.51	0.54	300
243	19:55:14.23	23.88	-34.49	-44.05	4.38	-0.23	350
244	19:55:20.23	23.83	-34.77	-44.25	4.32	-0.80	344
245	19:55:22.23	23.83	-34.72	-44.45	4.38	-0.74	329
246	19:55:43.23	23.74	-34.01	-39.58	3.29	0.67	973
247	19:55:45.23	23.73	-34.21	-39.26	3.10	0.80	1051
248	19:56:03.23	23.74	-33.72	-38.95	2.65	1.95	1153
249	19:56:07.24	23.76	-34.04	-39.78	2.72	2.14	980
250	19:56:10.23	23.83	-34.23	-40.50	2.72	2.40	838
251	19:56:13.23	23.85	-33.88	-41.19	2.78	2.78	702
252	19:56:19.20	23.90	-33.60	-42.39	2.97	3.16	512
253	19:56:26.20	23.92	-33.65	-42.78	3.17	3.10	472
254	19:56:31.20	23.91	-33.60	-43.81	3.74	2.84	365
255	19:56:33.20	23.91	-34.05	-44.15	3.87	2.59	339
256	19:56:40.20	23.83	-34.22	-44.52	4.06	2.33	329
257	19:56:41.21	23.84	-34.05	-43.43	3.87	2.20	415
258	19:56:44.20	23.73	-34.07	-45.64	4.51	2.01	243
259	19:56:46.20	23.73	-34.16	-43.57	4.12	1.56	392
260	19:56:48.21	23.66	-34.65	-45.73	4.51	1.63	248
261	19:56:52.20	23.64	-34.52	-44.93	4.44	1.24	302
262	19:57:01.20	23.65	-34.47	-41.92	3.81	0.80	602
263	19:58:01.16	24.27	-33.91	-35.22	-0.22	1.56	2610
264	19:58:02.17	24.27	-34.04	-35.23	-0.16	1.50	2590
265	19:58:27.12	24.24	-34.27	-34.95	-0.73	0.86	2812
266	19:58:43.13	24.13	-34.08	-34.34	-0.16	0.67	3280
267	19:58:54.13	24.05	-34.34	-34.75	0.67	0.61	2999
268	19:59:08.13	24.03	-34.48	-35.77	1.63	-0.03	2391
269	19:59:10.12	24.06	-34.44	-35.65	1.57	-0.23	2420
270	19:59:13.13	24.02	-34.48	-36.78	2.14	-0.35	1912
271	19:59:21.13	23.95	-34.50	-37.28	2.34	-0.48	1754
272	19:59:26.13	23.92	-34.36	-38.02	2.65	-0.67	1381
273	20:00:04.11	23.63	-35.31	-47.19	4.83	-0.93	179
274	20:00:10.11	23.57	-34.78	-46.44	4.76	-1.06	214
275	20:00:30.10	23.74	-34.44	-40.46	3.36	-1.06	812
276	20:00:35.07	23.82	-34.48	-38.97	2.91	-0.86	1182
277	20:00:41.06	23.76	-34.25	-39.33	3.04	-1.12	1094
278	20:00:46.07	23.74	-34.25	-39.30	2.85	-1.57	1063
279	20:00:53.06	23.75	-33.98	-38.79	2.65	-1.76	1203

280	20:00:56.07	23.76	-34.22	-38.63	2.40	-1.89	1299
281	20:01:06.07	23.84	-34.45	-40.22	2.72	-2.21	871
282	20:01:08.06	23.85	-34.14	-40.65	2.91	-2.34	780
283	20:01:30.06	23.89	-34.32	-41.07	3.17	-2.08	696
284	20:01:52.03	23.84	-34.71	-42.76	3.81	-1.50	480
285	20:02:06.03	23.87	-34.69	-44.27	4.06	-1.95	333
286	20:02:13.03	23.80	-35.01	-43.61	3.74	-2.08	411
287	20:02:15.03	23.81	-35.08	-45.17	3.93	-2.53	285
288	20:02:16.03	23.76	-34.79	-45.35	4.00	-2.65	275
289	20:02:19.03	23.74	-34.56	-44.59	3.81	-2.72	316
290	20:02:23.02	23.74	-34.78	-46.02	4.00	-2.97	226
291	20:02:31.02	23.87	-35.01	-45.25	3.55	-3.17	265
292	20:02:32.03	23.88	-34.57	-44.63	3.49	-3.17	305
293	20:02:41.00	24.02	-35.22	-46.69	3.49	-3.68	190
294	20:02:43.00	24.02	-34.91	-44.26	3.04	-3.36	334
295	20:02:45.00	24.06	-34.44	-44.05	2.91	-3.55	344
296	20:02:48.00	24.09	-34.58	-46.57	3.29	-4.00	190
297	20:03:00.00	24.08	-34.00	-42.30	2.59	-3.36	510
298	20:03:25.99	23.94	-34.31	-35.70	0.93	-1.44	2425
299	20:03:45.97	24.05	-34.43	-34.90	0.99	-0.16	2885
300	20:04:04.96	24.09	-33.96	-35.28	1.25	1.05	2578
301	20:04:10.96	24.08	-34.00	-35.45	0.80	1.50	2508
302	20:04:19.97	24.08	-33.75	-36.54	-0.03	2.33	1947
303	20:04:58.92	24.28	-33.72	-40.02	-1.50	3.23	848
304	20:05:01.93	24.30	-33.88	-40.93	-1.88	3.29	697
305	20:05:46.92	24.42	-34.10	-43.52	-1.44	4.12	386
306	20:06:01.90	24.32	-33.96	-42.92	-0.92	4.12	462
307	20:06:02.90	24.23	-34.04	-43.54	-0.41	4.31	389
308	20:06:04.90	24.24	-34.00	-42.63	-0.16	4.12	482
309	20:06:11.90	24.24	-34.18	-43.97	-0.41	4.38	353
310	20:06:13.90	24.27	-34.23	-45.41	-0.92	4.63	247
311	20:06:24.90	24.19	-34.31	-44.60	-0.16	4.50	317
312	20:06:36.90	24.24	-34.10	-45.88	-0.03	4.82	226
313	20:06:49.90	24.19	-34.47	-46.30	0.42	4.82	215
314	20:07:00.86	24.13	-34.30	-45.54	0.48	4.70	254
315	20:07:07.86	24.09	-33.94	-43.40	0.35	4.31	398
316	20:07:12.86	24.09	-33.90	-42.41	0.67	4.06	501
317	20:07:15.86	24.11	-33.60	-41.53	0.55	3.93	620
318	20:07:23.86	24.07	-33.82	-39.80	0.35	3.42	928
319	20:07:26.86	24.05	-34.07	-39.05	0.48	3.10	1114
320	20:07:36.86	24.08	-34.03	-38.72	0.03	3.03	1183
321	20:07:46.86	24.12	-34.01	-37.29	0.23	2.52	1644
322	20:08:14.82	23.92	-34.54	-34.71	0.35	0.48	3001
323	20:10:06.76	23.90	-34.10	-35.55	-0.54	-1.63	2455
324	20:13:45.65	24.31	-33.97	-39.28	-0.09	3.23	1051
325	20:14:34.62	24.13	-33.84	-41.43	-0.03	3.87	654
326	20:15:03.62	24.37	-34.38	-45.00	-1.56	4.38	284
327	20:15:17.62	24.47	-34.03	-45.99	-2.33	4.44	210
328	20:16:30.55	24.66	-34.17	-44.54	-2.84	3.74	289
329	20:16:34.54	24.65	-33.76	-42.60	-2.52	3.48	453
330	20:16:57.55	24.76	-34.15	-36.36	-0.99	1.82	1997
331	20:18:27.52	25.01	-34.08	-34.36	-0.67	0.22	2979
332	20:18:39.48	25.00	-34.42	-34.84	-0.86	-0.23	2692
333	20:25:20.28	24.57	-34.71	-35.09	0.61	-0.67	2716

### 120 kHz calibration

```
# Calibration Version 1.0.0.9
#
# Date: 2006-10-07
#
# Comments:
```

```

# just 120 kHz
#
# Reference Target:
# TS -40.40 dB Min. Distance 24.00
m
# TS Deviation 3.0 dB Max. Distance 28.00
m
#
# Transducer: ES120-7 Serial No. 907203422
# Frequency 120000 Hz Beamtype
Split
# Gain 20.24 dB Two Way Beam Angle -20.7
dB
# Athw. Angle Sens. 21.00 Along. Angle Sens.
21.00
# Athw. Beam Angle 7.73 deg Along. Beam Angle 7.71
deg
# Athw. Offset Angle -0.04 deg Along. Offset Angle -0.17
deg
# SaCorrection -0.38 dB Depth 0.00
m
#
# Transceiver: GPT 120 kHz 00907203422d 1 ES120-7
# Pulse Duration 1.024 ms Sample Interval 0.186
m
# Power 500 W Receiver Bandwidth 3.03
kHz
#
# Sounder Type:
# EK60 Version ComSounder
#
# TS Detection:
# Min. Value -50.0 dB
# Max. Beam Comp. 6.0 dB Min. Echolength 80
%
# Max. Phase Dev. 8.0 Max. Echolength 180
%
#
# Environment:
# Absorption Coeff. 26.3 dB/km Sound Velocity 1453.0
m/s
#
# Beam Model results:
# Transducer Gain = 21.38 dB SaCorrection = -0.39
dB
# Athw. Beam Angle = 7.48 deg Along. Beam Angle = 7.48
deg
# Athw. Offset Angle =-0.07 deg Along. Offset Angle=-0.12
deg
#
# Data deviation from beam model:
# RMS = 0.19 dB
# Max = 0.50 dB No. = 220 Athw. = -1.3 deg Along = -3.0
deg
# Min = -0.73 dB No. = 228 Athw. = -0.6 deg Along = -5.3
deg
#
# Data deviation from polynomial model:
# RMS = 0.15 dB
# Max = 0.37 dB No. = 83 Athw. = 4.4 deg Along = -2.8
deg

```

# Min = -0.45 dB No. = 248 Athw. = 0.2 deg Along = -2.4 deg

#

# Data:

#	No.	Time	Distance [m]	TS-c [dB]	TS-u [dB]	Athw. [deg]	Along [deg]	Sa
#			[m2/nm2]					
#								
	1	12:15:23.74	25.21	-38.20	-38.30	-0.29	0.24	1171
	2	12:15:25.73	25.21	-37.90	-37.98	-0.23	0.24	1259
	3	12:15:54.77	25.21	-38.05	-38.11	-0.23	0.17	1223
	* 4	12:15:55.77	25.21	-37.82	-37.89	-0.29	0.17	1289
	5	12:16:26.77	25.26	-38.12	-38.45	-0.23	0.71	1129
	6	12:16:30.77	25.28	-38.32	-39.15	-0.23	1.24	957
	7	12:16:35.81	25.30	-38.56	-39.99	-0.09	1.71	793
	8	12:16:40.82	25.32	-38.15	-40.25	-0.03	2.11	750
	9	12:16:47.81	25.35	-38.13	-41.20	-0.09	2.58	611
	10	12:16:52.81	25.37	-38.05	-42.26	-0.16	3.05	478
	11	12:16:58.81	25.39	-37.56	-43.27	-0.09	3.59	376
	12	12:17:12.81	25.42	-37.73	-46.40	-0.03	4.46	182
	13	12:17:24.81	25.49	-37.65	-47.89	0.11	4.86	127
	14	12:17:36.86	25.41	-37.64	-47.37	0.24	4.72	146
	15	12:17:44.86	25.36	-37.44	-47.40	0.91	4.72	144
	16	12:17:46.86	25.38	-37.46	-47.33	1.18	4.66	144
	17	12:17:52.86	25.32	-37.76	-46.58	1.11	4.39	174
	18	12:17:59.86	25.29	-37.41	-44.61	1.11	3.92	275
	19	12:18:03.86	25.23	-37.42	-43.18	1.11	3.45	390
	20	12:18:10.87	25.21	-38.09	-42.20	1.04	2.85	486
	21	12:18:15.86	25.20	-38.31	-41.62	0.98	2.51	562
	22	12:18:22.86	25.17	-38.04	-40.47	1.04	2.05	730
	23	12:18:28.86	25.14	-38.51	-40.20	1.04	1.58	769
	* 24	12:18:34.86	25.12	-37.46	-38.24	0.91	0.84	1180
	25	12:18:37.86	25.11	-38.26	-38.84	0.84	0.64	1026
	26	12:18:42.90	25.08	-38.01	-38.37	0.84	0.17	1160
	27	12:18:49.90	25.03	-38.59	-39.20	1.18	0.04	969
	28	12:18:54.90	24.99	-38.79	-39.97	1.65	0.10	821
	29	12:19:00.89	24.99	-38.28	-39.51	1.65	0.30	911
	30	12:19:05.90	25.01	-38.55	-40.09	1.71	0.71	807
	31	12:19:09.90	25.02	-38.35	-40.37	1.71	1.24	754
	32	12:19:15.90	25.04	-37.73	-40.54	1.78	1.78	727
	33	12:19:19.90	25.09	-38.26	-41.53	1.71	2.11	575
	34	12:19:25.90	25.12	-38.13	-42.41	1.78	2.58	462
	35	12:19:31.90	25.19	-37.66	-43.20	1.78	3.12	382
	36	12:19:40.90	25.18	-37.45	-45.25	1.91	3.85	242
	37	12:19:45.94	25.20	-37.49	-46.52	1.85	4.25	181
	38	12:19:48.93	25.21	-38.02	-47.82	1.91	4.46	130
	39	12:19:54.94	25.22	-37.85	-47.67	2.12	4.39	138
	40	12:20:01.94	25.31	-37.73	-46.64	2.65	3.85	171
	41	12:20:13.94	25.24	-37.43	-44.77	2.79	3.18	270
	42	12:20:15.94	25.23	-37.49	-44.08	2.65	2.98	314
	43	12:20:22.94	25.22	-37.77	-43.36	2.65	2.51	366
	44	12:20:27.94	25.21	-38.09	-42.71	2.65	1.98	435
	45	12:20:32.94	25.19	-38.08	-41.85	2.52	1.58	531
	46	12:20:34.94	25.18	-38.23	-41.81	2.58	1.31	537
	47	12:20:36.94	25.17	-38.35	-41.59	2.52	1.11	567
	48	12:20:38.93	25.16	-37.61	-41.13	2.65	1.11	624
	49	12:20:42.94	25.15	-38.56	-41.40	2.52	0.57	585
	50	12:20:45.93	25.14	-37.84	-40.87	2.65	0.37	653
	51	12:20:47.94	25.12	-38.63	-41.31	2.52	0.17	599
	52	12:20:48.98	25.12	-38.62	-41.42	2.58	0.10	586
	53	12:20:56.98	25.16	-38.80	-42.33	2.92	-0.23	473



54	12:20:58.97	25.17	-38.59	-42.46	3.05	-0.37	461
55	12:21:02.98	25.20	-38.97	-43.63	3.32	-0.70	350
56	12:21:12.97	25.22	-38.40	-43.33	3.46	-0.10	376
57	12:21:16.98	25.27	-38.16	-43.34	3.52	0.30	371
58	12:21:19.97	25.29	-38.24	-43.36	3.46	0.57	366
59	12:21:20.97	25.29	-37.97	-43.34	3.52	0.71	367
60	12:21:26.97	25.36	-38.20	-44.19	3.59	1.24	298
61	12:21:30.98	25.37	-38.30	-44.73	3.59	1.64	264
62	12:21:35.97	25.36	-37.59	-44.67	3.59	2.11	273
63	12:21:41.97	25.38	-37.79	-45.68	3.59	2.58	216
64	12:21:46.98	25.40	-37.98	-47.14	3.66	3.12	153
65	12:21:53.03	25.41	-37.72	-48.16	3.72	3.59	121
66	12:22:05.02	25.49	-37.90	-48.94	4.12	3.38	100
67	12:22:10.02	25.53	-38.08	-49.41	4.46	3.05	90
68	12:22:11.02	25.54	-38.26	-49.55	4.53	2.92	86
69	12:22:18.02	25.52	-38.20	-49.02	4.59	2.51	98
70	12:22:23.02	25.50	-38.51	-48.18	4.46	2.05	119
71	12:22:28.03	25.48	-38.57	-47.89	4.53	1.58	127
72	12:22:32.02	25.42	-38.46	-47.12	4.46	1.11	153
73	12:22:34.03	25.41	-38.45	-46.78	4.39	0.97	167
74	12:22:38.02	25.41	-38.04	-46.17	4.39	0.64	190
75	12:22:43.02	25.42	-38.03	-45.97	4.39	0.10	200
76	12:22:47.02	25.40	-38.30	-45.98	4.33	-0.23	200
77	12:22:52.02	25.39	-38.76	-46.53	4.33	-0.70	174
78	12:22:57.06	25.38	-38.80	-46.80	4.33	-1.17	163
79	12:23:03.06	25.31	-38.70	-46.82	4.26	-1.64	164
80	12:23:06.06	25.30	-38.24	-47.47	4.46	-2.04	141
81	12:23:08.06	25.30	-38.80	-47.21	4.19	-2.11	149
82	12:23:10.06	25.29	-38.64	-48.38	4.46	-2.44	115
83	12:23:14.06	25.27	-38.23	-48.25	4.39	-2.78	120
84	12:23:19.06	25.22	-39.30	-49.47	4.26	-3.11	91
85	12:23:25.06	25.27	-39.10	-50.55	4.46	-3.45	70
86	12:23:42.06	25.35	-39.95	-51.89	4.86	-2.98	51
87	12:23:44.06	25.36	-39.45	-51.33	4.93	-2.78	58
88	12:23:51.06	25.38	-39.44	-50.46	4.93	-2.11	71
89	12:23:55.06	25.42	-38.88	-49.55	4.93	-1.77	87
90	12:23:57.06	25.40	-38.84	-49.29	4.93	-1.50	92
91	12:23:58.06	25.40	-38.96	-49.11	4.86	-1.44	96
92	12:24:01.11	25.41	-38.82	-48.75	4.86	-1.10	106
93	12:24:02.11	25.41	-38.83	-49.02	4.93	-1.10	99
94	12:24:06.11	25.46	-39.92	-49.93	4.93	-0.63	80
95	12:24:12.11	25.55	-39.58	-50.07	5.06	-0.16	74
96	12:24:16.11	25.51	-39.03	-49.29	5.00	0.24	91
97	12:24:21.10	25.54	-38.46	-49.16	5.06	0.71	94
98	12:24:26.11	25.56	-39.59	-50.59	5.06	1.17	69
99	12:24:31.11	25.57	-39.05	-51.00	5.20	1.64	63
100	12:24:46.11	25.69	-38.58	-47.67	4.39	1.78	131
101	12:24:58.11	25.82	-37.96	-44.11	3.46	1.71	300
102	12:25:09.14	25.93	-37.73	-41.46	2.45	1.64	549
103	12:25:24.14	25.85	-37.58	-41.53	1.51	2.58	538
104	12:25:36.15	25.75	-37.64	-42.67	0.51	3.32	422
105	12:25:38.14	25.74	-37.44	-43.21	0.37	3.59	372
106	12:25:45.14	25.73	-38.04	-45.28	-0.23	4.05	225
107	12:25:46.14	25.68	-38.12	-45.85	-0.36	4.19	200
108	12:25:51.14	25.65	-37.45	-46.25	-0.70	4.46	184
109	12:26:03.15	25.61	-38.29	-48.73	-0.90	4.86	104
110	12:26:50.18	25.75	-38.31	-50.29	-1.57	5.13	72
111	12:26:53.19	25.75	-38.38	-49.87	-1.63	4.99	80
112	12:26:57.18	25.73	-37.98	-48.41	-1.63	4.72	112
113	12:26:59.19	25.72	-37.76	-47.37	-1.57	4.52	142
114	12:27:00.18	25.71	-38.25	-47.44	-1.63	4.39	140

115	12:27:01.18	25.71	-37.82	-46.71	-1.57	4.32	165
116	12:27:08.18	25.68	-37.51	-44.68	-1.63	3.79	263
117	12:27:09.18	25.67	-37.46	-44.57	-1.57	3.79	270
118	12:27:13.23	25.65	-37.90	-44.07	-1.63	3.45	304
119	12:27:15.22	25.60	-37.89	-43.44	-1.57	3.25	357
120	12:27:20.23	25.59	-37.53	-42.38	-1.70	2.92	455
121	12:27:24.22	25.58	-37.72	-41.65	-1.70	2.51	538
122	12:27:30.22	25.56	-38.23	-41.26	-1.70	2.05	597
123	12:27:36.23	25.54	-38.26	-40.74	-1.84	1.58	668
124	12:27:41.23	25.52	-38.70	-40.63	-1.84	1.11	681
125	12:27:47.22	25.49	-38.08	-39.79	-1.97	0.57	816
126	12:27:52.22	25.47	-37.76	-39.20	-1.90	0.17	932
127	12:27:57.22	25.41	-38.29	-39.79	-1.97	-0.30	834
128	12:28:02.23	25.43	-38.23	-39.95	-2.04	-0.70	799
129	12:28:07.22	25.38	-38.32	-40.26	-1.97	-1.24	756
130	12:28:12.22	25.37	-38.40	-40.73	-1.97	-1.64	679
131	12:28:17.27	25.35	-38.28	-41.33	-2.04	-2.11	587
132	12:28:19.27	25.34	-38.22	-41.47	-2.10	-2.17	565
133	12:28:24.27	25.32	-38.63	-42.46	-2.04	-2.58	445
134	12:28:25.31	25.32	-38.53	-42.60	-2.10	-2.64	434
135	12:28:30.28	25.30	-38.80	-43.70	-2.10	-3.04	337
136	12:28:31.27	25.29	-38.89	-43.83	-2.04	-3.11	326
137	12:28:36.27	25.28	-38.68	-44.86	-2.10	-3.58	260
138	12:28:42.27	25.22	-39.06	-46.57	-2.10	-4.05	176
139	12:28:48.27	25.21	-39.53	-48.56	-2.30	-4.45	111
140	12:28:52.27	25.20	-39.26	-49.99	-2.37	-4.92	80
141	12:29:02.27	25.22	-39.73	-51.19	-2.71	-4.99	61
142	12:29:06.27	25.31	-39.40	-51.18	-3.04	-4.92	59
143	12:29:07.27	25.33	-39.19	-50.86	-3.11	-4.85	65
144	12:29:13.27	25.38	-39.10	-49.47	-3.31	-4.32	88
145	12:29:18.27	25.39	-38.62	-47.73	-3.24	-3.91	132
146	12:29:23.31	25.41	-38.69	-46.33	-3.11	-3.45	183
147	12:29:28.31	25.41	-38.37	-44.86	-3.11	-2.91	258
148	12:29:34.31	25.48	-38.18	-43.67	-3.04	-2.44	335
149	12:29:36.31	25.49	-38.56	-43.58	-2.97	-2.24	341
150	12:29:39.31	25.50	-38.40	-43.05	-2.97	-1.97	385
151	12:29:44.31	25.52	-38.39	-42.43	-2.91	-1.57	449
152	12:29:49.31	25.54	-38.62	-42.25	-2.91	-1.10	468
153	12:29:54.30	25.55	-38.49	-41.72	-2.84	-0.63	533
154	12:30:00.31	25.57	-38.69	-41.85	-2.84	-0.10	517
155	12:30:05.31	25.59	-38.60	-41.56	-2.71	0.30	544
156	12:30:10.31	25.60	-38.48	-41.67	-2.71	0.77	535
157	12:30:15.30	25.61	-38.04	-41.64	-2.71	1.24	539
158	12:30:20.31	25.68	-37.88	-41.96	-2.71	1.64	491
159	12:30:26.35	25.70	-38.02	-42.67	-2.64	2.11	418
160	12:30:30.34	25.72	-37.64	-43.18	-2.64	2.58	372
161	12:30:37.34	25.75	-37.51	-44.08	-2.64	3.05	303
162	12:30:44.34	25.80	-37.84	-45.51	-2.57	3.52	212
163	12:30:45.35	25.81	-37.70	-45.44	-2.50	3.59	214
164	12:30:46.35	25.77	-37.58	-47.06	-2.71	4.05	149
165	12:30:54.35	25.79	-38.06	-48.54	-2.50	4.46	108
166	12:30:55.35	25.80	-37.85	-49.00	-2.64	4.59	97
167	12:31:33.39	25.97	-38.64	-50.60	-3.91	4.05	66
168	12:31:35.40	25.96	-38.65	-50.08	-3.84	3.92	73
169	12:31:37.40	25.96	-38.33	-49.92	-3.98	3.85	77
170	12:31:40.39	25.94	-38.35	-48.56	-3.84	3.45	105
171	12:31:46.39	25.93	-38.18	-47.34	-3.84	2.98	140
172	12:31:52.40	25.90	-37.95	-46.26	-3.91	2.45	179
173	12:31:57.40	25.88	-37.63	-45.40	-3.98	1.98	218
174	12:32:00.39	25.86	-38.59	-45.80	-3.91	1.71	199
175	12:32:02.39	25.85	-38.39	-45.37	-3.91	1.51	221

176	12:32:04.40	25.85	-38.01	-44.98	-3.98	1.31	243
177	12:32:07.39	25.79	-38.13	-44.92	-3.98	1.11	247
178	12:32:12.40	25.78	-38.45	-44.71	-3.91	0.64	261
179	12:32:13.40	25.78	-38.37	-44.77	-3.98	0.50	252
180	12:32:18.40	25.76	-38.19	-44.48	-3.98	0.17	274
181	12:32:26.40	25.75	-38.02	-44.27	-3.98	-0.23	291
182	12:32:31.40	25.73	-38.36	-44.92	-4.04	-0.70	249
183	12:32:35.43	25.71	-38.58	-45.37	-4.04	-1.17	223
184	12:32:41.44	25.69	-38.52	-46.19	-4.18	-1.70	184
185	12:32:46.44	25.67	-38.38	-46.71	-4.25	-2.11	164
186	12:32:52.43	25.60	-38.91	-47.88	-4.25	-2.58	126
187	12:32:56.43	25.60	-38.68	-48.65	-4.31	-3.04	105
188	12:33:04.43	25.60	-38.57	-49.33	-4.45	-3.25	90
189	12:33:34.43	25.68	-39.56	-51.47	-5.32	-1.77	55
190	12:33:38.47	25.70	-39.25	-50.95	-5.32	-1.50	62
191	12:33:42.47	25.71	-39.55	-50.73	-5.25	-1.10	65
192	12:33:48.47	25.74	-39.33	-50.03	-5.18	-0.57	77
193	12:33:54.47	25.75	-38.96	-49.62	-5.18	-0.16	84
194	12:33:57.47	25.76	-39.57	-50.28	-5.18	0.24	72
195	12:34:03.47	25.78	-39.13	-49.76	-5.12	0.77	82
196	12:34:07.47	25.79	-39.82	-50.70	-5.12	1.17	66
197	12:34:12.47	25.85	-39.64	-51.01	-5.12	1.71	60
198	12:34:26.47	25.87	-39.18	-51.02	-5.12	2.11	60
199	12:34:36.47	25.80	-38.75	-49.87	-4.85	2.31	80
200	12:34:43.51	25.76	-38.30	-47.82	-4.38	2.31	128
201	12:34:55.51	25.60	-38.22	-44.86	-3.38	2.31	255
202	12:35:06.51	25.51	-37.77	-42.53	-2.50	2.31	435
203	12:35:18.51	25.37	-38.03	-41.39	-1.57	2.31	586
204	12:35:24.51	25.30	-38.69	-41.73	-1.10	2.38	534
205	12:35:47.56	25.27	-38.62	-40.93	-0.96	2.05	651
206	12:35:50.55	25.26	-37.65	-39.17	-0.90	1.58	948
207	12:35:55.56	25.21	-38.59	-40.15	-1.17	1.44	784
208	12:35:57.55	25.20	-37.95	-38.88	-0.96	1.04	1028
209	12:36:03.55	25.21	-38.26	-39.04	-1.17	0.64	995
210	12:36:04.55	25.18	-38.42	-38.96	-1.03	0.44	1012
211	12:36:07.56	25.17	-37.90	-38.35	-1.03	0.17	1161
212	12:36:12.55	25.15	-38.37	-38.77	-1.03	-0.30	1042
*213	12:36:18.55	25.12	-37.99	-38.56	-1.10	-0.70	1098
*214	12:36:19.56	25.12	-37.89	-38.57	-1.17	-0.83	1096
215	12:36:23.56	25.10	-38.12	-38.97	-1.10	-1.17	998
216	12:36:29.56	25.08	-38.17	-39.65	-1.10	-1.77	866
217	12:36:32.55	25.03	-38.45	-40.42	-1.23	-2.04	746
218	12:36:33.56	25.03	-38.79	-40.86	-1.23	-2.11	675
219	12:36:38.55	25.02	-38.28	-41.22	-1.30	-2.58	620
220	12:36:44.55	25.00	-37.90	-41.83	-1.30	-3.04	541
221	12:36:50.60	24.98	-38.76	-43.84	-1.30	-3.51	338
222	12:37:04.60	24.99	-38.45	-44.83	-0.96	-4.05	267
223	12:37:08.59	25.01	-39.28	-45.86	-0.50	-4.18	212
224	12:37:15.59	25.02	-39.46	-46.98	-0.56	-4.45	164
225	12:37:21.59	25.01	-39.19	-48.41	-0.56	-4.92	117
226	12:37:22.59	25.00	-39.50	-49.02	-0.70	-4.99	101
227	12:37:25.60	24.99	-40.59	-51.46	-0.70	-5.32	58
228	12:37:26.59	24.99	-41.20	-52.03	-0.56	-5.32	51
229	12:37:34.59	24.96	-40.45	-51.21	-0.23	-5.32	61
230	12:37:37.60	24.92	-40.73	-51.21	0.04	-5.25	61
231	12:37:42.59	24.89	-40.33	-51.10	0.24	-5.32	64
232	12:37:48.59	24.85	-40.09	-50.59	0.31	-5.25	71
233	12:37:53.64	24.90	-39.44	-48.39	0.44	-4.85	118
234	12:37:59.63	24.92	-39.39	-46.41	0.37	-4.32	186
235	12:38:04.63	24.94	-38.92	-44.68	0.44	-3.91	276
236	12:38:11.63	24.97	-38.73	-43.01	0.51	-3.38	409

237	12:38:19.63	24.98	-39.45	-42.58	0.44	-2.91	453
238	12:38:25.63	25.00	-38.68	-41.00	0.51	-2.51	651
239	12:38:30.63	25.02	-38.29	-39.82	0.51	-2.04	847
240	12:38:35.64	25.06	-38.52	-39.46	0.58	-1.57	903
241	12:38:41.64	25.08	-38.59	-39.13	0.64	-1.10	984
242	12:38:44.63	25.09	-38.56	-38.96	0.71	-0.83	1015
243	12:38:46.63	25.10	-38.82	-39.09	0.64	-0.63	978
244	12:38:48.64	25.11	-38.09	-38.33	0.71	-0.37	1155
*245	12:39:01.68	25.17	-38.44	-38.48	0.17	-0.37	1125
*246	12:39:32.68	25.19	-37.89	-38.20	0.31	0.64	1208
*247	12:39:42.68	25.17	-38.32	-38.44	0.37	0.17	1136
248	12:40:14.72	25.02	-39.52	-41.51	0.17	-2.37	577
249	12:40:19.73	25.03	-38.30	-40.66	0.17	-2.58	691
250	12:40:23.72	25.09	-38.42	-40.92	-0.29	-2.64	648
251	12:40:26.73	25.13	-39.28	-41.59	-0.56	-2.51	555
252	12:40:29.72	25.16	-38.09	-40.72	-0.70	-2.64	678
253	12:40:47.73	25.14	-38.93	-42.47	-0.76	-3.04	453
254	12:40:52.72	25.12	-38.72	-43.47	-0.83	-3.51	358
255	12:41:08.76	25.04	-38.98	-46.64	-0.90	-4.45	175
256	12:41:25.76	24.97	-39.95	-48.84	-0.16	-4.85	106
257	12:41:35.76	24.84	-40.04	-49.08	0.71	-4.85	101
258	12:41:36.76	24.84	-39.67	-49.05	0.84	-4.92	101
259	12:41:42.76	24.79	-40.29	-49.71	1.31	-4.85	88
260	12:41:44.76	24.79	-40.38	-50.16	1.45	-4.92	79
261	12:41:56.76	24.80	-39.53	-47.31	1.31	-4.38	153
262	12:42:03.76	24.83	-39.23	-45.32	1.31	-3.85	244
263	12:42:09.81	24.84	-38.97	-43.92	1.45	-3.38	333
264	12:42:14.81	24.85	-39.17	-43.10	1.38	-2.98	406
265	12:42:20.80	24.90	-38.69	-41.73	1.45	-2.51	551
266	12:42:26.80	24.93	-38.37	-40.64	1.45	-2.04	695
267	12:42:31.81	24.99	-37.92	-39.59	1.51	-1.50	862
268	12:42:36.81	24.97	-37.91	-39.10	1.45	-1.04	982
269	12:42:41.81	24.99	-38.33	-39.39	1.51	-0.63	931
*270	12:42:51.81	25.02	-37.56	-38.53	1.45	0.30	1129
271	12:43:37.84	24.74	-38.15	-42.87	3.25	-1.17	424
272	12:43:43.84	24.71	-38.62	-43.92	3.32	-1.64	336
273	12:43:53.85	24.66	-38.65	-44.18	3.19	-2.11	317
274	12:43:57.84	24.65	-38.65	-44.90	3.19	-2.58	271
275	12:44:03.84	24.63	-38.88	-46.00	3.19	-3.04	209
276	12:44:08.85	24.62	-38.89	-47.05	3.19	-3.51	163
277	12:44:14.85	24.60	-39.28	-48.80	3.19	-4.05	110
278	12:44:24.88	24.58	-39.56	-50.39	3.25	-4.45	75
279	12:44:36.89	24.61	-39.80	-50.73	2.99	-4.65	70
280	12:44:40.88	24.64	-39.78	-49.69	2.52	-4.58	90
281	12:44:52.88	24.73	-39.72	-48.65	1.98	-4.52	112
282	12:44:58.89	24.74	-39.37	-47.86	1.98	-4.38	135
283	12:45:04.89	24.76	-38.86	-45.91	1.98	-3.91	209
284	12:45:09.88	24.78	-38.89	-44.48	1.85	-3.45	293
285	12:45:19.89	24.77	-38.52	-43.86	2.12	-3.18	337
286	12:45:51.92	24.71	-38.63	-44.77	2.58	-3.18	277
287	12:45:57.92	24.72	-38.91	-44.74	2.65	-2.98	278
288	12:46:03.92	24.74	-38.78	-43.61	2.65	-2.44	357
289	12:46:07.92	24.76	-38.83	-43.18	2.72	-2.04	395
290	12:46:13.92	24.78	-38.62	-42.40	2.72	-1.57	476
291	12:46:20.92	24.77	-38.26	-41.50	2.52	-1.44	586
292	12:46:24.92	24.73	-38.84	-41.07	2.18	-0.97	647
293	12:46:27.97	24.67	-38.60	-40.36	1.98	-0.70	778
294	12:46:28.97	24.67	-38.72	-40.35	1.91	-0.63	784
295	12:47:06.97	24.61	-38.37	-38.42	-0.36	-0.30	1197
*296	12:47:16.97	24.61	-38.06	-38.26	-0.50	-0.70	1243
297	12:47:21.97	24.59	-38.33	-38.82	-0.50	-1.17	1084

298	12:47:28.97	24.57	-38.35	-39.38	-0.50	-1.70	948
299	12:47:46.00	24.48	-38.05	-41.52	-0.63	-3.04	602
300	12:47:53.01	24.46	-39.08	-43.70	-0.56	-3.51	363
301	12:48:21.00	24.56	-38.56	-41.00	-0.83	-2.51	660
302	12:48:40.05	24.78	-38.57	-39.38	-0.23	-1.57	926
303	12:48:45.05	24.79	-38.44	-38.79	-0.09	-1.10	1075

### 200 kHz calibration

```

# Calibration Version 1.0.0.9
#
# Date: 2006-10-06
#
# Comments:
#
# Reference Target:
# TS -44.80 dB Min. Distance 23.00
# TS Deviation 4.5 dB Max. Distance 28.00
#
# Transducer: ES200-7 Serial No. 9072033191
# Frequency 200000 Hz Beamtype
Split
# Gain 24.01 dB Two Way Beam Angle -19.6
dB
# Athw. Angle Sens. 23.00 Along. Angle Sens.
23.00
# Athw. Beam Angle 6.32 deg Along. Beam Angle 6.22
deg
# Athw. Offset Angle -0.16 deg Along. Offset Angle 0.14
deg
# SaCorrection -0.28 dB Depth 0.00
#
# Transceiver: GPT 200 kHz 009072033f91 1 ES200-7
# Pulse Duration 1.024 ms Sample Interval 0.186
# Power 300 W Receiver Bandwidth 3.09
kHz
#
# Sounder Type:
# EK60 Version ComSounder
#
# TS Detection:
# Min. Value -50.0 dB
# Max. Beam Comp. 6.0 dB Min. Echolength 80
%
# Max. Phase Dev. 8.0 Max. Echolength 180
%
#
# Environment:
# Absorption Coeff. 39.8 dB/km Sound Velocity 1453.0
m/s
#
# Beam Model results:
# Transducer Gain = 22.03 dB SaCorrection = -0.31
dB
# Athw. Beam Angle = 6.43 deg Along. Beam Angle = 6.44
deg

```

```

# Athw. Offset Angle =-0.24 deg Along. Offset Angle= 0.17
deg
#
# Data deviation from beam model:
# RMS = 0.26 dB
# Max = 1.00 dB No. = 237 Athw. = 2.9 deg Along = -0.8
deg
# Min = -0.83 dB No. = 279 Athw. = 2.7 deg Along = -3.3
deg
#
# Data deviation from polynomial model:
# RMS = 0.23 dB
# Max = 0.87 dB No. = 237 Athw. = 2.9 deg Along = -0.8
deg
# Min = -0.68 dB No. = 241 Athw. = 3.0 deg Along = -1.8
deg
#
# Data:
# No. Time Distance TS-c TS-u Athw. Along Sa
# [m] [dB] [dB] [deg] [deg]
[m2/nm2]
#
1 23:37:27.65 25.79 -49.01 -49.09 -0.02 -0.20 70
2 23:37:28.66 25.91 -48.22 -48.36 -0.27 -0.32 82
3 23:37:30.66 25.83 -48.53 -48.64 0.16 -0.14 78
* 4 23:37:35.66 25.75 -49.22 -49.39 0.22 -0.20 69
5 23:37:45.66 25.77 -48.52 -48.66 0.22 -0.14 83
6 23:37:48.65 25.77 -48.41 -48.87 0.22 -0.63 79
7 23:37:53.66 25.74 -48.75 -49.25 0.16 -0.69 71
8 23:37:59.66 25.75 -48.29 -49.19 0.59 -0.81 70
9 23:38:01.65 25.75 -48.19 -49.22 0.47 -1.00 70
10 23:38:07.62 25.67 -46.99 -48.21 0.59 -1.06 85
11 23:38:08.62 25.71 -48.25 -50.41 0.53 -1.61 50
12 23:38:20.62 25.73 -48.61 -49.86 0.16 -1.24 56
13 23:38:32.62 25.73 -48.07 -49.49 0.04 -1.36 69
14 23:38:39.62 25.76 -48.56 -49.13 -0.21 -0.81 71
15 23:38:40.62 25.75 -47.84 -48.65 -0.27 -1.00 81
16 23:39:09.60 25.88 -48.66 -50.09 -0.39 -1.36 57
17 23:39:10.59 25.80 -48.84 -51.05 -0.39 -1.73 45
18 23:39:20.59 25.75 -48.45 -51.86 -0.63 -2.16 41
19 23:39:22.59 25.79 -49.15 -51.72 -0.57 -1.85 41
20 23:39:23.60 25.78 -47.73 -50.92 -0.51 -2.10 50
21 23:39:26.59 25.76 -48.14 -52.42 -0.51 -2.46 36
22 23:39:32.59 25.76 -47.55 -53.39 -0.63 -2.89 28
23 23:39:33.59 25.62 -47.95 -53.74 -0.51 -2.89 26
24 23:39:34.59 25.76 -47.95 -53.19 -0.76 -2.71 30
25 23:39:37.60 25.74 -47.33 -54.30 -0.45 -3.20 21
26 23:39:40.59 25.76 -47.14 -56.16 -0.82 -3.63 14
27 23:39:41.59 25.72 -47.21 -54.87 -0.82 -3.32 20
28 23:39:47.59 25.60 -46.99 -58.01 -0.57 -4.05 9
29 23:39:53.59 25.70 -46.89 -56.33 -0.39 -3.75 14
30 23:40:18.56 25.77 -47.40 -54.00 -1.06 -3.01 24
31 23:40:19.56 25.78 -47.87 -53.61 -1.12 -2.77 26
32 23:40:24.56 25.79 -47.78 -54.93 -1.37 -3.07 19
33 23:40:29.55 25.94 -47.00 -55.28 -1.98 -3.14 17
34 23:40:30.56 25.88 -48.53 -54.08 -1.49 -2.59 23
35 23:40:31.56 25.89 -47.20 -54.97 -2.29 -2.83 19
36 23:40:36.55 25.89 -48.09 -54.73 -1.92 -2.71 19
37 23:40:50.55 26.07 -47.82 -55.26 -2.22 -2.77 17
38 23:40:51.56 25.95 -49.00 -54.20 -1.86 -2.28 22
39 23:40:54.56 25.97 -48.26 -56.85 -2.47 -2.95 12

```

40	23:40:56.55	26.07	-46.73	-57.24	-2.90	-3.20	11
41	23:40:57.55	25.99	-47.02	-57.10	-2.90	-3.07	11
* 42	23:40:59.56	26.10	-46.81	-54.55	-2.53	-2.65	19
43	23:41:06.56	26.13	-47.92	-55.40	-2.71	-2.40	16
44	23:41:11.55	26.13	-48.12	-54.00	-2.47	-2.04	23
45	23:41:14.56	26.13	-49.13	-53.87	-2.35	-1.67	24
46	23:41:19.52	26.13	-48.81	-53.90	-2.53	-1.61	24
47	23:41:24.52	26.14	-48.61	-55.14	-2.90	-1.79	18
48	23:41:28.52	26.28	-48.42	-55.09	-3.02	-1.67	17
49	23:41:31.52	26.16	-49.20	-57.05	-3.26	-1.85	11
50	23:41:36.51	26.19	-47.53	-57.82	-3.81	-2.04	10
51	23:41:37.52	26.17	-48.87	-57.89	-3.45	-2.10	9
52	23:41:45.52	26.14	-48.94	-56.88	-3.45	-1.55	11
53	23:41:53.52	26.13	-48.40	-55.28	-3.26	-1.30	17
54	23:42:03.52	26.24	-48.64	-57.92	-3.88	-1.30	8
55	23:42:04.51	26.32	-49.05	-54.68	-2.90	-1.30	18
56	23:42:05.52	26.17	-48.00	-57.24	-3.75	-1.61	10
57	23:42:28.48	26.11	-48.44	-52.87	-2.16	-1.73	25
58	23:42:29.48	25.97	-47.89	-51.81	-1.92	-1.73	38
59	23:42:30.48	26.10	-48.92	-52.70	-1.98	-1.61	30
* 60	23:42:36.48	25.93	-47.37	-50.70	-1.67	-1.67	51
61	23:42:37.48	25.93	-48.49	-51.90	-1.55	-1.79	38
62	23:42:42.48	25.94	-48.66	-51.23	-1.25	-1.61	46
* 63	23:42:46.48	25.91	-47.45	-50.50	-1.31	-1.79	54
64	23:42:59.48	25.98	-48.48	-50.70	-1.43	-1.30	51
65	23:43:02.48	25.95	-48.93	-50.61	-1.25	-1.12	52
66	23:43:07.48	26.10	-48.99	-50.43	-1.43	-0.75	48
67	23:43:10.48	26.09	-48.95	-50.33	-1.55	-0.45	51
68	23:43:11.48	26.09	-48.82	-49.98	-1.31	-0.63	55
69	23:43:20.48	26.12	-48.78	-50.62	-1.74	-0.63	50
70	23:43:23.48	26.10	-49.12	-51.32	-1.98	-0.45	43
71	23:43:29.45	26.27	-48.92	-52.20	-2.41	-0.51	33
72	23:43:30.45	26.14	-48.75	-52.47	-2.59	-0.38	32
73	23:43:31.46	26.20	-49.11	-52.60	-2.47	-0.57	31
74	23:43:38.46	26.32	-49.26	-54.29	-2.96	-0.63	21
75	23:43:39.46	26.32	-49.26	-54.41	-3.02	-0.51	21
76	23:43:48.46	26.29	-49.08	-55.63	-3.45	-0.14	17
77	23:43:49.45	26.35	-49.15	-56.50	-3.57	-0.69	13
78	23:43:51.45	26.46	-48.81	-57.92	-4.00	-0.57	9
79	23:43:57.45	26.31	-48.59	-56.31	-3.69	-0.51	13
80	23:44:02.45	26.51	-48.55	-58.49	-4.18	-0.51	7
81	23:44:03.45	26.35	-49.03	-57.10	-3.75	-0.63	10
82	23:44:04.45	26.35	-48.88	-55.97	-3.57	-0.26	13
83	23:44:16.45	26.46	-48.99	-58.62	-4.12	0.78	7
84	23:44:25.45	26.46	-49.22	-57.82	-3.94	0.17	9
85	23:44:26.45	26.47	-48.87	-58.04	-4.06	0.29	9
86	23:44:32.41	26.35	-49.20	-56.48	-3.63	0.29	13
87	23:44:33.42	26.41	-48.59	-55.36	-3.51	0.29	16
88	23:44:38.41	26.36	-49.19	-58.10	-4.00	-0.14	9
89	23:44:55.42	26.30	-48.73	-53.06	-2.84	0.29	28
90	23:45:00.41	26.34	-49.29	-54.02	-2.96	0.23	23
91	23:45:16.42	26.16	-48.82	-51.73	-2.35	0.35	38
92	23:45:26.41	26.16	-48.38	-50.39	-1.98	0.29	52
93	23:45:35.38	26.19	-49.02	-50.89	-1.92	0.17	46
94	23:45:37.38	26.15	-49.28	-51.70	-2.16	0.17	37
95	23:45:47.37	26.13	-49.13	-50.41	-1.61	0.29	53
96	23:45:58.38	25.99	-49.14	-49.86	-1.25	0.10	59
97	23:46:03.38	26.11	-49.28	-50.11	-1.31	0.35	56
98	23:46:21.38	26.02	-48.95	-49.27	-0.88	0.10	66
99	23:46:22.37	25.96	-49.08	-49.35	-0.82	0.23	67
100	23:46:48.36	25.90	-49.07	-49.07	-0.21	0.10	73

*101	23:46:58.35	25.90	-49.28	-49.29	-0.21	0.23	69
102	23:47:13.35	26.09	-49.00	-49.42	-0.08	0.96	65
103	23:47:19.35	25.93	-49.06	-49.85	-0.21	1.27	56
104	23:47:20.35	25.98	-48.78	-49.66	-0.27	1.33	62
105	23:47:32.35	25.98	-48.96	-49.96	-0.76	1.27	58
106	23:47:39.35	26.10	-49.28	-50.29	-0.63	1.33	52
107	23:48:18.32	26.13	-49.18	-50.66	-1.25	1.27	50
108	23:48:19.31	26.16	-49.26	-51.27	-1.49	1.39	45
109	23:48:28.31	26.29	-49.27	-51.88	-1.92	1.27	35
110	23:48:37.31	26.32	-49.14	-53.16	-2.53	1.21	28
111	23:48:43.31	26.40	-49.07	-55.24	-3.14	1.39	17
112	23:48:44.28	26.46	-48.73	-55.18	-3.26	1.27	16
113	23:48:50.28	26.50	-49.09	-56.40	-3.45	1.39	13
114	23:49:19.28	26.63	-49.14	-60.50	-4.24	1.88	5
115	23:49:29.27	26.50	-48.45	-56.47	-3.63	1.39	12
116	23:49:33.28	26.62	-48.84	-57.47	-3.63	1.82	10
117	23:49:41.28	26.47	-49.29	-56.13	-3.20	1.69	14
118	23:49:53.25	26.47	-48.92	-53.90	-2.35	2.06	21
119	23:49:58.25	26.47	-49.11	-53.55	-2.29	1.88	23
120	23:50:01.25	26.47	-48.92	-53.95	-2.47	1.94	22
121	23:50:10.26	26.31	-48.81	-52.59	-1.86	2.00	31
122	23:50:28.25	26.10	-49.29	-51.27	-0.57	1.88	44
123	23:50:31.26	26.06	-49.01	-51.23	-0.51	2.00	42
124	23:50:42.25	26.08	-49.07	-51.38	-0.27	2.06	41
125	23:50:43.25	25.96	-48.82	-50.83	-0.15	1.94	47
126	23:50:45.25	25.97	-49.29	-51.26	0.22	1.88	44
127	23:50:50.25	25.95	-48.16	-50.93	-0.08	2.24	45
128	23:50:55.21	26.10	-48.93	-52.55	-0.02	2.55	31
129	23:50:58.22	26.06	-48.59	-53.40	-0.02	2.92	25
130	23:51:09.21	25.97	-49.09	-53.49	-0.33	2.79	25
131	23:51:10.21	25.97	-48.79	-54.03	-0.33	3.04	22
132	23:51:11.21	25.97	-48.09	-54.29	-0.45	3.28	21
133	23:51:19.22	25.92	-48.44	-55.50	-0.76	3.47	15
134	23:51:20.22	25.94	-49.07	-57.25	-0.88	3.71	11
135	23:51:21.21	25.97	-48.36	-57.56	-1.12	3.90	10
136	23:51:25.21	25.96	-48.67	-59.52	-1.61	4.14	7
137	23:51:28.21	25.79	-49.27	-58.71	-1.61	3.83	8
138	23:51:34.21	25.92	-48.40	-57.98	-1.25	3.96	9
139	23:51:36.21	25.93	-48.81	-56.73	-1.43	3.53	11
140	23:51:38.21	25.92	-49.09	-55.67	-1.49	3.16	15
141	23:51:39.21	25.91	-48.95	-56.60	-1.19	3.53	12
142	23:51:46.21	25.76	-48.80	-53.76	-1.37	2.73	24
143	23:51:47.22	25.80	-49.09	-53.90	-1.25	2.73	25
144	23:51:57.17	25.80	-48.64	-54.42	-1.80	2.79	21
145	23:52:11.17	25.96	-48.86	-57.01	-2.77	2.86	10
146	23:52:19.18	25.97	-48.45	-57.65	-3.08	2.92	9
147	23:52:21.18	25.94	-48.32	-56.45	-2.84	2.79	12
148	23:52:44.17	26.10	-49.12	-60.14	-3.02	3.53	6
149	23:52:53.17	26.26	-49.08	-56.49	-2.41	2.92	12
150	23:52:59.17	26.29	-48.86	-53.48	-1.92	2.31	24
151	23:53:25.14	26.23	-49.13	-53.06	-1.61	2.24	27
152	23:53:32.14	26.14	-49.00	-52.66	-1.19	2.37	32
153	23:53:40.14	26.13	-49.21	-52.21	-0.82	2.24	34
154	23:54:03.14	25.93	-49.03	-52.20	0.22	2.37	36
155	23:54:11.11	25.85	-48.65	-52.43	0.40	2.55	32
156	23:54:30.11	25.78	-48.80	-53.56	0.40	2.86	27
157	23:54:36.11	25.74	-48.72	-54.64	-0.02	3.22	21
158	23:54:45.11	25.74	-48.54	-54.55	0.28	3.22	20
159	23:54:54.11	25.73	-47.89	-56.02	0.47	3.71	14
160	23:55:00.11	25.71	-48.64	-56.62	0.16	3.71	13
161	23:55:03.11	25.61	-48.53	-57.28	0.59	3.83	11



162	23:55:10.07	25.56	-48.99	-55.51	0.71	3.28	14
163	23:55:13.07	25.58	-47.91	-57.02	1.02	3.83	12
164	23:55:15.08	25.61	-48.91	-56.68	1.20	3.47	13
165	23:55:20.07	25.58	-48.65	-58.61	1.02	4.02	9
166	23:55:21.08	25.54	-48.75	-58.05	1.38	3.77	10
167	23:55:25.07	25.62	-47.89	-57.58	0.71	4.02	10
168	23:55:38.07	25.54	-48.20	-53.59	1.08	2.86	27
169	23:55:40.07	25.59	-49.03	-55.04	0.65	3.16	19
170	23:55:45.07	25.57	-48.88	-53.79	0.83	2.79	26
171	23:55:52.07	25.56	-48.75	-53.37	1.08	2.61	27
172	23:56:01.07	25.56	-48.80	-53.56	1.51	2.43	28
173	23:56:04.08	25.56	-48.95	-53.52	1.57	2.31	27
174	23:56:05.08	25.61	-48.44	-53.06	1.75	2.18	30
175	23:56:09.07	25.58	-49.11	-53.19	1.69	2.00	28
176	23:56:28.03	25.60	-48.12	-51.25	1.63	1.57	45
177	23:56:37.04	25.58	-49.06	-51.28	1.44	1.21	46
178	23:56:39.04	25.55	-48.49	-50.34	1.44	0.84	57
179	23:56:50.04	25.57	-48.33	-51.01	1.87	0.72	50
180	23:56:52.04	25.58	-48.86	-51.56	1.93	0.47	43
181	23:56:54.03	25.59	-49.22	-52.56	2.18	0.41	33
182	23:56:58.04	25.64	-48.22	-52.06	2.36	0.04	37
183	23:56:59.04	25.71	-48.01	-52.43	2.54	-0.02	33
184	23:57:10.04	25.57	-48.75	-54.90	3.03	0.04	20
185	23:57:17.01	25.55	-47.67	-54.81	3.28	0.04	21
186	23:57:24.01	25.43	-47.07	-55.81	3.65	0.04	16
187	23:57:28.01	25.41	-48.22	-56.96	3.65	0.23	12
188	23:57:29.00	25.41	-48.64	-56.82	3.52	0.23	12
189	23:57:34.01	25.40	-48.24	-55.18	3.22	0.53	18
190	23:57:35.01	25.40	-48.74	-55.00	3.03	0.59	20
191	23:57:39.01	25.40	-48.78	-54.02	2.73	0.78	25
192	23:57:42.01	25.35	-48.68	-54.13	2.73	1.02	24
193	23:57:44.01	25.36	-48.94	-53.44	2.42	1.08	29
194	23:57:45.01	25.36	-47.61	-52.41	2.42	1.33	35
195	23:57:50.00	25.24	-48.26	-52.28	2.06	1.51	36
196	23:57:52.01	25.21	-47.62	-51.62	1.87	1.76	38
197	23:58:07.01	25.36	-48.87	-54.24	1.81	2.43	22
198	23:58:13.01	25.38	-48.94	-55.75	1.81	2.92	17
199	23:58:15.01	25.36	-48.71	-55.27	1.69	2.92	19
200	23:58:16.01	25.37	-47.98	-56.16	1.87	3.28	15
201	23:58:24.05	25.38	-48.89	-56.74	1.57	3.35	13
202	23:58:34.06	25.40	-48.02	-56.14	2.30	2.98	14
203	23:58:35.06	25.53	-48.26	-55.47	2.30	2.67	16
204	23:58:39.06	25.43	-49.18	-56.23	2.48	2.43	14
205	23:58:40.06	25.44	-48.59	-55.68	2.54	2.37	16
206	23:58:43.05	25.57	-48.91	-57.02	2.91	2.31	12
207	23:58:46.06	25.55	-48.18	-56.42	3.16	1.94	14
208	23:58:47.06	25.55	-48.34	-56.95	3.28	1.88	12
209	23:58:52.06	25.61	-48.69	-57.57	3.46	1.57	11
210	23:58:54.06	25.61	-47.53	-57.48	3.71	1.57	10
211	23:58:55.06	25.64	-48.01	-57.05	3.58	1.27	11
212	23:58:57.05	25.72	-49.07	-59.51	3.89	1.27	6
213	23:58:59.06	25.73	-47.73	-58.76	4.01	1.27	8
214	23:59:00.06	25.61	-48.18	-58.62	3.95	0.90	8
215	23:59:02.06	25.74	-48.88	-60.24	4.13	0.90	5
216	23:59:14.06	25.76	-48.26	-56.60	3.52	0.72	14
217	23:59:19.05	25.78	-48.74	-55.95	3.22	0.96	15
218	23:59:29.02	25.92	-48.82	-53.07	2.42	0.78	30
219	23:59:49.02	26.08	-49.13	-50.86	1.32	0.96	47
220	00:00:00.01	26.07	-49.12	-50.48	1.20	0.78	52
221	00:00:06.01	25.96	-48.88	-50.25	1.32	0.41	56
222	00:00:07.01	25.94	-48.51	-49.95	1.38	0.29	61

223	00:00:13.01	25.94	-48.65	-49.40	0.83	0.65	66
224	00:00:20.01	25.91	-48.86	-49.72	0.47	1.14	60
225	00:00:24.02	25.78	-49.19	-50.18	0.04	1.39	55
226	00:00:33.98	25.73	-49.28	-50.75	0.22	1.63	50
227	00:00:36.98	25.74	-48.86	-50.46	0.59	1.57	53
228	00:00:44.98	25.71	-48.28	-50.45	1.08	1.57	53
229	00:00:57.98	25.58	-49.15	-51.83	1.20	1.76	41
230	00:01:24.98	25.74	-47.99	-53.20	2.30	1.82	29
231	00:01:34.98	25.72	-48.58	-54.50	2.54	1.82	20
232	00:01:35.96	25.72	-48.54	-54.66	2.73	1.57	19
233	00:01:38.95	25.71	-49.11	-56.16	2.97	1.63	13
234	00:02:06.95	25.57	-49.08	-57.92	2.18	3.28	10
235	00:03:11.92	25.58	-49.21	-54.46	2.79	0.23	21
236	00:03:15.91	25.57	-49.11	-54.66	2.85	-0.26	21
237	00:03:21.91	25.55	-46.15	-52.32	2.91	-0.81	35
238	00:03:25.92	25.55	-48.16	-55.20	3.09	-1.00	18
239	00:03:27.91	25.58	-48.68	-54.33	2.73	-0.93	23
240	00:03:34.91	25.58	-47.93	-54.88	2.91	-1.42	18
241	00:03:37.92	25.52	-49.12	-56.95	2.97	-1.79	12
242	00:03:42.91	25.55	-47.96	-55.29	2.79	-1.85	17
243	00:03:44.88	25.55	-48.56	-56.98	2.91	-2.16	12
244	00:03:47.88	25.42	-47.41	-57.01	3.03	-2.46	11
245	00:03:55.88	25.54	-46.98	-55.61	2.79	-2.40	16
246	00:03:57.88	25.55	-47.01	-55.09	2.48	-2.52	18
247	00:03:59.88	25.52	-48.93	-56.49	2.42	-2.40	13
248	00:04:02.88	25.57	-47.94	-55.20	2.24	-2.46	18
249	00:04:05.88	25.56	-47.49	-53.57	1.81	-2.40	27
250	00:04:06.88	25.59	-47.37	-54.08	1.93	-2.52	24
251	00:04:11.88	25.60	-47.29	-53.39	1.63	-2.52	27
252	00:04:13.88	25.60	-48.80	-54.56	1.32	-2.59	20
253	00:04:17.88	25.74	-47.15	-52.25	1.26	-2.40	34
254	00:04:25.88	25.71	-48.07	-51.79	0.89	-2.10	38
255	00:04:26.88	25.59	-47.51	-50.70	0.71	-1.97	50
256	00:04:34.88	25.70	-48.07	-50.66	0.53	-1.79	52
257	00:04:35.88	25.59	-49.00	-51.35	0.59	-1.67	45
258	00:04:55.85	25.60	-49.11	-50.29	1.02	-0.63	56
259	00:05:08.85	25.57	-47.01	-48.98	1.44	-0.69	79
260	00:05:16.85	25.72	-47.25	-50.83	1.87	-1.24	45
261	00:05:18.85	25.70	-46.99	-49.80	1.69	-1.00	59
262	00:05:19.85	25.72	-48.48	-52.73	2.06	-1.36	28
263	00:05:20.85	25.61	-48.39	-53.73	2.30	-1.61	25
264	00:05:23.85	25.71	-48.20	-54.37	2.54	-1.67	22
265	00:05:26.85	25.70	-47.46	-53.40	2.42	-1.73	27
266	00:05:36.85	25.72	-47.26	-57.57	3.40	-2.22	10
267	00:05:43.85	25.59	-46.54	-58.40	3.65	-2.46	9
268	00:05:44.85	25.72	-48.45	-57.51	3.28	-1.85	10
269	00:05:47.85	25.73	-48.14	-56.76	3.28	-1.61	12
270	00:05:56.81	25.70	-48.00	-56.30	3.34	-1.24	14
271	00:05:58.82	25.63	-47.64	-55.27	3.28	-0.87	18
272	00:06:01.81	25.69	-46.85	-56.73	3.71	-1.24	12
273	00:06:08.81	25.57	-46.46	-58.44	4.13	-1.30	9
274	00:06:15.81	25.62	-47.72	-59.55	4.07	-1.42	7
275	00:06:18.82	25.60	-47.66	-58.83	3.95	-1.36	8
276	00:06:28.81	25.62	-46.72	-58.29	3.83	-1.97	9
277	00:07:18.78	25.62	-48.84	-60.44	3.03	-3.14	5
278	00:07:20.78	25.64	-48.76	-60.24	2.85	-3.26	5
279	00:07:21.78	25.66	-49.29	-60.43	2.73	-3.26	5
280	00:07:25.78	25.59	-48.71	-58.23	2.36	-3.07	8
281	00:07:26.78	25.60	-47.94	-58.57	2.24	-3.44	8
282	00:07:32.78	25.60	-49.26	-58.29	1.81	-3.26	8
283	00:07:33.78	25.61	-47.99	-57.03	2.06	-3.14	12

284	00:07:40.78	25.75	-49.08	-56.62	1.63	-2.95	13
285	00:07:47.78	25.77	-48.87	-56.36	1.14	-3.14	14
286	00:07:50.78	25.76	-48.42	-53.62	0.89	-2.59	26
287	00:08:02.75	25.75	-47.91	-53.89	0.83	-2.83	23
288	00:08:06.75	25.73	-48.51	-55.17	0.53	-3.07	16
289	00:08:07.75	25.61	-48.52	-56.04	0.95	-3.20	14
290	00:08:08.75	25.59	-48.68	-56.85	0.83	-3.38	12
291	00:08:11.74	25.67	-48.01	-57.61	0.89	-3.69	9
292	00:08:15.75	25.60	-48.12	-58.70	0.65	-3.93	8
293	00:08:16.75	25.57	-48.19	-58.14	0.95	-3.75	7
294	00:08:38.75	25.61	-48.88	-53.91	0.47	-2.65	23
295	00:10:29.68	25.22	-48.92	-49.42	0.71	-0.14	68
296	00:12:17.61	25.21	-48.87	-50.79	-1.00	1.69	52
297	00:12:22.62	25.21	-49.19	-50.58	-1.00	1.39	55
298	00:12:28.62	25.16	-48.82	-49.45	-0.82	0.90	72
299	00:12:34.61	25.07	-49.26	-49.85	-1.00	0.65	66
300	00:12:56.62	24.94	-49.11	-49.20	0.22	0.23	74

## Event Log

Time	Event	Lat	Lon	Comment
05/10/2006 20:48	1	-53.15117	-41.21994	Test XBT deployed
06/10/2006 17:57	1	-54.15887	-36.69725	Test CTD deployed for calibration
06/10/2006 18:07	2	-54.15886	-36.69726	CTD recovered
12/10/2006 20:08	3	-53.79976	-37.93687	Vessel On DP 300m north of shallow mooring
12/10/2006 20:11	3	-53.79977	-37.93686	Buoy Released
12/10/2006 20:13	3	-53.79976	-37.93688	Buoy on the surface and sighted, transponder recovered
12/10/2006 20:25	3	-53.80318	-37.93741	mooring grapnelled
12/10/2006 20:45	3	-53.80118	-37.94591	Mooring release hook recovered
12/10/2006 20:51	3	-53.80042	-37.94759	Mooring recovered to deck
12/10/2006 21:38	3	-53.78827	-37.94339	deck secure moving off station
13/10/2006 08:57	4	-54.05599	-39.39183	XBT Deployed. Commence Western Core Box @ W1.1S
13/10/2006 10:04	5	-53.87647	-39.44557	XBT Deployed
13/10/2006 11:11	6	-53.70197	-39.49702	XBT Deployed
13/10/2006 12:17	7	-53.39572	-39.28019	XBT Deployed
13/10/2006 13:20	8	-53.3486	-39.60116	XBT Deployed
13/10/2006 13:30		-53.32765	-39.59055	Transect 1.1 Complete
13/10/2006 14:38		-53.32043	-39.30306	Commence Transect 1.2
13/10/2006 18:55		-54.02219	-39.0894	End of transect 1.2 - A/C to run back up transect for RMT target fishing
13/10/2006 19:30	9	-53.95644	-39.10923	Slowing for RMT deployment
13/10/2006 19:33	9	-53.95288	-39.11344	Bridge ready to deploy
13/10/2006 19:41	9	-53.94956	-39.12328	Deploying RMT
13/10/2006 19:43	9	-53.94847	-39.12596	RMT Deployed
13/10/2006 19:59	9	-53.92261	-39.18206	RMT @ 346m
13/10/2006 20:23	9	-53.9225	-39.18216	RMT @ Surface
13/10/2006 20:27	9	-53.92413	-39.17934	RMT Recovered
13/10/2006 20:37	9	-53.92174	-39.18251	Moving off station
13/10/2006 22:00	10	-54.04002	-39.33141	Slowing for RMT deployment
13/10/2006 22:02	10	-54.03667	-39.3317	Bridge ready to deploy
13/10/2006 22:03	10	-54.03629	-39.33313	Deploying RMT
13/10/2006 22:05	10	-54.03554	-39.33548	RMT Deployed
13/10/2006 22:28	10	-54.00776	-39.39238	RMT @ 505m

13/10/2006 22:53	10	-54.00703 -39.39399 RMT @ Surface
13/10/2006 22:58	10	-54.01252 -39.38231 RMT Recovered
14/10/2006 00:42	11	-53.86781 -39.18566 Slowing for RMT deployment
14/10/2006 01:03	11	-53.86717 -39.18652 Clear to deploy RMT
14/10/2006 01:06	11	-53.87632 -39.16812 RMT Deployed
14/10/2006 01:17	11	-53.8655 -39.18818 Commence Recovery of RMT
14/10/2006 01:18	11	-53.86426 -39.18871 RMT @ Surface
14/10/2006 01:23	11	-53.86382 -39.18838 RMT Recovered
14/10/2006 01:29	11	-53.86354 -39.18785 Moving off station
14/10/2006 01:50	12	-53.84789 -39.1417 Slowing for CTD Deployment
14/10/2006 02:05	12	-53.84789 -39.14169 On Station
14/10/2006 02:21	12	-53.84788 -39.14169 Clear to deploy CTD
14/10/2006 02:23	12	-53.84791 -39.14168 CTD deployed
14/10/2006 02:41	12	-53.8479 -39.14169 CTD recovered
14/10/2006 02:51		-53.84479 -39.14473 Vessel moving off station
14/10/2006 05:00	13	-53.50529 -39.24487 commence slowing for CTD station
14/10/2006 05:02	13	-53.50101 -39.24712 Bow thruster problem
14/10/2006 05:20	13	-53.49321 -39.25096 bow thruster problem resolved
14/10/2006 05:24	13	-53.49283 -39.25065 V/L on station for CTD deployment
14/10/2006 05:28	13	-53.49282 -39.25068 CTD 1.2N deployed
14/10/2006 05:49	13	-53.4928 -39.25073 CTD @ depth 1000m
14/10/2006 06:07	13	-53.49278 -39.25105 CTD recovered
14/10/2006 06:19		-53.49237 -39.25119 vessel off station, proceeding to start of 2.1
14/10/2006 09:00	14	-53.28905 -39.03752 Commence Transect W2.1N @ 10.0kts
14/10/2006 10:02	15	-53.48366 -38.97845 XBT Deployed
14/10/2006 10:03	15	-53.48442 -38.97817 XBT Aborted
14/10/2006 10:05	16	-53.47248 -38.982 XBT Deployed
14/10/2006 11:07	17	-53.64552 -38.92816 XBT Deployed
14/10/2006 12:10	18	-53.97699 -38.55799 XBT Deployed
14/10/2006 13:14	19	-53.97613 -38.5523 XBT Deployed
14/10/2006 14:25		-53.96219 -38.52707 Commence Transect W2.2N@ 10kt Complete Transect W2.2N,
14/10/2006 19:36		-53.25461 -38.75209 Proceeding to Royal Bay due to Adverse weather conditions
15/10/2006 09:30	20	-54.49797 -35.75695 Slowing for RMT deployment
15/10/2006 09:36	20	-54.49792 -35.76329 Bridge ready to deploy
15/10/2006 09:42	20	-54.4932 -35.76705 Deploying RMT
15/10/2006 09:53	20	-54.48405 -35.77417 RMT @ 65m
15/10/2006 10:38	20	-54.44842 -35.7999 RMT @ Surface
15/10/2006 10:42	20	-54.44562 -35.80215 RMT Recovered
15/10/2006 10:50	20	-54.43965 -35.80737 deck secure moving off station
15/10/2006 11:33	21	-54.48486 -35.69377 Clear to deploy RMT
15/10/2006 11:36	21	-54.48264 -35.69473 RMT Deployed
15/10/2006 12:23	21	-54.40784 -35.70721 RMT at Depth
15/10/2006 12:53	21	-54.42908 -35.71777 Commence Recovery of RMT
15/10/2006 12:56	21	-54.42684 -35.71877 RMT Recovered
15/10/2006 13:46	21	-54.47255 -35.63159 V/L head to wind and 2Kts through the water
15/10/2006 13:56	21	-54.46627 -35.63808 RMT Deployed
15/10/2006 14:41	21	-54.43736 -35.65938 Commence Recovery of RMT
15/10/2006 14:45	21	-54.43488 -35.6608 RMT Recovered
15/10/2006 15:10	21	-54.40784 -35.70721

			V/L on station 0.5nm downwind of mooring site.
16/10/2006 17:09	-53.81139 -37.92998		Evaluating suitability of conditions for deployment
			Commence deployment of shallow water mooring –
16/10/2006 18:47	-53.80924 -37.92898		Commence moving ahead at 1 knot
16/10/2006 18:50	22 -53.80848 -37.92997		Buoy deployed
16/10/2006 18:52	-53.80809 -37.9306		Releases deployed
16/10/2006 19:19	22 -53.80242 -37.93854		Mooring Released, water depth 319m
16/10/2006 19:33	23 -53.79953 -37.94261		Vessel on DP 500m upwind of mooring reday to deploy ctd
16/10/2006 19:43	23 -53.79951 -37.94274		CTD deployed
16/10/2006 19:50	23 -53.7995 -37.94272		CTD stopped @ 303m
16/10/2006 19:59	23 -53.79953 -37.94271		CTD recovered
16/10/2006 20:13	24 -53.79946 -37.94272		commence deployment of Whale Listening buoy
16/10/2006 20:15	24 -53.79949 -37.94273		Whale Listening buoy deployed in 318m
16/10/2006 20:40	25 -53.80283 -37.9376		Vessel on DP over Shallow mooring site
16/10/2006 21:21	25 -53.8028 -37.93765		Vessel moving off station
17/10/2006 09:00	26 -53.60921 -41.07897		Vessel head to wind @ 2.5 Kts, assessing weather for RMT deployment
17/10/2006 09:28	26 -53.62231 -41.10645		Deploying RMT
17/10/2006 09:35	26 -53.62529 -41.11308		RMT Deployed
17/10/2006 09:43	26 -53.62965 -41.12149		RMT @ 32m
17/10/2006 10:11	26 -53.64213 -41.14929		RMT @ 43m
17/10/2006 10:40	26 -53.65464 -41.17896		recovering RMT
17/10/2006 10:43	26 -53.65621 -41.18192		RMT @ Surface
17/10/2006 10:49	26 -53.65962 -41.18791		RMT Recovered
17/10/2006 10:58	27 -53.66381 -41.1962		Deploying RMT
17/10/2006 11:02	27 -53.6658 -41.19996		RMT Deployed
17/10/2006 12:06	27 -53.69624 -41.25914		Commence Recovery of RMT
17/10/2006 12:14	27 -53.69927 -41.26579		RMT on deck
17/10/2006 12:22	28 -53.70205 -41.27225		RMT Deployed
17/10/2006 13:39	28 -53.73552 -41.34646		Commence Recovery of RMT
17/10/2006 13:45	28 -53.73875 -41.35231		RMT on deck
17/10/2006 15:04	-53.56922 -41.19658		V/L on DP awaiting deployment of whale listening buoy
17/10/2006 15:18	29 -53.56921 -41.19653		Whale Listening buoy deployed in 199m
17/10/2006 15:25	30 -53.59849 -41.21632		V/L off DP preparing for RMT
17/10/2006 15:28	30 -53.57068 -41.19738		Commence deployment of RMT
17/10/2006 15:32	30 -53.52185 -41.28156		RMT deployed
17/10/2006 15:36	30 -53.57726 -41.20164		Stop veering 80m cable out
17/10/2006 15:48	30 -53.58761 -41.2088		Commence recovery of RMT
17/10/2006 15:53	30 -53.5921 -41.21197		RMT @ Surface
17/10/2006 15:57	30 -53.5954 -41.2144		RMT Recovered
17/10/2006 16:00	-53.59822 -41.21615		Fishing postponed till further notice due to deteriorating sea conditions
17/10/2006 16:10	-53.51094 -41.28652		Decision make to proceed 20Nm NW to next whale buoy location
17/10/2006 19:53	31 -53.44581 -41.72734		Vessel stopped on D.P. in 193m water
17/10/2006 20:09	31 -53.44578 -41.72723		Whale Listening buoy deployed, ready to deploy whale listening buoy

# Cruise track

