P.O.L.

RRS 'James Clark Ross'

November 11, 1996 to
December 14, 1996

ACCLAIM: Sea level measurements in the Drake Passage

Cruise Report No. 28

PROUDMAN
OCEANOGRAPHIC
LABORATORY

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G.W. Hargreaves

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ABSTRACT

ACCLAIM Bottom Pressure Recorders have been used for making measurements since 1988, initially in the Scotia Sea and then later across the Drake Passage between the Falkland Islands and the Antarctic peninsula. The Bottom Pressure Recorders (BPRs) are combined with Inverted Echo Sounders (IES) and deployed along the track of TOPEX/POSEIDON satellites that collect altimeter data from the area.

During this cruise the BPR/IESs were recovered and re-deployed and the prototype CROCUS BPR deployed in 1995 was also recovered. A smaller version of the POL development MYRTLE called MINI-MYRTLE was deployed near Signy Island in the Scotia Sea.

The Sea Level Recorders at Rothera and Signy were serviced. New sensors were installed at Rothera with titanium housings and the logger at Signy was prepared for summer use after operating over winter on lithium batteries.

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KEYWORDS

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Inverted Echo Sounder, MYRTLE, ACCLAIM, Scotia Sea
British Antarctic Survey, CROCUS, Rothera, Signy

CONTRACT

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CRUISE PERSONNEL

POL Personnel

Grade 7	Ian Vassie
Senior Scientific Officer	Bob Spencer
Scientific Officer	Geoff Hargreaves
Scientific Officer	Jon Ashley

RRS James Clark Ross Personnel

Captain	Jerry Burgan
Chief Officer	Tony Reading
2nd Officer	Tony Gatti
3rd Officer	Simon Alletson
Chief Engineer	Duncan Anderson
2nd Engineer	Colin Smith
Radio Officer	Mike Gloistein
Electrician	Keith Rowe
Bosun	George Stewart

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OVERVIEW

The tide gauges and Drake Passage BPRs are part of ACCLAIM (Antarctic Circumpolar Current Levels from Altimeter and Island Measurements), a project to measure sea level in the Southern Ocean as part of the U.K. contribution to the World Ocean Circulation Experiment (WOCE) Core project 2. The associated research at POL interacts with international work in the United States, South Africa, Australia, France and Germany, and involves studies of ocean scale and mesoscale dynamics, changes in mean sea level, and comparisons with satellite altimeter data. The data are made available to the international community via the Permanent Service for Mean Sea Level (PSMSL). The ACCLAIM network is also a component part of GLOSS, producing accurate tidal and other dynamical information which is particularly valuable in these remote areas.

The CROCUS BPR recovered on this cruise is a prototype small instrument, which will lead to the possibility of more numerous deployments of "disposable" instruments in the future.

ACCLAIM BPRs have been deployed in the Drake Passage area since 1988, with regular recovery and redeployment.

POL CRUISE OBJECTIVES

1) To service the Sea Level Recorder at Stanley and recover data. Install new software in the logger and check the DCP timing.

2) To recover, service and re-deploy three IES/BPRs in the Drake Passage. To modify the existing IESs into CHIRP IESs.

3) To recover the CROCUS bottom pressure recorder.

4) To service the Sea Level Recorder at Rothera, recover the data and install a second set of sea sensors and steelwork. Recover the AanderaaWater Level recorder from the well.

5) To service the Sea Level Recorder at Signy and prepare for operation over the following winter.

6) To deploy MINI-MYRTLE in the Scotia Sea near to Coronation Island.

IES/BPR DEPLOYMENTS AND SLR INSTALLATIONS

Ship Preparation

Four POL personnel, Ian Vassie, Bob Spencer, Geoff Hargreaves and Jon Ashley, joined R.R.S James Clark Ross at Stanley in the Falkland Islands on November 12, 1996. The equipment was unpacked and stowed ready for use. Ballast weights were assembled ready for use, acoustic releases were fitted with batteries, the data logger set running and the CHIRP IES set up ready for use. The frame was assembled and made ready for deployment at the first recovery site. The ship departed Stanley on 13/11/95 at 08.00 hours. Just after sailing, a problem developed with the IES that meant it could not be deployed. Therefore, the first site was a recovery only and the deployment at Drake Passage North was postponed until the end of the cruise.

Wire testing acoustic releases 14/11/96

Four acoustic release mechanisms were attached to the CTD frame in pairs and taken to a depth of 2000m and 4500m. On both occasions, the acoustic conditions were very poor and it proved difficult to establish reliable communication, especially when trying to listen for the release acknowledgement signal. The releases were fired at the bottom of the CTD dip and on their return to the surface all of them had operated successfully.

Acoustic Information

Serial Number	*Transmit Frequency*	*Receive Frequency*	*Release Command*
58434	12.0 kHz	14.5 kHz	B
51329	12.0 kHz	10.0 kHz	C
58172	12.0 kHz	14.0 kHz	A

One of the new TR7000 microprocessor based acoustic releases was being deployed for the first time.

Serial Number	51370
ID Number	01
Transmit Frequency	12.0 kHz
Receive Frequency	13.0 kHz
Commands	Enable - A, Disable - B, Release - C, Pinger - D

PORT STANLEY SEA LEVEL RECORDER 12/11/96

The SLR at FIPASS, Stanley was serviced and the calibrated data downloaded and saved to STAN96.CAL. The SRAM memory card was replaced with one fitted with a new lithium battery. The DCP timing was checked with the synchroniser unit and the time then corrected. The SLR was then re-started.

DRAKE PASSAGE NORTH BPR/IES RECOVERY 14/11/96

EVENTS

20.10 GMT	Vessel on station
20.18 GMT	Release command transmitted using 15.0 kHz code C.
20.25 GMT	Release command transmitted using 13.5 kHz code C.
20.30 GMT	Ship had drifted off station quite a distance and was manouvered back into place.
20.50 GMT	The BPR was spotted on the surface 200m from the ship.
21.10 GMT	BPR brought onboard.

Total time on station: 1 hour.

Drake Passage North Recovery Summary

Acoustic conditions were very poor and it was difficult to interpret the Nagrafax chart display due to sea noise. The deck unit obtained slant range readings that were consistent with the deployment depth, so the first release was fired. A sloping trace was observed on the Nagrafax which then straightened up. The ship was drifting off station so the transducer was hauled inboard and the ship was manoeuvred back on site. Before the transducer could be re-instated into the water the BPR was spotted on the surface 200m from the ship.

CROCUS RECOVERY 17/11/96

EVENTS

11.45 GMT	Arrive on station
11.50 GMT	Release command transmitted using 13.5 kHz code B
11.58 GMT	Released successfully from ballast weight
13.00 GMT	Capsule spotted on surface near the ship

CROCUS Recovery Summary

CROCUS uses a burnwire release system rather than the usual pyrolease. The burnwire uses electrolysis to erode a piece of wire when a current is passed from it, through the seawater, to a cathode. It takes a few minutes for this to happen, so the result of firing the release command is not as instantaneous as with a pyrolease.

DRAKE PASSAGE CENTRAL BPR/IES RECOVERY 18/11/96

EVENTS

11.55 GMT	Vessel on station.
12.56 GMT	Release fired.
14.05 GMT	On the surface.
14.20 GMT	Brought on board the ship.

Drake Passage Central Recovery Information

Once again, acoustic conditions were poor and it was difficult to obtain reliable communications with the acoustic releases. Initially the wrong release code was being transmitted. Once the correct code was transmitted, the unit showed signs of returning to the surface.

DRAKE PASSAGE CENTRAL BPR/IES DEPLOYMENT 18/11/96

EVENTS

14.25 GMT	Released into the water.
15.35 GMT	On the seabed (approximately).

Drake Passage Central Deployment Information

The BPR was not monitored all the way to the seabed in order to save time for the CTD that was being performed near that station. Once the CTD was successfully completed, the ship passed over the deployment site and the acoustics were interrogated.

MYRTLE RECOVERY 19/11/96

EVENTS

16.40 GMT	On station.
16.43 GMT	Transmitting enable command to frame release.
16.50 GMT	Transmitting release command to frame release.
16.57 GMT	Re-transmit release command to frame release.
16.58 GMT	Transmitting release command to both frame acoustics.
17.12 GMT	Transmit enable command to podule release acoustic.
17.13 GMT	Release command sent to podule acoustic.
17.14 GMT	Confirmation of podule release.
17.15 GMT	Confirmation of frame release.
19.10 GMT	Podule spotted on the surface.
19.12 GMT	Main frame spotted on the surface.
19.30 GMT	Podule brought onboard.
19.40 GMT	Main frame brought onboard.

MYRTLE Recovery Information

The main frame acoustic release was enabled and transponded with in order to establish communication with it. Acoustic conditions were poor and obtaining a reliable signal confirming contact was difficult. It was not even possible to determine with the Nagrafax chart display whether communication with the acoustic release had succeeded.

The release command was transmitted to the main frame acoustic unit but no indication of its ascent to the surface was present. The release command was transmitted many times but without apparent success. The podule acoustic release was enabled and the podule released. The podule was transponded to and indicated that it was rising from the frame. The podule acoustic release, which is attached to the frame, was transponded to and it also provided an indication that it was rising to the surface. The action of releasing the podule seems to have provided the necessary stimulus for the main frame to release successfully. The recovery was slightly delayed due to a live broadcast by the BBC for Radio 2.

DRAKE PASSAGE SOUTH BPR/IES RECOVERY 20/11/96

EVENTS

17.44 GMT	On station
17.47 GMT	Release fired
17.48 GMT	Second release fired
18.11 GMT	Spotted on surface
18.18 GMT	Brought on board

Drake Passage South Recovery Information

For the first time on this cruise the acoustic conditions were excellent due to a slight swell and the 1000m deployment depth. Good communications were achieved with both of the acoustic release units whilst still on the seabed and all of the way to the surface.

DRAKE PASSAGE SOUTH BPR/IES DEPLOYMENT 20/11/96

EVENTS

18.24 GMT	Into the water
18.48 GMT	On the seabed

Drake Passage South Deployment Information

Both of the transponders worked well to the seabed. Acoustic conditions were excellent.

SERVICING AND INSTALLATION OF ROTHERA SEA LEVEL RECORDER

The ship arrived at the quayside at Rothera on 25/11/96 and started discharging cargo. It was intended that a set of sensors would be fitted into the well in addition to the sensors already installed. The new set of sensors would then be connected to the second Sea Level Recorder, which was installed the previous year. However, upon arrival at Rothera and assessing the condition of the current sensor housing, it was decided to remove the sensors and replace with the new arrangement.

Mechanical Detail

The sensors and associated steelwork are installed in the sea water intake well for the Reverse Osmosis (RO) plant. There was a lot of ice around the existing steelwork fittings which had to be chipped off before the fittings could be removed. The construction was then lifted out using a crane. The new sensors were fitted to a painted steel mounting frame of approximately 4 metres length at predetermined positions. The full tide sensor was fitted to the bottom of the frame and the half tide sensor was placed at the half tide point. The steelwork was then lifted into the well using a crane and fastened to the wall of the well. Plastic tubing of four inch diameter was fastened to the steelwork to form a stilling well and a heater element inside a copper tube was placed inside plastic tubing and fastened in place. The heater element is being used to try and prevent the surface water from freezing.

Servicing Sea Level Recorder

The main SLR (No1) at Rothera was opened up and the time difference was noted between the expected scan time and the actual scan time. The raw and calibrated data were then dowloaded and saved to files on the laptop PC. This process was repeated for the second logger which is in parallel with the main logger. The existing barometer in logger No1 was removed and replaced with a new one. A cable was installed to transfer the barometric signals from logger No1.to logger No2. The signal wiring inside the loggers was changed so that the cable from the well is fed into logger No2 first and then into logger No1. A serial data lead was fitted to the DCP output of logger No2 so that the Toshiba PC can be connected to it. This will allow either logger to be used for retrieving data.

The Aanderaa water level recorder was recovered from the well.

Rothera Sea Level Recorder Summary

The installation of the new sensors went very well and was aided greatly by the use of a crane. The re-wiring of the two Sea Level Recorders was time consuming but was completed successfully and is neater than the previous arrangement. There was a problem with logger No1 dumping data to the Toshiba PC. After the re-wiring, no data was being received by the PC. After having checked all of the cables, the hardware was traced back and replaced. Eventually the fault was located on the TDS CPU board as a faulty I/O line. The card was replaced and the system worked well.

SERVICING SIGNY SEA LEVEL RECORDER

Arrived at Coronation Island in the South Orkneys on Sunday 1/12/96 and went ashore on the first launch.

Servicing Sea Level Recorder

The SLR was opened up and found to be still running after having spent the winter operating on batteries alone. The time difference was noted between the expected timebase scan and the actual timebase scan. The raw and calibrated data were then dowloaded and saved to files on the laptop PC. The lithium batteries were replaced and the SLR was switched over to run on a battery backed mains supply for the summer period. The Toshiba laptop PC was reinstated and connected to the serial output of the SLR. The logging program was then started..

Signy Sea Level Recorder Summary

The journey ashore was quite rough and took a long time. The SLR servicing went well even though there was not a lot of time available. New lithium batteries were fitted for winter operation and a volunteer was found who would look after the system during the summer.

MINI MYRTLE DEPLOYMENT 2/12/96

EVENTS

09.00 GMT	On station.
09.19 GMT	Into the water.
10.02 GMT	On the seabed.

MINI MYRTLE Deployment Information

The deployment of MINI MYRTLE went well. MINI MYRTLE is a smaller version of MYRTLE, which has only one recoverable capsule instead of four. The capsule is fitted with a timer release mechanism and satellite transmitter. Acoustic conditions were excellent and the frame could be monitored all the way to the seabed.

DRAKE PASSAGE NORTH DEPLOYMENT 3/12/96

EVENTS

22.45 GMT	On station.
22.56 GMT	Into the water.
23.17 GMT	On the seabed.

Drake Passage North Deployment Information

Both of the acoustics transponded well to the seabed. The exact time the unit reached the seabed is subject to variation since there was a change in the slope at 23.17, but the trace did not become a straight line. This was probably due to the ship drifting.

CONCLUSION

The cruise objectives were fully achieved.

APPENDIX 1 - SLR AND BPR TECHNICAL INFORMATION

STANLEY SLR INFORMATION

Due to time restrictions, it was only possible to download the data and replace the memory card in the logger.

Timebase scan

Expected	Actual
23.30.00 GMT on 12/11/96	23.29.46 GMT

TDS Real Time clock

Actual	TDS time
23.19.00 GMT	23.18.04

The calibrated data were downloaded to STAN96

The TDS RTC was re-set at 23.45.00 GMT

The memory card was replaced and the logger re-started.

Timebase started at 00.30.00 GMT on 13/11/96
First scan at 00.45.00 GMT on 13/11/96

The logger stopped operating a few days before the ship arrived back in Port Stanley. It was necessary to re-visit the sea level recorder to find out why it had failed. The reason why it had failed was due to a power failure in the electricity supply. The supply problem was rectified, the stored data downloaded and the logger re-started. The data were stored in a file called STAN2.CAL.

The timebase was re-started at 13.30.00 GMT on 5/12/96
First scan at 13.45.00 GMT

DRAKE PASSAGE NORTH (POL 8) RECOVERY INFORMATION

Location details	- **Latitude**	**54° 56.65' S**
	- **Longitude**	**58° 23.11' W**
	- **Depth**	**1052m**
Acoustic Information	-	47133, 15.0 kHz/12.0 kHz/C
	-	47140, 13.5 kHz/12.0 kHz/C
On station	-	20.10 GMT on 14/11/96
Release fired on 47133	-	20.18 GMT

Release fired on 47140	-	20.25 GMT
On surface	-	20.50 GMT

The acoustic conditions were not very good due to the large swell and force 7/8 conditions. It was difficult to obtain a clear reading on the Nagrafax that communication with the acoustic release units had been achieved.
After transmitting the first release command, the display started to show a sloping line indicating that the frame had released. The release command was then transmitted to the second acoustic unit in order to disable the second pyro. The ship was drifting quite a long way off station, so the overside transducer was brought inboard and the ship manouvered back to the the station. As the ship approached the deployment site the BPR was spotted on the surface, 200m away.

Downloading the data

When the logger tube was opened up, a small quantity of water was found inside. It was discovered that this had entered the tube through one of the swagelok fittings of the Digiquartz sensor DQ 46267. When interrogated, the TDS computer had crashed out of its program. Fortunately, the timebase was still running so that the drift over the two years could be measured.

Timebase scan

Expected	Actual
17.15.00 GMT on 15/11/96	17.21.01 GMT

Timebase drift is 6 minutes 1 second or 361seconds slow.

Timebase frequency	-	32.76797 kHz
RTC frequency	-	32.76773 kHz

The data were downloaded to a file called DPN9496.RAW. It was not known when the TDS computer had stopped logging, only the downloaded data would reveal this. Fortunately, the data revealed that the TDS had stopped logging either on its way to the surface or when it had reached the surface, so a full two year data record had been recovered.

Data arrangement
The raw data file is made up of eight columns of numbers. The order of the columns is:

Column	Data	
1	time	
2	date	
3	temperature	DQ 44935
4	pressure	
5	temperature	DQ 46267
6	pressure	
7	temperature	DQ 52026
8	pressure	

CROCUS BPR (POL 10) RECOVERY

Location details	-	**Latitude**	**56° 50.16' S**
		Longitude	**57° 30.09' W**
		Depth	**2096m**
Acoustic Information	-	44712, 13.5 kHz/12.0 kHz/B	
On station	-	11.45 GMT on 17/11/96	
Release command transmitted	-	11.50 GMT	
Release command re-transmitted	-	11.57 GMT	
Release from seabed	-	11.58 GMT	
On surface	-	13.00 GMT	

Once again, acoustic conditions were not very good. There was quite a lot of sea noise being recorded on the Nagrafax but it was possible to establish communication with the BPR on the seabed. The first release command was transmitted at 11.50 but since this system was using the Benthos burnwire release mechanism, the ballast weight does not release the instant the command has been received. When tested in the laboratory, the release time was five minutes. When the BPR had not released after seven minutes, the release command was re-transmitted. One minute later the unit was giving confirmation of having released from the seabed. The burn time of the wire was concluded to be eight minutes, which corresponds to the time recorded during sea trials of Inverted Echo Sounders at Bermuda in 1991.

Battery Voltages

	New	Used
Acoustic	14.38V	12.79V
Logger	14.38V	11.98V
Burn wire	28.21V	26.31V

Downloading the data

Timebase scan

Expected	Actual
16.30.00 GMT on 18/11/96	16.30.42 GMT

The date on the TDS was correct at 18/11/96 but the time was incorrect.
Actual time - 16.32.00 TDS time - 16.27.08

The data was downloaded to a file called DPNNS956.RAW

Data Arrangement

The raw data file is made up of eight columns of numbers. The order of the columns is:

Column		Data	
1	-	time	
2	-	date	
3	-	temperature	DQ 41077
4	-	pressure	
5	-	not used	
6	-	not used	
7	-	not used	
8	-	not used	

DRAKE PASSAGE CENTRAL (POL 9) RECOVERY INFORMATION

Location details	-	**Latitude**	**58° 21.76' S**
	-	**Longitude**	**56° 21.28' W**
	-	**Depth**	**3476m**
Acoustic Information	-	51314. 10.5 kHz/12.0 kHz/C 46421, 14.0 kHz/12.0 kHz/D	
On station	-	11.55 GMT on 18/11/96	
Transmitting 10.5/C command	-	12.03 GMT	
Transmitting 14.0/C command	-	12.04 GMT	
Transmitting 14.0/C command	-	12.10 to 12.50 GMT	
Released using 14.0/D command	-	12.56 GMT	
On surface	-	14.05 GMT	

The acoustic conditions were poor and it was difficult to obtain a reliable indication of communication with the release. The acoustic information provided when the ship initially arrived on station was incorrect in that the command 14.0/C was being transmitted and not 14.0/D. The 10.5/C acoustic was interrogated but no response was forthcoming. This was no surprise since this unit did not respond to interrogation when deployed. Once the correct command was transmitted, the ballast weight was released and the frame began its ascent to the surface. Once the frame was on its way to the surface, it became easier to determine the acoustic signal on the Nagrafax display.

Downloading the data

When the logger tube was opened up, a small quantity of water was found inside. It was discovered that this had entered the tube through one of the swagelok fittings of a Digiquartz sensor. The water had not been present in the tube for long since there was very little sign of any corrosion and certainly none was evident on any of the electronics. When checked, both the TDS and timebase were operating normally.

Timebase scan		
Expected		Actual
23.45.00 GMT on 18/11/96		23.44.05 GMT

Timebase is slow by 55 seconds

Battery Voltage - 13.39V Logger after diodes.

Data Arrangement

The raw data file is made up of eight columns of numbers. The order of the columns is:

Column		Data	
1	-	time	
2	-	date	
3	-	temperature	QT 119016
4	-	pressure	
5	-	temperature	DQ 38173
6	-	pressure	
7	-	temperature	DQ 46279
8	-	pressure	

DRAKE PASSAGE CENTRAL (POL 9) DEPLOYMENT INFORMATION

Location details	-	**Latitude**	**58° 22.09' S**
		Longitude	**56° 21.50' W**
		Depth	**3856m**

Timings		
Into the water	-	14.25 GMT on 18/11/96
On the seabed	-	15.35 GMT
Acoustic Information	-	47140, 13.5 kHz/12.0 kHz/C 47133, 15.0kHz/12.0 kHz/C
Radio Beacon	-	160.725 MHz, Channel C

Logger	-	SSDL 6

Logger information

Sensors	-	DQ 40375		
	-	DQ 41079		
Timebase channels				
1	-	Temperature	-	DQ 40375
2	-	Pressure	-	DQ 40375
3	-	Temperature	-	DQ 41079
4	-	Pressure	-	DQ 41079

Sensor frequencies

DQ 40375	-	Temperature	-	169.993 kHz
	-	Pressure	-	31.964 kHz
DQ 41079	-	Temperature	-	170.423 kHz
	-	Pressure	-	32.260 kHz

SSDL 6 timebase started at 01.30.00 GMT on 13/11/96
First scan at 01.45.00 GMT on 13/11/96

The first two scans in the data file will be corrupted since the new data will be overwriting data already stored in the EPROM's which was generated during a trial. It was not possible to erase the EPROM's before restarting. First good data scan is at 02.15 GMT on 13/11/96.

MYRTLE (POL 7) RECOVERY INFORMATION

Location details	-	**Latitude**	**59° 43.69' S**
		Longitude	**55° 29.50' W**
		Depth	**3690m**

Acoustic Information

Main frame release	-	47136, 14.0 kHz/12.0 kHz Release C, Enable E, Disable F
Podule release	-	14.5 kHz/12.0 kHz Release B, Enable E, Disable F
Podule release	-	11.0 kHz/12.0 kHz/A
Podule transponder	-	11.5 kHz/12.0 kHz

On station	-	16.40 GMT on 19/11/96
Main release enabled (14.0/E)	-	16.42 GMT
Main release fired (14.0/C)	-	16.45 GMT

Main release fired again	-	16.50 GMT
Second main release enabled (13.5/E)	-	17.03 GMT
Second main release fired (13.5/D)	-	17.04 GMT
Main release fired again (14.0/C)	-	17.06 GMT
Podule release enabled (14.5/E)	-	17.12 GMT
Podule released	-	17.13 GMT
Main frame release indication	-	17.15 GMT
On surface (pod and frame)	-	19.10 GMT
Pod onboard	-	19.30 GMT
Frame onboard	-	19.40 GMT

The acoustic release systems used with MYRTLE are a little bit different than normal in that they are fitted with an enable and disable command for the transponder to conserve battery power. The acoustic conditions were very noisy and it was proving difficult to obtain a reliable indication of communication with the release via the Nagrafax display. A reasonable reading was being achieved on the slant range display of the Benthos deck unit after enabling the transponder. The release command was transmitted several times, but there was no indication that the frame had released from the seabed. After trying to release the main frame without much apparent success, it was decided to release the last remaining podule. The podule release was enabled and the release command subsequently transmitted. The podule was then interrogated and was indicating that it was ascending to the surface. With the knowledge that the podule had released, it was decided to try and release the main frame again. However, when the acoustics were interrogated, they were indicating that the frame had already released and was on the way to the surface. The exact time of the podule and main frame reaching the surface is not known. They reached the surface half way through a live radio broadcast to BBC Radio 2 in London by John Dunn. It was only after the transmission finished that the podule was spotted ahead of the ship and then the frame a few minutes later nearby. Spotting the instruments was difficult due to the sun's reflection on the water.

Downloading the data

The podule was opened up first and the data downloaded from the EPROM's. The data was read directly from the EPROM using the S4 programmer. A program was then written to translate the data into useable ASCII characters. Timebase scans from the main data logger were monitored whilst the tube was still fitted to the frame by using the infrared data link connected to a laptop PC. Once the timebase drift had been measured, the logger was removed from the frame and the tube opened up. It was at this point that it was noticed that the connector lead from the external battery pack had leaked and caused one of the pins to corrode. When the logger was opened up, the logger was still working except that the battery supply to the tape mechanism was dead and as a result, the tape had not been storing any data. Also, one of the sensor connectors had leaked causing the signal from a quartzdine sensor to fail. When the data from the podule were examined it was determined that this failure had occurred in August 1996, with the logger having operated since November 1992.

Timebase scan

Expected	Actual
23.30.00 GMT on 21/11/96	23.29.35 GMT on 21/11/96

The timebase drift is 25 seconds fast

DRAKE PASSAGE SOUTH (POL 6) RECOVERY INFORMATION

Location details	- **Latitude**	**60° 51.01' S**
	- **Longitude**	**54° 43.01' W**
	- **Depth**	**1040m**
Acoustic Information	-	46481, 14.5 kHz/12.0 kHz/C
	-	47148, 11.5 kHz/12.0 kHz/C
On station	-	17.44 GMT on 20/11/96
Release fired on 47148	-	17.47 GMT
Release fired on 46481	-	17.48 GMT
On surface	-	18.11 GMT

Acoustic conditions were very good and communication was established with both sets of acoustics whilst the unit was still on the seabed. Both of the release units fired first time and the Nagrafax display showed a clear trace of the ascent.

Downloading the data

The data logger tube was opened up and this time no water had leaked into the tube. This was not unexpected since this logger had been used successfully on the ADOX deployment in 1993.

Timebase scan

Expected	Actual
00.00.00GMT on 22/11/96	00.02.19 GMT on 22/11/96

The timebase is 2 minutes and 19 seconds or 139 seconds slow.

The TDS time was 23.52.05 when the real time was 00.05.00 GMT

The data was downloaded to the file DPS9496.RAW

Data Arrangement

The raw data file is made up eight columns of numbers. The order of the columns is:

Column		Data	
1	-	time	
2	-	date	
3	-	temperature	QT 49187
4	-	pressure	
5	-	temperature	DQ 46251
6	-	pressure	
7	-	temperature	DQ 43513
8	-	pressure	

DRAKE PASSAGE SOUTH (POL 6) DEPLOYMENT INFORMATION

Location	-	**Latitude**	**60° 50.96 ' S**
	-	**Longitude**	**54° 43.36' W**
	-	**Depth**	**1170m**
Timings			
Into the water	-	18.24 GMT on 20/11/96	
On the seabed	-	18.48 GMT	
Acoustic Information	-	46421, 14.0 kHz/12.0 kHz/D 58434, 14.5 kHz/12.0 kHz/B	
Radio Beacon	-	154.585 MHz, Channel A	
Logger	-	SSDL 3	
Logger Information			
Sensors	-	DQ 44935	
	-	DQ 46267	
	-	DQ 52026	
Timebase channels			
1	-	Temperature	DQ 44935
2	-	Pressure	
3	-	Temperature	DQ 46267
4	-	Pressure	
5	-	Temperature	DQ 52026
6	-	Pressure	

Sensor frequencies

DQ 44935	-	Temperature	-	166.375 kHz
	-	Pressure	-	32.955 kHz
DQ 46267	-	Temperature	-	170.900 kHz
	-	Pressure	-	33.125 kHz
DQ 52026	-	Temperature	-	169.747 kHz
	-	Pressure	-	32.791 kHz
Battery Voltage	-	14.75 V		
Current consumption	-	3.82 mA (sleep mode)		

SSDL 3 timebase was started at 01.45.00 GMT on 20/11/96.
First scan at 02.00.00 GMT on 20/11/96
The original set of electronics from SSDL 3 was not used for this deployment due to the possibility of salt-water corrosion damage. This logger had leaked on its previous deployment and there were signs of corrosion on some of the electronic boards. A new logger was assembled using the parts recovered from the MK6 BPR and SSDL 4. Even though SSDL 4 had also leaked, the electronic boards had not suffered corrosion damage.

ROTHERA SLR INFORMATION

Location details	-	**Latitude**	**67° 34'S**
		Longitude	**68° 08'W**

Logger Number 1
Timebase scan on 25/11/96

Expected	Actual
13.45.00 GMT	13.44.52 GMT

The timebase of logger number 1 is fast by 8 seconds

The TDS RTC of logger No1

Actual time	TDS time
13.53.00 GMT	13.52.01

The RTC is fast by 59 seconds

The data were downloaded to ROTH96_1.CAL for calibrated data and ROTH96_1.RAW for raw data.

Logger Number 2
Timebase scan on 25/11/96

Expected	Actual
22.15.00 GMT	22.14.27 GMT

The timebase of logger number 2 is 23 seconds fast.

The TDS RTC of logger No2

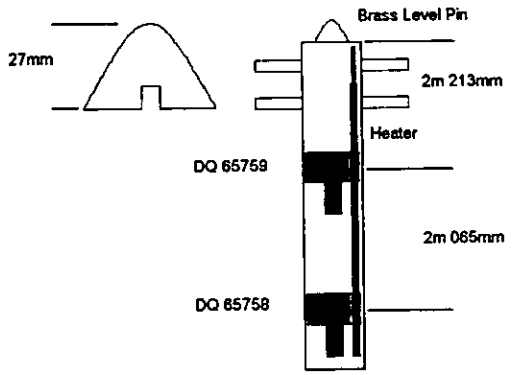
Actual time	TDS time
22.19.00 GMT	22.19.12

The RTC is slow by 12 seconds

The data were downloaded to ROTH96_2.CAL for calibrated data and ROTH96_2.RAW for raw data.

After the data had been downloaded from logger No 1, it was possible to begin work on replacing the hardware. The power supply to the sensors in the well was disconnected and the old steelwork was then removed from the well using a crane. A lot of ice had built up on the wall of the well near the steelwork and this had to be chiselled off before fitting the new steelwork could commence. The new steelwork was then lifted into the well with the crane and fastened to the concrete wall.

The new steelwork installation at Rothera is shown. The sensors are mounted on a painted steel support, which in turn is bolted to the well wall. A plastic tube is also fitted to the steel support frame and a copper tube containing a heating element is placed inside. This is being used to help prevent ice from forming during the winter enabling the full tidal range to be measured accurately. A brass levelling pin was fitted to the top of the steel support and the distance was measured between this and the POL benchmark at the top of the well.



Levelling distances

POL well benchmark to level pin	-	1.681m
POL well benchmark to half tide	-	3.921m
POL well benchmark to full tide	-	5.986m

The digiquartz sensor acting as the barometer inside Logger No 1 was replaced with a new sensor and all of the wiring connections were re-made.

The sensor signals from the well are now fed along a grey twisted pair cable.

White	Half Tide Temperature
Grey	0V
Red	+ve Supply

Black	Half Tide Pressure
Yellow	Full Tide Temperature
Orange	0V
Blue	Full Tide Pressure
Green	0V

The cable from the well enters the pumphouse where the loggers are located and is first fed into Logger No 2 and then into Logger No 1. Inside each logger, BNC leads are connected to the sensor signals and then connected to the BNC plugs on the front panel of the tidegauge. The barometer signal is fed via another grey twisted pair screened cable into Logger No 2 and connected to the BNC sockets on the front panel.

Barometer Connections

White	Barometric Temperature
Grey	0V
Blue	Barometric Pressure
Green	0V

Sensor Supply Voltages

Well sensors	-	5.89 V
Barometric sensor	-	5.88 V

Sensor Frequencies

	Logger No 1	Logger No 2
Barometric pressure	33.333 kHz	33.332 kHz
Barometric temperature	171.571 kHz	171.570 kHz
Half tide pressure	34.190 kHz	34.190 kHz
Half tide temperature	171.941 kHz	171.942 kHz
Full tide pressure	34.080 kHz	34.082 kHz
Full tide temperature	170.021 kHz	170.022 kHz

Starting Loggers on 26/11/96

	Logger No 1	Logger No 2
Timebase started	17.00.00 GMT	17.30.00 GMT
First scan	17.15.00 GMT	17.45.00 GMT

The system was left running overnight and checked on 27/11/96. It was found that Logger No 1 was not dumping data to the Toshiba. After a lot of investigative work, it was found that the

problem lay with the TDS CPU card. This was replaced with one of the spare cards and the system worked properly.

Logger No 1
Timebase re-started 20.30.00 GMT on 27/11/96
First scan at 20.45.00 GMT

Logger No 2 timebase was not affected during the investigative procedure, although the system clock was modified in order to force a data dump. This was performed as a check for the software and therefore there will be a couple of data records that have an incorrect time stamp.

SIGNY SLR INFORMATION

Location details - **Latitude** **63° 43'S**
Longitude **45° 36'W**

The logger at Signy had been running on Lithium batteries over the winter, since Signy became a Summer Only base. When the logger box was opened up, the logger was found to be still working.

Timebase scan

Expected	Actual
17.30.00 GMT on 1/12/96	17.30.47 GMT

The TDS RTC time

Actual	TDS Time
16.54.00 GMT	16.56.38 GMT

The calibrated and raw data was downloaded to SIG95-96.DAT and SIG95-96.RAW respectively. The last recorded scan was at 16.45 on day 336, 1996 with a scan count of 25636.

Battery Voltage
Lithium batteries - 13.17 V

New batteries were installed once the data was downloaded and the logger re-started.

Timebase started at 18.45.00 GMT on 1/12/96
First scan at 19.00.00 GMT

MINI MYRTLE (POL 11) DEPLOYMENT INFORMATION

Location details	-	**Latitude**	**60° 03.09'S**
		Longitude	**47° 09.80'W**
		Depth	**2300m**

Timings

Into the water	-	09.19 GMT on 2/12/96
On the seabed	-	10.02 GMT
Acoustic Information	-	51329, 10.0 kHz/12.0 kHz/C 51370, ID 01, 13.0 kHz/12.0 kHz/C
Radio Beacon	-	159.480 MHz, Channel B
Logger	-	Mini MYRTLE

Main Logger Information

Sensors	-	DQ 43122 DQ 40190	

Timebase channels

1	-	Temperature	DQ 43122
2	-	Pressure	
3	-	Temperature	DQ 40190
4	-	Pressure	
5	-	N/C	
6	-	N/C	

Scan interval	-	60 minutes
Battery Voltage	-	14.46 V

Main logger supply consists of a small internal pack to get the system going and a larger external pack. External pack consists of 6 packs@13Ah giving a total of 78Ah.

Current consumption

Nominal	-	11.48 mA
Sleep mode	-	4.70 mA

Main Logger
Timebase started at 12.00.00 GMT on 1/12/96
First scan at 13.00.00 GMT
The scans were monitored using the infra red output from the logger, as well as the serial lead.

Satellite Podule Self Timer Release

Battery Voltage	-	14.46 V

Current consumption

On switch on	-	28mA
Program running	-	0.1mA

The timer was started at 23.09 GMT on 1/12/96 and was set to release 8070 hour later. This corresponds to 336 days and 6 hours. The time and date of the capsule release is November 3 1997 at 05.00 GMT. The capsule will start transmitting data back to POL via Argos at 08.00 GMT.

Satellite Podule Logger
The satellite podule was started at 00.34 GMT on 2/12/96

The remote data transmitter was used to transmit data into the podule before it was mounted on the frame.

The 2 pin FAWL socket was connected to the data output of the podule so that data could be monitored once the sphere was sealed. A 1k resistor was inserted in series with the leads to the data output to protect against large currents being drawn if water leakage occurs in the plug. Data transmissions from the main logger were monitored using the FAWL connector on the podule. This showed that the infra red link was working satisfactorily.

A test transmission of the Argos transmitter was carried out between 22.00 on 30/11/96 and 19.00 on 1/12/96.

DRAKE PASSAGE NORTH (POL 8) DEPLOYMENT INFORMATION

Location details	-	**Latitude**	**54° 56.64' S**
		Longitude	**58° 23.02' W**
		Depth	**1077m**
Timings			
Into the water	-	22.56 GMT on 3/12/96	
On the seabed	-	23.17 GMT	
Acoustic Information	-	46481, 14.5 kHz/12.0 kHz/C 47178, 11.5 kHz/12.0 kHz/C	
Radio Beacon	-	160.725 MHz, Channel C	
Logger	-	SSDL 2	
Logger Information			
Sensors	-	QT 49187	
	-	DQ 46251	
	-	DQ 43513	

Timebase channels

1	-	Temperature	QT 49187
2	-	Pressure	
3	-	Temperature	DQ 46251
4	-	Pressure	
5	-	Temperature	DQ 43513
6	-	Pressure	

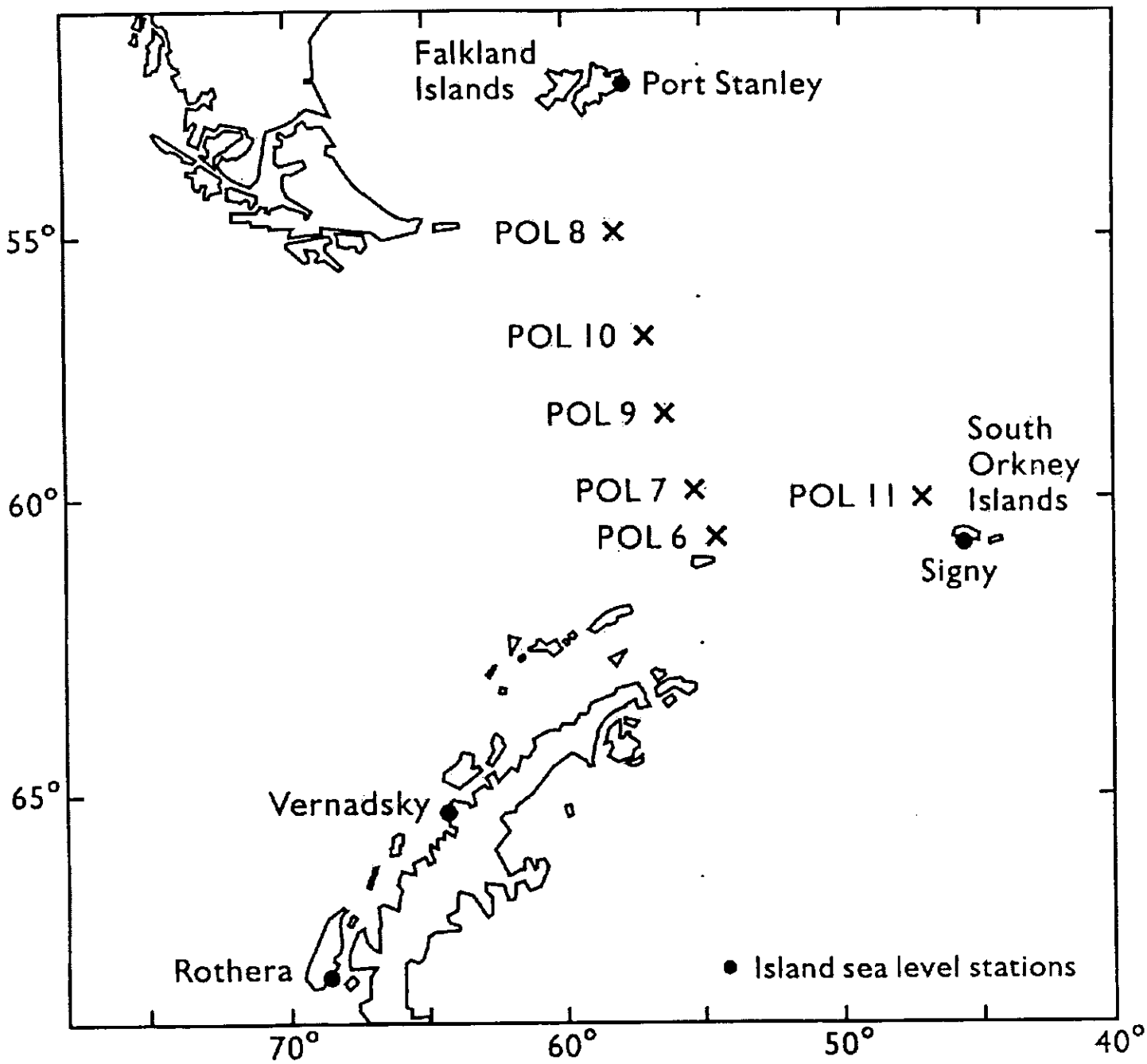
Sensor frequencies

QT 49187	-	Temperature	-	43.4915 kHz
	-	Pressure	-	21.3964 kHz
DQ 46251	-	Temperature	-	170.4136 kHz
	-	Pressure	-	32.9515 kHz
DQ 43513	-	Temperature	-	171.5328 kHz
	-	Pressure	-	33.0043 kHz

SSDL 2 timebase started at 15.15.00 GMT on 23/11/96
First scan at 15.30.00 GMT

Battery Voltage	-	14.75 V
Current consumption	-	4.66 mA (sleep mode)

MAP OF POSITIONS OF BOTTOM PRESSURE RECORDERS



GLOSSARY

ACCLAIM	-	Antarctic Circumpolar Current levels from Altimeter and Island Measurements
BPR	-	Bottom Pressure Recorder
CTD	-	Conductivity, Temperature and Depth Profiler
CPU	-	Central Processing Unit
CROCUS	-	Capsule for the Recovery of Ocean Circulation Under the Sea
DCP	-	Data Collection Platform
FIPASS	-	Falkland Islands Passenger and Sea Service
I/O	-	Input/Output
MYRTLE	-	Multi-Year Return Tidal Level Equipment
SIL	-	Single In-Line
SLR	-	Sea Level Recorder
SRAM	-	Static Random Access Memory
TDS	-	Triangle Digital Services
WLR	-	Water Level Recorder
WOCE	-	World Ocean Circulation Experiment