JR03:

RRS James Clarke Ross
South Georgia
Marine Biology
January 1993

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Cruise Report

RRS *JAMES CLARK ROSS*

Cruise JR03

Pelagic Ecosystem Studies

South Georgia

January 1993

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Despite the need to spend periods of time trialing and proving gear I am pleased to say that largely because of peoples diligence and professionalism, both in the UK and on the ship, much of the gear and equipment was both ready and made to work succesfully, enabling us to carry out a good deal of the programme as planned. Although some areas of work were carried out more satisfactorily than others (problems encountered are largely covered in the relevant sections of reports) it would have been unrealistic to have expected more and overall I am of the opinion that most participants are happy with what was achieved.

Acknowledgements

Thanks are due to the great number of people at BAS HQ through whose efforts we were able to get into the field. As always the success of these ventures is in no small way dependent on the support that we get from the ship. I am pleased to say, that as usual, our science received the highest possible level of support, for which fact we are all extremely grateful. On a personal note, I would like to express my thanks and appreciation to all onboard who made my job as chief scientist easier than it might otherwise have been.

2. NARRATIVE (PW)

31st Dec 1992: Scientific personnel, Master, Officers and Crew joined the ship at 1800 hrs after a trouble free flight to the Falklands.

1st Jan: Most outgoing personnel left the ship at 0630 hrs. Cargo work and gear assembly started later in the morning. Meeting with Captain, Chief Officer and Chief Engineer at midday to determine sailing time. Requirements to prepare as much gear as possible before departure and to reach Shag Rocks around dusk means departure at 1600hrs on 2nd.

2nd Jan: Gear preparation continued. RMT readied in morning and Multinet started in afternoon. Party from 'Abel J' toured ship in late morning. Ship departed FlPASS at 1600, muster stations called and starboard lifeboat launched. Once clear of Cape Pembroke calibration of ADCP carried out.

3rd Jan: Personnel largely involved in preparation and fine tuning of gear and instrumentation. Fine weather allowing people to acclimatise to life onboard. Underway logging and acoustics commence.

4th Jan: Scientific watches start 0001 hrs. RMT deployed over Shag Rocks shelf after dark. Z nets and water bottles for secondary production experiments undertaken as well.

5th Jan: Arrive Bird Island 1500hrs to disembark Peter Prince. Weather good and personnel ashore for an hour. In the evening the vessel ran up a transect established on previous cruises to the NW of Bird Island. CTD's were carried out at 53 49s 38 16W and 53 11s 39 15W.

6th Jan: CTD's completed at 0500 hrs. Vessel then proceeded to start point for an acoustic survey which commenced after the deployment of Z nets and water bottles at 1545. 30 mile legs at 10 mile intervals, at right angles to the shelf break, were run at 8kts. Cruise meeting in the morning to finalise the programme for the middle part of the cruise.

7th Jan: Survey continues in calm conditions

8th Jan: Survey finished at 0230 hrs. On basis of acoustic data main transect position was decided on as 54 13S 36 08W to 53 32S 35 21W. Stations A-D are located 10 miles apart along the middle part of the transect. A CTD transect (10 drops at 5 mile intervals) commenced from the inner end of the transect.

9th Jan: CTD's completed around 0300. ADCP/acoustics run back to inner shelf complete by 1100 hrs. At this point it was intended to intensively use the multinet to fish each of the 4 stations 3 times by day and the same by night. Gear problems with the multinet and the RMT (not acknowledging the closing signal) frustrated attempts to properly start this part of the programme.

10th Jan: Early morning spent target fishing for krill using the RMT. Some krill encountered but the presence of salps caused one of the nets to split. The multinet was then succesfully used throughout the rest of the day, although few larval fish were encountered.

11th Jan: Multinet aboard in the early hours of the morning when power was lost to the system. Investigation showed that the termination needed remaking. Schedule re-jigged in light of the gear problems and also in view of the lack of fish larvae. It was agreed that this work would be concentrated at the inner end of the transect and in the bays.

ADCP/acoustic runs undertaken along the transect in the morning. Multinet ready later in day and target fishing for krill commenced. F-net deployed in evening which resulted in live krill which were set up in jars for moulting experiments. Multinet fished krill swarms during the night and early hours.

12th Jan: ADCP/acoustic transect commenced but abandoned as weather deteriorated. Decision made to retire to Cumberland East Bay to undertake fish work.

13th Jan: Multinet worked well, encountering of all things dense krill marks. A comparison with the RMT was not possible as the release gear leaked. Agassiz hauls carried out on the inner shelf over muddy ground in the late morning provided demersal fish samples. Vessel

then proceeded out onto the transect again to target fish for krill. By late evening vessel had been stopped to examine the commutator on the aft motor, pending a decision on whether to remove the brushes. It was hoped that a reply from Cegelec by next morning would solve the problem. Overnight the ship on thruster power only. Z net and water bottle sampling undertaken.

14th Jan: Decision made to lift brushes and ship underway again on one motor by 1100hrs. Target fishing again with a useful multinet haul in the evening providing krill.

15th Jan: ADCP/acoustic run started just after midnight and target fishing again during daylight. Vessel repositioned at outer end of transect to undertake repeat CTD transect. Weather rapidly deteriorated from 2300 hrs onwards. Radio sched with Bird Island in the evening. They relinquish their option on the 48 hour slot they had at the end of the programme.

16th Jan: On thruster power overnight. Recommenced CTD' s at 0800 hrs as weather had moderated. Cruise meeting at 1000 hrs to discuss remaining programme.

17th Jan: CTD transect completed at 0500 hrs followed by ADCP calibration and noise trialing for scientific echo-sounder.

Zooplankton work using the LHPR scheduled to begin at midday. Unit deck tested OK but failed to function properly on deployment and was recovered. Problem was found to be a short circuit in the flow meter wiring to the co-axial cable. Relaunched but powered out at 200m. Restarted but it was obvious from the gauzes that it had wound straight through. RMTl rigged and used instead of LHPR and worked well with the DWNM.

18th Jan: Stations sampled in turn using RMT. Z net also deployed.

19th Jan: Completed zooplankton sampling at 1000 hrs. LHPR water tested again and functioned correctly. A great relief but a little too late to make full use of. Target fishing then commenced on the inshore end of the transect primarily to gather data on characteristics of targets seen acoustically and to continue trialing with the multinet. Vessel moving to the east of the main transect down towards Royal Bay.

20th Jan: Target fishing continued through the night. Plenty of krill swarms observed and fished through on a number of occasions. Break off at 1400 hrs and head towards Cumberland West Bay to commence fish work.

21st Jan: Overnight multinet hauls went well. First daylight hauls indicated net had not fired and on further investigation it was discovered that a transistor had burnt out.

Agassiz hauls, Z nets and another ADCP calibration continued during the day.

22nd Jan: Multinet up and running again. Agassiz hauls in the morning and acoustic noise trialing in the afternoon.

23rd Jan: Continue with multinet in quite windy conditions. Component failure experienced around dawn so a change made to the RMT. CTD's carried out at mid points along transects into bays. Wind force 7 by afternoon making it difficult to work the inner shelf. Vessel proceeded to King Edward Cove where anchors dropped and ships personnel put ashore for an afternoon. Ship visited by civilian harbour master and commanding officer of garrison. Vessel departed 1600 hrs for Cumberland West Bay.

24th Jan: Final night of fishing in the bays and a comparison between the multinet and RMT systems undertaken. Vessel proceeded to Leith Harbour for the echo-sounder calibration, tying up at the buoy in flat calm conditions at around 0700 hrs. CTD deployed and acoustic calibration commenced. Succesfully completed by 1500 hrs. Uplift of Husvik personnel undertaken by ship. Most scientific personnel ashore for an hour or two in the afternoon. Vessel departed Leith 1930 hrs for Shag Rocks.

25th Jan: Out along the shelf further acoustic noise trialing commenced around 0300 hrs. LHPR water tested again succesfully at 1100 hrs. Arrived Shag Rocks early evening where Z nets and water bottles were initially deployed followed by two multinet hauls.

26th Jan: Work complete by 0200 hrs. Ship enroute for Mare Harbour at 12kts. De-mobilisation of cruise started with gear dismantling and stowing away of cargo. Scientific watch keeping ended at midday.

27th Jan: Packing and cleaning of gear continues. Good progress made in calm weather.

28th Jan: Vessel alongside Gold Rover in Mare Harbour by 0800 hrs. Bunkering started shortly afterwards. Labs and scientific hold cleared of gear which was transferred to the afterdeck under tarpaulins. Scientific hold and labs swept cleaned and scrubbed out as appropriate. Depart Mare Harbour early afternoon. Tie up at FIPASS 1700 hrs.

29th Jan: Scientific personnel assisted with transfer of cargo to shore and stores to ship. Majority departed ship 1100 hrs, except some ISG personnel who were effecting a changeover with their counterparts for the Geophysics cruise.

3. BIOLOGICAL STUDIES

3.1. Fish Biology (MGW)

Five objectives were set for ichthological study during the MLSD research cruise to South Georgia during January 1993. These were:

1. Sample neritic larval fish to observe interannual variations in occurrence, composition and abundance

2. Collect samples of *Lepidonotothen larseni* to investigate muscle structure and development.

3. Sample neritic larval fish at Shag Rocks for comparison with the South Georgia shelf assemblage.

4. Sample larval fish across the junction between continental shelf and slope at South Georgia to assess relations with physical oceanographic features.

5. Collection of young fish for age and growth studies.

: a summary of work on these topics is given below.

3.1.1. Interannual variations in young fish occurrence, composition and abundance at South Georgia.

Introduction: The main objective of this study is to make collections of larval fish at sites that are regularly sampled during OBP/PES studies to accumulate data about the overall levels of interannual variation in occurrence, composition and abundance among the early stages of the demersal fish at South Georgia.

Methods: A longitudinal transect was established in Cumberland Bay East divided into inner and outer sections. Physical characteristics were measured along the transect by means of underway Ocean logger and ADCP and the characteristics of the water column by use of a CTD profile at the midpoint of each section.
The zooplankton was sampled by RMT8+1M initially for direct comparisons with former data (North and Murray 1992) and then by Multinet samples for more detailed observations of the vertical distribution patterns. The Fnet was used for collections in the O-2m range. The transect was occupied on two occasions: the first for one day and the second for three days. During each 24 hour period, two hauls during daylight and two hauls during darkness were conducted along the transect. The Fnet was deployed for 20 minute twice while an RMT or Multinet haul was in progress. Each RMT deployment was three 30 minute oblique hauls over the range O-210m while the Multinet deployment was operated over a similar depth range with each oblique was divided into three depth strata O-70, 70-140, 140-210m. each strata sampled for 10 minutes three times. Total wet-weight biomass of the samples was estimated by displacement. The major components of the samples were then recorded. All fish were extracted, identified, measured and fixed for subsequent investigation.

Observations. The physical conditions prevailing during the study were very similar to those encountered formerly. Temperature declined steadily from the surface without any major

thermocline. ADCP profiles were collected and have yet to be evaluated but examination of the current direction/strength vectors against depth along the transect suggested a region of relative stasis at 80 m.
RMT8 collections during the first period of investigation showed that the larval fish assemblage was restricted in diversity and abundance in comparison with the former detailed study and differences in size range of the species captured. Collections with the Multinet during the second period of study were similar in composition and abundance to those during the first period. Among the fish sampled, young ***Trematomus hansoni*** were the most abundant larval stage present, followed by decreasing numbers of ***Lepidonotothen nudifrons, Artedidraco mirus, Champsocephalus gunnari*** and ***Gobionotothen gibberifrons. The*** marked differences in composition and abundance values between years (1987, 1991, 1993) suggest large interannual differences in recruitment by demersal fish at South Georgia.

3.1.2. Investigate **muscle structure and development in *Lepidonotothen Larseni.***

Introduction: The main objective of this study was to collect samples of young ***L. larseni*** to investigate the muscle organisation and structure during early development. These samples are required to continue the research, in collaboration with St Andrews University, about the energetics, activity and muscle development of Antarctic fish from difference niches.

Methods: Samples of juvenile ***L. larseni*** were collected by Agassiz trawl during 20 minute tows on the inner shelf adjacent to Cumberland Bay East. Larval fish were obtained from the routine RMT and Multinet hauls. Specimens were identified, measured then preserved in Bouins formal/acetic/picric acid fixative.

Observations: Samples of the bentho-pelagic juvenile stages were readily captured using the Agassiz trawl during daylight. The pelagic larval and early post-larval stages were rarely encountered among samples of ichthyoplankton at any locality during the course of JR03 but a small number (<20) where accumulated from catches. These and the juvenile specimens will be presented for histological investigation by Professor Ian Johnston's rersearch group at St Andrews.

3.1.3. Larval fish at Shag Rocks

Introduction: The main objective of this element of the study was to collect samples of larval/post larval fish for comparison of size and development for species also occurring on the shelf at South Georgia. Observations during JB 11 (1991) suggested that large but consistent size differences were to be found when comparing the size of ***Champsocephalus gunnari*** at each locality. It was not possible to determine whether these size differences were due to greater age or faster growth during **JB11.**

Methods: Samples were collected after dark using the RMT8+1M and Multinet as multiple oblique hauls from surface to near the sea-floor. Fish were extracted from the catches directly after capture, identified, measured and then fixed in 70% alcohol to retain the integrity of the otoliths.

Observations: Larval ***Patagonotothen guntheri*** dominated the catches at Shag Rocks but ***Harpagifer georgianus, Champsocephalus gunnari, Lepidonotothen larseni, Notolepis coatsi,***

Racovitsia glacialis, Electrona antarctica and Protomyctophum choriodon were also represented in small numbers. Few C. *gunnari* were collected at Shag Rocks and from sample sites at South Georgia. No marked size differential was evident between specimens collected at Shag Rocks and South Georgia. Examination of the otolith microstructure will be used to reveal the hatching dates at both localities.

3.1.4. **Larval fish distribution in relation to the junction between continental shelf and slope at South Georgia**

Introduction: The main objective was to investigate the composition and structure of the larval fish assemblages in relation to the oceanographic features associated with the junction between the oceanic and neritic biota at South Georgia This was undertaken to address the question: 'What mechanisms are responsible for maintaining the neritic communities with extended pelagic phases at an oceanic island such as South Georgia'?

Methods: The initial oceanographic data was determined by means of a box survey over- and adjacent to the northern continental shelf of South Georgia (using acoustics, underway Ocean Lopper and ADCP) to provide circa-synoptic observations of zooplankton biomass, temperature, salinity, fluorescence and water column structure. This survey showed that the major parameters were aligned parallel to the bathymetry. A 50nm transect was selected for detailed study by inspection of this data, across the shelf into oceanic water at a locality with high densities of zooplankton (krill) biomass. Oceanographic data was collected along the transect at the beginning and end of the survey period by means of CTD profiles at 5 mn intervals to demonstrate the vertical structure and Ocean Logger observations to illustrate the horizontal structure. ADCP profiles were also obtained. The composition and abundance of the zooplankton was determined by Multinet, RMT8 and Fnet samples in the upper 210m from 2 shelf stations and 2 oceanic stations located along the transect on either side of the shelf break. Stations were to be occupied during daylight and darkness and replicated three times. Samples were worked up as for objective '1'.
Observations: Samples collected from both the oceanic and neritic segments of the transect were almost devoid of larval fish. Salps or krill were the dominant component of the zooplankton in the upper 210m. The lack of larval fish and hazard to net operation owing to the high numbers of salps resulted in the ichthyological element of the investigation beginning deferred. Oceanographic and zooplankton results may still well be able to used to address part of the query.

3.1.5. Age and growth studies.

Introduction: Samples of larval, postlarval and juvenile fish were collected during JR03 for age and growth studies to determine such events as hatching dates and growth patterns during their early life history. The nototheniids, *Gobionotothen gibberifrons, Notothenia rossii, N. neglecta* and the Channichthyid, C. *gunnari* were the target species. Estimates of growth rates and development patterns have been derived so far from time-series collections or extrapolation using hatching dates from the literature. The objective is to use micro-increment analysis of the otoliths as a means of validating estimates of age, determining dates of hatching and examining the growth patterns during the first year of development. Thereby producing more accurate values for growth and a description of growth patterns during the critical pelagic phase.

Methods: The majority of samples of young fish collected during JR03 were fixed and preserved in 70% alcohol therefore most of the fish collected during the Cruise will be suitable for age and growth investigation.

Observations: Few larval fish were encountered during JR03 over the shelf at South Georgia and so the majority of the specimens collected were from Shag Rocks and Cumberland Bay East. The large numbers of postlarval *P. guntheri* from Shag Rocks should be useful in determining the early growth history of this species.

Acknowledgements.

It is very appropriate to gratefully acknowledge the professionalism, help and support afforded by the Officers and crew on RRS James Clarke Ross and well as the invaluable work undertaken by ISG staff during the cruise. I also want to thank fellow MLSD participants for their considerable help, support and encouragement without whom I would not have been able to undertaken any of the work.

3.2. **Secondary Production** (PW, RS)

Experimental work this year was concerned with the initiation of a new project investigating egg production in Antarctic Copepoda. *Rhincalanus gigas* and *Calanus similiimus* were selected for study based on their abundance and reproductive status at this time of year. Later in the cruise, *Calanoides acutus* was also sufficiently abundant to undertake some incubations.

Live animals were obtained by deployment of a vertically hauled ring net (Z net) from the mid-ships gantry using the SAPS winch which remained onboard from the STAP cruise. Nets were veered to 200 m and hauled slowly upwards to the surface. Water to incubate live animals was collected from 20-30 m depth using 301 Go-Flow bottles loaned by RVS.

Catches were sorted under a Wild M5 microscope using a cold light source. Live females were transferred either individually or in batches of 5 or 10 into tubular perspex cylinders closed off at the lower end with 800 micron netting. These were suspended in 1.51 jars filled with sea-water and placed in incubators running at ambient sea-water temperature (3.5 - 4.5° C). The catch residue was then preserved for further analysis. 24 hour incubations (short term) and longer were undertaken. In the former case experiments were taken down after the elapsed time, eggs produced were counted and females preserved. Longer term experiments were subject to water changes every 24 hours or so, after which eggs produced in the preceding 24 hours were counted. Females in long term experiments were initially subject to a number of different regimes. Some were maintained in filtered sea-water, some at half ambient particle concentration and others at ambient concentrations. Negligible egg production in all 3 combinations caused the termination of this part of the programme and the transfer of all long term experiments to ambient concentrations in the grazing wheels, where we were sure that females would be in contact with food at all times. Although under these conditions females were also in contact with their eggs, losses due to predation were thought to be low. Usually only a small number of egg membranes were recovered in the water siphoned off every day alongside the freshly laid eggs. Whether egg production under these conditions increased significantly with respect to containment in the perspex inserts will have to await statistical analysis. More faecal material was however observed in the grazing wheel jars, the conclusion being that food could be a limiting factor under the original experimental

conditions.

At the time that each short term experiment was set up, or in the case of long term experiments, water changed, samples of sea-water were preserved with Lugols Iodine and a sample run through the multisizer. From 12/l/93 chlorophyll samples were also taken. These data should allow us to look at the effect of chlorophyll levels and phytoplankton species composition on egg production. On three occasions during the course of our studies, relatively high levels of egg production appearred coincident with elevated levels of phytoplankton and an increase in species diversity. These observations were made at Shag Rocks on 5/l/93 and 25/l/93 and off Royal Bay on 20/l/93. This part of the study will be looked at carefully in conjunction with work already underway within the group on food selectivity in copepods.
All gear and other equipment used in these studies performed well (although see Gear Report). One Z net was lost through failure of a Karabiner.
It had been hoped that the newly acquired LHPR system could be used to obtain profiles to monitor diurnal change in the depth distribution of female copepods and to see where in the water column copepod eggs were most abundant. Unfortunately this was not possible this year despite great efforts by Paul Woodroffe to overcome some of the software problems (See his report). Our patience was rewarded towards the end of the cruise when on a couple of occasions the system functioned properly in the water when tested. I am confident that the major problems have now been overcome and that in future years we will have a viable system.

3.3. Krill Ecology (HH)

3.3.1. Background

The restriction of the pelagic larval stages of some neritic populations of Antarctic fish to the on-shelf area suggests a continental shelf-break front. This shelf break is an area where krill swarms are often found, which begs the question why should krill be present, sometimes in great quantity, in a zone which may be acting as a boundary for some ichthyoplankton and zooplankton species.

3.3.2. Specific Objectives

The primary objective for this cruise was to investigate the nature and geographical position of krill in relation to the physical and biological features which make up the shelf-break zone. This study was designed in conjunction with the Fish group in order to maximise the effort allocated to water structure discrimination and minimise time required for travel between study sites.
A secondary objective, contributing further to work done in the vicinity in previous years, was to get an estimate of the growth of freshly caught krill, with a technique known as the Instantaneous Growth Rate (IGR) experiment.
Tertiary objectives include work done to extend the data on distribution and length/frequencies of krill collected on past cruises, and the preservation of krill for further biochemical analyses to extend the dataset on krill feeding (gut fluorescence, gut fullness, etc.) started on JR02.

3.3.3. Sampling Protocol

A grid survey was conducted to site the krill/fish transect in a position perpendicular to the shelf break zone where krill could be expected (see Appendices 8.2.2. and 8.2.3. respectively). The transect ran offshore/onshore with the shelf break zone lying across its midpoint. The hydrographic structure along the transect was then investigated with a series of ten CTDs stationed 5nm apart. Following this, two separate periods of 24 hrs were used to investigate the geographical position, biomass and structure of krill swarms in relation to the oceanography of the shelf break zone.

ADCP/acoustics runs were used to collect data on water structure and krill biomass along the transect, and krill were sampled by Multinet after searching for suitable targets using a zig-zag track along the shelf break. The krill targets were looked for in a corridor delineated by depths of about 200m and 500m in the onshore/offshore direction, and a distance along the shelf break estimated to be within the applicability of the transect oceanographic data. The extent of the corridor will be shown more precisely when ship track data are available for these periods.

In the first 24 hr period allocated to krill studies (K1), two blocks of 6 hrs were to be used for ADCP/acoustics transecting, and two blocks for krill target searching and fishing. For the second 24 hr period (K2), these blocks were to be organised in a different order so that, at the end of the allocated krill time, effort at each activity would have covered both daytime and nighttime equally. In the event, one ADCP/acoustics run was abandoned due to bad weather, and a last run was sacrificed to gain more searching and fishing time, as suitable day targets had been hard to find.

3.3.4. **Data collected - Krill data**

The following lists the events where krill and krill data were collected.

1.	Event 019/020	RMT Net 1 fished open all the time, so no depth discrimination. 100 animals measured and matstaged.
2.	Kl-Event 031	Multinet fished through 'salpy' diffuse layer, 2 mins/net. Krill in nets 1 & 2 frozen at -60 for later biochemical analyses and length/matstage measurement.
3.	Kl-Event 033	F Net caught enough live animals in good condition for an Instantaneous Growth Rate (IGR) experiment to be set up.
4.	Kl-Event 034	Multinet. Krill in nets 1,2,3,4 & 6 into -60. Clean catches, salps avoided. IGR set up from net 4.
5 & 6.	Kl	1 acoustic/ADCP run completed, 1 aborted due to bad weather....headed for Cumberland Bay for MGW.
7.	Event 038	Cumberland Bay opportunistic krill from MGW's nets Nets 6,7,8, & 9 had krill. Froze 4 trays (112 animals) from each. Swimmers in 9,8, & 7 were set up in the cold room for 6 hrs for faecal strings - for comparison with material from oceanic stations. Matstaged and measured 100 krill from 9,8, & 7 afterwards.
8.	K2-Event 044	Multinet. Salps.
9.	K2-Event 045	Multinet after lots of searching. Krill in nets 4 & 9. Animals from net 9 to -60.
10.	K2-Event 054	Multinet. 100 krill measured net 6.
11.	K2-Acoustic/ADCP run	
12.	Event 058	Multinet on target. Catch sorted.
13.	Event 076	LHPR test deployment caught krill. Put swimmers in after deck tank and started IGR. Froze some in -60.
14.	Event 104	4 trays frozen in -60.
15.	Event 105	Target multinet for DGB towards Royal Bay. 100 krill measured in nets 1,3,5 7, & 9. Some krill in other nets.

For catch details and other opportunistic measurements of krill, see length/frequency logs and catch logs held by Cathy Goss.

Most of the krill that were successfully target fished were immediately frozen at -60°C for matstaging, measurement and biochemical analyses later.
The krill and moults that were produced by the IGR experiments were fixed for matstaging and measurement later. The intermoult periods were calculated at the end of the experiments (see Table 1)

Table 1. Krill Moult Data

Event Number	IGR code	Net type	Date/start time (YYJJJ HHMMSS)	Number moulted	Inter-moult period
E033	IGR1 Red	F net	93012 000641	12	33.3 days
E034	IGR1 Blue	Mnet 4	93012 032219	15	26.7 days
E076	IGR2 Blue	RMT	930 18 030954	12	33 days[1]

1. One animal dead

3.3.5. **Data collected - Supporting data**

For CTD data and oceanographic interpretation, Carolyn Symon (CS) should be consulted.
For thermosalinograph salinity calibration, see CS.
For ADCP raw data, PNT should be consulted, and for oceanographic interpretation of this data, see CS.
For acoustic data, and acoustic transect events, CG should be consulted.
For underway monitoring data, e.g. Sea Surface Temperature, fluorescence, etc., see AGW.

3.3.6. **Specific contributions by other personnel on the cruise**

The Multinet, RMT and Fnet were designed and managed by DGB
ISG personnel (Paul W, VA, GB) contributed DWNM, CTD deployment, data handling and PC support
The EK500 was driven by CG
The ADCP was driven by PNT
Underway monitoring was managed by AWAM
Data management and transportation was done by AWAM & PNT

4. GEAR

4.1 Net Sampling (DGB)

This cruise has seen the first real use of two major new items of gear developed within MLSD and ISG, these are the **Horizontal Antarctic Multiple Plankton Sampler** (H-AMPS) and the **Down Wire Net Monitor,** (DWNM). Both were conceived in the early 80's, the DWNM having to await the arrival of JCR with a conducting towing cable before it could be developed.

Although both items require further refinement, their performance on this cruise has fully justified the faith placed in the original ideas. Used in combination they comprise a very potent sampling tool.

The H-AMPS employs 9 seperate cod-ends to sample catches by a single fixed $2m^2$ mouth net, the whole being mounted in an aluminium frame. Sample intervals can be as short as 10 seconds allowing discrimination between targets only 20m apart. The overall design incorporates features that are intended to minimise the nets detectability by plankters and so reduce avoidance.

The DWNM which is replacing the limited and now unreliable acoustic system that we have used for many years is designed as a sensor package with command functions. Both the physical design of the underwater unit and the surface software allow the sensor suite to be varied according to the gear or sampling method being undertaken.

At present we have sensors for depth, temperature, conductivity, PAR, flow rate, and cylinder angle (horizontal = 0 degrees). We have a futher sensor to give height off the bottom (max 50m), which we failed to get working owing to a (soluble) problem with the power supply.

The system runs from a PC, for which Paul Woodroffe, who has also been responsible for the electronics, has produced very user friendly software. Commands are acted upon instantly and reliably direct from the keyboard.

On the cruise we have used the system successfully with RMT, H-AMPS and LHPR.

Most sampling over the stern has been done with the **13mm conducting cable ('Biological Winch' wire.).** This system has no compensation to maintain wire tension when the ship is pitching. However the winch does have a tension control that will allow wire to pull off when tension goes above a preset point and this can be used to cushion the snatch experienced when the vessel pitches forward. The electrical part of the electro mechanical termination failed at one point but this was soon repaired. However the termination has several undesirable features and I will be looking at better ways of doing it for the future. I would expect that we will be able to go right through a long season without the need to re-terminate the cable due to general wear and tear.

The cable monitoring unit, a three sheave system to give tension, rate of veer/haul and length of wire out is rather vulnerably mounted just outside the spurling pipe. Its electrical connections leave much to be desired and the mounting position leads to erratic readings on the rate meter when the gear is near the surface and the vessel pitching. These points have been addressed in a request submitted to the ship for work to be done during refit.

The Scientific Communication System which allows a net launcher on the afterdeck to talk directly to the winch driver in the UIC was inoperative following a fire in its control panel prior to the cruise. This is a very valuable feature and must be restored. The only alternative is a two way radio which requires a spare hand to operate, often, just when both hands are required for net launching.

During the cruise a **simple wire drier** was made for drying the conducting cable before it goes down the spurling pipe, the prototype was very successful and further examples will be made.

The 'F' Net was operated from the scientific EFFER crane on the foredeck, this worked well and does allow for easy change in depth of the net if required. The net fishes well out from the bow wave.

Vertical nets were operated over the side gantry using wire from the 'Clean chemistry' winch supplied by RVS for the STAP cruise. This is not a long term solution to the serious problem created by having the hydrographic wire included in the traction winch system. The problem will have to be addressed at an early opportunity and a solution found.

4.2 **Electronics support** (Paul W)

I spent most of my time on this trip developing a new system, the Down Wire Net Monitor, and fortunately my colleague, Vsevolod Afanasyev, has found a natural affinity for CTD deployments which gave me plenty of time for software re-writes and hardware modifications.

4.2.1. Down Wire Net Monitor

Cruise JR03 has provided a difficult and extremely useful trial for the Down Wire Net Monitor system, the results of which have been, or will be, implemented to make the system fit the user requirement more closely and with maximum reliability. I am happy that we can deal with all of the problems that are outstanding on the system and, as the system was used with RMT, MultiNet and LHPR, I am confident that we have already encountered all the serious snags that were awaiting us. The outstanding problems that need addressing are as follows:

1) The 24V Power supply, which is used for the pinger and the battery trickle charger, generates too much noise when under heavy load - this effectively jams the communications link and thus the pinger was not used.

2) The LHPR flowmeters do not register.

3) The ABC system level B port occasionally hangs up causing data loss.

4) Occasional communications errors - I am hoping to reduce these to almost zero at 9600 baud (which is the data rate we currently use) and to increase the baud rate to 19200 with the same level of reliability.

I am delighted with the reliability of the system, which, in combination with the MultiNet, has contributed towards the success of this cruise.

4.2.2. **CTD System**

Technical snags on the CTD system were limited to connection problems and no planned

deployments were lost. Unfortunately, due to an administrative error, we were only able to use 6 Niskin bottles on this trip. Fortunately this did not prove to be a handicap.

4.2.3. **Oceanlogger System**

With reference to Mr Murrays report, we will try to address the relevant criticisms of this system at the nearest opportunity, though with reference to the comments about data averaging and sample rates - the system software is designed to fulfil the ABC philosophy that all data processing should be performed at level C unless, as in the CTD system, the data rate of the instrument is greater than 1 sample per second. The sample period on the Oceanlogger, which goes down to 1 second should, according to Mr Nyquist, allow the user to observe data with a period of 2 seconds (O.5Hz). This should be adequate for most user requirements, surface sampling wise, and fully meets the design specification - er.....there wasn't one.

There are obvious hardware problem with this system, some of which may have been caused by the enormous waves that engulfed some of the met instruments during JR02 and obviously we will attempt to rectify these as soon as possible. The problems with the thermosalinograph are extremely disconcerting and merit considerable investigative effort.

4.2.4. **EK500 Echosounder**

This system proved reliable throughout its first operational season - a far cry from the dreadful EK400, and proved to be a useful scientific tool. I am a little worried by the results of the Leith calibration which show a considerable change in the system since the Potter Cove calibration, performed at the beginning of JR02. I suggest that we contact Simrad for their comments on this.

5. SCIENTIFIC INSTRUMENTATION AND LOGGING

5.1 Acoustics

5.1.1. Simrad EK5OO Echosounder (CG)

Operation

a) A set of menus and submenus are used to send commands to the sounder and allow users separate control of the screen display, printed output and integration parameters. Although some limited use was made of kermit to transmit commands, this was slow and unreliable, most of the settings were selected manually; this is generally quite rapid with a short list of options for most frequently used items. The menus have the disadvantage that it is easy to use different settings for the printer and display, and because there is a time delay before the printer records become visible, the printed output was wrongly set on a few occasions. A paper record was made of all settings at the outset of the cruise (these were as used by Jon Watkins on JR02) only a comparatively small number were regularly altered: logging interval, layer picture, noise margin and thresholds being the most significant, others affected the display and printed record.

a) The joystick control on the main unit is already showing signs of deterioration and probably should be replaced; if not pushed forcefully enough commands were not always entered immediately, and in some situations this could mean that the chart was marked late, or integration was interrupted.

c) Software for logging integrated output from the EK500 was written by Paul Woodroffe in LabWindows. It provides a method of saving raw and converted integrator results and comments in three separate files, with a continuous readout of the file sizes being accumulated. Dave Richmond began the process of logging the sounder to the ABC system via the Ethernet Port, establishing a connection between them the day before the unit was dismantled and removed from the UIC room.

5.1.1.1. Data Collection

Phil Trathan, Alistair Murray and I together ran the sounder for most of the time when the ship was underway south of the APFZ Rates of data collection with different combinations of reset interval and layer configuration have shown those which are practical for various types of survey. Almost all of the time the maximum layer number (500) was used to give lm layers over the top 250m at two threshold levels, The data from only one of these levels will be used and on future cruises when the effect of the threshold has been established, only one will probably be needed. A test file using 10 different thresholds over the same depth range, with 36 second reset intervals, was run when both dense and diffuse targets appeared in the water column. This should produce comparative data to determine the best level to use in future. The shortest acoustic runs while nets were being towed used reset intervals of between 36 and 60 seconds. The shortest interval available is 14.4 seconds, but such short times produced unmanageably large files. Longer transects were logged at 2 - 3 minute intervals. Over 22 days of survey over 240Mb of data were collected and two copies of each file backed up approximately daily onto 80Mb cartridge tapes. Over 12 RMT events 33 multinets and around 83 transects had acoustic results logged.

5.1.1.2. Calibration

A sphere calibration was carried out at Leith Harbour on 24 01 93. Starting at 1000 hrs GMT, measurements were taken from 23mm (for 120kHz) and 60mm (for 38kHz) diameter copper spheres provided by Simrad, at standard and working pulse lengths and band widths. A 38.1 mm tungsten-carbide sphere was also used at both frequencies for comparison with earlier calibrations. The calibration was simplified by using previously measured and marked lines to suspend the spheres under the ship. The 23mm sphere also needed to be suspended above an extra weight (the 60mm copper sphere was used for this purpose) to counteract movement as the ship swung in the wind. 8 hours were needed to complete these measurements. There was not time to carry out the lobe program.

5.1.1.3. Interpretation of Echoes

5.1.1.3.1. Echoes from Non-Biological Targets

a) Net control switching - old net monitor: On some occasions a dense spike, familiar from the EK400 charts, appeared, while on other occasions the only evidence of this was an interruption in the bottom trace.

b) False bottom echoes: False bottom echoes were caused by reverberations between the bottom and the surface. These were far more frequent than encountered with the EK400 sounder on the John Biscoe and often very strong. This could be explained by the combination of good weather, the ship's stability and other physical differences in parameters such as beam width or transmit power. Two strategies could be used to avoid these echoes or stop them once they began. The first is to select a slower ping rate (and lose detail) and the second is to have someone continuously monitoring the depth and adjusting the depth window to a realistic range until the water depth is greater than about 1000m.

c) Noise

(i) Internal: We encountered a major drawback with this sounder on sea trials: high noise levels at 120kHz even before the transducer was plugged into the system. Although some improvement was made when part of the hardware was returned to Simrad in Norway the levels still appear high in comparison with the EK400. Evidence for this comparison comes from watching targets migrating up or down through the water column that appear or disappear into a 'blind' zone on the 120kHz display that starts at around 100-150m depth. Only the strongest echoes are visible below this depth. The composite chart that recorded alternate pings from the two frequencies used on the EK400 may have masked a similar depth limitation on weak echoes from 120kHz. Comparison of calibrated results from both sounders should resolve this uncertainty.

(ii) External: At the start of the cruise when travelling at 12-13knots between Stanley and South Georgia, I used the sounder's passive mode (ie listening to the ambient noise in the water column) to establish what value to use for the sounder's noise margin **setting. (The** calm crossing we had was ideal for this). This parameter provides a filter for all signals below the chosen level. The manual recommends that it should be kept as low as possible but a 7dB setting was needed to remove all but the smallest trace of noise when displayed using -82dB colour minimum setting. Having fixed this level at 12 knots I was surprised to encounter an additional level of noise at 12OkHz that only first appeared when we **sailed** off

the shelf after calling at Bird Island. I decided not to mask it with a further increase of the noise margin but instead logged its appearance and disappearance. It is clearly connected in some way with the ships propulsion system, switching off sharply a short while before the ship stopped for any reason and starting suddenly as soon as the ship began to get underway. This pattern of occurrence was further modified by the ship travelling on and off shelf but in the reverse way to that usually encountered: more noise encountered off-shelf and less on-shelf.

(iii) Noise Trials:

Four separate sets of noise trials were carried out using passive and active modes, at both frequencies, both on-shelf and off-shelf. They were aimed at understanding the speed-related noise described in the previous paragraph and at providing a record of the noise encountered at speeds used for different work activities performed. Following noise measurements made during sea trials in summer 1992, 8 knots was chosen as the preferred speed for transects where acoustic survey was the primary or an important aim. The first test on 16 January used an octagonal track devised to test the effect of wind direction in relation to ship's direction, but, owing to the light wind, it was only possible to make straightforward observations on noise levels at around 8 knots (100 shaft rpm) at both frequencies in passive mode in deep water. The lack of strong wind throughout the cruise prevented a full series of comparisons that would have been possible with this track design, where one leg was in the same direction as the wind and the remaining legs turned through 45" until a regular octagon was completed. The subsequent three tests were made when time was available between other activities using sections of straight course. On the 17 January different speeds were tested in active mode with settings as close to usual operational ones as possible. The engine was run in both normal and quiet modes; the latter mode was considerably noisier at these frequencies at all speeds. Quiet mode uses more fuel than normal mode and is not recommended for acoustic surveying.

5.1.1.3.2. Echoes from Biological Targets

Separate charts for each frequency, density information displayed in colour, and variable chart speeds mean that the echocharts do not look very much like the charts form the Simrad EK400. Fishing with the RMT and multinet has provided evidence that particular marks on the echochart were caused by krill and others by salps. Mysids were the only other targets that were caught in sufficient quantity to attempt to correlate with chart marks. Where substantial numbers of krill were caught during target fishing, lengths of 100 animals (or the total if that was less than 100) were measured.

5.1.2. SIMRAD EA500 Echosounder (PNT)

5.1.2.1. The EA500 ran successfully for the duration of the cruise. There were no software or hardware problems encountered. Towards the end of the first half of the cruise Dave Richmond successfully enabled the level 'A' interface so that the EA500 could log data through to the level 'B'. Data were therefore collected from 08/01/93.

There is no repeater screen for the EA500 in the UIC room which makes it difficult to monitor data quality. The only indication available is from the level 'B' messages on the level 'B' console. These messages include the current depth. In normal practice, if the attached recommendations are followed, this should be a satisfactory arrangement.

The EA500 is actually part of the ships navigation equipment and under the current standing instructions the bridge make occasional changes to its setup. These changes are related to manually altering the range settings. However, on a number of occasions the EA500 was left with the wrong bottom settings. Near to regions where the depth changed rapidly (shelf break areas), this had the result that a false bottom was detected at twice the depth of the true bottom, or that a constant bottom was recorded at the exact depth of the bottom setting. This false bottom was logged to the level 'B' on a number of occasions and as a consequence, considerable care will be required to validate the data. It is possible that using the EA500 in auto-ranging mode may alleviate some of these problems.

To reduce mutual interference, EA500 pinging was synchronised to the EK500. This meant that if the EK500 was switched off, the **EA500** was unable to ping until pingmode normal was selected by the operator. Therefore, if the EK500 is not sounding, the bridge must be notified so that the EA500 can be switched to pingmode normal.

5.1.2.2. Recommendations

If useful data are to be derived from the EA500, stringent protocols must be agreed with the bridge to remove the possibility of false data being recorded. These protocols should include instructions to run the EA500 in auto-ranging mode and for notifying the UIC room if the EA500 setup is changed. Arbitrary changes should be discouraged. Similarly, **to** prevent unnecessary error messages on the bridge, proposed changes to the EK500 pingmode should be communicated to the bridge before they are made.

5.2. **Sonar (AWAM, DGB)**

5.2.1. A Furuno sonar model CSH 50 is installed on the RRS James Clark Ross. The system is not presently connected to any navigation instruments; it can accept gyrocompass and log inputs and is then capable of providing a "true motion" display. (We do not know whether the data formats of our navigational instruments are compatible.) Two displays and control panels are provided: one in the Underway Instrumentation and Control (UIC) room. and the other on the bridge. The instrument in the UIC room is most inconveniently sited at the opposite side of the lab from the EK500 sounder, Down-Wire Net Monitor (DWNM) PC and winch controls. This severely limits its usefulness during fishing operations. The system operates at 53 KHz. Interference from the sonar was visible on the scientific sounder - see the report on the EK500 by Catherine Goss. There are a number of settings such as pulse duration, TVG function and the like which can be set by dip switches on the instrument in the UIC room. Instrument settings for our work will probably differ from those required for navigation. The instrument in the UIC room should be configured with the appropriate settings for the scientific work to be undertaken. The instrument which is first to be switched on gains control of the displays; this should be the UIC room instrument when scientific work is in progress. The UIC display is of noticeably poorer quality when it is acting as the slave than when it is controlling the system. The sonar system is highly sophisticated and clearly needs to be configured correctly, used appropriately and interpreted with care. Experience on the cruise suggests that interpretation of the display is not straightforward - even given the joystick-controlled cursor with (apparently) a read out of range and depth to target. The display can be set to "slice" mode. This is not a vertical slice through the water - rather it is an oblique section along the beam in the currently selected bearing relative to the ship.

The slice shows a combination of range and depth information (that is the depth is a function of the range). Changing the gain setting can cause a marked change in the appearance of the targets displayed.

5.2.2. **Some observations on interpreting the sonar display**

During net hauls in West Cumberland Bay the display was monitored to provide warning of any change in bathymetry. Positioning the cursor on the edge of the bottom echo does not give the true depth - when tested over a fairly level 200 m bottom the estimated depth from the sonar was about 160 m. The first indication of rising sea bed was a narrowing of the bottom echo rather than a change in range, presumably because the echo was sharper from a surface inclined towards the ship.

During net hauls with the multinet we attempted to use the sonar to measure the depth of the net - which was known accurately from the pressure sensor mounted in the DWNM. By varying the angle of tilt of the sonar it was possible to observe a return from the net over a depth range of nearly 50 m. A strong echo was observable over a range of 20 m depth. It was very difficult to get the estimated depth of the net correct - even with foreknowledge of the true value!

During acoustic searches for suitable targets for krill fishing a careful watch was made for targets ahead of the ship which might then pass through the EK500 beam. Several were observed on both instruments. Invariably a target which looked large and strong on the sonar display appeared relatively small and disappointing on the EK500 Careful choice of gain and other settings on the Furuno might help to tune its sensitivity to provide more comparable indications on both the Furuno and Simrad systems.

5.2.3. Use **of sonar during krill target** fishing

Undoubtedly the sonar will be of great help in target fishing operations but at present it seems far better at detecting shoals of “red herrings” than anything else! With the present “ship’s head up” display there is a great tendency to chase one’s tail until you are literally targeting the ship’s wake!

If we were able to interface the sonar with the log and gyro to give a “true motion” display there would be less tendency to do this. However, the same principle will apply, in that to chase off after any likely target irrespective of where it appears on the screen will not be a lot of help. In the limited trials that we carried out it was apparent that krill swarms did not show up well at ranges greater than 3-400 m. Thus, if a target is more than a few degrees off the ship’s course, the vessel would still be turning when (if) it passed over the swarm and consequently the net would possibly not pass through the swarm at all.

To overcome these problems we think that we should purchase and study a copy of the manual with a view to maximising the range at which swarms can be detected while minimising the “rose-tinted spectacle” effect that makes the least little discontinuity look like a krill bonanza.

Further, we do not think that the sonar should be used as an alternative to our well tried acoustic search methods, rather, it should be used to fine tune the catching runs. We think that a good scheme would be to get the search area centred on the VMS workstation display

and zoomed to the largest possible scale. When swarms are encountered on the search they should be marked on the monitor screen with chinagraph. At the end of the search a suitable course can be chosen to pass through the area of greatest likelihood of an encounter. Once settled on this course the sonar should be set to concentrate on a very limited area, say 10° either side of the bow and used to direct the ship only towards swarms that appear in this window.

5.2.4. **Recommendations**

1) MLSD should purchase two (or more) copies of the manual.

2) We should explore the possibility of interfacing the ship's gyro and log to provide a "true motion" display.

3) We should decide what we want out of the instrument.

4) Someone should be trained to use and interpret the sonar for our purposes.

5) The instrument should be set up appropriately.

6) The issue of who controls the instrument - scientists or the bridge - must be resolved and working procedures agreed with ship's officers.

7) During refit the problem of interference between the various acoustic systems should be resolved.

5.3. ADCP (PNT)

5.3.1. ADCP status

The RDI 150kHz ADCP was in operation throughout the cruise. Neither the instrument or the IBM Data Acquisition System (DAS) gave any hardware problems. The firmware was version 17.07 and the IBM DAS software was version 2.48.

5.3.2. ADCP testing

The internal diagnostic tests provided by the DAS were run successfully on 31/12/92 whilst the ship was moored at FIPASS, Stanley. They were also run successfully on 21/01/93. RDI VMTEST diagnostics were run on the 21/01/93, these tests all completed successfully. On 21/01/93 the RDI RINGTEST diagnostics were run in order to collect test data for analysis by RDI.

5.3.3. ADCP control profiles

Two ADCP control profiles were setup on 31/12/92 whilst the ship was moored at FIPASS. These two profiles were identical apart from differences associated with bottom tracking mode and water tracking mode. They were used throughout the cruise.

5.3.4. ADCP calibration

On leaving FIPASS on 02/01/93 a standard calibration zig-zag was steamed immediately the ship reached open water. The seastate was calm and there was little or no wind. Each leg was steamed for 20 minutes with a 120 second ensemble time. Constant RPM to produce a ship speed of circa 8 knots was maintained. Turns of 90° were carried out at the end of each leg and the new course achieved within 4 minutes (the best turn was within 2 minutes). The first leg proved to be ineffectual, with the ADCP showing a poor percentage of good pings. This was the result of the shallow water. When the depth increased to more than 75 m a better percentage of good pings was achieved. An extra leg was carried out at the end of the run in order to provide seven good legs and six turning points. Following analysis of the results of this calibration it was decided that future calibrations should be carried out in a water depth of more than 100 m.

A second calibration at 05:30 GMT on the 08/01/93 was aborted due to an increasing seastate (above force 7) and a consequential loss in data quality (percentage good dropped to below 70%). A third calibration was undertaken at 08:00 GMT on the 17/01/93. This calibration was again run at constant RPM to produce a ship speed of about 8 knots. The seastate was calm, with less than 10 knots of wind. A final calibration was carried out at 17:00 GMT on 21/01/93, again this was carried out at constant RPM to achieve a ship speed of around 8 knots. The seastate was again calm with a low swell and with less than 12 knots of wind. The second, third and forth calibrations were all carried out over the South Georgia shelf in a water depth of between 180 m and 250 m.

5.3.5. ADCP data collection

All ADCP data was collected with an ensemble period of 300 seconds, The two different ADCP control profiles were used according to sea depth. Data were collected to a depth of greater than 600 m on a number of occasions, always during periods when the seastate was very calm and the ship was steaming at, or below a speed of 8 knots. Generally bottom tracking mode lost the bottom between 200 m and 300 m, whilst water tracking mode could only reach to a depth of about 375 m. The ADCP was switched on throughout the cruise and data were logged continuously. In a number of areas data were collected in greater detail.

A box survey was carried out to the north of South Georgia, running 7 parallel legs (Fig. 1) at 8 knots. The box survey was designed to cross the South Georgia shelf break, starting in 250 m of water and ending in 3500 m. During this survey the seastate was calm, with little wind apart from on the final leg when the seastate rose to above force 5. The box survey was started at 18:45 GMT on 06/ 01/93 and completed by 05:30 GMT on 08/01/93.

A single transect, chosen on the basis of zooplankton abundance over the box survey, was steamed a number of times during the cruise (Fig. 2). This transect ran perpendicular to the shelf break, starting in 250 m of water and ending in 3500 m. Although ADCP data was collected at all times, three complete runs of the transect were recorded at 8 knots, with no stoppages for nets or CTD drops.

ADCP data was also collected in and around the vicinity of Cumberland Bay (Fig. 3). Again, although data was collected at all times, a number of runs through the bay at 8 knots were undertaken and data recorded.

5.3.6. ADCP data transfer

ADCP data is normally collected either directly onto the shipboard 'ABC' computing system 'C' level via a serial link from the PC controlling the ADCP, or onto one of the PC's disc drives. At the beginning of the cruise the serial link to the 'C' level was found to be inoperative, due to a faulty printer buffer. All ADCP data were therefore collected onto the PC's hard disc and archived to floppy disc. Some data was subsequently transferred to the 'C' level via FTP.

5.3.7. ADCP **data analysis**

The DAS does not provide any user analysis software. The only method currently available is via software (PSTAR) supplied by the James Rennell Centre for Ocean Circulation. The PSTAR software may be run either interactively, or via Unix shell scripts. The scripts currently on the ship are unusable and full of bugs. Running the programs interactively was straightforward once various supporting files were located. If further use is to be made of PSTAR, then the scripts and supporting file structure should be rationalised and a copy of the documentation should be obtained for the ship.

In the absence of an oceanographer on the ship, it was decided not to analyse the ADCP data beyond determining whether the calibration runs were acceptable.

5.3.8. **Future requirements**

RDI currently market a suite of software for the ADCP which not only collects data, but provides user analysis and plotting routines. It is strongly recommended that use of this software be investigated.

It is further recommended that a 3D GPS receiver is obtained for the ship, to enable accurate heading information to be recorded. At present gyrocompass drift and heading bias (see separate report on navigational instruments by Alistair Murray) leave interpretation of ADCP data open to error (Gywn Griffiths pers. comm.).

5.4. **Under-way Sampling** (AWAM)

54.1. The uncontaminated seawater supply was run from 18: 15 GMT on 3/l/93, position 52" 34' S 5 1" 37' W, until 12:45 on 27/l/93, position 52" 34' S 51" 47' W. This gave coverage from well to the north and west of the Polar Frontal Zone down to South Georgia and back. Sensors logged on this cruise are listed in table 1. The oceanographic variables were of greatest interest to the scientists on this cruise, although various meteorological data are also collected. Data are displayed and logged using the PC-based oceanlogger system (version 1) written by Paul Woodroffe. This software behaves in a radically different way to the original metlogger and previous oceanloggers aboard RRS John Biscoe. In the current oceanlogger, input channels are sampled every 10 seconds (user configurable); in previous logging programs samples were taken every second and then averaged over a user-chosen interval (of order tens of seconds). Data are transferred using RVS Ship Message Protocol to the level 'B' system and thence to the level 'C' where users can access them for analysis. In order to monitor the operation of the logging system, regular (hourly if other commitments allowed) checks were made by watch keepers. The time, ship's position, sea surface temperature,

salinity and fluorescence were noted from the PC displays in the UIC room. The reading on the Turner Designs Fluorometer in the prep. lab was noted and a check made on the water supply. The log sheets for the cruise are attached. These are of great value when processing the data as notes have been made when spikes were observed. This procedure also ensured that less than two hours of data were lost when a fuse failed in the PC. At the end of the cruise the salinometer and fluorometer were flushed with fresh water and the latter drained.

5.4.2. Sea **surface temperature**

The Meteorological Office temperature sensor is mounted on the inside of the ship's hull and the data from this were judged to be unrepresentative of the sea temperature so this sensor was not logged. The sea temperature was taken from the PRT sensor mounted very close to the hull intake in the uncontaminated sea water supply. This sensor has a resolution of only ± 0.1 C which may not be adequate for all oceanographic purposes.

5.4.3. **Salinity**

Salinity was calculated using the manufacturer's algorithms from the conductivity and temperature data from the SeaBird thermosalinograph. In order to calibrate the instrument, 25 water samples were taken from the outlet. Bottles were rinsed five times in de-ionised water, then left to soak. When a sample was taken the bottle was rinsed five times in sea water before being filled. The neck was then dried and the bottle sealed. The times and approximate positions of these samples are detailed on the attached log sheets (which also include 12 samples taken to calibrate the CTD). I was unable to measure any salinity values for these samples on board as I was recommended not to attempt to use the AutoSal salinometer. The samples are stowed in the cool store for analysis on return to the UK. In my opinion the data from the thermosalinograph may not be very reliable. Monitoring of the oceanlogger display often showed a tendency for a downward drift of order 0.2 or so psu over a period of hours. When the instrument was drained and then refilled the salinity value showed a distinct step upwards. Times when the instrument was drained are shown on the attached log sheet - note that not all instances are shown here, some were unrecorded before 07/01/93. It could be that there is a problem with small bubbles accumulating in the thermosalinograph. The outflow from the instrument was run through a plastic hose into a measuring cylinder and small bubbles were visible rising to the surface. Bubbles also clung to the outside of the hose - these accumulated afresh between hourly inspections of the water supply. I suggest we consider the possibility of installing a de-bubbling mechanism in the water supply to the thermosalinograph The salinity data also appear unexpectedly variable in comparison to those I saw recently on RRS Discovery. This was the case even when in deep ocean away from the influence of the shelf or the polar front. This might perhaps be due to the different method of sampling mentioned above. I suggest that these data are thoroughly inspected before any use is made of the results. I consider that the number of samples taken for calibration is inadequate - the oceanographers on Discovery cruise 198 (in the Bellingshausen Sea at the same time as JCR02) took hourly samples which were analyzed on the following day.

5.4.4. Chlorophyll fluorescence

The instrument was left configured as it had been for JCR02, no adjustments were made to the sensitivity or span controls. The blank correction was zeroed. The settings as found are shown in table 2. The instrument appeared to work satisfactorily throughout the cruise. More than 70 water samples were filtered through 4.7 cm Whatman GF/C filters for later extraction and chlorophyll determination. Samples were taken at approximately six hour intervals when the ship was running transects - less frequently at other times. At the beginning of the cruise 200 ml was taken; this was later increased to 250 ml and then to 500 ml. The filters were placed in petri slides and frozen at -20 C. At the end of the cruise they were transferred to the -60 C freezer for return to the UK. The log of the samples taken is attached - note this also includes other samples from CTD water bottles and zooplankton experiments. The instrument was run in autoranging mode. When it is changing range different filters are introduced into the optical path (see the manual for details). This process takes several seconds during which the instrument reading may be off scale. If the oceanlogger software samples during this time it will produce a massive spike in the logged data. These are visible on the PC display - and have sometimes been recorded on the hourly log sheets.

5.4.5. Other sensors

No checks have been made on any of the other, mostly meteorological sensors. However, it was noted that the wind speed and direction displayed on the PC did not seem to match a subjective assessment of the outside world!

5.4.6. Summary and Conclusions

A large data set has been collected of which the temperature and fluorescence (when calibrated) seem likely to be of good quality. I suggest that the salinity data be treated as suspect until proved otherwise.

There are a number of differences between the new logging system on the RRS James Clark Ross and that used on previous MLSD cruises on RRS John Biscoe. The 6.5 m depth of the water intake is very different from the Biscoe's 2 m intake. Most of the sensors are new and are sited in different places in relation to the waterline. The different method of sampling, that is once every 10 seconds instead of averaging 1 second samples over a window, means that the data collected are not strictly comparable with any other data sets collected in previous years from RRS John Biscoe. As a consequence of the different sampling, spectral analysis of data collected on this cruise will not be comparable with that on previous years' data. However, the data are likely to provide satisfactory synoptic maps - albeit with higher sampling variability than before. We should consider carefully how we wish data to be sampled in the future and specify any modifications to software in good time for ISG to plan, carry out and test any work done.

The system of watch keepers monitoring the oceanlogger has proved its value and I suggest that it be continued on future cruises. This idea was adapted from the procedures in use aboard RRS Discovery where it was deemed essential to the success of a rigorous under-way survey.

Towards the end of the cruise, I found time to inspect the water intake, filters and pumps. The filters were just in the process of being cleaned. On return to the UIC, I felt that I could

see a change in the level of variability of the graphically displayed data. This may be rather subjective but I suggest that until it is demonstrated that such changes do not affect the data, we ask that the watch keeper be informed of any work carried out on the system by the engineers and that this be recorded. On the last day of sampling a similar increase in the level of variability was observed. The water supply was switched to run through a filter which had been recently cleaned with no observable effect on the pattern of the trace.

It would be very useful if the various manuals for the instruments and sensors were collected together in one place - at present they are scattered around the ship. It would also be helpful to have documentation for the new logging software when it is finalised

If MLSD is to get maximum scientific value from the oceanlogger system, then certain standard procedures must be adopted. The system must be properly maintained and operated. Sensors must be calibrated at appropriate intervals. Sea water samples for thermosalinograph calibration should be taken much more frequently than has been our practice in the past. In order to process these samples we will need to be able to operate a salinometer at sea. Samples for chlorophyll extraction should be taken very frequently - ideally every hour if possible. Any lower frequency runs the risk of missing features of interest. This means that we will have to invest in a bench fluorometer for measuring discrete samples. The necessary filtering kit, glassware and consumables will also need to be provided. Under-way sampling cannot be successfully run unattended. At present it is not clear whose responsibility it is to oversee the running of the system. We should evolve some new procedures, document them and work to them in order to ensure that the data collected will meet the scientific needs of the division,

Table 1. Details of sensors logged on cruise JCR03.

Sensor'	Details	status
Sea(M)	Met Office supplied - mounted on the inside of the hull.	off
Sea(S)	PRT 100, supplied by SHS, mounted in the uncontaminated sea water supply between the filters and the pumps.	on
Salinity	SeaBird thermosalinograph model SBE 21, sited in the prep. lab.	on
Fluoresc	Turner Designs model 10 through-flow fluorometer, sited in the prep. lab.	on
Flow	Liter-meter, mounted between the thermosalinograph and the fluorometer in the prep. lab.	faulty
PAR[2]	Didcot Instruments type DRPl on the foremast.	on
TIR[2]	Kipp & Zonen CM5 on the foremast.	on
Humid[2]	Vaisala HMP 35A Humidity and temperature probe mounted in a screen on the foremast.	on
AirTemp[2]	Vector Instruments PRT type T351 mounted in a screen on the foremast.	on
Pressure[2]	Vaisala PA1 1 digital barometer in the UIC room.	on
WindSpd[2]	Vector Instruments A100M on the foremast.	suspect
WindDir[2]	Vector Instruments W200 windvane on the foremast.	suspect

1 Names as on the oceanlogger display screen.

2 Further details, including calibration data, are in the ISG Metlogger System Documentation.

Table 2. Settings of the controls on the Turner Designs model 10 fluorometer on JCR03. See user's manual for details.

Control	Setting
Blank	0
Span	0
X1/X100	X1
Sensitivity (coarse)	fully clockwise (maximum sensitivity)
Sensitivity (fine)	at the furthest extent towards the instrument

5.5. Navigation Logging (AWAM)

5.5.1. Navigational data logged on the cruise were: position from GPS, speed from the doppler and electro-magnetic logs, and heading from the gyro compass. Data were passed to the RVS level 'B' computer via level 'A' interfaces. Data were then transferred from the level 'B' to level 'C' on the Sun workstations where users could access them. The various streams of navigation data are combined in level 'C' to produce a file of ship's positions at 30 second intervals. The various data sources are described below followed by a discussion of the processing of these data. (Photocopies of relevant sections of the manuals referred to below are available from Alistair Murray.)

55.2. **GPS**

The GPS positions were provided by a Trimble 4000 DL receiver. This uses the World Geodetic System (WGS84) for geographical coordinates. The receiver functioned without known problems throughout the cruise. Positions were logged every 10 seconds for most of the cruise, except during ADCP calibration runs when logging was every second. The largest gap in coverage when in the research area was just over ten minutes on 09/01/93 and was due to a power failure affecting the computers. There was another gap of nearly eight minutes on 17/01/93. PDOP was low, typically about 1 - 2, maximum 4.3, in the cruise area (51" 40' to 54" 21' S, 35" 01' to 57" 51' W). Over a test period of forty minutes logged whilst alongside at FIPASS, the scatter in GPS position was less than 90 m.

5.5.3. **Gyrocompass**

The ship's gyrocompass is a Sperry Marine MK-37 mod E. The serial data output from the compass is interfaced through a level 'A' into the level 'B' logging system. Speed and latitude correction are available through manual control and these adjustments are made as necessary by the ship's officers. The compass is known to have a bias. The ship's officers use an offset of -2.0" for navigation and this value was used in calculations with the level 'C' program relmov. The bias has not been measured accurately enough for scientific purposes such as processing ADCP data. All gyrocompasses drift over short and long time-scales. We have no knowledge of any measurements of the drift characteristics of the instrument aboard RRS James Clark Ross. We do not have any way of monitoring this during a cruise. Accurate heading information could be made available by use of a three dimensional attitude GPS receiver such as the Ashtech 3D receiver recently installed aboard RRS Discovery. (A paper describing the use of the Ashtech receiver is available from Dr Gwyn Griffiths of the James Rennell Centre for Ocean Circulation, Southampton, Alistair Murray has a copy.) The headings can be used directly to process ADCP data and are also useful to model the errors in gyro heading. In high southern latitudes GPS coverage is much poorer than in the study area of cruise JCR03. Where GPS coverage is poor or interrupted it is very important to have accurate heading (and speed) data to give the best possible dead reckoning navigation between fixes. A knowledge of the recent error history of the gyrocompass would be essential for this.

5.5.4. **Electra-magnetic Log**

The ship is provided with a Chemikeeff Aquaprobc electro-magnetic log mark V. This provides a measurement of the ship's fore-aft speed. The instrument response is not linear. The graph of transducer output against measured speed shown in the manual shows a

curvilinear response which implies that the error in speed measurement depends on the speed. The instrument has the capacity to store a look-up table of values to provide a series of linear segments to approximate this curve. A calibration procedure is given in the manual. Values in use during cruise JCR03 are shown in table 1. The ship's second officer believes that this log over-reads by about 0.5 knots at slow speed and less at high speeds.

5.5.5. Doppler Log

The ship is fitted with a Sperry Marine SRD 421S dual axis doppler log. This provides measurements of both fore-aft and port-starboard speed. This is a sophisticated microprocessor-controlled instrument, using three transmit-receive channels at 250 KHz. It can operate in either water- or bottom-tracking mode and is usually operated in the latter configuration. The manual gives details of two calibration procedures. The first is an automatic calibration function to correct for rotation offset in the mounting of the transducer. This was almost certainly done when the ship sailed a measured mile after leaving the Tyne in summer 1992. The second procedure provides for a scaling factor of up to ±10% to be applied to the speed output from the log. As far as is known no scaling factor was in use during this cruise. The manual also lists a number of environmental factors which are known to affect the performance of doppler logs. These include factors affecting the back-scattering of sound in water, vessel trim and list, current profile in the water column and sea state. The ship's officers believe that this log is unreliable in the cold clear waters of the Southern Ocean.

5.5.6. Use of navigation data

The ability to steam at a known speed through the water is important for net hauls. It was noticeable on this cruise that at times there was a wide discrepancy between the doppler and electro-magnetic logs. On occasion the doppler log gave a speed almost twice that of the electro-magnetic log. For MLSD net fishing purposes, accurate speed indication in the range 2 - 4 knots from at least one of the logs is highly desirable.

Data logged to the level 'C' computer system are processed by a suite of RVS programs. All navigation programs use the concept of a navigation time "window". This is a user-specified time interval for the output data from the programs. On cruise JCR03 a navigation window of 30 seconds was used. The heading and speed data are combined to produce a file of ship's relative motion (program relmov). On JCR03 the raw electro-magnetic log output and the heading from the gyrocompass with an offset of -2.0" were used. The program seems to expect speed port-starboard as well as fore-aft but the former is not available from our electro-magnetic log because it is not fitted with a dual axis transducer. This may have caused some problems in the processing. An examination of one hour's data showed all records in the relmov output file to have been marked as "reject" by the program. We need to find out if the program can be run successfully without port-starboard speed. The relmov output file was then used in conjunction with the GPS fixes from the Trimble receiver as input to the bestnav program. This uses the relative motion data to calculate an expected position given the last good fix. The predicted position is then compared with the new fix. If the new position would require an unrealistic relative motion - that is greater than a user-specified maximum water current - then the fix is rejected and the program repeats this process with the next available fix. A program gps_av is available which smooths GPS fixes according to user-chosen criteria. The program smooths by linear regression and a number of weighting policies are available. The output from gps_av can be used as input to bestnav

if required. The gps_av program was not used on JCR03. The programs are described in the RVS level 'C' manuals and training notes (available from Alistair Murray). Care is required in processing navigation data using these programs as there is clearly a lot going on which is hidden from the user. An investigation of all the intermediate stages and final output from one hour's data is still in progress. The raw data are, of course, still available and it is likely that we may wish to reprocess these when we gain experience of running the programs.

The RVS level 'C' software provides programs for plotting ship's track. Good plots are fairly easy to obtain and can be produced with little effort once a template is set up. The plots can be output on any of the graphics devices accessible from the Sun workstations. I have not yet discovered how to remove time annotations from a plot of raw fixes - the programs do not seem flexible enough to allow this.

The ability to look up on computer the ship's position at a given time in the recent past was a great benefit. This had been much needed on previous cruises aboard RRS John Biscoe. The vastly superior accuracy and greater frequency of GPS fixes compared to the Transit satellite system is also a very welcome development.

5.5.7. **Recommendations**

1) It would be a great benefit to the scientific use of the data logged from the navigational instruments if records of all calibration data could be kept centrally and made available at the beginning of a cruise.

2) Results of processing of the logged data should be made known to the ship's officers where this would help in their assessment of the accuracy of calibrations in current use.

3) Navigation processing by RVS software should not be taken on trust without checking of intermediate stages.

Table 1. Chemikeeff electro-magnetic log calibration data in use during cruise JCR03 - 28/01/93), supplied by the radio officer (C. Waddicor). See manual for details.

Shaft rpm	True speed (measured mile)	Calibration data (Southern Ocean)'
060	4.83	3.70
090	7.55	6.85
120	9.95	9.70
150	11.93	12.05
180	13.86	14.53

2 These figures have proved to give a more accurate estimate of speed over the range of shaft r-pm. The curve produced closely resembles the example curve in the manual. As far as I know they were obtained by trial and error.

5.6. Event Log (PNT)

During the cruise all discrete operations were event logged. This included all net and water bottle operations. Continuous logging by the 'ABC' system was in use for most other operations, including CTD drops and oceanlogger functions. Acoustic data collected by the EK500 and the ADCP were not event logged.

It was acknowledged before the cruise that the event log system was in a state of flux and that a suitable system should be developed in the light of JCR02 and JCR03. The event log was therefore recorded separately onto hand written sheets and also onto a PC using software provided at very short notice by Paul Woodroffe (ISG). This method was felt to be satisfactory for the current cruise, but needs to be improved for future MLSD cruises. In particular separate workstations are necessary, each capable of event entry in different areas of the ship. Other features such as different net opening times within a haul must also be allowed for as well as a sensible station numbering scheme. Station numbering may best be governed by the bridge.

6. COMPUTING (PNT, AWAM)

There is an impressive provision of hardware and software aboard the James Clark Ross, however, much remains to be done before the full potential of the facilities can be realized. To this end, our report necessarily contains some constructive criticism, although our overall assessment of the facilities is very favourable.

The computing report for the cruise is set out under the following headings: Vax software, PC software, network communications and Sun software. After briefly detailing the various platforms we provide a synthesis according to our previously stated strategy and desired objectives for the computing system.

6.1. Vax software

Only those areas which are felt to be general purpose are considered, no specialized software is covered. The areas considered to be of general interest are: database, statistical and graphical software. The Vax is set up in a manner very similar to that at Cambridge, although the printer queues and the job queues do not have the same names. Graham Butcher (ISG) has now rationalised this and we hope it will not be a problem in the future.

Oracle

Oracle version 6 is currently available on the Vax. A moderate amount of use was made of Oracle throughout the cruise, and it will become of much greater importance during future MLSD science programmes. During the cruise Graham Butcher (ISG) implemented system procedures to enable Oracle userids to be setup and for taking regular backups of Oracle tables.

Loading data into Oracle is extremely fast, given the current low usage of the Vax. Various scripts were produced which load RVS level 'C' *listit* format data directly into Oracle, once it has been transferred to the Vax from the level 'C' Sun workstation. Now that these scripts have been established as templates, future data loading should be a simple matter of tailoring the appropriate template. This process relies upon a manual transfer process, first from the level 'C' to *listit* format, second via file transfer (FTP) to the Vax, and third into Oracle itself. This system must be refined for the future, preferably with automated data transfer. It is possible for some of the Vax file space to be mounted as a network file service (NFS) on the Suns (see Graham Butcher's report for details) and it might be possible to use this instead of FTP, thereby avoiding multiple physical copies of extensive data sets.

Generating templates for database interrogation was considered, but felt to be inappropriate due to the varied nature of database queries normally encountered. However, despite the above, certain templates for queries in common use (such as position at a given time) should be designed. Before this can be done, however, MLSD must produce a detailed set of table descriptions for Oracle use on the ship. These need not be the same as those currently in use by the OBP database in Cambridge. In particular, the storage of track data in a single table as in the current OBP database must be seriously re-evaluated for data collected at fine scale (of order 10 second intervals). Accurate positional information is critical for ADCP data, but may not be as important for other types of data where the emphasis is on course and distance run.

Loading large datasets into Oracle is possible, but the limitations imposed by the disc capacity

and query time for large tables must be taken into account. In the future MLSD must evaluate precisely which data are loaded and at what scale. In particular, automated collection by the EK500 can produce very large tables; one example loaded during the cruise contained 38000 records from one hour of data collection. This implies that particular layer pictures may be inappropriate for routine use.

Statistical packages

Minitab was not initially available on the Vax as the current licence had expired, although this was rectified as soon as possible. SAS was also available, though was not tested beyond simple calculations. GENSTAT was also available and worked as expected. The program MIX, available from NCS through Keyworth may be a useful addition for many people within MLSD.

Uniras

The only means of producing graphical displays on the Vax was by running EMU-TEK (see elsewhere in this report) on a PC to emulate a Tektronix 4208 display terminal. The levels of Uniras software currently available on the Vax are believed not to be the same as those in Cambridge. If this is the case, they should be brought into line as soon as possible. The printer and plotter queues within Uniras point to Oban, Bangor and Keyworth and not to the printers available on the ship. Graham Butcher (ISG) has rectified this in part, so that it is now possible to get laser printer plots. The addition of a colour plotter would be very useful, and the redeployment of the Tektronix 4693DX currently dedicated to producing screen dumps for the Sun workstations, should be seriously considered. Indeed all printers and plotters should be available as network services.

6.2. **PC software (including Pathworks)**

The individual PC configurations were not the same and problems were experienced in running the same piece of software on different PCs. Some software which had been working satisfactorily after help from Alistair Murray during MLSD sea trials (August 1992), was now no longer working due to changes in the PC configurations. For example EMU-TEK, previously working after MLSD sea trials, would not run on one of the PCs (JRPQ); these problems should be rectified as a matter of priority.

The changes in PC configuration may have occurred during JCR02. Before any changes are made to a working configuration, a backup copy should always be taken. In the absence of a tape streamer to port a standard configuration to each PC, it is suggested that a standard configuration is built, tested and stored on the Vax and subsequently loaded via Pathworks onto each PC.

Maintaining consistency amongst a number of communal PCs is probably a very difficult management task, however, it is important that a policy is established, and enforced, so that the PCs are not tailored to individual idiosyncrasies. For example the WordPerfect on at least one PC (JRPR) was not configured as standard - some of the function keys had been redefined. This is not sensible in a multi-user environment.

Pathworks is a very useful addition to the computing environment, but it is important that some training is provided for those expected to maintain it on the ship. This is particularly important as the Pathworks software was not configured correctly. For example, BSVC was the default node available though SETHOST, rather than JRVA. This is probably due to a

BAS headquarters control file being used to build the services table, rather than a new file having been created. There was also an acute shortage of low memory (e.g. only 395 Kb on JRPR) in which to run programs due to the loading of all Pathworks network drivers. The expanded memory loading facilities available via EMM386 and EMSLOAD should be used to overcome this. A working configuration for a Viglen with the D-link card is available from Alistair Murray at Cambridge.

For most of the cruise there was no PC available that possessed both a network connection and a tape streamer. This meant that there was no easy route for transfer of PC software brought on tape; this was both unexpected and inconvenient. The PC reserved for the CTD has a tape streamer, but no network connection. Following advice from ISG, it was decided not to attempt to interface this PC to the network, due to possible adverse interactions with the CTD logging. Towards the end of the cruise, however, a portable local area network (LAN) card was available for the CTD PC. The 3.5" floppy disc controller on the CTD PC operates the PC tape drive, this means that only 5.25" discs can be used, which is also very inconvenient. As a PC with both a network connection and a tape streamer will be necessary on future cruises, it would be helpful if a permanent network connection could be established for the PC and if the version of EZTAPE could be upgraded to the latest version as currently used in MLSD.

All PCs contained a large number of files which originated from previous cruises. Many of these were cleared by Graham Butcher (ISG) at the beginning of the cruise, but a policy should be developed, and responsibility assigned, for the removal of all old files at the end of a cruise. This should also be extended to include those PCs which are not intended for communal use (e.g. the ADCP and CTD PCs).

During the cruise Graham Butcher (ISG) carried out backups of all communal PCs on a regular basis; this was very valuable.

6.3. **Network performance**

No serious network traffic problems occurred during the cruise, and transferring large files between hosts worked well although network operations sometimes seemed slower than at Cambridge.

The terminal server gave a number of problems and sessions often hung up. This caused considerable inconvenience as it was necessary to restart the server which could only be done by ISG personnel. The hang-ups most commonly occurred during graphical sessions, whilst running Uniras with EMU-TEK.

6.4 **Sun software**

No problems were experienced with UNIX software. The addition of printer drivers for Word Perfect would make the package more useful. Uniras libraries are already loaded on the Sun (for the level 'C' software) the addition of the user interface software would be a welcome addition. (This may well be available at little or no cost under the NERC licence agreement_)

6.4.1. RVS 'ABC' computing system - level 'A'

The system aspects of the RVS ABC hardware and software were configured and supported by David Richmond (ISG). There were some problems with the level 'A' interfaces, in particular, there were problems with the new application for the CTD level 'A'. This new level 'A' was supposed to be a bug fix for the previous version shipped with the interface and used on JCR02. Unfortunately, it appears not to have been fully tested by RVS. There were also problems with the application for logging the EA500 echo sounder.

These problems were successfully resolved by David Richmond - despite the lack of documentation of the EPROM programming involved. However, bathymetric data for a large part of the cruise could not be collected.

See separate report by David Richmond for details of level 'A' problems.

6.4.2. RVS 'ABC' computing system - level 'B'

The level 'B' appears to have performed satisfactorily although the uninterruptible power supply did not protect the system when the scientific power supply failed.

The winch system does not log successfully through to level 'B', possibly because it issues incorrect ship message protocol. This should be investigated before the next MLSD cruise as there is a requirement to log the amount of wire veered for net deployments on the biological wire.

6.4.3. RVS 'ABC' computing system - level 'C'

Only the level 'C' application software was used by Marine Life Scientists. Much time was spent attempting to use this software to process data to MLSD requirements. Despite one of us (Alistair Murray) having been on a course at RVS Barry, the results were very disappointing. The software is unreliable, inconsistent, inflexible and very badly documented. A major barrier to effective use of the software is that it is not designed for more than one user. It is clearly intended to be operated exclusively by RVS personnel and great difficulties arise when more than one user attempts to utilize the system. This makes it unsuitable for the way in which MLSD operates.

Details of problems encountered so far are included as an appendix. These should be raised with RVS through the appropriate channels. Tasks which were attempted included use of the interactive graphical data editor and processing navigation data, CTD data and under-way sampling data.

The interactive graphical data editor is one of the potentially useful facilities provided by the level 'C' system. The editor provides a means of graphically selecting data (for 'example spikes) and changing their status (for example from good to suspect) in the level 'C' files. To prevent accidental editing of raw data status, procedures should be defined for use of the editor. This may require that extracts of data are copied to files where the user has write access. Training a wider group of people to use the data editor is very desirable, so that scientists can validate their data as early as possible.

It is possible that the navigation processing may prove to be the most useful part of the level 'C' for MLSD purposes. However, it is still not clear exactly what the software is doing and how we should best configure it. The track plots produced look good - especially with the new South Georgia coastline from MAGIC which was set up in level 'C' format by David Richmond. A brief examination of the various intermediate stages of navigation processing revealed unexpected results, indicating that further investigation is necessary. Detailed examination of the navigation processing is still in progress - see separate report by Alistair Murray.

We were unable to process data on level 'C', that had been logged through the CTD level 'A' interface, largely because the documentation for the CTD calibration program was totally inadequate. A request to RVS for information did little to clarify the situation. Although plots of individual CTD profiles were available on the PC using the EG & G software, these were only in monochrome and it was not possible to contour a set of profiles. Colour plotters and contouring software are only available on other platforms, therefore some means of data transfer is necessary so that the full data sets can be made available during future cruises. This would be best achieved using a permanently installed network connection so that data could be transferred to the Vax and loaded into Oracle.

Producing plots of under-way sampling data using the level 'C' software proved very time consuming, largely because the documentation was ambiguous and the programs frequently crashed (see Appendix). Although plots of sea surface temperature and chlorophyll along the ship's track were eventually produced, contouring of these data on the level 'C' system was not attempted. These data had already been successfully transferred to the Vax and contoured there.

6.5. **Discussion**

The computing facilities on the James Clark Ross are superb and many of the problems which were previously associated with data capture and data logging at sea, have been overcome. The 'ABC' system, though not the ideal tool for the purpose, could provide an acceptable data capture and logging facility. Given some of the problems encountered on this cruise, however, its reliability must be open to question.

The user analysis software provided by the 'ABC' system falls far below expectations. However, even at this level, there are still some functions which could be used by most MLSD scientists, without too much 'hand holding' from computer experts. These are primarily track and navigation functions. Most analysis functions, however, are undoubtedly better carried out with standard packages on the Vax. Introduction of similar standard packages on the Sun would be a great advance.

We therefore strongly recommend that, in the future, MLSD avoids expending time and resources in becoming familiar with all of the level 'C' software, but concentrates its effort to ensure that validated data arrives on the Vax within a time scale appropriate to biological surveys, of order one hour at most. This process must be as automated as possible, requiring minimal user intervention and avoiding, as far as possible, multiple copies of large datasets.

Potentially very large datasets can now be produced by the James Clark Ross and it is important that these are validated as soon as is possible, certainly before the end of a cruise. If validation is left too late, it will not be so easily carried out. Metadata, that is information

about the data collection protocols, equipment, instrument settings and calibrations, must also be collected and stored with the actual data. This is essential, if the data are to be of use at some unspecified date in the future.

6.6. **Problems experienced with RVS level 'C' software** (AWAM)

A number of problems were experienced with RVS level 'C' application programs. These are detailed below. In general the documentation was found to be inadequate and the error messages from the programs uninformative and of little help in correcting problems.

1) proctd. The documentation of this program in the manual is so trivial as to be useless. No information is given as to what the program does or what algorithms are employed. The "self-documenting" calibration file is only intelligible if one already knows what it is about! What is deltat? What does 'factor 5 is deltat row in this tile counting only data rows from 0' mean? What is the time constant? How is this used? Why are there apparently two scaling factors (the first and third of the five for each variable)? Unfortunately, the reply to our request for information received from RVS during the cruise did not help very much as it seemed to us to assume that we already understood the answers to our own questions! The error messages from this program overwrite the menu on screen which makes them extremely hard to read.

2) prof, profplot. There is a bug in this program which caused us to experience numerous arithmetic exception errors. This appears to be associated with the choice of fence mark interval. This problem is not listed under known bugs. The manual page description of the scale setting is misleading. The manual says this is the 'size at which the profile should be drawn in data units per mm'. In fact it appears to be the number of mm per data unit.

3) **annotplot, profplot, trackplot.** Why do we have
trackplot trackspec gridspec
but
annot/profplot gridspec annot/profspe ? This sort of inconsistency makes the software very hard to use.

4) **grid.** The extent from the lower left hand side of the grid is given as a positive number although in fact it is negative. This is confusing! Gridsize 00 gives an arithmetic exception error - so how can the drawing of grid lines be suppressed? Why is coastline in track not grid - this would seem a more logical place?

5) track, trackplot. If one specifies only fixes with OOOOH time annotations these annotations are still produced although unwanted.

6) **xyprep.** This program created files in /rvs/control/spec although environment variable LCMAPS was set to -/spec Eventually a further environment variable LCXYPLOT was discovered by looking at the source of the program. This setting is not documented in the manual pages.

7) **environment variables.** There is no list of all the environment variables in the documentation.

8) anylist/mutli formats. The syntax of the formats for these programs is not given in the manual. Apparently these are in C language format - but it should not be assumed that all users will be programmers familiar with this language!

9) **relmov.** Does this program require both speedfa and speedps inputs? Running it without speedps appears to give all "REJECT" values in the output file. If this is not the reason what other possibilities should be explored?

10) editor. Apparently graphical selection by rubber banding is not available in non-timeplot mode - is this so? Suggestion: it would be useful if changing the status of data changed it's colour on the graph - rather than making it disappear completely. Perhaps this could be made an option in future?

11) credat. The manual says that one's own directory can be specified for the form file but this doesn't work on the JCR system.

Answers to the above questions would be greatly appreciated. Updates to the manual pages for the programs concerned would also be very useful.

6.7. **ABC System: Data Capture and Analysis** (DR)

6.7.1. The first level of the ABC logging system consists of small LevelA computers which are locally attached to instruments and are used to convert the data from the instruments into a common format known as Ships Message Protocol, SMP. This data is sent to the LevelB computer via serial RS232 links and this level acts as a data repository and instrument activity indicator. This then passes the data to the LevelC computer where it is available for analysis. Not all instrument logging follows this pattern and some, such as the ADCP and the meteorological instruments attached to the Oceanlogger are logged by PC's which then pass on the data to the LevelC computer.

6.7.2. The list below shows which instruments were logged and how much data they produced during this cruise.

INSTRUMENT: Ships gyro compass.
DATAFILE: gyro
START TIME: 93 002 16:43:32 STOP TIME: 93 029 11:l0: 18
DATA RECORDS: 421447
VARIABLES: heading
COMMENTS: A -2 degree offset must be added to give true heading.

INSTRUMENT: Trimble GPS unit.
DATAFILE: gps_trim
START TIME: 93 002 16:43:31 STOP TIME: 93 029 11:10:17
DATA RECORDS: 42 1249
VARIABLES: lat lon pdop hvel hdg svc sl s2 s3 s4 s5
COMMENTS: Good pdop values and good coverage of the S-Georgia area.

INSTRUMENT: Oceanlogger PC attached to various met instruments.
DATAFILE: oceanlog
START TIME: 93 002 16:43:30 STOP TIME: 93 027 12:48:40
DATA RECORDS: 191681
VARIABLES: wspd wdir atemp mstemp sstemp hum par tir fluor flow press sal
COMMENTS: None.

INSTRUMENT: Kalman navigation filter on ships VMS.
DATAFILE: kalman
START TIME: 93 006 19: 16:58 STOP TIME: 93 025 09:41:20
DATA RECORDS: 27840
VARIABLES: lat lon
COMMENTS: Logs unreliably, reason to be determined and problem rectified.

INSTRUMENT: Ships electromagnetic speed log.
DATAFILE: em-log
START TIME: 93 002 18:00:59 STOP TIME: 93 029 11:10:16
DATA RECORDS: 302489
VARIABLES: speedfa
COMMENTS: None.

INSTRUMENT: Ships doppler speed log.
DATAFILE: dop_log
START TIME: 93 002 18:02:14 STOP TIME: 93 029 11:10:16
DATA RECORDS: 418906
VARIABLES: speedfa speedps
COMMENTS: None.

INSTRUMENT: PC based winch monitoring system.
DATAFILE: winch
START TIME: 93 004 13:46:48 STOP TIME: 93 026 02:26:41
DATA RECORDS: 16271
VARIABLES: cabltype cablout rate tension btension comp angle
COMMENTS: Logs unreliably, possibly due to incorrect SMP arriving at the LevelB, reason to be determined and problem rectified.

INSTRUMENT: PC based ADCP system.
DATAFILE: adcp_pro
START TIME: 93 002 12:57:13 STOP TIME: 93 021 19:22:12
DATA RECORDS: 116944
VARIABLES: bindepth heading temp velew velns velvet-t velerr ampl good specwid directn bottomew bottomns depth

DATAFILE: adcp_raw
START TIME: 93 002 12:57: 13 STOP TIME: 93 021 19:22:12
DATA RECORDS: 467776
VARIABLES: rawdopp rawampl rawgood beamno bindepth
COMMENTS: Due to a faulty RS232 buffer this instrument was not logged via a serial link with the LevelC during this cruise. However data files logged to the PC's disk drive were later transferred to the LevelC manually.

INSTRUMENT: Neil Brown MkIII CTD.
DATAFILE: bas_ctd
START TIME: 93 005 20:00:21 STOP TIME: 93 023 23:24:11
DATA RECORDS: 94339
VARIABLES: pres temp cond chl deltat
COMMENTS: The new 68030 based CTD LevelA performed well despite an early hiccup with an updated control program. However there were problems processing the collected data.

INSTRUMENT: PC based down-wire net monitor.
DATAFILE: netmon
START TIME: 93 015 16:58:20 STOP TIME: 93 026 04:44:10
DATA RECORDS: 76450
VARIABLES: depth temp cond light flow1 flow2 flow3 angll ang12 ah fluor spl sp2 sp3 sal net
COMMENTS: Excellent instrument.

6.7.3. The rest of this section deals mainly with problems encountered with the ABC system during the cruise and also makes some recommendations on improving the system for MLSD use.

(A) **Level A Concerns.**

On the whole, most of the LevelA's performed quite reliably during the cruise. However some problems were encountered that were mostly related to carrying out LevelA software updates.

(1) Adding a new application to a LevelA to allow logging of water depth from the Bridge mounted Simrad EA500 echo sounder took much longer than expected. This was due to two main problems. The software used to generate new application files for LevelA's, which was newly supplied by RVS on an update tape, was incorrect. The problems were minor but took a little time to track down, this would indicate that these applications had not been tested prior to release.

(2) Updating the controlling software for the newly purchased CTD LevelA was also problematic. The latest RVS software update contained instructions that the software controlling this LevelA should be replaced with the latest release. This was carried out and the LevelA would not subsequently operate. Consultation with RVS produced the information that the supplied application software may not be of the same release as the system software and that the promable files should be regenerated from the supplied source files on the LevelC. The application software was regenerated and the LevelA subsequently worked, however it was not possible to generate new system software as some required files were missing from the release tape.

(3) Some LevelA's still occasionally 'fall over', for example the Simrad EA500 reset itself and increased it's set logging rate, fortunately this was noticed before the data file on the LevelC was filled. There was also an unexplained gap of 7 minutes in the GPS logging. These problems seem to be related to poor interprocess signalling allowing pipes between processes to become blocked due to overfilling.

(B) **Level B Concerns.**

The Level B performed very well during this cruise and only went down once due to a power failure and the battery on its' UPS needing replacing. The only problem encountered was at the start of the cruise when updated software was loaded, it was then not at first possible to establish an ethernet link between the Levels B and C computers. This was due to a simple fault in the installation instructions relating to internet broadcast addresses, however it took a little time to establish what the problem was.

(C) Level C Concerns.

The data logging part of this system worked very well and no difficulties were encountered. However the data analysis and processing software proved very difficult to use, mainly due to the poor quality of the documentation provided with it, see Alistair Murray and Phil Trathan's report for more details of these problems.

6.7.4. **Conclusions and Recommendations**

The ABC system performs quite well as a data logging system, however it leaves a lot to be desired as a system for data analysis and display. It would seem that the best approach is to use the system for logging data and then integrate superior display and analysis software packages with it. This would involve determining which packages would best suit the needs of the scientists using the system and then investigating how to closely integrate these packages with the logging system so that logged data is quickly and easily available for analysis. This is a prime requirement if the logged data from preliminary surveys is to be used as a driving force in the early determination of the structure of a cruise. The software should also be as easy to use as possible as nothing annoys people more than having to spend time learning new software and circumventing software problems when they could be doing something constructive instead!

6.8. **Computer Support** (GB)

6.8.1. **Objectives**

1. To provide a computing service to support all aspects of Scientific Computing during the MLSD Cruise, JAN '93.
2. To continue to learn about the ABC, RVS data acquisition System and look for ways that will benefit BAS
3. To assist, time permitting, with the ships non - scientific computing problems.

6.8.2. **Methods**

1. To provide various computing services (listed below).
2. To assist DJR with the production of level C plots, graphs and tracks.
3. To assist JCR permanent personnel with computing problems.

Scientific Computing Services Provided

The Scientific Computing Services can be divided into 3 different areas :

a) Communal, networked PCs
b) Sun workstations
c) DEC VAX mini computers

Communal Networked PCs

The 5 networked PCs enabled full distributed computing. Using the usual client/server model they provided the following services :

i) file service
ii) disk service
iii) shared printing
iv) e-mail
v) terminal emulation (Xl 1, VT320) via LAT
vi) distributed database processing
vii) peer to peer file transfer
viii) network broadcasting

As this is the first time these services have been provided it is probably worth explaining how they work and some of the benefits that can be gained from them.

File service

This is probably the easiest to understand. An extra drive (labelled as M:) was created on all 5 PCs. Although, to DOS users, this appears as a local drive it is physically located on the VAX. This means that all files saved on that drive are covered by the daily VAX backups (Details given below). The access time for this disk is similar to that of the C: drive. Files stored in this way are accessible to VAX users.

Additionally users can create (and delete) further drives that are physically located in their individual VAX accounts. This makes file PC - VAX file transfer easier.

The M: drives are "owned" by different VAX accounts for each PC. If all M: drives on the 5 PCs were accessing the same area, then a situation might occur where 2 users were editing the same file simultaneously. DOS (a single user system) does not cater for this situation.

The benefits to be gained from this service are :

1. If an accidental "del *.*"I command removes all files from a directory then the files can be recovered from tape backups (daily backups are held for at least 14 days).

2. Any type of hardware failure of an individual PC is inconsequential as it's M: drive can be mounted on another PC.

3. A fire in the computer room destroying PCs and VAXes would not destroy the data as the backup tapes are stored in a different part of the ship.

Disk service

The disk service is similar but subtly different. A single "container file" is created on the VAX (it can be of any of a series of sizes between 360 KB and 256 MB). This file appears as a formatable disk to the PC user (it can also be made read only). File transfer to and from this type of virtual disk is significantly faster than that provided by the file service described above. Transfers of 40 MB in 10 minutes are normal. The benefits from this service are :

i) Backup of individual internal PC disks are accomplished quickly and without using tapes. The DOS command "XCOPY C:\ D:" is used.

ii) An application virtual disk can be created giving users access to a greater range of applications than can be held on a single PC. Upgrades are performed only once.

iii) A container file can be created in Cambridge of an individuals PC disk containing all files and directories on that disk. That single file can be brought by tape and copied to JRVA. This gives the user an identical PC environment without the need of moving any hardware or using any complicated backup commands.

To access the PC files within the container file from VMS a utility called PCDISK is available.

Printing services

The printing services are currently set up so that all of the networked PCs can access any of the 3 printers in the Data Prep room. This is achieved by using the VAX printing queues which resolve any printer access contention. This service can be extended further in the future.

Printing is carried out from within applications such as WordPerfect by simply issuing the normal print command (the drivers having previously been set up for the appropriate printers and virtual ports LPTl:, LPT2: and LPT3:).

If printing is required from the DOS prompt ie outside an application, the command "COPY <filename> LPT3:" can be used for example. All PCs have the same connections - the details are given in the "welcome message" for each PC.

There is small price to pay for printer sharing - printing takes a few seconds longer and might also be held up by other people using the printer.

The System Manager can monitor the states of the printers and queues through the normal VAX System Management utilities. Paper jams, lack of paper and changes in printer settings are all relayed to the Manager via opcom broadcasts.

E-mail service

Users can access their VAX e-mail without having to logon to the VAX host. Automatic notification of arrival of new e-mail can be set up but for only one user id at a time. This was obviously not done on the shared communal PCs.

For sending e-mail, the product Pathworks PC-mail can be used with a specified choice of editor. This might have benefits in the future for people preferring to use WordPerfect to send their e-mail and SENDMSGS.

Terminal emulation

Three additional terminal emulators are provided with the Networking software :

i) The "sethost" command is used to give a VT320 terminal emulation (without graphics). This command once connected gives a fast response time to the Host and has good keyboard mapping (although most PC keyboards have less keys than say for example DEC ones)

ii) The VT320 emulator program, which runs under MS-windows also gives VT320 emulation with the additional benefit of "cut and paste" being available between windows. It uses user installable fonts to mimic the host allowing double height characters but not bold, underline or flashing characters. These characteristics are translated by the use of user definable colour

iii) The DWDOS286 product gives full X-Windows emulation and could be an important product in the future. This will allow true distributed computing where the PC is solely responsible for the graphics display processing with the main processing being carried out on the remote host. At present, however, there are no X-Windows applications on the JCR.

The previously used emulator, kermit, is still in place on most PCs and could also be adapted to run with the network software.

The academic version of Emu-Tek appears to use hard coded addresses making it non-relocatable and unsuitable for use with the network software. This is disappointing because it is the only method of accessing the Unit-as graphics suite. A new version is on its way from Cambridge.

Peer to peer file transfer

If files need to be transferred between PCs, the Network File Transfer (NFT) program can be used. This best done from within MS-windows. One PC must run a program called FAL (File Access Listener) - this can be done by clicking on the icon. Whilst this is running in background the PCs disks are available to other PC users. Another PC user can get directory listings, copy in either direction and overwrite files on the PC running FAL. This a very powerful but dangerous feature of Pathworks and must be used with caution. Password and file access protection are available if required.

Whilst FAL is running the user can run any other program as normal under Windows. The file transfer is fairly fast - between 10 -100 KB / second. Files can be copied in either direction between PCs by “dragging” filenames from one window to another.

Broadcast service

This service was set up on all 5 PCs to allow VAX - PC and PC - PC broadcast messages to be made. The benefits of being able to do this are :

i) If the System Manager needs to shut down the network at short notice, notification can be given to PC users.

ii) If colleagues are working in different parts of the ship and say for example they are using portable PCs they can communicate without knowing where the other is as long as the node name is known.

A message can be sent that appears at the bottom of the receivers machine. This will not be received, however, under MS-windows or some applications, but will be stored for display later.

Distributed Database processing

A PC version of Oracle has been installed on some PCs. This means that these PCs can become clients of the VAX server Oracle Database using the high speed communications the network provides. In the future it is likely that there will be a dedicated database server computer allowing other hosts to free off cpu usage.

Disadvantages of the Network

The main disadvantage is that if the network “goes down” all the services are lost. Normal System Management preventative maintenance requires this to occur for at least one hour every week. During this time such things as printing and access to M: drives are not available.

Housekeeping duties

Continuous Virus Checking was carried out on all communal PCs The C: drives were backed up weekly and the M: drives daily.

The fact that “Communal Personal Computer” is a contradiction of terms means that some users did not always return the computer to their “normal state” after finishing. This was particularly noticeable with WordPerfect users.

Attempts were made to minimise this by making some files (PIF, autoexec, and config) read only. and providing a userexec file which was modifiable.

Sun Workstations

The 3 Sun workstations (BASl, BAS2 and BAS3) provided the platform for the level C software (part of the RVS, ABC data acquisition system). This was managed and maintained by DJR. The level C provides collection, processing, visualisation and presentation of data collected from the ships scientific and navigational instruments via the level A and the level B computers.

This data is available in binary and text form to all who have access, including dumb terminal and terminal server access.

Several cabins were set up with "dumb terminals" in this manner allowing connections to host computers such as BASl, BAS2, BAS3 and JRVA.

Output from the level C computers can be directed to any of the following devices :

HPlaser jet III
Declaser Postscript printer
Zeta A0 colour vector plotter
HP7475 A3 colour vector plotter
Tektronix colour printer

2D, multi-layered 2D, contoured 2D and 3D plots, graphs and tracks can be produced on these devices using the level C software.

Having stated these facts it was generally felt that the "usability" of the level C software is not good and will soon be running on an unsupported platform (Sunview). The navigational plots seem to give the best results.

DEC Vaxes

For the first time a second VAX computer was available to cover the possibility of hardware failure of JRVA. One spare disk, a processor, 16 Mb main memory and a tape drive were available.

JRVA provided the PC Services, the BAS Messaging System and Data Transfer Systems and the following data processing tools :

Uniras
Oracle
SAS
Genstat
Minitab
C, Pascal and Fortran compilers

The intention was to create the same computing environment as BAS HQ.

Significant work was carried out with the Oracle database to allow "roll back" to any

point in the cruise. Three utilities were written so that a database administrator could carry out his tasks in a safe and easy way.

Information about the newly created PC network and existing Sun and VAX connections were entered into Oracle tables.

The VAX disks themselves were backed up every day with tapes being cycled fortnightly. Full backup tapes were also kept for 3 weeks.

This means that users wishing to recover deleted files , could usually do so. The data is protected by keeping all tapes away from the computer room.

An easier way of transferring files between VAX and Suns was developed. This involves mounting part of the Sun NFS file system on a VAX disk. Files saved in that area appear to be in two places at the same time (on the Sun and VAX systems). NFS container files can also be created in similar manner to Pathworks container files.

These could be useful features if the ABC System is modified to suit the BAS VAX based environment.

Additional

Work was carried out for :

Ship's Master		Training in SENDMSG and WordPerfect
Ship's Chief Engineer		Training in the alternate backup method for the ships computerised Cargo Management System. Also WordPerfect and SENDMSG
Ship's Radio Officer	-	Training with Pathworks and Windows,
Ship's Catering Officer	-	Training with WordPerfect.
Ship's 2nd Officer		Assistance with the ship's VMS (Voyage Management System) and satellite weather mapping PC.
General		Plots of the ships track for various officers.

6.8.3. **Conclusions / Recommendations**

The new PC network adds considerable value to the existing PCs.

There have been criticisms of the network's speed of operation. This could be because of the general use of 8-bit network cards (as opposed to 16-bit cards) or because there is too much traffic on the LAN. The officers IPX and the Sun TCP protocols are also active and the fact that there are different protocols make measurement difficult. Experiments could be made (preferably when there was no data logging or cargo management software

running) to ascertain the cause of the slow running and hopefully improve the general performance.

More use could be made of the Sun workstations, possibly using a more modern windowing system. This would exclude some level C graphical work, however.

More graphical and CAD packages should be made available with CDA (compound document architecture). These should be compatible with the BAS preferred word processing package.

A colour printer such as the HP Colourjet - used on the Research Ship Discovery would be an advantage. If this was not possible then ways of redeploying the existing Tektronix machine should be investigated. At present it is only useful as a screen dump machine for the Sun computers.

6.8.4. **Additional Information**

A variety of tape drives are available for taking data back to HQ. These can also be used to backup lap top computers in case of damage in transit.

7. LABORATORIES, LOGISTICS ETC (PW)

7.1. Laboratories **These** notes largely preceded a general MLSD cruise de-briefing held on 25/2/93. Some of the points raised at that meeting are re-iterated here where they have a bearing on JR03. They are largely my own impressions and the results of discussion with people during the cruise and immediately afterwards. As such they don't represent an exhaustive list of all points raised.

The scientific personnel on JR03 numbered 12 and as such, many of the laboratories were not used. The wet lab was heavily used for sample sorting and part of the main lab for placement of the multisizer. The prep lab was used for monitoring the fluorometer and for taking underway samples to calibrate the instrumentation. The main focus was the UIC room and it became apparent early on that this was going to become the 'nerve centre' for scientific operations. The rough and scientific workshops were extensively used for gear preparation and repair.

The wet lab facilities are good. The wooden deck surrounded by a generous (and operational) scupper meant that it could easily be kept clean. There are only two workplaces for mounting microscopes but the overspill can be accomodated in the main lab. The sorting table is generous in size but the joints need sealing and the rough edges, smoothing over. The provision of power outlets is again very good but the two deckhead mounted sockets, aft of the table, present a real hazard to anyone of normal height. They should either be cut off or moved inboard of the table.

The UIC room was heavily used, containing as it does much of the logging equipment and scientific instrumentation. It was generally felt that a regrouping of equipment and display screens would have made it easier to undertake some activities. For example, the DWNM display, the EK500 and the winch readouts cannot all be viewed at the same time. The sonar, mounted on the port side should also be relocated to become part of the acoustic array.

The UIC room did however contain some of the gear for use on the geophysics cruise. It was noted that RVS, on behalf of geophysics , had moved the EK500 echosounder from its original position in the racking system on the starboard forward bulkhead, to accomodate their own equipment. This seemed uneccessary as it was insisted upon that the EK500 be removed at the end of the cruise anyway. I would simply observe here that the UIC room is large enough to take most pieces of equipment that are used by both divisions.

As a focal point for operations great use was made of the noticeboard. A larger one would be useful as would the provision of wipeboards, not only here but in other labs as well.

7.2. **Cold Facilities**

The cool specimen room was used to carry out some krill experimental work. It maintains its temperature well when unoccupied but is a very small facility when viewed alongside the two walk in freezers. Its size means that the temperature rises noticeably when more than one person is setting up experiments. It is also difficult to see how, in its present configuration, it could be used for the return to the UK of live fish from Signy, for example. Its use for the cool transport of biological cargo to the UK could also pose problems for subsequent cruises that wished to carry out experimental work.

7.3. Other Facilities

The provision of an outdoor gear clothing annexe is a great step forward. However the heating and ventilation to this area are insufficient to dry wet outdoor clothing. On John Biscoe the drying rooms performed this function. There are no such facilities on JCR at present.
The standard issue sea boots and working boots were seen to badly mark the interior working floors, particularly in the UIC room and adjacent alleyways. To insist on boot removal (particularly working boots) is a little unrealistic, especially as crew members come in to drive winches etc. We should explore ways of protecting the floors.

7.4. Deck Work and Gear Handling

The extensive rear working deck area made it much easier than in the past to safely deploy and stow gear without risk to either personnel or gear. However deployments would have been safer still if the scientific intercom system had been in operation (see gear report). The deck matrix system is excellent for securing gear in place. The use of a 'pound' based on the matrix and constructed of metal upstands and wooden planking would allow sorting of Agassiz and other trawl catches away from the line of work.
From time to time the leaking hydraulic system made work on the afterdeck precarious.
Gear deployments from the foredeck were limited to the F-net. This is a relatively easy operation requiring only two people. The use of the Effer cranes means that the net can be placed outboard of the ships bow wave.

7.5. Scientific Hold

Thanks to the outgoing ship and scientific personnel much of our gear was in place when we arrived, having been left in specified locations or brought down from the scientific hold.
As there were four cruises this season it was generally agreed at the outset that only the cruise in progress should have access to the scientific hold, other gear onboard for other cruises being held in ships stowage. This worked to a degree. Cargo in common usage by the STAP and MLSD cruises was left in the scientific hold. Despite the initial agreement on use of the hold a number of items for use on the geophysics cruise were also placed here eg. towed bodies, racking etc. It is also fair to say that a proportion of STAP gear that we had not signalled our need for was also in place. Space in the hold was thus barely adequate and in addition it was necessary to locate four incubators here for experimental work, it having been agreed that only krill work would take place in the cool specimen room. Both the scientific equipment store and the tape store were also unavailable to us as these were also filled with geophysics gear, requiring that the general consumables for all cruises be placed in the scientific hold.
At the end of the cruise the hold was emptied of all MLSD and STAP gear, apart from a small number of items, principally from the STAP cruise that were marked as fragile. These were left in the cage in the scientific hold rather than entrusting them to general stowage. The stowage of gear was undertaken at Mare Harbour because of the need for a fast turnaround of gear for the geophysics cruise.
On the basis of this season I think it not unreasonable that the cruise in progress have sole occupancy of the hold, other than for specified items of fragile gear which will be better located in the cage. There appeared to be little such justification for the presence of much of the geophysics gear. Above all, it highlights the need for cruise organisers to get

together before the field season to discuss their needs and come to some workable solutions about the placement of gear, mobilisation times etc. This needs the involvement of BAS logistics and where possible input from the ship.
MLSD cargo was lifted from the scientific hold onto the afterdeck, covered with tarpaulins and in Stanley transferred onto trailers ashore. Geophysics gear was then broken out from the forward hold, transferred aft and then replaced by MLSD gear. This highlighted the rather wasteful effort in handling cargo more times than should have been necessary. A better solution, which we should consider in future, would have been for our gear to have been transported south in lockable containers which could then have awaited incoming scientific personnel. At the end of the cruise gear from the labs and hold could be packed straight into these containers, which could then await transport to the UK at FIPASS either by BAS ships, or, if urgent repair was required, could be commercially freighted to ensure an early return for overhaul and repair. This is especially pertinent as the PES 10 year strategy document indicates that some important items of gear will be in the field most years.

7.6. **Scientific Manual**

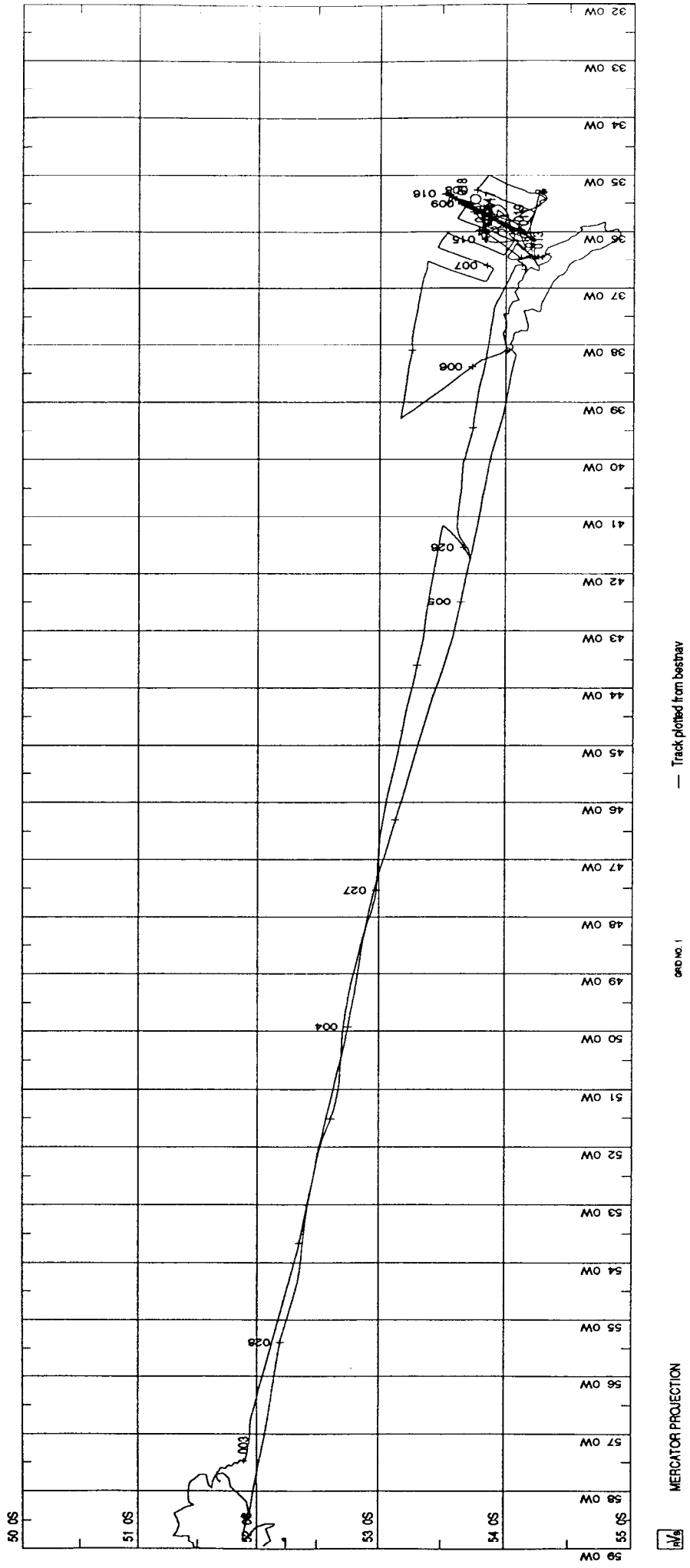
Several people bemoaned the lack of information on the ships scientific facilities. It came as a great and pleasant surprise for me to find, halfway through the cruise, that a manual exists covering much of the information requested. A copy was passed onto me by the Chief Officer. I understand a copy should have been available in the Chief Scientist's cabin. It wasn't! I understand that one of its functions is to inform non BAS JCR users about this superb vessel and to assist them in planning cruises. It would have been a great help to me to have known about its existence before I and others started planning the cruise early in 1992!

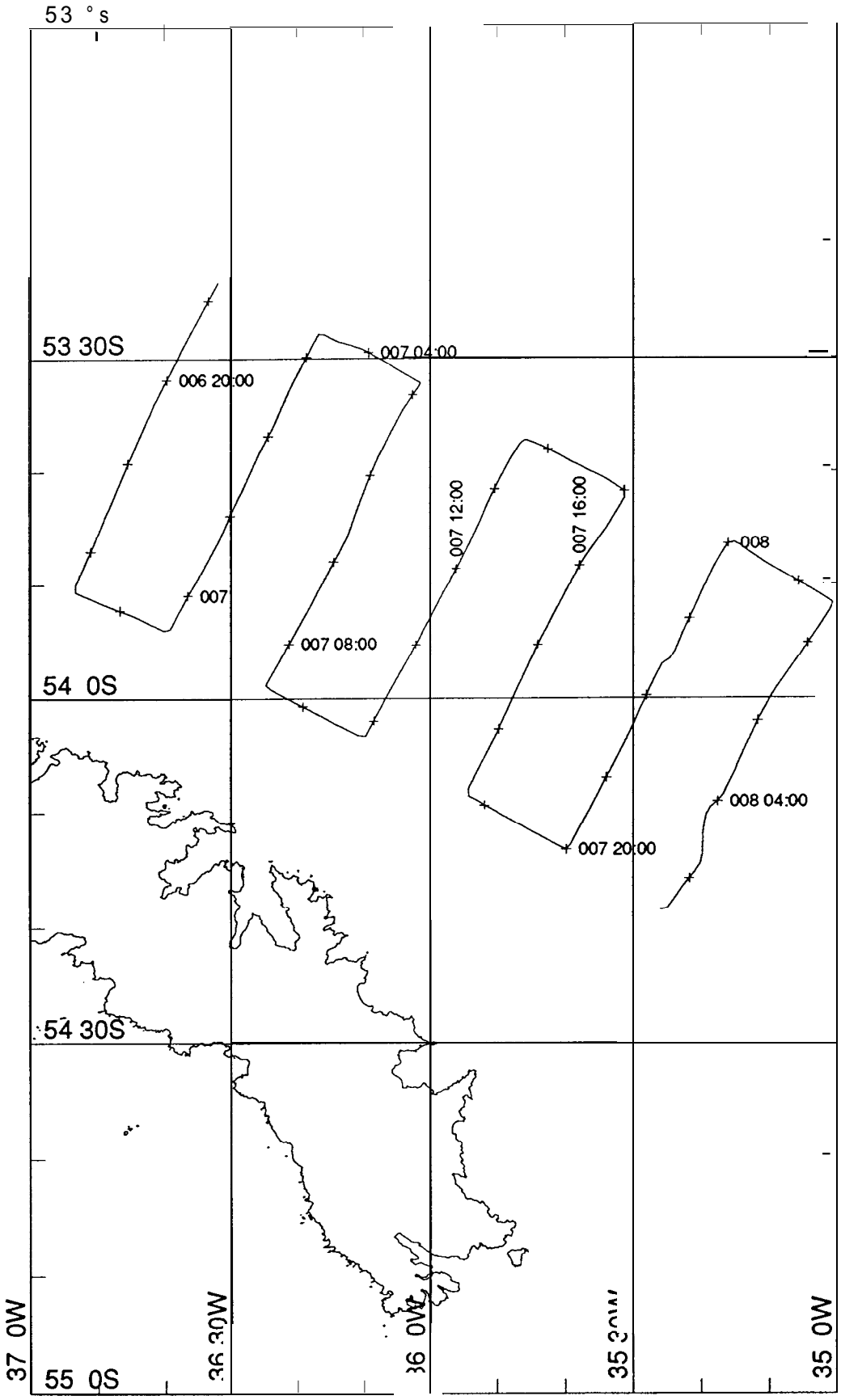
8. APPENDICES

8.1. Crew List

Officers	C.R.	Elliot	Master
	D.J.	Cutting	Chief Engineer
	M.J.	Dixon	Extra Third Engineer
	T.F.	Ellison	Third Engineer
	A.	Gatti	Third Officer
	W.R.	Kerswell	Second Engineer
	J.B.	Marshall	Chief Officer
	G.C.	Morgan	Second Officer
	N.E.	Thomas	Electrical Officer
	C.A.	Waddicor	Radio Officer
	R.K.	Walters	Catering Officer
	S.A.	Wright	Deck Engineer
Crew	A.M.	Bowen	SGl
	D.	Bretland	MGl
	M.	Brookes	CPO (Deck)
	D.	Connell	MGl
	T.N.	Dixon	Asst Cook
	J.M.	Dodd	SGl
	D.	Greenwood	Steward
	D.A.	Hunt	Second Cook
	M.H.	Jones	Second Steward
	J.	Newall	Steward
	D.J.	Peck	SGl
	B.D.	Riley	SGl
	J.W.	Summers	CPO (D) (Sci)
	T.	Sweeney	Chief Cook
	B.	Wickenden	SGl
	J.H.	Williams	PO (Deck)
Scientists	V.	Afanasyev	ISG (Electronics)
	D.G.	Bone	Gear Technology
	G.	Butcher	ISG (Computing)
	C.	Goss	Acoustics
	H.J.	Hill	Krill Biologist
	A.W.A.	Murray	Biometrician
	D.J.	Richmond	ISG (Computing)
	R.S.	Shreeve	Zooplankton Biologist
	P.N.	Trathan	Biological Modeller
	P.	Ward	Zooplankton Biologist (CSO)
	M.G.	White	Fish Biologist
	P.	Woodroffe	ISG (Electronics)

Cruise Tracks





RVS MERCATOR PROJECTION

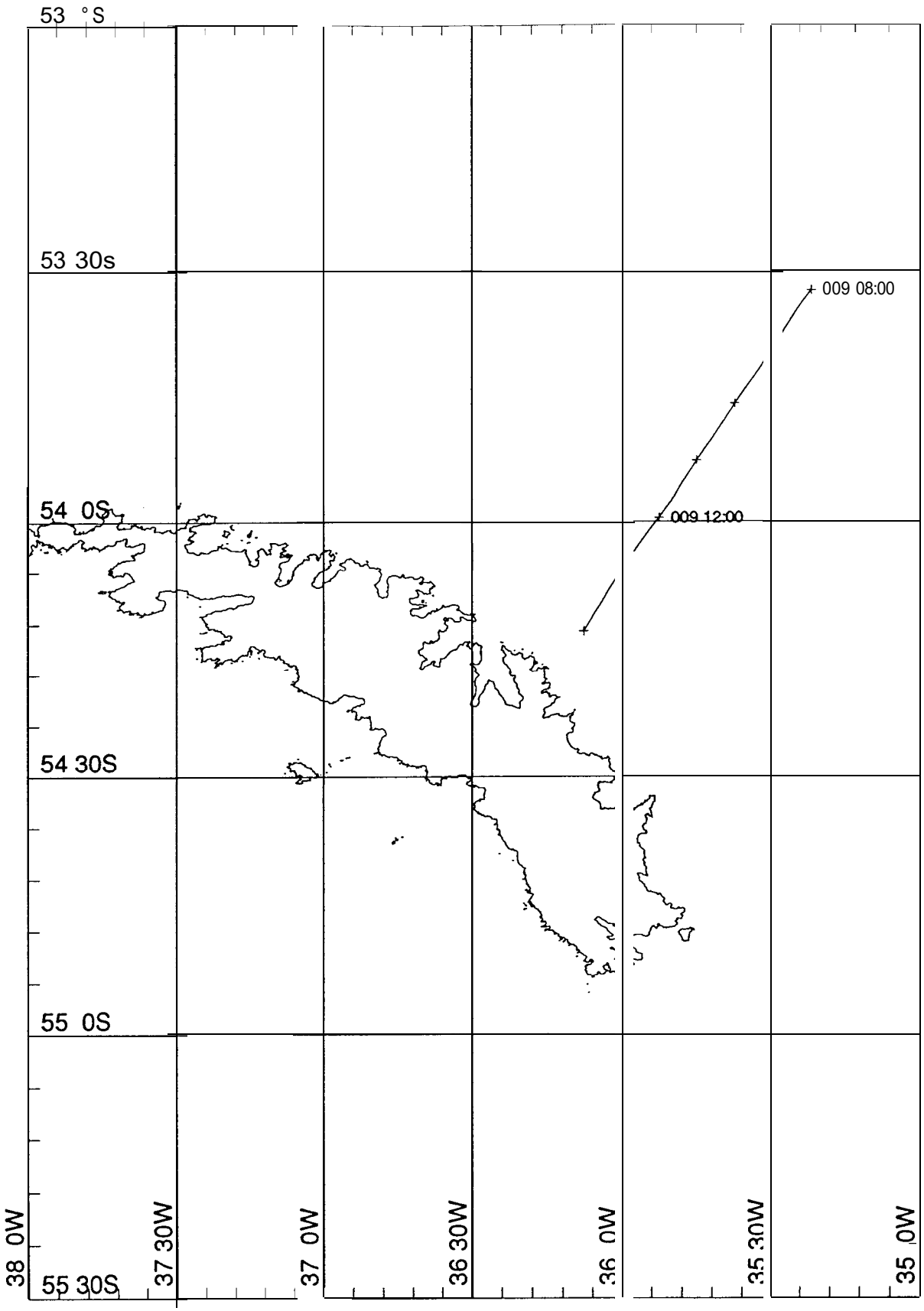
GRID NO. 1

SCALE 1 TO 1000000 (NATURAL SCALE AT LAT. -54)

INTERNATIONAL SPHEROID PROJECTED AT LATITUDE -54

Box Grid, South Georgia, 6th - 8th Jan 1993

+

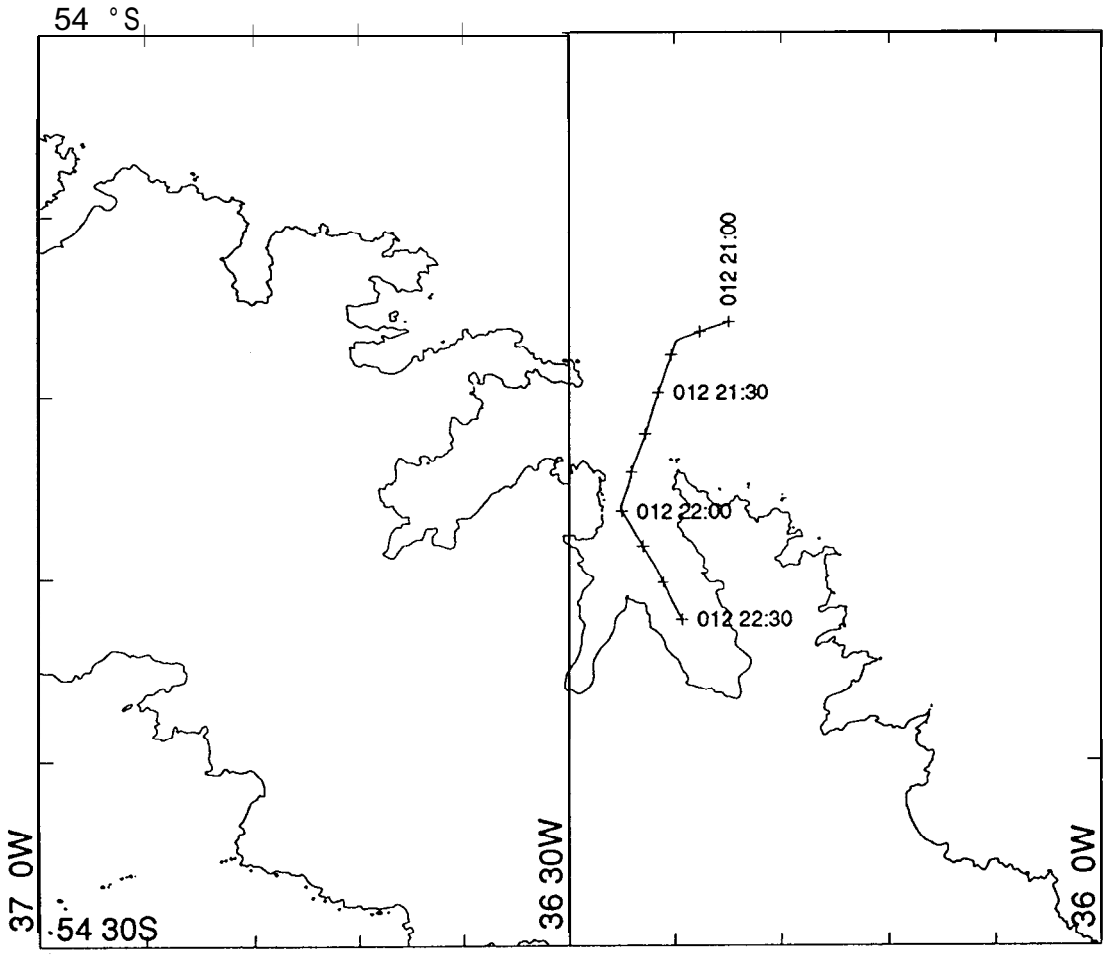


RVS MERCATOR PROJECTION GRID NO. 1

SCALE 1 TO 2169789 (NATURAL SCALE AT LAT. -0.9)

INTERNATIONAL SPHEROID PROJECTED AT LATITUDE -54

Krill Fish Transect, South Georgia, 9th Jan 1993



RVS MERCATOR PROJECTION **GRID NO. 1**

SCALE 1 TO 468421 (NATURAL SCALE AT LAT. -54)

INTERNATIONAL SPHEROID PROJECTED AT LATITUDE -54

Cumberland Bay Approach, 12th Jan 1993

8.3. Event Log

Event	Starttime	Endtime	Code and Decription
0001	93005 011000	93005 032411	RMT8 AT SHAG ROCKS FOR MGW
0002	93005 043010	93005 044527	WBOT * 2 TO 30M FOR PW/RS
0003	93005 050000	93005 053500	ZNET * 2 TO 120M FOR PW/RS
0004	93005 223000	93005 224500	WBOT * 2 TO 30M AT STN 2 FOR RS
0005	93005 223000	93005 224500	WBOT * 2 TO 30M AT STN 2 FOR RS
0006	93005 224500	93005 230000	ZNET * 2 TO 100M AT STN 2 FOR RS
0007	93006 071335	93006 071352	ZNET * 2 AT STN 6 FOR PW/RS
0008	93006 07 1456	93006 07 1720	WBOT * 2 TO 30M FOR PW
0009	93006 180000	93006 183000	WBOT * 3 TO 30M FOR RS
0010	93006 183000	93006 184500	ZNET * 2 TO 100M FOR RS
0011	93008 154700	93008 155200	WBOT * 2 TO 30M FOR RS
0012	93008 155900	93008 162700	ZNET * 2 TO 200M FOR RS
0013	93009 073000	93009 075000	WBOT * 2 TO 30M AT STN Y FOR PW/RS
0014	93009 170000	93009 171500	ZNET * 2 TO 200M FOR RS
0015	93010 004525	93010 031341	RMT8 AT STN C NET FAILED TO OPEN FOR MGW
0016	93010 032046	93010 045705	RMT8 AT STN C NET FAILED TO OPEN FOR MGW
0017	93010 055143	93010 055213	WBOT * 2 TO 30M FOR PW
0018	93010 075500	93010 080600	RMT8 NET OPEN ALL THE TIME FOR HH
0019	93010 083324	93010 093947	RMT8 FOR HH
0020	93010 100809	93010 104358	RMT8 FOR HH
0021	93010 140800	93010 154000	MNET AT STN A FOR MGW
0022	93010 160000	93010 161500	WBOT * 2 TO 30M FOR RS
0023	93010 201000	93010 214000	MNET AT STN A FOR MGW
0024	93011 001000	93011 021900	MNET AT STN A FOR MGW
0025	93011 042120	93011 055000	WBOT FOR PW
0026	93011 055634	93011 062550	FNET FOR MGW
0027	93011 062605	93011 065000	FNET FOR MGW
0028	93011 160000	93011 161500	WBOT * 2 TO 30M FOR RS
0029	93011 161548	93011 164500	ZNET * 2 TO 200M FOR RS
0030	93011 195744	93011 195744	NULL ENTERED IN ERROR
0031	93011 195844	93011 210312	MNET TARGET FISHING FOR HH
0032	93012 000013	93012 000254	ZNET FOR RS
0033	93012 000641	93012 011304	FNET TARGET FISHING FOR HH
0034	93012 032219	93012 040038	MNET TARGET FISHING FOR HH
0035	93012 061555	93012 062122	WBOT * 2 TO 30M FOR PW
0036	93012 181000	93012 182500	WBOT * 2 TO 30M FOR RS
0037	93012 183000	93012 185500	ZNET * 1 TO 100M AND * 1 TO 200M FOR RS
0038	93013 001517	93013 014905	MNET IN CUMBERLAND BAY FOR MGW
0039	93013 044534	93013 061829	MNET IN CUMBERLAND BAY FOR MGW
0040	93013 082700	93013 095600	MNET IN CUMBERLAND BAY FOR MGW
0041	93013 124500	93013 130529	AGGZ FOR MGW
0042	93013 164000	93013 164719	WBOT * 2 TO 30M FOR RS
0043	93013 165500	93013 172000	ZNET * 2 TO 200M FOR RS
0044	93013 185648	93013 201250	MNET TARGET FISHING FOR HH
0045	93013 215244	93013 232019	MNET TARGET FISHING FOR HH
0046	93014 033500	93014 035500	FNET LOST BORROWED RMT8 COD END
0047	93014 061500	93014 062000	WBOT * 2 TO 20M BETWEEN B AND C FOR PW
0048	93014 063000	93014 074000	ZNET * 2 TO 200M BETWEEN B AND C FOR PW
0049	93014 074400	93014 080400	FNET FOR MGW
0050	93014 081300	93014 083300	FNET FOR MGW
0051	93014 113600	93014 120600	FNET FOR MGW
0052	93014 123500	93014 130500	ZNET * 2 TO 200M FOR PW
0053	93014 200500	93014 203500	FNET TEST FOR DGB

Event Starttime Endtime Code and Decription

0054 93014 211400 93014 220300 MNET FOR HH
0055 93014 232802 93015 002227 ZNET * 2 TO 200M FOR RS
0056 93014 232500 93014 232800 WBOT * 1 TO 20M FOR RS
0057 93015 094000 93015 094500 WBOT * 2 TO 30M FOR RS/PW
0058 93015 181100 93015 190404 MNET TARGET FISHING FOR HH
0059 93015 191619 93015 192140 WBOT * 2 TO 30M FOR RS
0060 93015 192718 93015 195315 ZNET * 2 TO 200M FOR RS
0061 93016 171256 93016 172000 WBOT * 2 TO 30M FOR RS
0062 93016 172053 93016 174000 ZNET * 2 (200 pm) TO 200M STN D FOR RS
0063 93016 220000 93016 221500 WBOT * 2 TO 30M FOR RS
0064 93016 223000 93016 230040 ZNET * 2 (200 pm) TO 200M STN C FOR RS
0065 93017 021955 93017 025925 ZNET * 2 (200 pm) TO 200M STN B FOR RS
0066 93017 053000 93017 055000 ZNET * 1 (200 pm) TO 200M STN A FOR PW
0067 93017 055100 93017 061000 ZNET * 1 (200 pm) TO 200M STN A FOR PW
0068 93017 151142 93017 151402 LHPR NO COMMUNICATIONS AT STN D FOR PW
0069 93017 153347 93017 153944 LHPR NO COMMUNICATIONS AT STN D FOR PW
0070 93017 170000 93017 170000 ZNET NET LOST OFF END OF WIRE
0071 93017 170545 93017 173611 ZNET * 2 TO 200M AT STN D FOR RS
0072 93017 180431 93017 184105 LHPR TEST DEPLOYMENT AT STN D FOR PW
0073 93017 194457 93017 200303 WBOT * 2 TO 30M AT STN C FOR RS
0074 93017 200339 93017 203024 ZNET * 2 (200 pm) TO 200M AT STN C FOR RS
0075 93017 214935 93017 223651 ZNET * 2 (200 pm) TO 200M AT STN D FOR RS
0076 93018 030954 93018 044500 RMT8 AT STN D FOR PW
0077 93018 050000 93018 051500 WBOT * 2 TO 30M FOR PW
0078 93018 052000 93018 061000 ZNET * 2 (200 pm) TO 200M AT STN D FOR PW
0079 93018 072000 93018 082000 ZNET * 2 (200 pm) TO 200M AT STN C FOR PW
0080 93018 101730 93018 111900 RMT8 AT STN D FOR PW
0081 93018 120000 93018 123000 ZNET * 2 TO 200M AT STN D FOR PW
0082 93018 140131 93018 143611 ZNET * 2 TO 200M AT STN C FOR PW
0083 93018 170800 93018 183257 RMT1 AT STN A FOR PW
0084 93018 185648 93018 193402 ZNET * 2 TO 200M AT STN A FOR RS/PW
0085 93018 193425 93018 194327 WBOT * 2 TO 30M AT STN A FOR RS/PW
0086 93018 210000 93018 212800 ZNET * 2 TO 200M AT STN B FOR RS/PW
0087 93018 223955 93019 005512 RMTl STN A FOR PW
0088 93019 005448 93019 005556 NULL
0089 93019 005502 93019 005548 NULL
0090 93019 005629 93019 012355 ZNET * 2 (200 pm) TO 200M AT STN A FOR RS
0091 93019 012338 93019 024829 NULL
0092 93019 015744 93019 024821 LHPR FOR DGB
0093 93019 033000 93019 050738 RMTl AT STN A FOR PW
0094 93019 053000 93019 061100 ZNET * 2 TO 200M AT STN A FOR PW/RS
0095 93019 061800 93019 063000 WBOT * 2 TO 30M AT STN A FOR PW/RS
0096 93019 080000 93019 084426 ZNET * 2 TO 200M AT STN B FOR PW
0097 93019 095438 93019 113000 RMTl AT STN A FOR PW/RS
0098 93019 114800 93019 122401 ZNET * 2 TO 200M AT STN A FOR PW
0099 93019 132432 93019 140500 LHPR TEST DEPLOYMENT AT STN A
0100 93019 154346 93019 170500 MNET TARGET FISHING FOR DGB
0101 93019 180719 93019 200000 MNET TARGET FISHING FOR DGB
0102 93019 200933 93019 204500 ZNET * 2 (200 pm) TO 200M FOR RS
0103 93019 205000 93019 211000 WBOT * 2 TO 30M FOR RS
0104 93019 223856 93019 235122 MNET TARGET FISHING FOR DGB
0105 93020 023030 93020 024522 MNET TARGET FISHING FOR DGB
0106 93020 044000 93020 052725 MN-ET TARGET FISHING FOR DGB
0107 93020 085300 93020 091100 MNET TARGET FISHING FOR DGB
0108 93020 140312 93020 153000 MNET TARGET FISHING FOR DGB
0109 93020 154000 93020 160000 WBOT * 2 TO 30M FOR RS

Event	Starttime	Endtime	Code and Decription
0110	93020 160000	93020 162841	ZNET * 2 (200 pm) TO 200M FOR RS
0111	93020 210440	93020 225519	MNET IN EAST CUMBERLAND BAY FOR MGW
0112	93020 212400	93020 222300	FNET IN WEST CUMBERLAND BAY FOR MGW
0113	93021 002628	93021 021634	MNET IN EAST CUMBERLAND BAY FOR MGW
0114	93021 004512	93021 014000	FNET * 2 (20 MIN EACH) FOR MGW
0115	93021 031908	93021 050400	MNET IN INNER CUMBERLAND BAY FOR MGW
0116	93021 034538	93021 043000	FNET IN CUMBERLAND BAY (INNER) FOR MGW
0117	93021 064000	93021 083307	MNET IN CUMBERLAND BAY (INNER) FOR MGW
0118	93021 065300	93021 074100	FNET IN CUMBERLAND BAY (INNER) FOR MGW
0119	93021 121500	93021 123000	AGGZ INNER SHELF FOR MGW
0120	93021 141700	93021 145500	AGGZ INNER SHELF FOR MGW
0121	93021 154912	93021 162234	ZNET * 2 TO 200M OFF CUMBERLAND BAY FOR RS
0122	93021 162400	93021 164500	WBOT * 3 TO 30M OFF CUMBERLAND BAY FOR RS
0123	93021 214526	93021 223500	MNET IN WEST CUMBERLAND BAY FOR MGW
0124	93021 220218	93021 225844	FNET (2 * 20 MIN) WEST CUMBERLAND BAY FOR MGW
0125	93022 002559	93022 021803	MNET IN EAST CUMBERLAND BAY FOR MGW
0126	93022 003000	93022 012500	FNET (2 * 20 MIN) EAST CUMBERLAND BAY FOR MGW
0127	93022 030633	93022 045012	MNET IN EAST CUMBERLAND BAY FOR MGW
0128	93022 032922	93022 035000	FNET (1 * 22 MIN) CUMBERLAND BAY FOR MGW
0129	93022 035500	93022 043000	FNET (1 * 20 MIN) CUMBERLAND BAY FOR MGW
0130	93022 071222	93022 083908	MNET IN CUMBERLAND BAY FOR MGW
0131	93022 073500	93022 075800	FNET (1 * 23 MINS) EAST CUMBERLAND BAY FOR MGW
0132	93022 080500	93022 083913	FNET (1 * 22 MINS) EAST CUMBERLAND BAY FOR MGW
0133	93022 105928	93022 125636	MNET OUTER EAST CUMBERLAND BAY FOR MGW
0134	93022 111000	93022 113000	FNET (20 MIN) OUTER EAST CUMBERLAND BAY FOR MGW
0135	93022 113400	93022 115400	FNET (20 MIN) OUTER EAST CUMBERLAND BAY FOR MGW
0136	93022 140500	93022 145200	AGGZ (20 MIN ON BOTTOM) CUMBERLAND BAY FOR MGW
0137	93022 163727	93022 171033	WBOT * 3 TO 30M OFF CUMBERLAND BAY FOR RS
0138	93022 171055	93022 174648	ZNET * 2 TO 200M OFF CUMBERLAND BAY FOR RS
0139	93022 210221	93022 230000	MNET WEST CUMBERLAND BAY FOR MGW
0140	93022 210500	93022 212500	FNET WEST CUMBERLAND BAY FOR MGW
0141	93022 213000	93022 215000	FNET WEST CUMBERLAND BAY FOR MGW
0142	93022 235822	93023 022115	MNET EAST CUMBERLAND BAY FOR MGW
0143	93023 001716	93023 003700	FNET EAST CUMBERLAND BAY FOR MGW
0144	93023 040751	93023 060005	MNET INTO EAST CUMBERLAND BAY FOR MGW
0145	93023 041000	93023 043300	RMT8 EAST CUMBERLAND BAY (INNER) FOR MGW
0146	93023 043553	93023 045500	FNET (23 MINS) EAST CUMBERLAND BAY FOR MGW
0147	93023 073300	93023 092500	RMT8 EAST CUMBERLAND BAY (INNER) FOR MGW
0148	93023 083000	93023 085000	FNET CUMBERLAND BAY FOR MGW
0149	93023 085800	93023 091800	FNET CUMBERLAND BAY FOR MGW
0150	93023 112116	93023 133940	RMT8 EAST CUMBERLAND BAY (OUTER) FOR MGW
0151	93023 113214	93023 115307	FNET EAST CUMBERLAND BAY (OUTER) FOR MGW
0152	93023 120141	93023 123604	FNET EAST CUMBERLAND BAY (OUTER) FOR MGW
0153	93023 145843	93023 152500	ZNET * 2 TO 200M NORTH WEST CUMBERLAND BAY FOR RS
0154	93023 153600	93023 155000	WBOT * 2 TO 30M FOR RS
0155	93023 205454	93023 224003	RMT8 IN WEST CUMBERLAND BAY FOR MGW
0156	93023 213156	93023 215150	FNET IN WEST CUMBERLAND BAY FOR MGW
0157	93023 215900	93023 221900	FNET IN WEST CUMBERLAND BAY FOR MGW
0158	93024 013909	93024 033315	RMT8 IN EAST CUMBERLAND BAY FOR MGW
0159	93024 042050	93024 052548	MNET FOR NET COMPARISON FOR DGB/MGW
0160	93024 071704	93024 090020	MNET IN STROMNESS FOR MGW
0161	93025 220500	93025 221500	WBOT * 2 TO 30M FOR RS
0162	93025 221500	93025 225300	ZNET * 2 TO 100M FOR RS
0163	93026 000348	93026 022503	MNET AT SHAG ROCKS FOR MGW
0164	93026 024829	93026 045705	MNET AT SHAG ROCKS FOR MGW