FRANKLIN

National Facility
Oceanographic Research Vessel

RESEARCH SUMMARY

CRUISE FR 10/91

Sailed Sydney	1500	Friday 15 November 1991
Arrived Noumea	1130	Tuesday 3 December 1991
Sailed Noumea	1000	Wednesday 4 December 1991
Arrived Sydney	0900	Sunday 15 December 1991

OCEAN TRANSPORT IN THE TASMAN AND CORAL SEAS

Dr John Church, Dr Gary Meyers, Mr Fred Boland
CSIRO Division of Oceanography

Associate Professor Matt Tomczak
Ocean Science Institute
The University of Sydney

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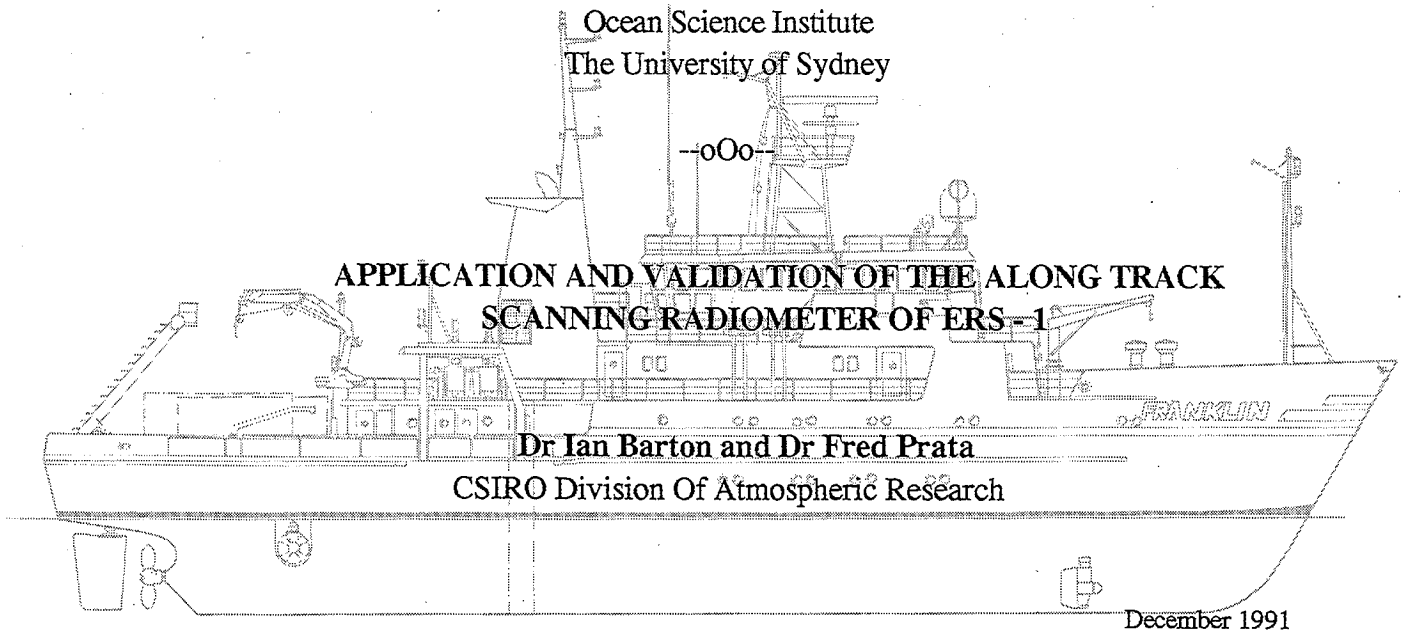
APPLICATION AND VALIDATION OF THE ALONG TRACK SCANNING RADIOMETER OF ERS - 1

Dr Ian Barton and Dr Fred Prata
CSIRO Division Of Atmospheric Research



December 1991

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AUSTRALIA

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Research Summary

Cruise Fr 10/91

1. Itinerary

Departed Sydney	1500 Friday, 15th November, 1991
Arrived Noumea	1130 Tuesday, 3rd December, 1991
Departed Noumea	1000 Wednesday 4th Decemeber, 1991
Arrived Sydney	0900 Sunday 15th December, 1991

2. Scientific Programs

Project 1 - Ocean Transport in the Tasman and Coral Seas

Drs John Church, Gary Meyers and Mr Fred Boland, CSIRO DO
Assoc Prof Matt Tomczak, OSI, Sydney University

Project 2 - Application and validation of the along track scanning radiometer of ERS-1

Drs Ian Barton and Fred Prata, CSIRO DAR

3. Cruise Narrative

After sailing from Sydney, we steamed straight to the inshore end of the mooring section (See the attached cruise track.). We then steamed over the mooring section to get a better idea of what the bathymetry was like (there is very little bathymetry data available for this area). The first (inshore) mooring was deployed before breakfast on the 17th of November. The next two moorings were deployed on the same day. The fourth mooring was not attempted on this day because of deteriorating weather - the Doppler profilers could not be moved safely from the forward end of the rear deck in the conditions. The 30°S CTD section was commenced overnight, and the remaining three moorings were deployed on the 18th in better conditions. The mooring work went without incident (see attached report).

The 30°S CTD section was then continued, and was completed on the 26th of November. The new CTD deck unit, rosette unit and display system were being used for the first time on this cruise. The most serious problem with the CTD system was caused by a misaligned board in Micro 6. Apart from that there were some problems with misfires of the rosette.

The section from New Zealand was commenced on the 27th of November and was completed without incident (apart from a few misfires) on the 2nd of December. Because the port call had been moved back one day and because we had made up a

substantial amount of time on the New Zealand - Noumea section, we did the first few stations of the 23°S section before steaming into Noumea.

After leaving Noumea, we continued the 23°S section in good, but mostly cloudy weather. CTD work continued, but the cloudy weather was not ideal for the ERS-1 verification work. The 'Flying Fish' was deployed for the first time (without electronics) on the 5th of December and again after some adjustment to the harness on the 7th of December.

A number of satellite tracked drifters were deployed for George Cresswell along this section. In addition, Rick Bailey (who had joined the ship in Noumea) performed a number of XBT and XCTD trials and calibrations.

The 23°S section was completed on the 9th of December and a number of transects across the East Australian Current using the Doppler profiler and XBT's were performed. The repeat of the inshore part of the 30°S section was commenced on the 12th of December but was abandoned on the 13th of December because of deteriorating weather (40 knot North-Easterly winds with stronger gusts and squalls). We then steamed towards Sydney, performing another ADCP/XBT transect across the EAC into Sugarloaf Point on the way.

4. Results

The near surface currents measured with the acoustic Doppler current profiler (See the attached figure) are consistent with the main results from the CTD sections. On the CTD sections, the strongest currents (about 2 ms^{-1})were in the East Australian Current near the mooring deployment site at 30°S. The CTD data shows the 16°C isotherm descending from a depth of about 200m on the upper slope to about 450m less than 100km offshore. Further east there were less intense northward and southward flows.

The flow to the east immediately to the north of New Zealand was weak. This is in agreement with the late winter section completed in September 1989 (Fr 10/89) but not the late summer section completed in February 1990 (Fr 2/90). There were two easward jets at about 32°S and 27°S. Along this section, the 16°C isotherm rose from a depth of about 350m south of New Caledonia to the surface north of New Zealand.

On the 23°S section there was a southward flow on the upper slope. Further east there were alternating northward and southward flows. The acoustic Doppler current profiler data indicates a considerable eastward near surface flow in the central part of the 23°S section.

Almost the entire distance between the 23°S section and Sydney (almost 34°S) the East Australian Current was meandering on and off the shelf. The largest southward currents were off the shelf east of Sugarloaf Point. The southward flow was characterised by temperatures above 23°C. On the inner shelf the currents were weaker and surface temperatures a couple of degrees cooler.

5. Summary

The CTD and mooring work all went well. The new CTD system saves time during stations. This amounted to more than a day over the length of the cruise.

The XCTD/XBT verification program was completed successfully.

A considerable amount of data was collected for ERS-1 calibration. However, the flying fish could only be deployed for a limited period because of unsuitable weather conditions.

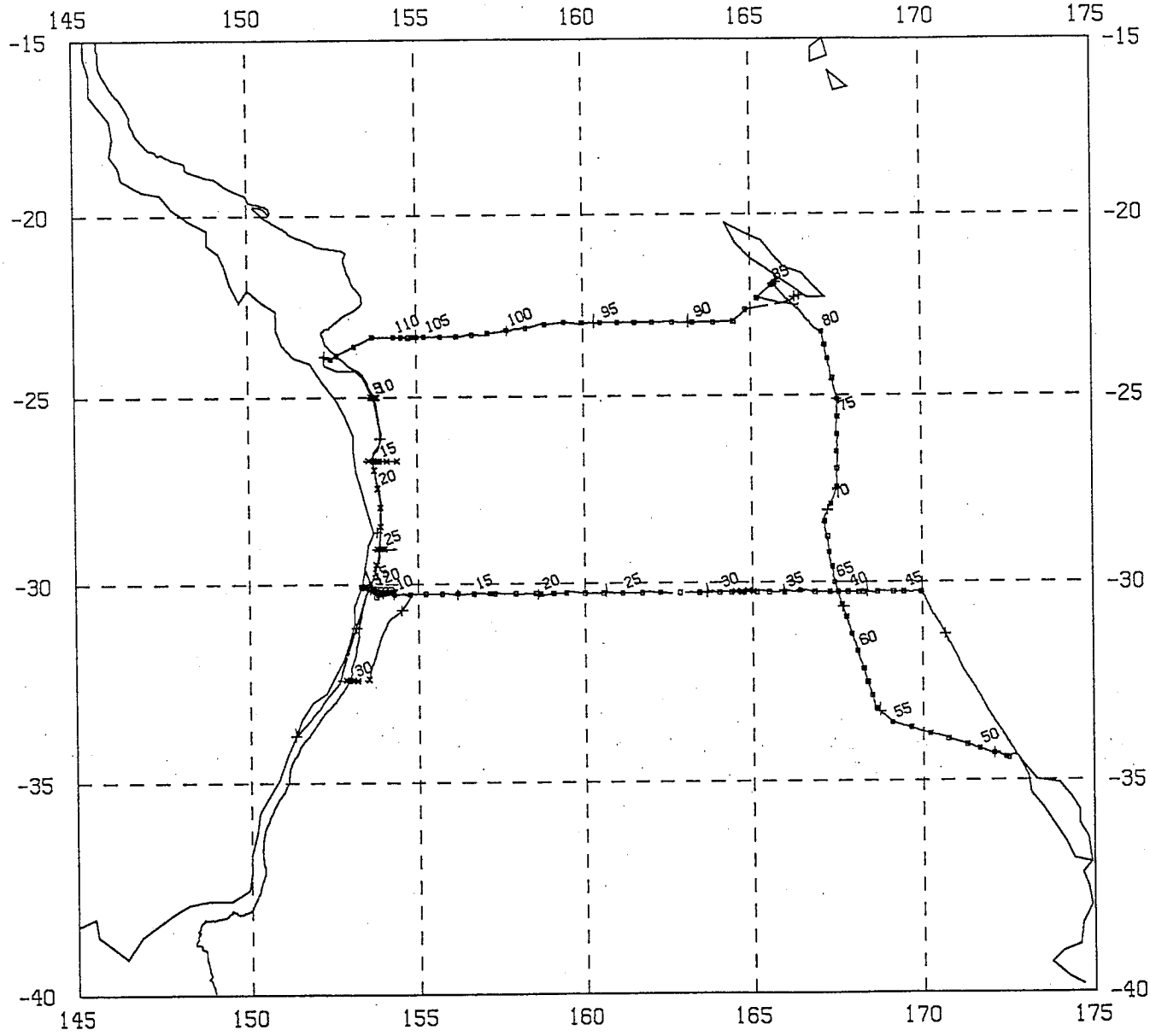
6. Personnel

Leg 1 - Sydney to Noumea

Neil White	CSIRO DO - Chief Scientist
Fred Boland	CSIRO DO
Kevin Miller	CSIRO DO
Danny McLaughlin	CSIRO DO
Ron Plaschke	CSIRO ORV
Bob Griffiths	CSIRO ORV
Phil Adams	CSIRO ORV
Bernadette Heaney	CSIRO ORV
Phaedra Hay	OSI - Sydney Uni
Bob Cechet	CSIRO DAR

Leg 2 - Noumea to Sydney

Neil White	CSIRO DO - Chief Scientist
John Church	CSIRO DO
Kevin Miller	CSIRO DO
Rick Bailey	CSIRO DO
Ron Plaschke	CSIRO ORV
Bob Griffiths	CSIRO ORV
Phil Adams	CSIRO ORV
Bernadette Heaney	CSIRO ORV
Daniel Large	OSI - Sydney Uni
Bob Cechet	CSIRO DAR
John Bennet	CSIRO DAR


145
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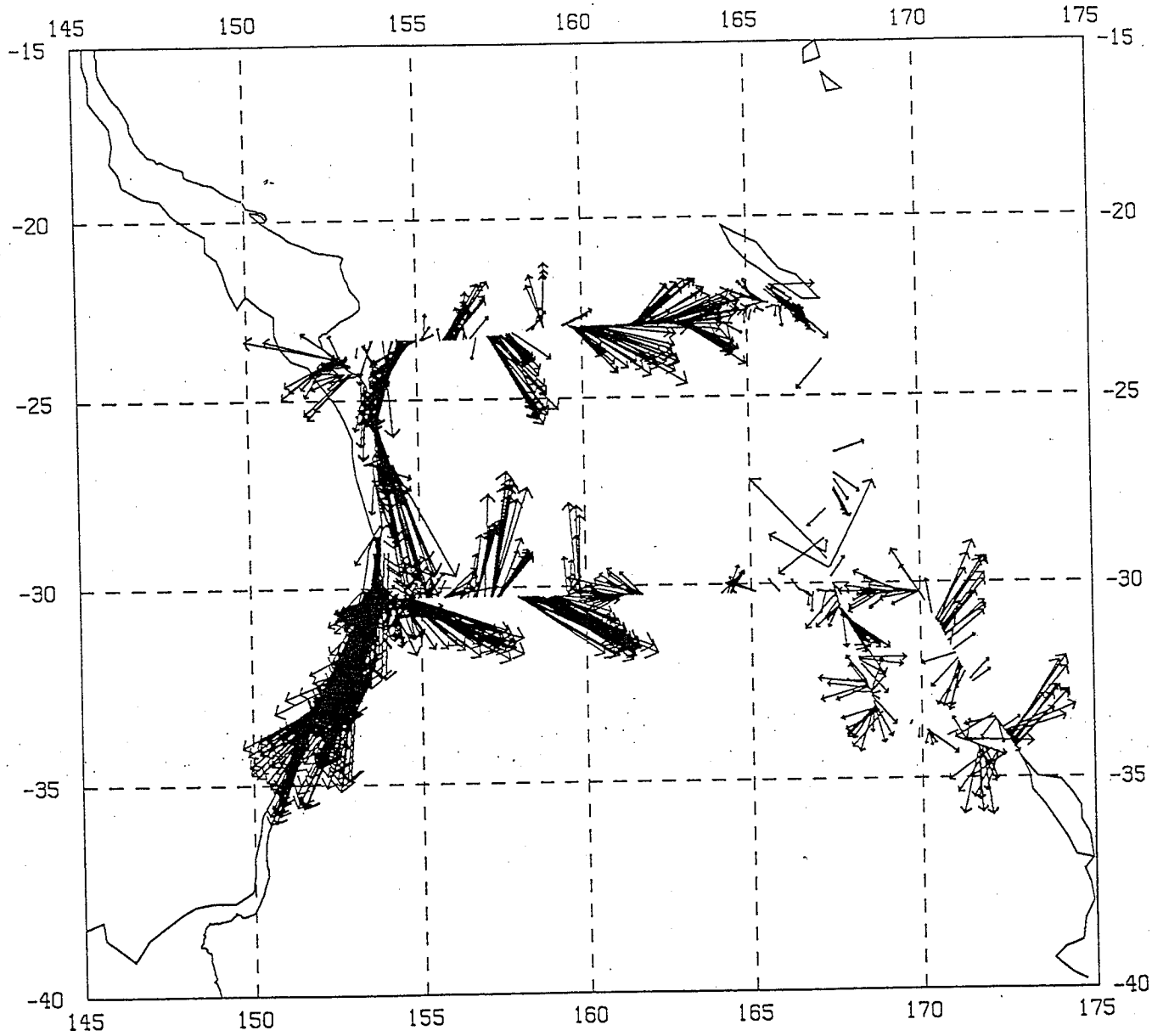
GPS CØRRECTED VECTØRS AT 20 METRES

START 15-NØV-1991 04 57 04
END 13-DEC-1991 23 58 57



.5 M/S

5 ENSEMBLES AVERAGE
CØNFIDENCE LEVEL = 0.15

ALIGNMENT ERRØR = 1.2
SCALING FACTØR = 0.990

14-DEC-1991 07 00

CRUISE FR10/91 SYDNEY TO SYDNEY (VIA NOUMEA) 15 NOV TO 15 DEC 1991

Validation of Along Track Scanning Radiometer (ATSR)

Bob Cechet
CSIRO Division of Atmospheric Research (DAR)

The goals of this project were to:

(1) to obtain shipborne radiometer, radiosonde and satellite radiometer data while within the ATSR swath (approx. 500 km) when the ERS-1 satellite maintained a 3-day repeat orbit cycle ("ground truthing" the remotely sensed data).

(2) to compare the performance of ATSR sea surface temperature (SST) algorithms with NOAA 11 & NOAA 12 AVHRR SST algorithms in similar atmospheres, by considering nearest overpasses (within 3 hours).

Generally good weather conditions were experienced during the first leg (Sydney - Noumea, 18 days) of the cruise. Coincident satellite, atmospheric and surface data was obtained on 59 occassions. During the second leg (Noumea - Sydney, 12 days), it was planned to increase the emphasis on the collection of coincident data in humid atmospheres. Unfortunately, rain and bad weather associated with tropical activity and also an east-coast low-pressure system, brought lengthy periods of cloudy conditions which halted data collection. Coincidences were obtained on 20 occasions, in atmospheric profile conditions characterised by lower-troposheric moist east to northeast winds which significantly increased the amount of precipitable water compared to leg1.

The radiometer was used to obtain a series of multiple wavelength and multiple view angle sea surface radiance measurements. These will be used to validate ATSR SST algorithms. Sky measurements were carried out whenever conditions permitted. Only a few short periods of calm seas prevailed. The radiometer was used to estimate the 'skin' temperature, while the 'bulk' temperature was measured by the thermosalinagraph (or CTD when available). Seas of 1 metre or greater with winds above 10 knots were the norm; therfore "skin - bulk" differences were small during most of the cruise. Twenty-six radiosondes were launched. The radiosonde data gave precipitable water vapour amounts ranging from 1.09 to 4.91 g/cm^2. These data will be used in atmospheric transmittance models to study the effects of water vapour absorption on satellite-borne radiometer SST measurements in the 10-12 micron atmospheric water vapour window.

The weather permitted the major cruise goal (of obtaining ATSR coincidences) to be achieved on 13 out of the possible 19 opportunities. In total, "ground - truth" data for 13 ERS-1 orbits, 33 NOAA-11 orbits and 33 NOAA-12 orbits was obtained. The cruise has provided some excellent data and sufficient ATSR coincidences and ATSR/AVHRR adjoining coincidences to produce a valuable validation data set.

John Bennett from DAR joined the cruise on leg 2 to trail the towed body TASITA, (Towed Air-Sea Interaction Temperature Analyser, better known as the "flying fish") which is planned to be deployed during the TOGA - COARE field experiment in 1992/93. TASITA is designed to profile the lowest two metres of the atmosphere and the upper metre of the ocean, in undisturbed water outside the wake of the ship. The aim of the instrument is to collect data to study the surface heating of the ocean surface in the tropics under clear sky and light wind conditions. Suitable sea conditions for the deployment of the towed body from the CTD winch to test the mechanical stability of the instrument were difficult to obtain. TASITA was initially trailed (without electronic components) in seas of 0.5 to 1 metre. It become unstable at towing speeds greater than 6 knots. The complete unit was trailed in Hervey Bay (behind the reef) for a short time to test that the on-board dataloggers and sensors functioned as designed. The east-coast low pressure system which increased the sea state during the last week of the cruise impeeded the further deployment of TASITA.

XBT/XCTD TESTS AND CALIBRATIONS

Several types and makes of XBTs were calibrated against the CTD as part of an international collaborative effort to test and improve the depth formulae of the XBT. Several studies have found that the various types of XBTs are not performing to manufacturers' specifications . Sparton of Canada are now producing XBTs in competition with Sippican of USA, and these probes were therefore tested and evaluated. The new Sippican XCTD was also tested against the CTD. This is the first time, after many years of development, that the XCTD has been tested and deployed scientifically. Both the XBT and XCTD are important instruments for the large scale ocean observing networks of the Tropical Ocean Global Atmosphere (TOGA) program and the World Ocean Circulation Experiment (WOCE).

Data on the Sippican T-4 and the Fast T-5 type XBTs was collected to reinforce earlier findings that the T-4 falls faster than the fall rate given by the manufacturer's depth formula (depth error found to be approximately 15m at 460m), and that the Fast T-5 falls at approximately the rate given by the manufacturer. Initial results from this cruise support these earlier findings.

The Sparton T-7 XBTs were found to accurately measure SST (at 3.8m, XBT-CTD = -0.01 deg C), but were found to have a significantly greater depth error than the equivalent Sippican T-7 XBT. The Sparton T-7 XBT was found to be falling faster (depth error approximately 35m at 760m) than even the Sippican T-7 XBT (known depth error approximately 26m at 760m). The manufacturers' stated accuracy for both probes is +/-15m at 760m. This is an important finding with significant ramifications for the various international data archives (which do not necessarily record probe type or make) and their users.

The Sippican XCTDs were found to accurately measure SST (at 3.8m, XCTD-CTD = -.001 deg C) and SSS (XCTD-CTD = -0.042 ppt), after approximate correction for the CTD reading low by 0.04ppt. There did, however, appear to be a potential response time error in the thermocline region, with the XCTD constantly lagging the CTD. Depth errors of features in temperature and conductivity observed in the thermocline were of order 5-30m. The probes were dropped so as to minimize any displacement of the thermocline by ensuring the XCTD and CTD were coincident at some point within the thermocline, and so it is not believed the variations are the result of temporal variability within the thermocline. Typical errors in temperature and salinity (after correction) at 400m (centre thermocline) were approximately 0.26 deg C and 0.06 ppt respectively (cf manufacturer's quoted accuracies of +/- 0.03 deg C and +/- 0.03 mS/cm). At 800m (base of thermocline), these errors were reduced to 0.02 deg C and 0.024 ppt respectively. The XCTD also continually malfunctioned at 900m. with a small abhorrent inversion in the conductivity measurement leading to consistent errors in salinity.

The CTD data now needs to be calibrated before final analyses and conclusions are drawn on the XBTs and XCTDs.

Appendices

A - General equipment

One 5 litre Niskin bottle was lost (it was missing when the CTD was retrieved at the end of a station). Another was found to have a broken bottom bracket and replaced. Such a breakage could well account for the lost bottle.

The Intech SATNAV could only be coaxed into life after a few days. Some system needs to be set up to replace the dead-reckoning positions provided by the Intech during gaps in GPS coverage. (This system has been begun).

The GPS coverage was extremely patchy for several days. This was apparently caused by the failure to update the satellites in the U.S. This underlines the need to have the system mentioned above.

The temperature in the ops room oscillates between being 'arctic' and being 'tropical' with very little middle ground. Presumably the thermostat needs to be attended to (and, perhaps moved to a better position - it is right next to a door).

Some of the chairs in the ops room need to be re-upholstered/replaced. In the case of the swivel chairs replacement is the preferred option as they have a way of swinging around and damaging things in rough weather.

If the flying fish and the 24 botle rosette are both to be used on any future cruise, there needs to be better arrangement for storing and securing the flying fish between tows.

Parts of the rear deck (especially under the HIAB crane) can become very slippery because of spilt oil. Could this area and the area near the rear gates be treated with non-stick paint.

B - Computing report

The new CTD display system worked well and seemed to meet with general approval. The old system has been disabled and should only be resurrected as a last resort (we have spares of all the required equipment).

In general all systems worked reliably. Some XBT analysis programs (similar to the existing CTD analysis programs) were made available.

The exabytes performed well once the spare board was put in. Why was this spare not put in on the previous cruise (Fr 9/91) as suggested by telex? The tapes from Fr 9/91 were copied to exabyte during this cruise.

The XBT system worked once the two (original and spare) GPIB boards were set to the correct settings. Apparently the problems on Fr 9/91 were largely due to the original board being set to the same settings as the spare, rather than vise-versa!

FRANKLIN CRUISE REPORT
FR10-91
PHILLIP ADAMS
DATE:15-12-91.
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CTD

The new CTD deck unit and display were installed prior to the start of the cruise. Due to the magnetic interference caused by the rack cooling fans,on the monitor,the system was run with the back off the rack and the fans turned off.

The Rosette failed to operate at depths below 700 meters.The "Y" cable was replaced and the rosette functioned correctly.

A new oxygen sensor was fitted,a new sensor to be ordered from Hobart.The new sensor produced an error in it's output which was depth related,the sensor was tightened in it's socket,removing the problem.

CTD No 4 was installed in the 12 bottle frame.

24 BOTTLE ROSETTE

The rosette occasionally misfired on the first bottle when the rosette had 24 bottles loaded,it was also difficult to set the trigger on the first bottle.

The problem was excess movement in the intermediate shaft between the motor and the trigger mechanism.This was partially removed,however a new shaft will have to be manufactured in Hobart.

Another problem is,that the top plate is slightly warped.(due to it's initial installation in the 24 bottle stainless frame) This could contribute to the occasional misfire.Due to the significant amount of corrosion on the top plate and the above problem,a new top plate should be purchased.

At the end of the cruise the u/w electronics was removed from the 24 bottle rosette and placed in the 12 bottle unit.

A new u/w electronics module should be ordered specifically for the 24 bottle rosette

MICRO 6

The CTD program would hang occasionally with disk read write errors.A bus grant card was found to badly seated.After re-seating,the micro functioned correctly.Towards the end of the cruise the micro suffered from read errors to the disk,the power supply loom was replaced fixing the problem.The contacts on the old loom looked ok,however the contact spring tension was significantly reduced.

D - Moorings report

FR10/91

Mooring Deployments

Six moorings were laid during the first days of the cruise, three on Sunday 17th and three on Monday 18th November. The weather on the 17th was not good - wind about 25 knots from the south. On the 18th it was calm. There was a strong current running, about 3 knots on the shelf break and 1.5 knots offshore.

All the moorings were laid without major incidents. The mooring at 4000 metres (TAS05) was moved east about 1 mile after the results of the bottom survey and lengthened by 400 metres. The last mooring (TAS06) was shortened by 120 metres.

Mooring positions and depths were:

TAS01	30 02.640S	153 30.663E	95 METRES
TAS02	30 03.827S	153 32.643E	200 METRES
TAS03	30 03.389S	153 33.648E	700 METRES
TAS04	30 07.021S	153 38.768E	2051 METRES
TAS05	30 10.511S	153 56.153E	4400 METRES
TAS06	30 07.138S	154 20.790E	4590 METRES

The line is obviously a little wiggly. We have a little to learn about working in such strong currents.

Meters used include 5 from Sydney University and 2 from the Antarctic Division. Note that Sydney University are expecting their meters back next October, they are apparently unaware that this was to be a 2 year project.

The bottom survey showed several feature not shown on the charts. An additional survey at 30 05S would be helpful. Bottom slopes at 2 of the sites (700 and 2000 metres) are quite steep, about 1 in 4.

Notices concerning the positions of the moorings were sent to the Fishermen's Co-ops at Ballina, Evans's Head, Wooli Head, Clarence River and Crowdey Head.

F.M.Boland

TRIMBLE NAVTRAC GPS

An agent from Taylor's returned the Navtrac after a "software update".The set did not lock up,during the cruise,as was previously the case.

GPS

There was bad GPS coverage,mostly on a weekend,for most of the cruise.There had been no prior notice of the lack of coverage.

FLYING FISH

The system,from Atmospherics Physics,had one of it's Data Takers fail.A burnt resistor was replaced and the Datataker re-assembled.

INMARSAT

Midway through the cruise the system failed to respond to incoming telex's,intermittently.The air circulating around the unit appeared too hot.The temperature in the Radio room was reduced and the system worked well for the rest of the cruise.

PA SYSTEM

A new waterproof hand microphone and amplifier were installed next to the rear A Frame starboard side.It is to be mounted inside the stainless steel housing for the rear A Frame hydraulic controls.The fused 24 volts supply comes from the FWD OP"S room PA junction box (in the ceiling) and is routed via the main phone JB and telephone #44 in the steering flat,to the rear deck.

After consultation with the skipper and 1st mate the berthing intercom unit next to the rear A Frame was removed,as was the control unit on the bridge.These units will be boxed up and sent to Hobart,where they will be stored in the Electronics area in the OMS store.

XBT SYSTEM

Half way through the cruise the system would continually indicate a faulty probe on startup.The fault was traced to a dirty earth contact on the Launcher Changeover Switch,in the OP's room.The switch was o/hauled and gave no further trouble.

3.5 KHZ SOUNDER

This unit was removed from the ship at the end of the cruise and given back to RANL.The bits and pieces used for the installation were placed in the scientific hold.