RESEARCH SUMMARY

CRUISE FR 6/92

Sailed	Lae	1030	Tuesday	14 July 1992
Called	Madang	0900-1100	Saturday	18 July 1992
Arrived	Madang	0800	Wednesday	22 July 1992
Sailed	Madang	0800	Thursday	23 July 1992
Called	Lae	1100-1400	Friday	Fri 31 July 1992
Called	Lae	2045-2130	Friday	Fri 31 July 1992
Arrived	Townsville	0830	Tuesday	4 August 1992

Principal Investigators
Dr Eric Lindstrom
CSIRO Division of Oceanography
Dr Steve Murray
Louisiana State University, USA
Dr Hideo Inaba
Tokai University, Japan

TOGA-COARE ENHANCED MONITORING

Including
Joint Australia-Japan Equatorial Mooring
&
New Guinea Coastal Undercurrent Measurements

August 1992

Cruise Summary FR06/92

Itinerary

Leg 1			
Departs	Lae, PNG	1030	Tuesday 14 July 1992
Arrives	Madang, PNG	0900	Saturday 18 July 1992
Leg 2			
Departs	Madang, PNG	1100	Saturday 18 July 1992
Arrives	Madang, PNG	0800	Wednesday 22 July 1992
Leg 3			
Departs	Madang, PNG	0800	Thursday 23 July 1992
At anchor	Por Island, PNG	1200-1500	Monday 27 July 1992
At anchor	Dreger Harbor, PNG	1200-1500	Tuesday 28 July 1992
At anchor	Dreger Harbor, PNG	1200-	Thursday 30 July 1992
		0700	Friday 31 July 1992
Calls	Lae, PNG	1100-1400	Friday 31 July 1992
Calls	Lae, PNG	2045-2130	Friday 31 July 1992
Arrives	Townsville	0830	Tuesday 4 August 1992

Scientific Program

JOINT AUSTRALIA-JAPAN MOORED INSTRUMENT ARRAY (CYCLE 6)
This project commenced in November 1989 and involves maintaining a current meter mooring on the equator at 147°E. The mooring is part of the Tropical Ocean Global Atmosphere (TOGA) moored observing array for observing currents in the equatorial Pacific Ocean. This cruise was the sixth cycle, marking the end of the CSIRO involvement in the field phase of operations and the end of the third Tokai University surface mooring deployment. A subsurface mooring belong to Tokai University is scheduled to remain in place until February 1993.

MOORED CURRENT METER ARRAY IN THE NEW GUINEA COASTAL UNDERCURRENT
The principal aim of this experiment is to directly measure the currents in and transport through Vitiaz Strait, Papua New Guinea, over an annual cycle. A line of five moorings were deployed across the strait from a US research vessel in February 1992. The primary task of R/V Franklin during FR06/92 was to recover, service, and redeploy the moorings, collect CTD and ADCP data for use in later interpretation of the moored data.

Principal Investigators

Dr. Eric Lindstrom, CSIRO Division of Oceanography (now affiliated with Texas A&M University, USA)
Professor Hideo Inaba, Tokai University, Japan
JOINT AUSTRALIA-JAPAN MOORED ARRAY

Dr. Eric Lindstrom, CSIRO Division of Oceanography (now affiliated with Texas A&M University, USA)
Dr. Stephen Murray, Louisiana State University, USA
MOORED CURRENT METER ARRAY IN THE NEW GUINEA COASTAL UNDERCURRENT

Results

The cruise track and instrument sites are shown in Fig. 1a and 1b. In all, five current meter moorings, four pressure gauges and one meteorological station in Vitiaz Strait were recovered, serviced, and redeployed. One current meter mooring was not recovered. Forty one CTD stations were completed to support the Vitiaz Strait analysis. An extensive set of ADCP transects were collected. Near-surface flow at some of the key transects is shown in Fig. 2. Currents over 2 m/s (4 knots) were often encountered.

A single mooring thermistor chain mooring on the equator at 147°E was recovered and a short section of five CTD stations was collected to support this data. A upward looking ADCP mooring was interrogated acoustically and several hours of ship's ADCP data were collected for comparison with the moored data when it is recovered at a later date.

Cruise Narrative

FRANKLIN departed Lae at 1030 on 14 July after an uneventful loading of equipment. The replacement gyro compass was not operable so makeshift ADCP calibration had to be used. The VAX computer initially refused to boot but was made operable by the removal of the floating point co-processor card. Two CTD stations (#1-2) designated A1 and A4 were completed overnight.

In Vitiaz Strait a five-mooring cross-channel array of moorings had been deployed in February 1992 from R/V MOANA WAVE (operated by University of Hawaii). The five moorings, proceeding northeast across the channel, are named "Cathy St. George", "Pam Stein", "Sussie Owens", " Gianna Amore", and "Kristene Rose." On 15 July current meter moorings "Amore" and "Stein" were recovered without incident. However, winds rose on the afternoon of 15 July to greater than 35 knots, preventing further mooring recovery operations that day. Overnight was spent working our way up the Strait toward mooring "Karen Foster", located between Long Island and New Guinea. Enroute, ADCP transects were completed from Umboi Island to Tolokiwa Island to Long Island to New Guinea (the last transect also known as CTD line "B").

At first light on 16 July an attempt was made to fire the acoustic releases on mooring "Foster." Although communication was established with the releases, the release commands were not executed by the instruments and plans for immediate recovery of the equipment were abandoned. The ship then returned as quickly as possible (against the 3 knot current and 25 knot winds) down the Strait to the main mooring array. Mooring "St. George" was successfully recovered late in the afternoon. That evening was spent completing CTD Line "D" from the New Guinea coast to Umboi Island (D1-D6, CTD #3,4,5,7,8,9).

The remaining two moorings in the main array, "Owens" and "Rose" were recovered on the morning of 17 July. The quick recovery of these two moorings allowed enough time to reach mooring "Foster" before dark that same afternoon and make another recovery attempt. Once again the releases failed to confirm release commands and the recovery operation was abandoned. Overnight CTD Line "B" was completed (from Long Island to New Guinea - B8-B2, CTD #10-16). CTD operations were suspended at

0500 on 18 July in order to make our scheduled port call at Madang at 1100 that day.

Mooring equipment was offloaded in Madang for servicing. The Louisiana State team stayed ashore to complete the work. FRANKLIN left Madang at 1700 on 18 July with the Tokai University team of Inaba, Moriya, and Iida. The rest of the day and the 19th were spent enroute to the equator at 147°E for mooring work. Enroute an ADCP test was completed in Ismrud Strait and CTD stations were done at 1°S and 0° 30'S on 147°E (CTD #17-18).

On the morning of 20 July the entire Tokai University thermistor chain mooring was successfully recovered. Also the subsurface ADCPmooring was located and the acoustic release was interrogated. It will remain in place for another six months. The successful mooring operations were followed by continuation of the CTD section on 147°E to 1°N (CTD #19-21). While steaming back to Madang on 21 July the gyro error causing problems for ADCP calibration was successfully overcome by the replacement of an electronics board.

FRANKLIN arrived in Madang at 0800 on 22 July. The offloading of the Tokai University party and loading of the Vitiaz Strait mooring equipment went smoothly. Everyone enjoyed Madang and its offerings during an overnight stay.

The ship set off on 23 July to complete work in Vitiaz Strait. Acoustic ranging was completed on mooring "Foster" during the late afternoon. The acoustic release on this mooring had again failed to release and dragging operations are to be attempted when all the Vitiaz moorings are recovered in 1993. CTD stations were completed at the ends of Line "B" (B1 and B7, CTD #22-23). Overnight was spent in slow progress down the strait against strong currents (up to 4 knots) and strong winds (up to 40 knots).

Mooring "Stein" was redeployed on 24 July without incident. The remainder of the day and evening was spent doing surveys of the topography at the remaining mooring sites and collecting ADCP data across the array line.

Moorings "Amore" and "St. George" were deployed on the morning of 25 July. The remaining moorings were then prepared for deployment while CTD line "D" was completed for the second time during the voyage (D1-D7, CTD #24-30). ADCP reciprocal course data were also collected along this line. FRANKLIN passed well offshore of the Sialum pressure gauge site during the afternoon. It appeared too rough for the required small boat operations but a closer approach than one mile to examine the passage into the lagoon was not permitted.

On the 26 July mooring "Rose" was deployed on the northeast side of Vitiaz Strait. Afterward an approach to Mandok and Por Islands was attempted. A pressure gauge and meteorological station are maintained at Por for the duration of the experiment. Unfortunately squally conditions caused the master to abort the attempt. Returning to the Strait, the last mooring "Owens" was deployed at mid-channel. Overnight, ADCP transects from Umboi Island to Tolokiwa Island and from Tolokiwa to Long Island were done and the along-channel CTD section started from the northern end (A10-9, CTD #31-32).

The morning of 27 July dawned fine and breezy (20-25 knots) with FRANKLIN awaiting another attempt to reach Mandok Island. This time the good weather and careful navigation led us safely to anchor off Mandok. A shore party was dispatched to Mandok's sister island Por and in a matter of three hours they had serviced the instruments and returned to the ship with the first six months of data. Work resumed on the along-channel CTD section overnight (A8-A5, CTD #33-36).

On the 28th it was determined that sea conditions would not permit the safe entry of a small boat to the Sialum pressure gauge site. This determination was made from 0.5 mile offshore. An alternative plan was arranged. FRANKLIN moved down the coast to Dreger Harbor and landed a shore party (Murray, Fredericks, and DeMers) to reach Sialum by road. While at anchor in Dreger Harbor, a diving team also recovered and redeployed the pressure gauge in the harbor only a few hundred meters from the ship. After three hours in the harbor FRANKLIN returned to the Strait and completed the along-channel CTD section started two nights earlier (A4-A2, CTD #37-39). The shore party was advised to return to Dreger Harbor on the 30th to rendevous with FRANKLIN.

29 and 30 July saw the completion of the CTD section across the southern approaches to Vitiaz Strait (F6-F8, F5-F1, CTD #40-47) and collection of ADCP data along the line from Nussing Island (New Guinea) to Pileo Island (New Britain). At midday on 30 July FRANKLIN re-entered Dreger Harbor and anchored. The shore party boarded at about 1600. Mairi Best of University of Chicago joined the ship here with rock and fossil specimens from the terraces surrounding Vitiaz Strait. She had sought assistance in transport to Townsville. The planned departure from Dreger Harbor at 1700 was postponed due to inability to free the the anchor. At sunset efforts to free the anchor were postponed until morning and overnight was spent at anchor.

31 July 1992 was a day of many fortunes for FRANKLIN. Thankfully, the first efforts at dawn to raise anchor were successful. A thick wire rope was found entangled in the anchor. FRANKLIN sailed immediately for Lae. There, later in the morning, the main body of Louisiana State mooring equipment was off-loaded. Steve Murray and Rod Fredericks disembarked to handle the storage and shipping arrangements for the gear. The ship departed about 1400, but three hours out of Lae in the Huon Gulf our attention was drawn by a helicopter. It guided FRANKLIN to a drifting barge with 31 shipwreck survivors aboard. The tug moving the barge (MS Land-Sea Eagle) had sunk quickly at 0400 that morning. One man and two children were lost in the disaster. The 24 adults and 7 children who survived were ferried to FRANKLIN with our small boat. While shocked and thirsty, none were injured. They were provided with dinner enroute back to Lae, where they disembarked at 2100. The barge (carrying a 10000 gallon tank of diesel fuel and drums of gasoline) was left to drift. Authorities were notified of its position for salvage by some other vessel. FRANKLIN set sail once again for Townsville.

The final homeward journey was an uneventful voyage through China Strait and Palm Passage into Townsville.

Summary
Overall the voyage was very successful. The planned work was eventually completed. Adventure with the anchor stuck in Dreger Harbour and serving as rescuers of shipwreck survivors were unexpected events and handled admirably by all involved. The requirements of the scientific work were largely met but hampered on occasion by the caution with which FRANKLIN approaches coastal and near-shore operations. In this expedition both the deep-sea capabilities of the ship and the ability to approach in-shore were needed and tested. Thanks are due to the officers and crew of FRANKLIN for an excellent final result in the extraordinary conditions of Vitiaz Strait.

Most scientific systems worked well, although problems early in the voyage with the VAX, the interface with the ship's gyro, and CTD Unit #4 conductivity and oxygen led to a considerable waste of time and effort. The CTD display programs and the ADCP data logging programs are very nice and robust. The scientific sounder is excellent.

Some FRANKLIN systems failed to work adequately during the voyage. There were several bouts of fresh water flooding in cabins B and C. The A/C for the operations room and VAX requires constant monitoring and switching in order to maintain operation. The temperature in the operations room is often uncomfortably cool for the human inhabitants. The winch for the rescue boat failed.

Personnel
Texas A&M University
Eric Lindstrom, Chief Scientist

CSIRO Division of Oceanography
Jeff Butt, Cruise Manager
Jan Peterson
Daniel McLaughlan
Ron Plaschke
Phil Adams

Louisiana State University Coastal Studies Institute (Legs 1&3 Only)
Stephen Murray (Disembarked in Lae 31/7)
Rodney Fredricks (Disembarked in Lae 31/7)
Floyd DeMers
Walker Winans
Steve Dartez

Tokai University (LEG 2 Only)
Hideo Inaba
Hiroshi Moriya
Masaki Iida

Figures

1a) Cruise track, stations, and mooring sites for the three legs of the expedition.

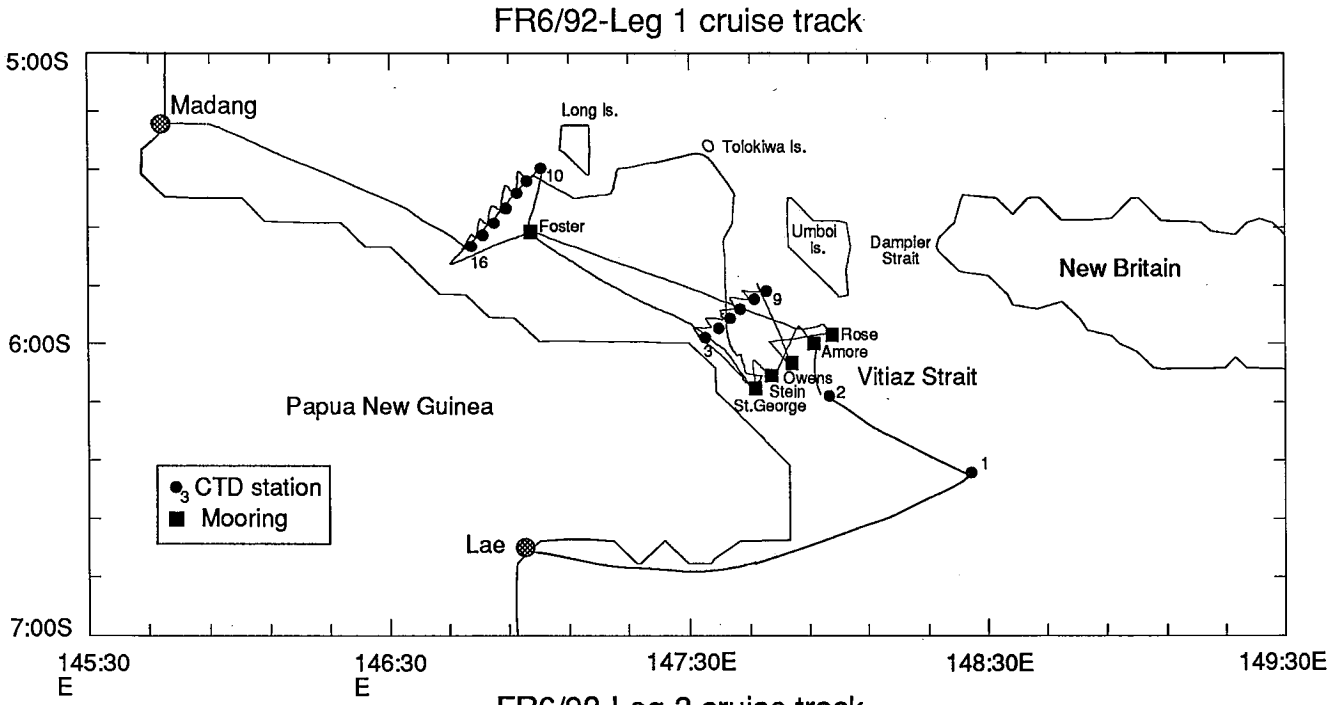
1b) CTD station names for the Vitiaz Strait expeditions of 1991-93.

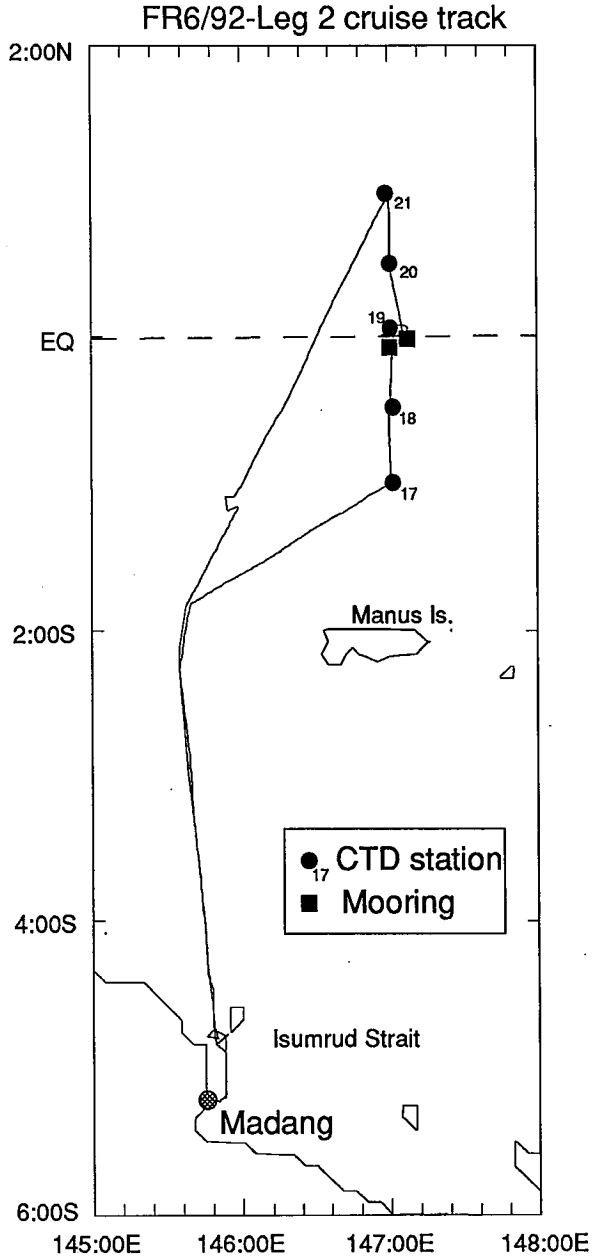
2) Current vectors at 20m in Vitiaz Strait.

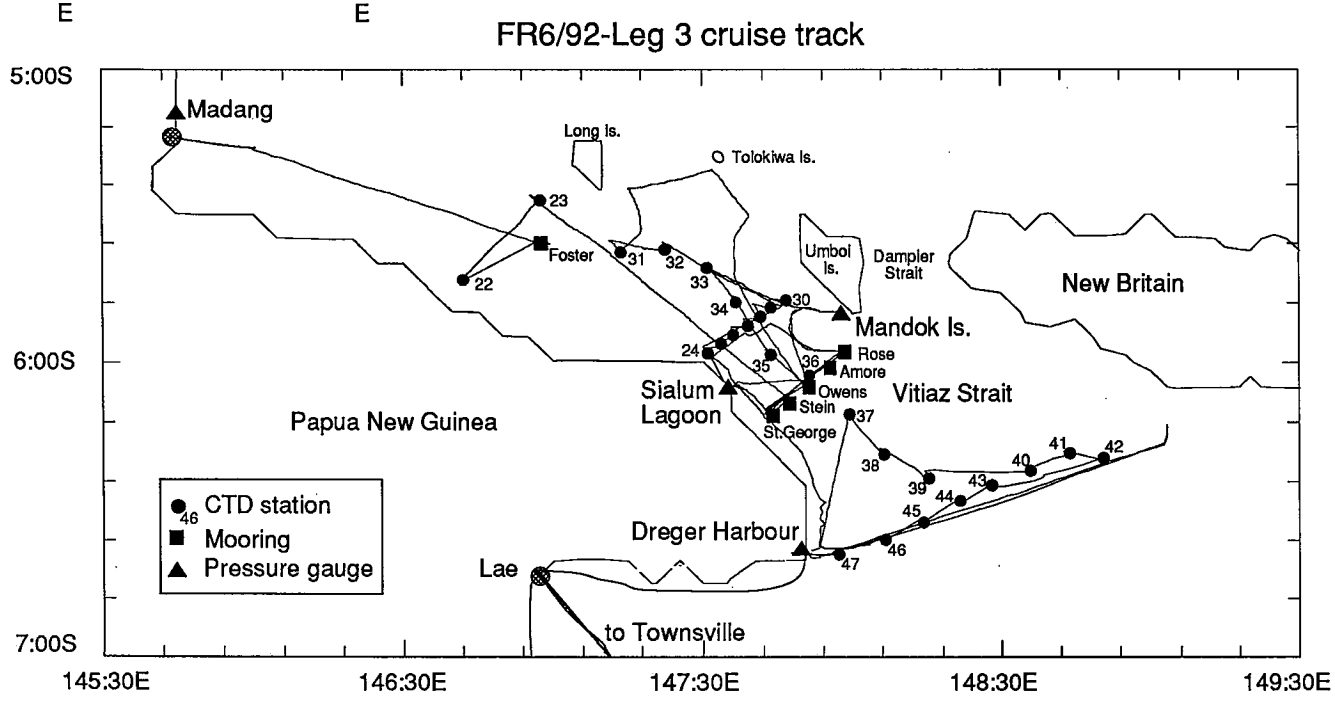
Appendices

1) Computing Report

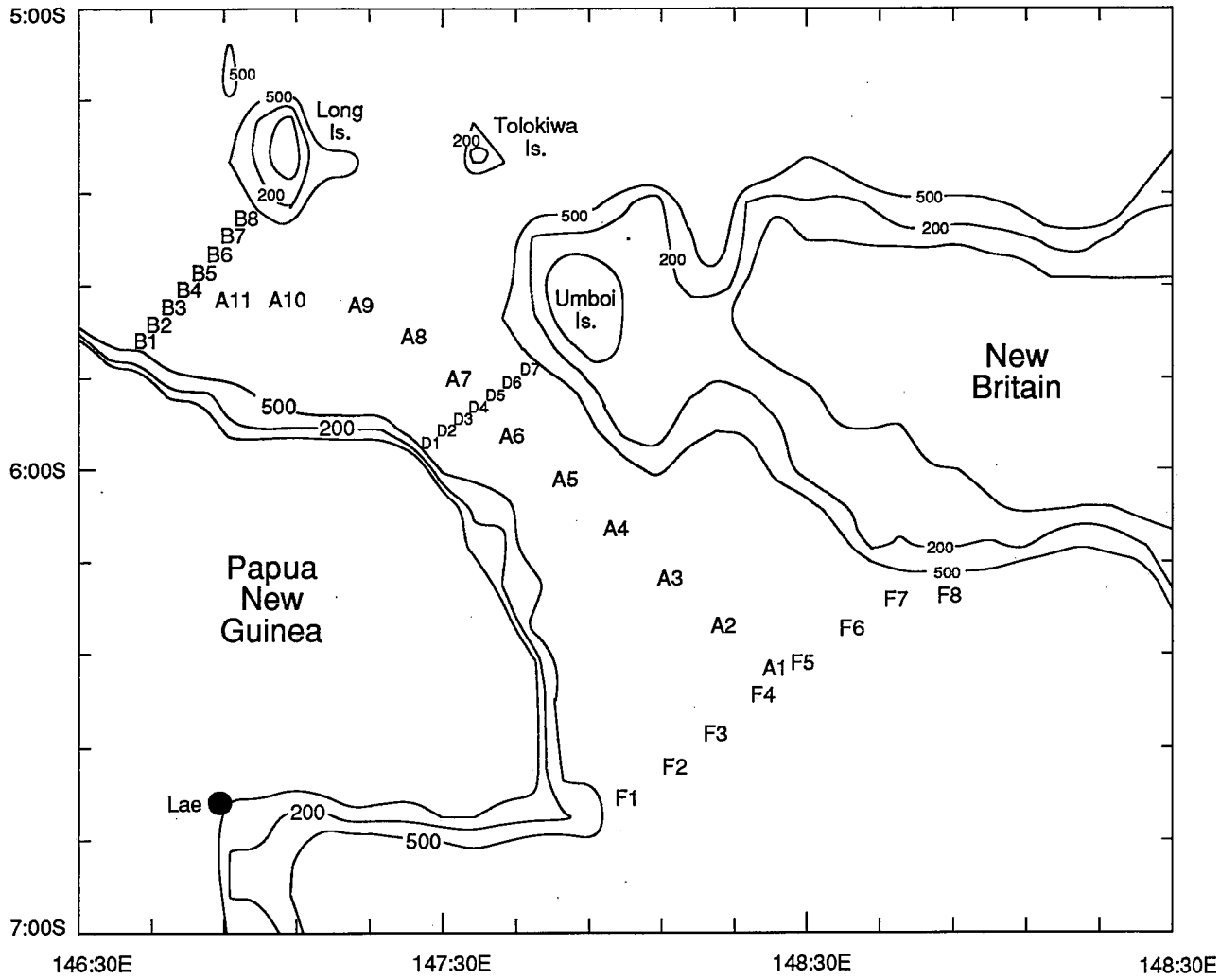
2) Electronics Report


FR6/92-Leg 1 cruise track
5:00S
6:00S
7:00S
145:30 E
146:30 E
147:30E
148:30E
149:30E
Madang
Long Is.
Tolokiwa Is.
Foster
Umboi Is.
Dampier Strait
New Britain
Rose
Amore
Owens
Stein
St.George
Vitiaz Strait
Papua New Guinea
Lae
CTD station
Mooring


FR6/92-Leg 2 cruise track
2:00N
EQ
2:00S
4:00S
6:00S
145:00E
146:00E
147:00E
148:00E
Manus Is.
Isumrud Strait
Madang
CTD station
Mooring


FR6/92-Leg 3 cruise track
5:00S
6:00S
7:00S
145:30E
146:30E
147:30E
148:30E
149:30E
Madang
Long Is.
Tolokiwa Is.
Foster
Umboi Is.
Dampler Strait
New Britain
Mandok Is.
Rose
Amore
Owens
Stein
St.George
Vitiaz Strait
Sialum Lagoon
Papua New Guinea
Dreger Harbour
Lae
to Townsville
CTD station
Mooring
Pressure gauge

Vitiaz Strait CTD stations



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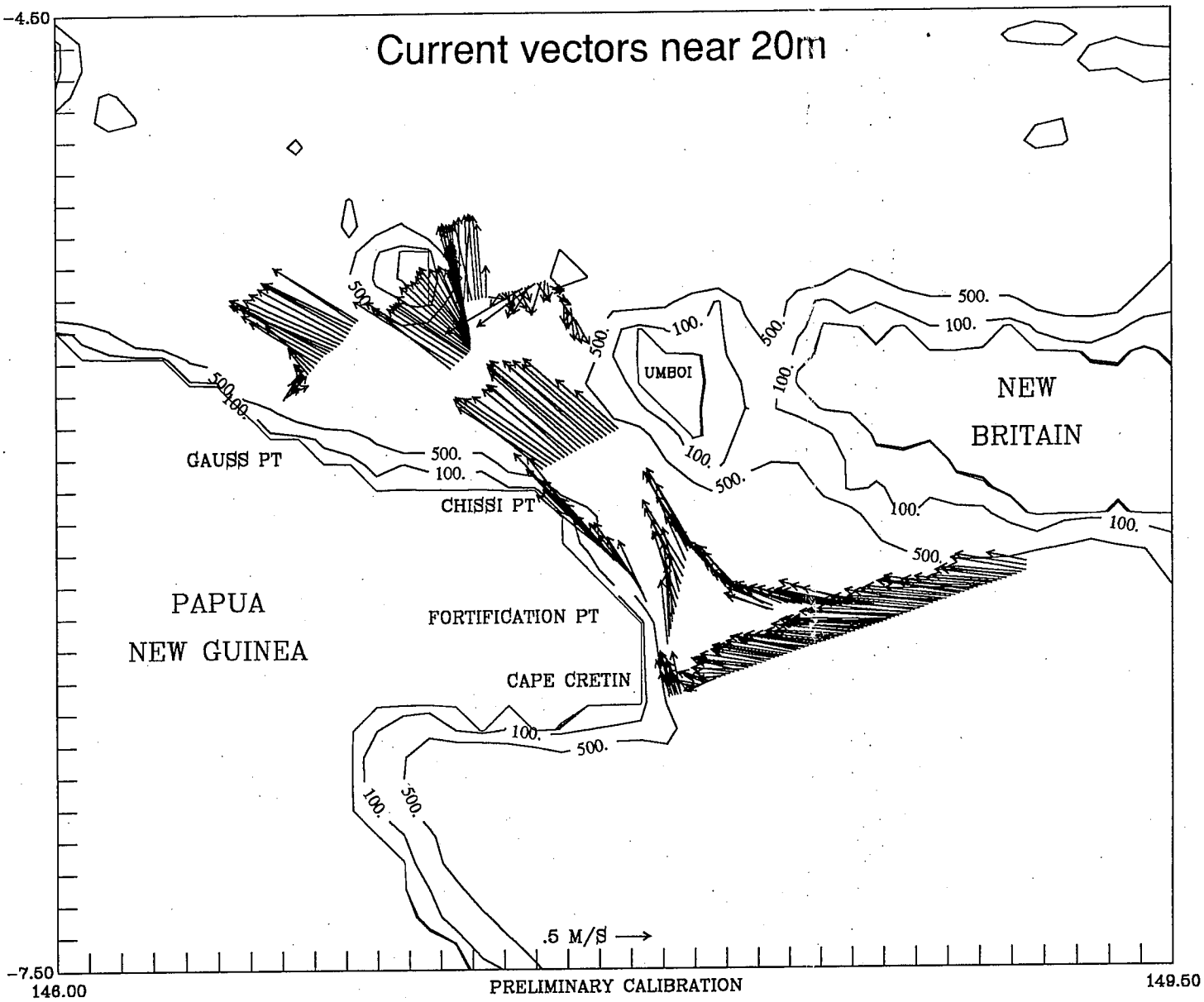
Current vectors near 20m
-4.50
-7.50
146.00
149.50
PRELIMINARY CALIBRATION
.5 M/S
PAPUA
NEW GUINEA
NEW
BRITAIN
GAUSS PT
CHISSI PT
FORTIFICATION PT
CAPE CRETIN
UMBOI
500.
100.

FR6/92 Computing Report

Jeff Butt

The software worked extremely well. There were several hardware problems, most of which have been experienced in the past. It is annoying to have to deal with the same old problems, especially when some could be avoided by timely doses of preventative maintenance.

TIME/Calender clock

The major problem was the intermittent reliability of the calender clock circuit board. The reason for this was later determined as due to battery acid leaking onto the (very dusty) circuit board. Up until its replacement (2300 July 17 UTC) the time was constantly varying despite regular time setting and use of TIMSET. Data collected in this period will be difficult to sequence. During FR6/91 similar problems were experienced due to flat or failing batteries on this board. In future it would be wise to regularly replace the batteries so as not to jeopardise the integrity of the Data logging time reference.

VAX

At the start of the cruise the VAX would not boot. Messages to the effect that 10% of the main memory was bad were received. After removal of the floating point co-processor board the VAX did boot successfully. Later on in the cruise this board was replaced and worked flawlessly.

In the early stages the SYSTEM disk (DUA0:) refused to spin up, necessitating booting the system from the USERDISK (DUA1:). This worked fine, though the Laser Printer QMS was not usable. It was discovered that DUA0: had dropped its drive belt. Replacement allowed the VAX to boot normally, however the belt was prone to falling off whenever DUA0: was restarted (eg. after a port call). The belt has stretched with use; the same problems were experienced on FR6/91. It seems that the belt needs to be replaced more regularly than is the current practice!

AIR CONDITIONERS

The air conditioners in both the VAX and Operations room required constant supervision and regular defrosting. This is a long running problem when in near-equatorial regions.

GYRO

Due to the fact that the replacement GYRO (fitted in Lae at the start of the cruise) was incompatible we were forced to use the old GYRO with its huge direction dependent errors. During Leg 2 experimentation with the SDC boards found that the new one (a new version, installed prior to FR5/92) was the cause of the large errors (range of about 11 degrees error). Reinstatement of the old SDC board saw the error return to about 0.5 degrees.

MICROS

No problems were experienced with any of the PDP's.

GPS

Coverage was virtually 24 hours per day and SA was active. Occasionally when GPS faltered wildly inaccurate SATNAV fixes were observed on the DELP screen.

ADCP

The ADCP itself worked well, however GYRO problems coupled with GPS-SA severely reduced the accuracy of data collected 'real-time' during Leg 1. It was fortunate that in Leg 3 there was sufficient time to repeat ADCP transects conducted in Leg 1.

CTD

At the start of the cruise there were several problems with the software, but these were related to Time problems mentioned above. The new logging software works well and saves about fifteen minutes per CTD cast. The screen dump printer caused a few hassles with paper jams, resulting in losing the screen dump. Presently upon cessation of the screen dump the T-S curve is automatically removed from the screen. It would be useful if this were not the case as subsequent manual screen dumps then miss out on this figure.

TRILOG occasionally dropped out for no apparent reason during CTD casts.

PDR

The comparatively new PDR is an excellent instrument. The only problem encountered with it was that the PDR logging software reset does not reset the PDR unit and printer with a usable set-up. This should be changed.

HYDRO

During FR5/92 the automatic transfer of CTD data to the HYDRO program was disabled to allow testing/development of a PC based version of HYDRO, however this measure was not reversed at the cessation of the cruise. As a result during FR6/92 all data had to be entered manually; this was an avoidable inconvenience.

CRUISE REPORT FR06-92

Technician: P Adams

Date: 4-Aug-92

GYRO

A new S.G Brown Gyro (SGB 1000) was installed in Lae by service engineer,Joe Monahan.After the unit was operational several hours were spent trying to interface the unit to the Synchro to Digital converter.The correct voltages appeared to be present however the converter would not follow correctly.It was swapped back to the old gyro and worked correctly.A modification to the wiring diagram was faxed to the boat from the parent company in England,using this modified wiring circuit the correct voltage swing could not be obtained from the S2 & S3 winding.

R1 & R2 approx	26.5V @ 390Hz
S1 & S2 approx	2.5V - 10.5V
S1 & S3 approx	2.5V - 10.5V
S2 & S3 approx	4.1V - 5.5V

Due to limited documentation,further work on the unit was delayed until more information on the unit was obtained.

The contact at the parent company,Mr P Machin,indicated that a modification kit was available to interface the new unit to the old MK10.

The logged gyro error observed on leg2 of FR05 was traced to a new synchro to digital converter board.The board was replaced,the error returning to approx 0.5 degrees.The new board will be returned to Hobart for further checking.

The Shipmate satnav would not interface to the SG1000 synchro output due to the non standard S2/S3 voltage.

The step by step o/p from the gyro also appears to be non standard.The voltages measured are as follows

Phase 1	-11vdc to -56vdc
Phase 2	-46vdc to -56vdc
Phase 3	-11vdc to -56vdc

Voltages measured with respect to the common i/p.

The phase 2 led on the heading i/face board would not change state when the gyro was precessed.The other two phases appear to be operating correctly.

MICRO 3

The Clock Timer Interface board was replaced when the individual micro's failed to keep the correct time.

The board had small amounts of corrosion from the leaky ni-cad backup batteries and was full of dust.A spare board was installed whilst the old one was repaired.

The batteries off both boards were removed and new sets will be installed prior to the next cruise.The original board has been re-installed.

VAX

The vax would not boot,intermittently,stopping before VMS was loaded into memory.The boot tape was cleaned and all the boards were reseated in their sockets.Following this a solid,10% or greater memory error,occurred.

The fault was traced to a faulty floating point board.The board was removed,and the system was able to boot correctly.The edge connector,ic sockets and ic contacts were cleaned and re-inserted.

Following a shutdown,due to air conditioner icing,the system failed to boot from drive 0.The boot operation was changed to drive 1,getting the system operational.

The drive belt on drive 1 was re-installed and the drive operated correctly.A new belt should be installed when the system is next serviced and drive 0 should be checked.

After leaving Madang the floating point board was re-inserted and the boot operation returned to drive 0.The system is at present operational,however it should be given a major service at the next port period.

CTD 4

CTD 4 was installed in the 12 bottle rosette prior to the start of the cruise.

The salinity trace became noisy and due to the limited time available CTD 1 was installed in it's place.

During the replacement of the conductivity cell,deep pitting was observed around the sensor o'ring seals,on the sensor housing.
The housing was removed and all o'ring surfaces were machined.The unit was re-assembled and tested to 500 meters.The new conductivity cell appeared to be functioning correctly.

The unit will be shipped back for re-calibration after the cruise.

CTD 1

The oxygen sensor and receptacle on CTD 1 was replaced.The new receptacle required modification to the thread to enable installation.This unit will be shipped back to Hobart for calibration after the cruise.

ALTIMETER

The altimeter on CTD #1 failed after several casts it was replaced with the altimeter off CTD #4.

The unit failed due to salt water ingression of the transducer.One side of the transducer measured 46 ohms to the case,the other side also indicated leakage measuring 500K ohms to the case.

For comparison the operational transducer was checked and it as also showing signs of leakage at 3 Megohms.

HONEYWELL MONITORING SYSTEM

The ship's monitoring system would not come on line after a power interruption.The fault was traced to a sticky boot tape in the electronics workshop.

MISCELLANEOUS

HOLD STORAGE

During the cruise the CTD units had to swapped.This exercise proved dangerous for both the equipment and the personnel involved due to the improper stacking of drums and boxes in the area.(if the weather had been rough it would have been too dangerous to attempt the removal of the CTD) The only way to guarantee safe access to the electronic equipment in this area is to have some form of control over the space (ie a partition between the electronics/oms area and the rest of the hold).This would allow the area,if required,to be stacked in an orderly fashion with some guidance/help from oms/electronics personnel.

EQUIPMENT TO HOBART

Fluorometer,battery pack and spares.
Ctd #1,Ctd #4,u/w spares.
1150 deck unit and spares.
Pdp Wren disk drive.
PH probes.
SDC board and lead.
Met Station deck unit.
Altimeter plus spare boards.
Portable Sony Cro.
Dec pdp 11/73 CTI timer board.

CTD Processing Notes
Fr06/92
D.J. Vaudrey

General.

Note: This data had previously been issued with incorrectly applied temperature calibration coefficients. This report applies to the revised data.

RV Franklin cruise Fr06/92 was predominately a mooring recovery cruise in equatorial water adjacent to Papua New Guinea and was divided between two projects under the Chief Scientist Dr Eric Lindstrom. 47 CTDÕs were carried out in and around Vitiaz Strait to support the Moored current meter array in the New Guinea coastal undercurrent. The Second mooring recovery was the joint Australian-Japan Moored Instrument Array on the equator.

The cruise was commenced with CTD unit 4, which was changed after Station 10, as the real rime display trace appeared noisy. CTD unit 1 was placed in the rosette. Unfortunately a new master file was not instituted with the change in CTDÕs and some software modifications had to be carried out to enable processing to proceed using only one master file. Post cruise examination of the data from CTD unit 4 did not reveal any problem with the data from Unit 4 and could only be put down to the fact that it was the first time that this scientific party has used the revised real time display and was not familiar with its form. Logging failures also occurred during station 9 and 10, and system time was incorrectly set at one stage.

This cruise was the first cruise calibrated using temperature calibration coefficients scaled in t90 units. Some changes had to be made to software to ensure temperatures used internally within the SAL78 routines were t68 units.

Station List.

1. 6 bottles fired at 750 decibars.
2. Rosette ramp set at position 6 and positions 1, 2, 3 10, 11 and 12 fired at 750 decibars for test firing.
3. No apparent problems.
4. No apparent problems.
5. Lost data communications on upcast ~ 872 decibars. Data logging failed. Data returned at 424.9 dBar. Restarted logging as station 6 for samples.
7. Observers commented Sal trace seemed spikey.
8. No apparent problem.
9. System rebooted, due to file handling problem. Time not set correctly.
10. Did not wait for thermometers at rosette position 2 to equilibrate due to shoaling bottom.
11. First station with CTD # 1. Replaced CTD #4.
12. Thermometers at position 2 hungup.
13. System time notice out by 24 minutes.
14. Misfire at position 7. Indicated out of synchronisation on refire. Bottle 9 closed at surface.
15. No response from Bottle 4, OK on retry.
16. No apparent problems.
17. DO sensor erratic on upcast. Misfire at position 1, retry OK. Misfire at position , but probably successful.
18. No apparent problems.
19. No apparent problems.
20. No apparent problems.
21. No apparent problems.
22. Altimeter not working?
23. Close approach to bottom to test altimeter. Misfire indicated at position 5, appeared to have fired.
24. Altimeter NOT working. No response from altimeter on first attempt to fire position 4.
25. Altimeter playing up again.

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26.     No apparent problems.
27.     Altimeter working intermittently.
28.     Altimeter no working.
29.     No apparent problems.
30.     Data logging failed during upcast, successfully restarted.
31.     No apparent problems.
32.     No apparent problems.
33.     New altimeter fitted.
34.     Aborted first dip due to bow thruster failure.
35.     No apparent problems.
36.     No apparent problems.
37.     No apparent problems.
38.     No apparent problems.
39.     Misfire indicated on position 6, but appears to have fired.
40.     No apparent problems.
41.     No apparent problems.
42.     No apparent problems.
43.     No apparent problems.
44.     No apparent problems.
45.     No apparent problems.
46.     No apparent problems.
47.     No apparent problems.

Calibration Information.

Temperature  Coefficients (T-90) - (November 92 Post cruise temperature calibration)
        Stations 1-10   - Unit  4
                Temperature Bias =0.99966
                Temperature Offset = +3.3508e-06 oC
        Stations 11-47  - Unit 1
                Temperature Bias = 0.99983
                Temperature Offset = -2.9976 e-03 oC

Conductivity (Cell Factors)
                S.D Salinity following calibration =  0.0026 psu
                        using 336 out of 413 bottles.
Offset Term     Cond Term       Stn. Dep. Term

Stations      1, 10  pres. bounds       0.0  6500.0, edit=  2.8
-.34056281E-02   0.10017523E-02 -.41503020E-07,  n =      59
                std. dev. =     0.48148E-02

Stations     11,  20  pres. bounds       0.0  6500.0 edit=  2.8
-.69280709E-01  0.10010253E-02  0.80606505E-08,  n =      65
                std. dev. =     0.15008E-02

Stations     21,  29  pres. bounds       0.0  6500.0 edit=  2.8
-.66060930E-01   0.10011844E-02 -.53820748E-08,  n =      64
                std. dev. =     0.19122E-02

Stations     30,  47  pres. bounds       0.0  6500.0 edit=  2.8
-.66908348E-01  0.100009163E-02 0.62397590E-08,  n =     141
                std. dev. =     0.21519E-02

Pressure Offset (Individual Stations)

station 001    offset = -4.40   station 002    offset = -4.40
station 003    offset = -4.90   station 004    offset = -4.20
station 005    offset = -4.30   station 007    offset = -4.30
station 008    offset = -4.20   station 009    offset = -4.00
station 010    offset = -4.70   station 011    offset = -1.10
```

```
station 012    offset = -1.10   station 013    offset = -1.00
station 014    offset = -0.60   station 015    offset = -1.00
station 016    offset = -0.60   station 017    offset = -2.10
station 018    offset = -1.60   station 019    offset = -1.60
station 020    offset = -2.00   station 021    offset = -1.80
station 022    offset = -1.90   station 023    offset = -1.30
station 024    offset = -2.20   station 025    offset = -1.20
station 026    offset = -1.20   station 027    offset = -0.90
station 028    offset = -1.10   station 029    offset = -1.10
station 030    offset = -0.70   station 031    offset = -1.60
station 032    offset = -1.20   station 033    offset = -2.00
station 034    offset = -1.60   station 035    offset = -1.30
station 036    offset = -1.40   station 037    offset = -1.80
station 038    offset = -0.90   station 039    offset = -1.30
station 040    offset = -1.20   station 041    offset = -1.00
station 042    offset = -1.20   station 043    offset = -1.40
station 044    offset = -0.60   station 045    offset = -0.70
station 046    offset = -0.90   station 047    offset = -0.80

Station 1 - 10  (Unit 4)
Down cast First Order :+8.4561e-03      Upcast First Order : -5.3668e -03
    Ò        Second Order : -1.3702e-05    Ò   Second Order : -3.1088e-06
    Ò        Third Order : -+6.7540e-09    Ò      Third Order : +3.7279e-09
    Ò        Fourth Order : -1.3336e-12    Ò      Forth Order : -9.6233e-13
    Ò           Fifth Order : -1.3702e-17          Ò      Fifth Order : +7.6358e-17

Station 11- 47  (Unit 1)
Down cast First Order :+8.6203e-03      Upcast First Order : -2.6182e -03
    Ò        Second Order : -1.3318e-05    Ò   Second Order : -1.6092e-06
    Ò        Third Order : +7.4695e-09     Ò      Third Order : +2.7248e-13
    Ò        Fourth Order : -1.6429e-12    Ò      Forth Order : -7.8409e-13
    Ò           Fifth Order : +1.2231e-16          Ò      Fifth Order : +6.5036e-17
```