HYDROGRAPHIC RECONNAISSANCE SURVEY FOR THE MOONLIGHT HEAD 3D SEISMIC CAMPAIGN

FUGRO SURVEY JOB NO. - HY16611

Client	:	Benaris Energy NV 27 Howitt Street South Yarra, 3141 Victoria
Date of Survey	:	2 - 8 October, 2003
Date of Report	:	31 October, 2003
Checked	:	_____
Authorised	:	_____

CONTENTS

FIGURES

TABLES

APPENDICES

DRAWINGS

FUGRO DRAWING NO.	DESCRIPTION	SCALE
16611_001	GEOSWATH BATHYMETRY (1 OF 3)	1:10,000
16611_002	GEOSWATH BATHYMETRY (2 OF 3)	1:10,000
16611_003	GEOSWATH BATHYMETRY (3 OF 3)	1:10,000
16611_004	GEOSWATH BATHYMETRY – EXTENSION OF TURNING AREA	1:2,500

EXECUTIVE SUMMARY

Fugro Survey Pty Ltd (Fugro) was contracted by Benaris Energy NV (Benaris) to provide hydrographic survey services for a reconnaissance survey for the Moonlight Head 3D Seismic Campaign in the Otway Basin. Operations were undertaken between 2 and 8 October 2003, using GeoSwath multibeam bathymetry system and high Starfix.Spot dual frequency DGPS positioning system. Operations were conducted from the 16 metre utility vessel, 'MV Lauren', operating out our Port Fairy, on a 12 hour/day operational basis.

The survey was conducted along in the vicinity of the NE (inshore) boundary of the proposed Seismic Survey Area and the extended Vessel Turning Areas at the NW and SE ends of the defined Seismic Survey Area. The survey coverage was directed specifically to locate and map the position of the 20m isobath as well as a shoal area in the SW extension of the eastern vessel turning area. Survey coverage is therefore not continuous along the defined survey and vessel turning boundaries.

North of 5716800 N the 20m isobath lies 50–1,900m outside (inshore) of the defined vessel turning and 3D survey areas. South of this latitude the 20m isobath lies 300–500m inside (ie. to SE) of the defined vessel turning and 3D survey areas. Shoal areas of less than 15m occur regularly along the nearshore limits of the survey coverage throughout the area.

There is a shoal area approx 1km SE of the eastern vessel turning are boundary where minimum water depth of 19.8m occurs.

The shallow areas along the shoreline, particularly to the south of 5716800 N and in the shoal area to the SE of the planned survey area represent potential hazards to planned survey operations.

Recommendations include aappropriate consideration of the bathymetry information for survey planning and application of extreme caution when operating in the proximity of the defined shallow areas (less than 15-25m depth +/- 0.7m).

1.0 INTRODUCTION

1.1 The Project

Fugro Survey Pty Ltd (Fugro) was contracted by Benaris Energy NV (Benaris) to provide survey services for a hydrographic reconnaissance survey for the Moonlight Head 3D Seismic Project in the Otway Basin, Victoria. This report detail the methods adopted during the reconnaissance survey and the results obtained during the survey.

The project was required to provide bathymetry information to assist in the planning of the upcoming Moonlight Head 3D seismic survey. Proposed sail lines for the seismic vessel were planned to run close to the coastline approximately between Curdle Inslet and Moonlight Head. The published bathymetry along this section of coastline was not suitable to adequately plan for the seismic survey. The reconnaissance survey was undertaken to determine bathymetry along the inshore edge of the proposed seismic survey area to essentially ensure that there is enough water depth to carry out the seismic operations.

The survey was conducted along the shore edge of the proposed Moonlight Head seismic area approximately 41km in length. It extended along the coastline from a point southeast of Warrnambool to a point south of Port Campbell. A further survey was carried out on request of the Client Representative in the southern most section of the Provisional Benaris Turning Area to identify shallow areas highlighted on the Admiralty Chart for the area. The area of operations is shown overleaf in the general location diagram in Figure 1-1.

Fugro chartered the 16m utility vessel *MV Lauren* from Undersea Marine Pty Ltd (Undersea Marine) for the project. Survey operations were carried out from 2-8 October, 2003.

The primary instrument used to conduct the survey was a Geoacoustics GeoSwath system. This system provided a swathe of high-density seabed bathymetry data perpendicular to the vessels track.

The seabed data evaluation included in this report has been conducted in accordance with the terms of the contract between Fugro and Benaris covered by the Service Warranty presented in Appendix A.

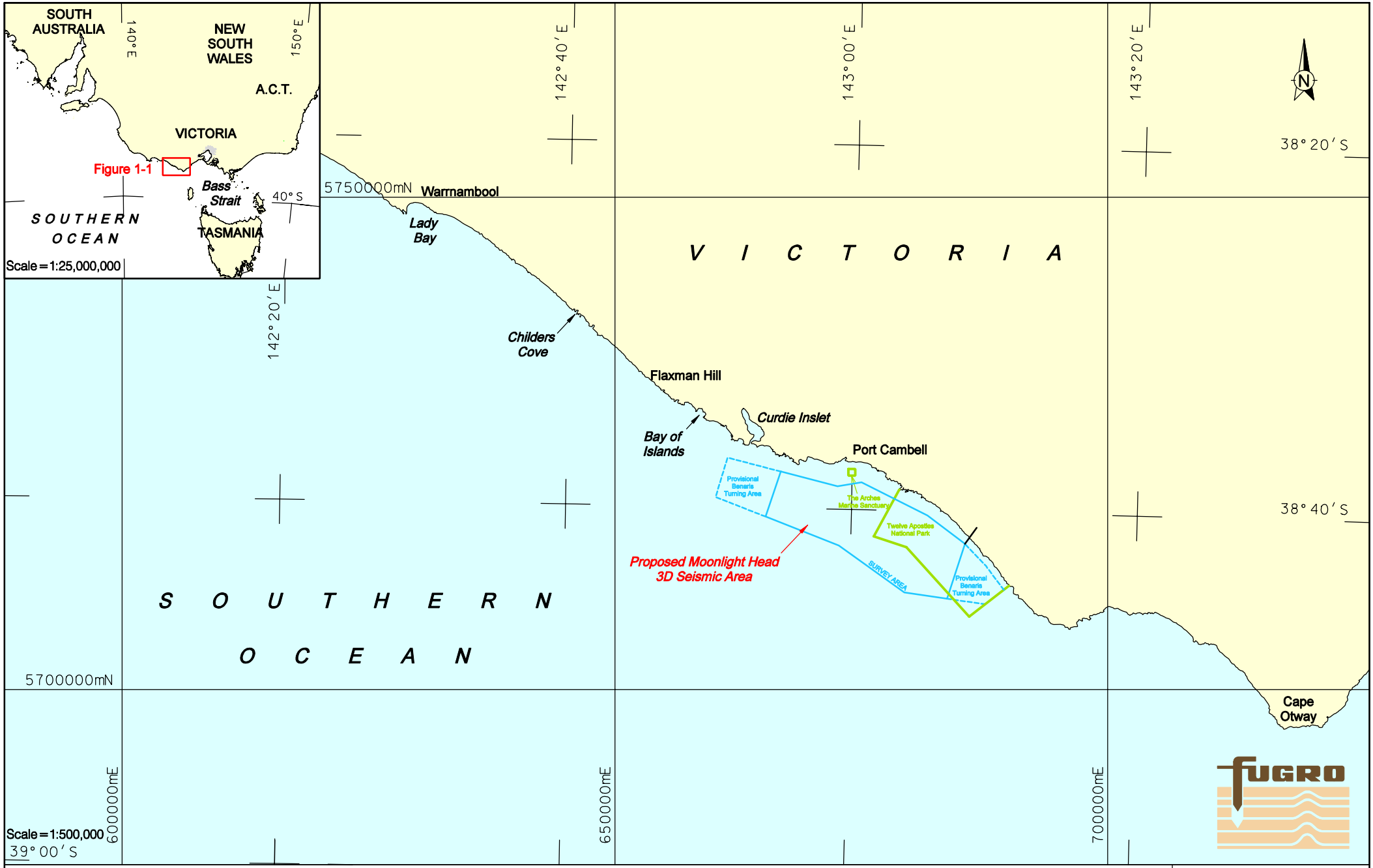
1.2 Project Objectives

The objective of the survey was to delineate shoal areas with the potential to impact on the seismic vessel operations. The focus of this survey was along the northeast (inshore) edge of the proposed Moonlight Head 3D seismic survey area.

1.3 Scope of Work

In order to achieve the objectives identified in Section 1.2, Fugro's services were employed for the following data collection purposes:

- To accurately measure and map the water depth, and to identify any variations in the seabed topography where water depth are less than 25m.
- To acquire bathymetry data over any areas within the proposed seismic vessel turning areas where water depths are less than 25m.



GENERAL LOCATION DIAGRAM

FIGURE 1–1

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- To acquire bathymetry data along the inshore most limits of the seismic survey area and the nearshore extents of the turning areas.

- To acquire bathymetry data over any other locations close to the seismic investigation where these water depths may potentially impact the conduct of the seismic survey.

Fugro provided the following systems/services for the purpose of acquiring the above data:

- Vessel positioning and survey navigation.

- Swathe bathymetry system for bathymetric mapping of water depth and seabed topography.

- Single beam echo sounder (SBES) for measuring water depth along the survey tracks.

- On-board digital data acquisition, recording and processing systems.

- Suitably experienced survey personnel.

- Onshore data processing, mapping and reporting services.

The original scope called for the following areas to be surveyed:

- A single 30km line along the nearshore limits of the seismic survey area and associated vessel turning areas.

- A series of small survey areas at locations where the water depths along the near shore limits of the seismic survey and turning areas could possibly be less than 25m.

At the start of survey operations the Client Representative instructed operations to be targeted at delineation of the 20m isobath at the inshore limits of the survey area and vessel turning areas as well areas shallower than 20m within the defined scope to the survey. Survey objectives and line coverage were adjusted accordingly.

Survey lines were run with a real time display of the (tidally uncorrected) GeoSwath depths enabling the Client Representative to decide where infill lines were required to fulfill the scope of work.

The quality and work procedures followed during the course of operations were linked to Fugro's HS&E management system and all activities conducted were carried out in accordance with the requirements of these HS&E procedures

The project involved data acquisition and processing, resulting in a report and drawings being delivered to Benaris in both hard copy and electronic format.

1.4 Reporting Format

The submitted report describes the survey results, equipment, field procedures, data reduction techniques and health, safety and environmental matters. The report also contains the appendices, providing supporting documentation and additional details for the project.

The drawings included display the bathymetry at a horizontal scale of 1:10,000 plus a 1:2,500 scale drawing of the Provisional Benaris Turning Area survey.

The report is supplied to Benaris in hard copy format and also digitally in Adobe pdf format and the final drawings supplied digitally in Microstation DGN format.

2.0 DATA REDUCTION

After completion of the field work, all electronic and hard copy records were returned to Fugro's Perth office for processing and reporting. The processing, interpretation and charting procedures used are briefly explained in the following sections.

2.1 Navigation

The navigation data obtained were of good quality and editing of the data logged in Starfix.Seis was completed offshore and required no further onshore processing. The editing process involved each survey runline being checked for navigation spikes using Swath32. The package offers a graphical page to replay the recorded vessel track along the runline and interactive editing of data spikes, if required. Trackplots were produced for the multibeam data.

2.2 Multibeam Bathymetry

The project required a significant amount of multibeam data QC and processing (primarily velocity, tidal and draft corrections and first pass spike removal) to be undertaken during the survey to confirm adequate coverage, provide preliminary bathymetry and plan adjacent survey lines.

The GeoSwath processing suite was used, to perform the above mentioned corrections. For the first pass spike removal of the multibeam data set, an automatic de-spiking process was perform using an along and an across track filter. These filters remove data that is statistically bad.

Manual editing of data in Fugro's Starfix software (Surface) using a cross profile scan method was then performed post survey to refine the spike editing process.

The resultant data set was gridded using the parabolic method with parameters applied as noted in Table 2-1. Full electronic datasets (gridded and ungridded) were provided to the client.

Location	Bin Size	Search Radius	Gridding Method
Moonlight Head	1m	2m	Parabolic

TABLE 2-1 : MULTIBEAM GRIDDING PARAMETERS

Following gridding of the GeoSwath data, for charting purposes, the soundings were colour banded at 5m interval and bathymetric contours generated for inclusion on the final drawings.

Depths were reduced to Lowest Astronomical Tide (LAT) using predicted tides derived from the simple harmonic motion constituents published in the Australian National Tide Tables for Warrnambool (Port Number 61380). LAT at this location is 0.5m below MSL.

2.3 Sound Velocity Profiles

Speed of sound was determined by measured profile dips taken at three locations across the surveyed areas. The data was entered into the Swath32 software where the velocity profiles closes to each sounding was applied.

Profile data is tabulated and displayed graphically in Appendix B.

2.4 Single Beam Echo Sounder

The high frequency (200kHz) bathymetry data from the echo sounder were edited in Starfix.Proc to remove any spikes and gross anomalies and provide a comparison and QC check with the multibeam bathymetry for the offshore survey.

Depths were reduced to Lowest Astronomical Tide (LAT).

The predicted tidal data is included in Appendix C.

3.0 RESULTS

The results of the Moonlight Head Reconnaissance survey are presented as three 1:10,000 scale, four panel alignment drawings. Each drawing contains two track chart panels and two bathymetry panels (Drawing Nos. 16611_001 to 16611_003). The survey of the extension of the Provisional Benaris Turning Area is presented as a 1:2,500 scale drawing showing the shallowest areas (Drawing No. 16611_004).

3.1 Data Quality

3.1.1 Navigation & Positioning

The Starfix.MRDGPS and F180 systems provided reliable, stable and accurate positioning. Monitoring throughout the project confirmed the systems were performing within specifications.

Vessel line keeping was reasonably good overall. Large swells and cross winds were occasionally experienced and some difficulties in line keeping occurred. Where such occurrences significantly affected data quality, the survey line was re-run for improved data quality.

The vessel track and survey coverage is presented in the track chart panels (panels 1 and 3) on each of the drawings.

3.1.2 Bathymetry Data

Both the GeoSwath bathymetry and single beam echo sounder data were of a suitable quality for reconnaissance survey purposes. The GeoSwath system was calibrated with an initial speed of sound calculated from an SVP dip prior to calibration. Subsequent speed of sound profiles were applied to the data in post processing.

All seabed depth values referred to in this report are derived from edited and tidally reduced data. The bathymetric soundings are reduced to Lowest Astronomical Tide (LAT) using predicted tides for Warrnambool. Tidal mismatching of 0.2-0.3m is evident in some adjacent lines suggesting the published constituents do not accurately model the physical tides offshore from the port location.

The prevailing weather patterns during the survey resulted in large long period swells being experienced during data collection. The motion systems used on this project were a Coda Octopus F180 and a TSS DMS05. Both systems handled the conditions remarkably well with little evidence of artefacts from the long period swell remaining in the processed data. Inevitably, with the focus on the longer period swell, there is evidence of the smaller wave motion remaining in some of the data.

The GeoSwath system did not perform well when the vessel experienced sharp rolling motions in adverse sea conditions. The scattered “gaps” in the colour coded bathymetry drawings are evidence of this problem. Some of these lines were re-run in critical areas, however it was not considered necessary where the water depth was deep enough.

3.2 Seabed Topography

The survey coverage along the northern boundary of the 3D seismic area and adjacent vessel turning area was carried out to obtain delineation of the 20m isobath. As a result, the water depths reflected in the survey results occur predominantly in the range of 10–30m and survey coverage is not continuous along the defined inshore boundary of the 3D survey area and vessel turning areas. Discussion of the survey results is therefore based on reference to the 20m isobath in relation to these defined boundaries.

To the north of latitude 5716800 N (refer to Drawing No. 2, panel 4) the 20m isobath lies at a variable distance of 50-1900m shoreward of the 3D survey and vessel turning area boundaries (refer to Drawing No. 1, panels 2 and 4). Within this area, minimum depths of 19.7m occurs at a closest range of approximately 50m from the 3D survey boundary at 5721000 N (refer to Drawing No. 2, panel 2). Water depth shoal rapidly from 20m to less than 10m in several places.

There is no survey coverage of the west vessel turning area boundary, however the survey coverage to the north indicates depths of 20m or less occur at a range of 450m from the north boundary of the vessel turning area at the west end.

At latitude 7716800 N the 20m isobath intersects the north boundary of the 3D survey area and occurs at a variable distance of 300–500m inside (ie. to the SE) of the boundary of the 3D survey. The 20m isobath lies almost parallel to the boundary of the survey area and this trend continues in a SE direction up to the east boundary of the vessel turning area (refer to Drawing No. 3, panel 2). Within this area, water depths typically shoal gradually to between 14.5–15.0m at the north limit of the survey data coverage. The inshore survey coverage extends 5km further east along the shore line reaching a closes approach of approximately 500m from the charted shoreline (refer to Drawing No. 3, panel 3). The 20m isobath continues along the SE trend, however shallowest depths between 10m and 11m occur in several places at the inshore limit of the survey coverage.

As noted in the east vessel turning area, the 20m isobath lies between 300–500m inside (ie. to the SE) the defined boundary and minimum depth of 13m is recorded at the NE boundary (refer to Drawing No. 3, panel 2).

Survey coverage was extended to the SE of the vessel turning area boundary to map a charted shoal area. The shoal area occurs approximately 1km SE of the defined vessel turning area boundary (refer to Drawing No. 3, panel 4). The shoal is broadly defined by the 35m isobath and a complex of several smaller shoals with water depth of less than 25m. A detailed drawing of the shoal area is provided (refer to Drawing No. 4). Shallowest depth of 19.7m occurs at 687878 E 5707520 N with other shoal areas in the depth range of 22–24m occurring to the SE.

Extreme caution should be taken if survey operations are to be conducted in the vicinity of the defined areas of shallow water with less than 20m depth.

4.0 CONCLUSIONS AND RECOMMENDATIONS

The scope of work and survey objectives for reconnaissance multibeam bathymetry survey along the NE boundary of the proposed Moonlight Head 3D seismic survey operational area was successfully completed in survey conditions that varied from fine to moderate. The following results were achieved:

- Water depths delineating the 20m isobath were mapped in the nearshore extents of the northern 3D survey and vessel turning area boundaries and extensions thereof.

- Bathymetry data was obtained over locations close to the seismic investigation in the nearshore areas as well as in the extension of the eastern vessel turning area. Additional survey coverage was obtained at this location. Where water depths of less than 25m were noted, this may potentially impact the conduct of the seismic survey.

- The survey equipment performed well throughout survey operations. The Geoacoustics GeoSwath system proved to be a useful tool for undertaking this type of reconnaissance survey. Generally it performed well in the weather conditions that were encountered.

From these survey results it is concluded that:

- The 20m isobath lies shoreward of the defined survey and turning area boundaries along a large part of the boundary north of 7716800 N and it is surmised therefore that water depths of greater than 20m occur along the defined boundary which was not covered by the survey data. However, it must be noted that the assumption of deeper water occurring along this defined boundary area is based on available published chart data only.

- South of 7716800 N the 20m isobath lies 300–500m inside the defined boundary area and shoal areas of less than 15m occur closer to shore. These shoal areas are considered potentially hazardous to vessel operations.

- Minimum water depths of 20m and 13m occur in the survey data coverage in the vicinity of the of the NW and SE vessel turning areas respectively.

- The shoal area in the SE extension of the eastern vessel turning area has charted depths of less than 25m and shallowest depth of 19.8m. It therefore poses a potential hazard to vessel operations.

In considering various contributory factors including the survey conditions during data acquisition as well as post processing parameters, the accuracy of the charted reconnaissance survey water depths is estimated to be +/-0.7m. Positional accuracy of the MRDGPS system and charted information is +/-3m.

Based on the survey results, it is recommended that:

- Appropriate consideration of the bathymetry information provided is given in planning of survey operations; and

- Operations in the proximity of the defined shallow areas (less than 15-25m depth +/- 0.7m) are conducted with extreme caution.

5.0 PROJECT CONFIGURATION DATA

5.1 Geodetic Parameters

All coordinates supplied in this report are referenced to the Geocentric Datum of Australia (GDA94). GPS operates in reference to the World Geodetic System 1984 (WGS84). There is negligible difference between WGS84 and GDA94, and no transformation is required when converting from WGS84 to GDA94. The geodetic parameters are listed below:

Datum	**:**	**WGS84**
Reference Spheroid	:	World Geodetic Spheroid 1984
Semi-Major Axis	:	6378137.000m
Inverse flattening (1/f)	:	298.257223563
Datum	**:**	**GDA94**
Reference Spheroid	:	Geocentric Reference System of 1980(GRS80)
Semi-Major Axis (a)	:	6378137.000m
Inverse flattening (1/f)	:	298.257222101
Projection	**:**	**Universal Transverse Mercator**
Grid	:	Map Grid of Australia (MGA94)
Central Meridian (CM)	:	141° East (UTM Zone 54)
Origin Latitude	:	0°
Hemisphere	:	South
False Easting	:	500000m
False Northing	:	10000000m
Scale Factor on CM	:	0.999600
Units	:	International Metres

5.2 Horizontal Control

The coordinates of the Starfix.DGPS reference stations used during the project to reference the satellite positions are presented in Table 5-1.

STARFIX DGPS REFERENCE STATIONS					
Station	**Id**	**Latitude**	**Longitude**	**Height**	**Uplink**
Melbourne	385	37° 48’ 29.029” S	144° 57’ 48.019” E	82.101m	Optus/APSat
Bathurst	336	33° 25’ 46.902” S	149° 34’ 01.959” E	756.784m	Optus/APSat
Adelaide	355	34° 55’ 51.842” S	138° 36’ 12.776" E	54.427m	Optus

TABLE 5-1 : STARFIX DGPS REFERENCE STATIONS (WGS84)

5.3 Vertical Control

Bathymetric data has been reduced to lowest astronomical tide (LAT) using constituents published in the Australian National Tide Tables (ANTT) for Warrnambool (port number 61380).

6.0 SEQUENCE OF EVENTS

On 2 September, 2003, the vessel was mobilised from a previous project carried out in the same area, and, after a weather delay and equipment checks, the survey was carried out from 4 - 6 October, 2003. The following day the Client Representative confirmed adequate coverage had been completed enabling demobilisation to commence. Fugro personnel returned to Perth on 8 October, 2003.

Full details of Fugro involvement in the survey are presented in the Daily Operations Reports presented in Appendix D.

7.0 SURVEY EQUIPMENT, VESSELS AND PERSONNEL

7.1 Equipment Listing

Positioning System

3 x Signal down converters/demodulators c/w cables and antennae (1 spare)
2 x Trimble 4000 series GPS receivers c/w cables and antennae (1 spare)

Navigation & Data Logging System

2 x Starfix.Seis navigation software installed on Pentium computers (1 spare)
2 x Helmsman's monitors (1 spare)
2 x SG Brown gyrocompasses c/w power supply, cables, UPS (1 spare)
1 x Maxtor external storage device

Single Beam Echo Sounder System

2 x Odom DF3200 Echo sounders c/w 24khz/200khz transducers (1 spare)
2 x TSS DMS05 motion sensors (1 spare)
1 x Applied Microsystem SVP 16 sound velocity probe
1 x Seabird SBE 19 CTD probe (spare)
1 x bar check

Multibeam Bathymetry System

1 x GeoAcoustics GeoSwath system
1 x Coda Octopus F180 motion sensor system (spare)

Side Scan Sonar System

2 x Glog/Gplot geophysical data processing/recording systems (1 spare)
2 x Geoacoustics dual frequency towfish (1 spare)
2 x Geoacoustics transceiver (1 spare)
2 x 200m soft tow cable (1 spare)

Data Processing

2 x Starfix.Proc/MicroStation/GeoSwath processing computers (1 spare)
2 x Bubble jet printer
1 x Maxtor external storage device

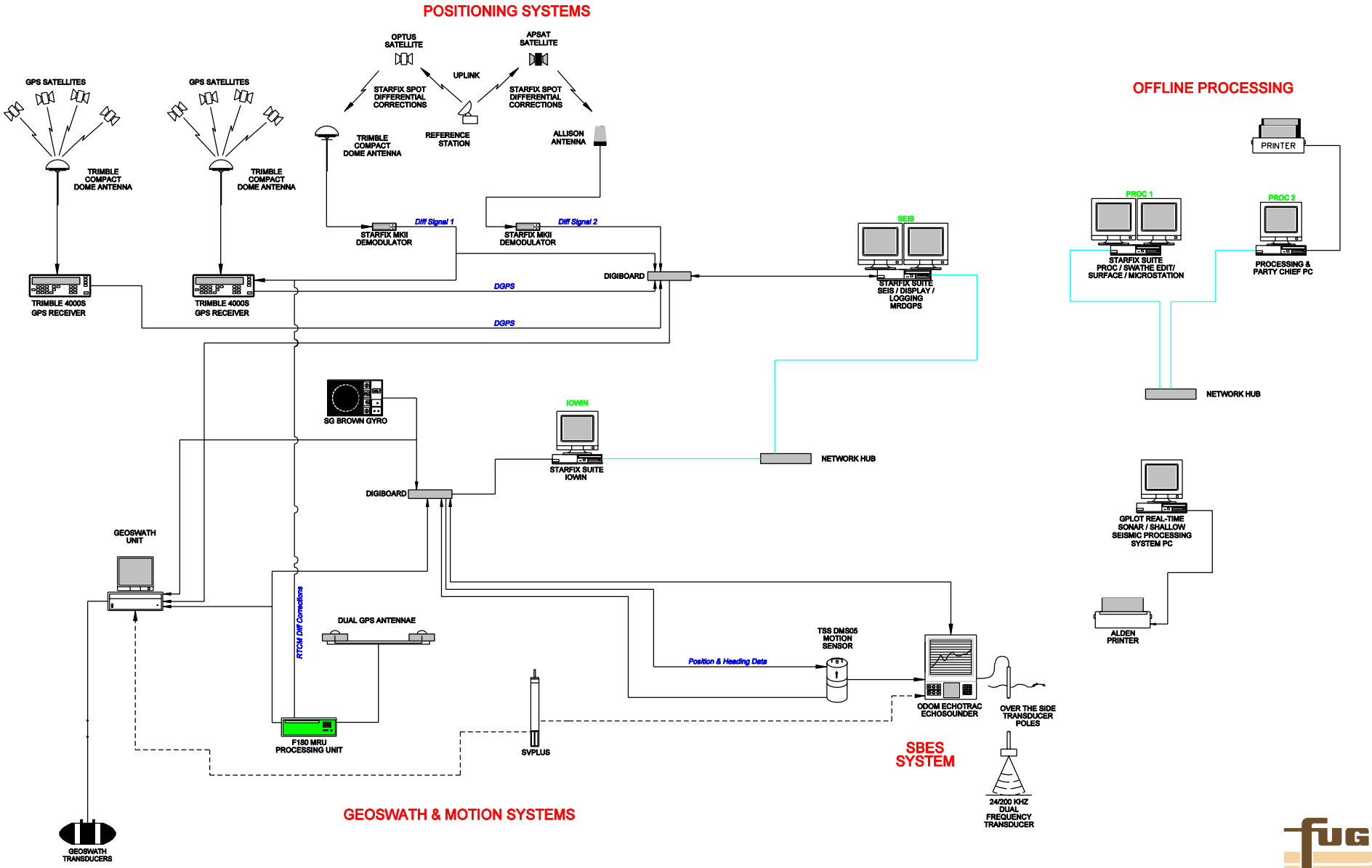
Communications

1 x CDMA phone/fax/e-mail system

Land Survey

1x Leica 1080 total station
2x tripods and prisms

All systems were supplied with associated power supplies, antennae, interconnecting cables, transducers and consumables. An equipment configuration diagram showing the various items and their relationships is included in Figure 7-1.



EQUIPMENT CONFIGURATION DIAGRAM

FIGURE 7–1

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7.2 Survey Vessel

The survey vessel utilised for the project was the *MV Lauren.* The vessel is a single screw, single engine aluminium launch with an overall length of 16m, a beam of 5m and a nominal draft of 1.6m. The vessel is operated by Undersea Marine and was well equipped for the survey operations.

Transducer poles were mounted on the either side of the vessel to carry the GeoSwath transducer on the port side and the single beam sounder transducer on the starboard side. All positioning antennae were mounted on the aft handrail of the fly bridge to ensure satellite masking was minimised. Survey equipment was set up and secured on two tables in the wheel house.

A vessel offset diagram is shown in Figure 7-2.

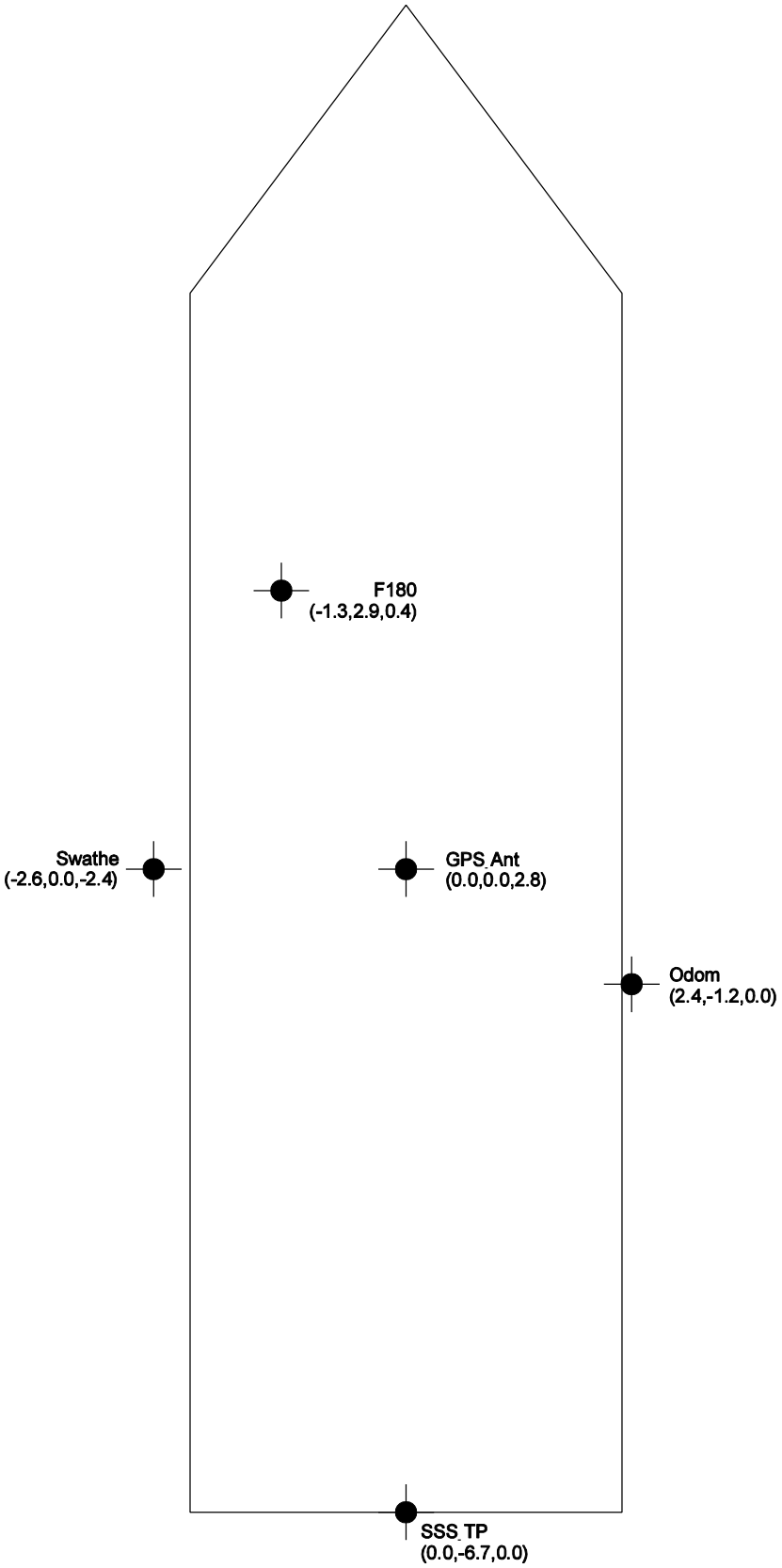
7.3 Personnel

The following Fugro personnel were involved in the survey:

J. Richards	Party Chief/Hydrographic Surveyor
G. Laurent	GeoSwathe Operator
S. Hyde	Processor
A. Janczewski	Technician

Also onboard the vessel for the duration of the project was:

D. Duel	Client Representative



VESSEL OFFSET DIAGRAM – MV LAUREN

FIGURE 7–2

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8.0 TESTING, VERIFICATION & CALIBRATION

Equipment calibrations were carried for the previous project, and are discussed below.

8.1 Gyro Compass Calibration

The SG Brown 1000s gyrocompass was secured in the wheelhouse of the *MV Lauren*. The unit was calibrated between 1445 and 1454 on 17 September, 2003, while the vessel was moored alongside Moyne River Wharf. A diagram depicting the calibration is presented in Appendix E.

The alignment of the edge of the wharf was calculated from measurements from coordinated bollards on the wharf. A series of 15 taped measurements were then made from the edge of the wharf to points on the vessel centreline near the bow and stern of the vessel. These measurements were used to calculate the angle of the vessel's centreline from the known wharf alignment. The time was recorded with each set of measurements so that the calculated heading could be compared to the observed gyro heading simultaneously logged with Starfix.Seis.

The mean correction shown in Table 8-1 obtained for the gyrocompass.

Gyro Compass	Mean Correction
SG Brown	1.52^0

TABLE 8-1 : GYRO CALIBRATION RESULTS

Following the calibration, the correction values were entered in the navigation software for the duration of the project, and were applied to raw incoming gyro compass heading data to provide corrected vessel heading information for all positioning calculations.

Results of the gyro compass calibration are enclosed in Appendix E.

8.2 Static DGPS Verification

The primary positioning system comprised a single frequency Trimble GPS receiver operating in conjunction with Starfix.MRDGPS. Reference stations at Melbourne, Adelaide and Bathurst were utilised. Starfix differential corrections were received from both APSat and Optus satellites. The secondary navigation system comprised the F180 GPS receiver with direct injection RTCM corrections, from the Melbourne reference station via the APSat satellite (Starfix.Spot DGPS).

To establish the integrity of the positioning systems, a taped measurement was made from a coordinated point on the wharf and transferred along the wharf to a temporary mark, adjacent to the primary navigation GPS antenna. Offset measurements were then made from the vessel's common reference point (CRP) to the temporary mark and entered as a fixed offset into the Starfix.Seis vessel file. The observed coordinates of the offset position were then compared directly against the computed coordinates of the temporary mark. Data was logged for the primary system between 1735 and 1745, at one second intervals in Starfix.Seis. The results are summarised in Table 8-2.

Measurement	Easting	Northing
Survey Mark Coordinates	608506.3m	5750246.9m
Observed GPS Coordinates	608506.7m	5750251.5m
C-O Difference	-0.4m	-0.6m

TABLE 8-2 : STATIC DGPS CHECK – PRIMARY NAVIGATION SYSTEM (GDA94)

Details of the static DGPS verifications are enclosed in Appendix F.

8.3 F180 Calibration

The Coda Octopus F180 system was used to supply heave, pitch and roll data to the GeoSwath system and supply secondary position and heading data to the navigation system. The F180 has two main components, an Inertial Motion Unit (IMU), and two GPS antennae, forming a baseline to calculate heading corrections for updating the IMU.

The F180 unit's IMU was placed inside the wheelhouse. Its antennae were mounted on the aft handrail of the fly bridge. Offset measurements from the IMU to the primary F180 GPS antennae were measured with offset tape. Additional offset measurements where made to the CRP and the GeoSwath transducer head from the IMU to enable the output of the unit's heave to be applied to the transducer position.

The vessel was manoeuvred through a series of tight figure eight curves and acceleration changes until the accuracy of the system had achieved an acceptable level. The internal calibration routine within the F180 then resolves the linear and angular offsets, the results of which are shown in Table 8-3. However, whenever the F180 is operating, these values are continually being refined and better calibration values may be saved during normal survey operations, hence they are the initial calibration values only. These manoeuvres were undertaken between 0945 and 1010 on 17 September, 2003, in the bay outside Port Fairy harbour.

The antenna separation distance represents the length of the baseline vector between the two antennae for the system. The calculated distances were then compared to tape offset measurements and proved to be to be within the 5mm tolerance recommended by the manufacturers.

F180 Calibration Results	
X offset	- 3.180 ± 0.033m
Y offset	+ 0.230 ± 0.033m
Z offset	- 2.250 ± 0.413m
Rotation	+ 89.01 ± 0.16°
Elevation	- 0.29 ± 0.12°
Antenna separation	1.53m

TABLE 8-3 : F180 CALIBRATION RESULTS

With the baseline and offsets resolved, the system was fully operational according to manufacturer's specifications.

8.4 Motion Sensor Verification

The TSS DMS05 motion sensor was installed adjacent to the single beam echo sounder transducer pole and configured to output heave corrections to the echo sounder. Correct operation of the motion sensor was tested during mobilisation by raising and lowering the sensor, and checking the magnitude and sign of the heave corrections on the Odom Echotrac DF3200 MK 11 echo sounder.

8.5 Single Beam Echo Sounder Calibration

For this project, the echo sounder transducer (24kHz and 200kHz) was mounted on an over-the-side pole on the starboard side of the vessel. The echo sounder, an Odom Echotrac DF3200 MK 11 was calibrated using a measured sound velocity in the water column and a bar check to determine the transducer draft setting.

At each bar check, the motion sensor was disconnected from the echo sounder and a circular disc deployed directly beneath the transducers at varying depths to 3m below the sea surface. The draft setting in the echo sounder recorder was adjusted to produce a digitised output equal to the depth of the bar. This process was repeated for both the high and low frequencies.

The initial draft values observed and used throughout the project are shown in Table 8-4.

Transducer	Draft
High Frequency – 200kHz	0.95
Low Frequency – 24kHz	0.95

TABLE 8-4 : SBES BAR CHECK RESULTS

A summary of the bar check results and copies of the analogue trace for each bar check are included in Appendix G.

8.6 GeoSwath Calibration

The GeoAcoustics GeoSwath was calibrated on 20 September, 2003, using a four line patch test in accordance with the GeoAcoustics GeoSwath requirements. A prominent ridge on the seabed near the start of the survey area was used as the calibration site.

Prior to commencing the calibration procedure the velocity of sound through the water column was measured using a Seabird SBE 19. The required survey lines were run, and the data collected. The draft of the multibeam echo sounder transducer was calculated by application of a measured offset. All other vessel offsets relevant to the processing of multibeam data had been previously measured, checked and entered to the calibration processing system.

Calibration values were calculated using the GeoAcoustics proprietary software Calibrator32 (via GeoSwath32), and then checked manually in Starfix.Surface. The results of the calibration were used throughout the project. These results are detailed in Appendix H and summarised below in Table 8-5.

Correction	Post Calibration Value
Latency	+0.79s
Roll (stbd plate correction)	+1.34°
Roll (port plate correction)	-0.58°
Pitch	-0.03°
Heading	+1.4
Draft	1.6m

TABLE 8-5 : GEOACOUSTICS GEOSWATH CALIBRATION RESULTS

8.7 Sound Velocity Probe

A Seabird SBE 19 CTD probe was used to determine the speed of sound through the water column. During vessel mobilisation, and prior to departure from Moyne Wharf, the SBE 19 unit was wet tested to confirm correct operation.

The SBE 19 is calibrated by the manufacturer on an annual basis. A copy of the calibration certificate and full details of the SVP results are enclosed in Appendix B.

8.8 Side Scan Sonar Verification

A GeoAcoustics side scan sonar system was carried onboard as a back up for the GeoSwath system. The operation of the side scan sonar was verified during mobilisation using a series of in-built tests, which confirm printing resolution and the accuracy of the slant range and speed processing. The towfish was ‘rub’ tested and ‘wet’ tested to ensure correct transducer operation and that all connections were sound. During the wet test, the return signals were input into the GLog/GPlot system to verify the operation of the digital processing/recording system and the operation of the hard copy printer.

The tow cable was measured and marked in order to obtain accurate layback figures.

9.0 SURVEY OPERATIONS

9.1 Mobilisation & Operational Overview

9.1.1 Project Preparations

This project continued on from a similar one carried out for a different client in the same locality, consequently the project preparations and mobilisation of the *MV Lauren* in Port Fairy had already been carried out. However planning of the proposed survey lines was discussed with the Client Representative on 3 October, 2003.

A key component of the preparation was the compilation of project documentation that included health, safety, environmental, quality management and operational procedures. This was a process that involved close interaction between Benaris and Fugro.

Additional information regarding the preparations is also documented in the Health, Safety and Environment Management section of this report (see Section 10).

9.1.2 Vessel Mobilisation

The *MV Lauren* was mobilised on a previous job which begun on 15 September, 2003, alongside Moyne Wharf, additional survey personnel joined the survey on 29 and 30 September, 2003. Prior to commencing mobilisation tasks, survey personnel undertook a project induction at the Caledonia Inn, Port Fairy. On 2 October, 2003, personnel from Fugro, Benaris and Undersea Marine that were sailing with the vessel attended the project induction. The purpose of the meeting was to provide technical information on the project, to introduce the operational objectives and to develop health, safety and environmental objectives. The HS&E objectives are discussed further in Section 10 of this report and the minutes for the induction are contained in Appendix I.

On 15 and 29 September, 2003, on the previous project, the offshore survey team received vessel inductions, and held a mobilisation JHA/toolbox meeting. Mobilisation activities then resumed. To ensure all necessary survey systems were correctly installed and that basic system checks and function tests were acceptable, a mobilisation and calibration task checklist was implemented, with senior survey personnel taking responsibility for their areas.

The four main work areas on the vessel are summarised in Table 9-1.

The tasks included interfacing of pre-installed equipment, additional equipment installation and interfacing all systems. It was also required to complete static and calibration trials as detailed in Section 8.0.

Area	Key Systems/Activities
Bridge	Navigation systems and helmsman display. SBES and GeoSwath systems. Analogue survey system control. Glog/Gplot system control.
6' spares container	Land based storage area
Processing Room	SBES and GeoSwath QC/data processing. Party Chief workspace. Communications and internet facilities.
Vessel backdeck	Towfish deployment. Transducer pole deployment.

TABLE 9-1 : MOBILISATION AREAS AND SYSTEMS

The Party Chief and Vessel Master inspected all systems to confirm that they were suitably secure and that the vessel integrity had not been compromised.

9.2 Vessel Positioning & Survey Navigation

All surface positioning was performed using Starfix.MRDGPS interfaced to Fugro Survey's Starfix.Seis navigation and data logging system. Seis was operated using the geodetic parameters as detailed in Section 5.1. Both the positioning and navigation systems were installed in the wheelhouse. All navigation antennae were installed on the aft handrail of the fly bridge so that they had clear satellite visibility.

A scaled outline of the vessels and selected sensor positions were displayed at each navigation update, with the position of the selected sensors computed using the interfaced gyro reading and measured offsets from the vessel file. This detail was displayed on the navigation system and helmsman is monitor.

While the navigation system was on-line, all raw sensor data interfaced into the navigation computer were logged to hard disk using Starfix.Logging which created a separate file for each sensor containing sensor specific time tagged data. For each survey line these files were logged to a unique directory based on date and time. As well as the sensor inputs, geodesy, runline information and navigation files were also logged.

Data was output at each fix event to a text file in summary form on the Starfix.Seis computer. This information included date, time, runline name, start and end coordinates, fix number, coordinates of each offset position, quality figure, gyro heading, speed, depth, KP and offset of each offset position. This file contained all on-line system settings and navigation summary data. An example of the Starfix.Seis configuration print out is included as Appendix J.

Survey Run Logs were completed for each line detailing line name, direction, start and end times, start and end fix numbers. A copy of the Survey Run Logs is presented in Appendix K.

9.3 GeoAcoustics GeoSwath Sounder

The GeoAcoustics GeoSwath system was operated at 125KHz and bathymetry data was logged within the systems logging format. The ping rate of between four and six pings per second ensured a maximum rate of data and the system adjusted its actual output for the prevailing water depth. Motion sensor and attitude data from the F180, as well as heading information from the SG Brown gyrocompass were also interfaced to the GeoSwath computer.

The recommended default settings were used in the GeoSwath unit and a sound velocity of 1500m/s was adopted for the project. The sound velocity setting was not changed during the project, and the measured sound velocity profiles were applied to the data during post processing. There was no draft setting in the multibeam unit and the measured draft values were applied to the data in the post processing stage.

The GeoAcoustics GeoSwath was operated throughout the project on variable ranges to ensure that no outer beams were truncated and any bad data was removed in the post processing stage.

9.4 Motion Sensors

9.4.1 Coda Octopus F180

The Coda Octopus F180 was used to provide high quality motion sensor data to the GeoSwath system. The TSS message was output from the unit and interfaced directly into the GeoSwath topside unit. The pitch and roll data was obtained from direct measurements in the F180 IMU. Heave data was calculated for the GeoSwath transducer location by the application of lever arm measurements in the F180 unit.

As discussed in Section 8.3, the system was calibrated in accordance with manufacturer's recommendations at the commencement of the project. Once the calibration solution had been achieved the system maintained a high level of accuracy throughout the surveys.

9.4.2 TSS DMS05

A TSS DMS05 motion sensor was installed on the deck of *MV Lauren* adjacent to the single beam echo sounder pole. Serial heave output was directed to the Odom Echotrac DF3200 MK II echo sounder to provide a real-time heave corrected seabed trace on the echo sounder's paper trace.

The heave bandwidth was set to "long period" (16 seconds) to suit the conditions experienced on site. This figure was monitored throughout the project to ensure ongoing suitability.

9.5 Single Beam Echo Sounder

Corrections from the motion sensor were interfaced to the echo sounder and applied to the raw depth measurements. The echo sounder recorder was configured to output its HEAVE string, where a heave-corrected seabed trace is shown on the paper echo roll along with the raw water depth and heave trace, while the raw water depths plus the heave values were passed to the Starfix.IOWIN computer for logging.

Annotated fix marks, generated by Starfix.Seis were printed on the echo sounder paper roll. Annotations included line name, time and date at start of line, the date, time and fix number at each fix, and the end of line time.

A constant sound velocity of 1502m/s and the transducer draft of 0.95 metres were set into the echo sounder recorder at the start of the survey operations and checked after completion of the run lines. Sound velocity measurements and draft checks were conducted at various times throughout the survey. Negligible changes in vessel draft were observed over the duration of the project. Results from the SVP measurements were only utilised during the post-processing phase.

Results of the bar checks are presented in Appendix G.

9.6 Velocity Probe

An Seabird SBE19 velocity profiler was used onboard the *MV Lauren* to measure the speed of sound in the water column. Sound velocity profiles were taken at regular intervals during the survey operations. The probe was deployed to the seabed over the stern of the vessel manually.

During the survey the GeoSwath was operated using a constant velocity of sound setting of 1501m/s. The measured sound velocity data were used in the post processing of all bathymetric data.

Results for the velocity measurements are presented graphically in Appendix B.

9.7 Data Processing

A data processing workstation was set up at the Caledonia Inn to enable interactive data QC and to speed up the processing and charting progress.

The data processing involved several computer systems and software, including Fugro's Starfix.Proc suite, GeoAcoustics GeoSwath suite and Microsoft Office systems. The computers accessed the data via a Maxtor external hard drive (with a second unit for backup).

The multibeam bathymetry dataset was partially processed onshore. The key aspects of the data analysis were to determine the acceptability of the data quality for meeting the survey objectives, to determine data coverage and to aid the assessment for additional survey runlines.

Further processing of the GeoSwath data took place in Fugro's Perth office.

9.8 Offshore Survey Management

9.8.1 Operational Control

The Party Chief, in consultation with the Vessel Master and the Benaris Representative primarily carried out offshore management of the project. The purpose of this control was to ensure the survey was conducted in an efficient, timely and safe manner. This involved such tasks as identification of work priority, selection of runlines to be surveyed, to minimise non-operational periods, for example periods of low tide, and weather and equipment downtime.

Operational control also involved effective communication with the Fugro office and Project Manager in Perth. Systems onboard that were used to facilitate this were satellite and CDMA phone, fax and e-mail services. Ship-to-shore radio communications were available as a back up to these systems. Key documentation summarising the daily events, reporting on production to date and including any interesting findings were the Daily Operation Reports which were used for the duration of the field operations and are presented in Appendix D.

9.9 Demobilisation

Upon completion of the scope of work the vessel was demobilised in Port Fairy on 7 and 8 October, 2003. Fugro personnel got off the vessel and transited to Adelaide and Perth on 7 and 8 October, 2003, hand carrying all electronic and analogue data.

10.0 PROJECT HEALTH, SAFETY & ENVIRONMENT MANAGEMENT

10.1 Project Preparations

On award of the contract Fugro commenced the planning processes for the project. The plans developed covered many aspects of the project including, Health, Safety, Environment, Quality, Operational and Emergency Response issues and initiatives. These plans reviewed the key objectives for the project and set out how Fugro intended to undertake the operations to comply with the objectives. The plans and key components are discussed in more detail below.

10.1.1 Health, Safety & Environment Management Plan

The Health and Safety Management Plan had a four fold purpose:

- To provide the client with a clear statement of methods by which Fugro will provide its services in a safe manner.
- To define the safety responsibilities, reporting systems and operational procedures that are to be followed by Fugro staff and contractors.
- To act as a bridging document between Fugro's contractors safety systems and the Fugro safety system.

One of the key aspects of this plan was to identify the macro health and safety objectives for the project (other specific objectives were developed later by the individuals directly involved in the project). The macro objectives were:

- Zero fatalities.
- Zero lost time injuries.
- Zero alternate duty injuries.
- Zero medical treatment injuries.
- Minimise health problems.
- Zero environmental incidents (i.e. reports to DMPR).

The Plan brought together many of Fugro's safety work practices in the form of a hazards register which involved a step by step review of the project to identify the key hazards anticipated for different tasks and then proposed procedures to minimise or eliminate the risk. The job hazard register was essentially reviewed in the form of job hazard analysis prior to commencing a task.

The Health, Safety and Environmental Management Plan was summarised in tabular form by the project Inspection and Test Plan (ITP). This Register identified all the commitments made by Fugro in the Safety Plan and was used as a concise reference table by the Party Chief during the operations.

10.1.2 Quality Plan

The conduct and management of the survey was carried out as per the requirements of Fugro's Quality Plan. For this project the Quality Plan was integrated into the Project Procedures (Ref. FSPP16603). The Quality Plan was produced to provide the structure for meeting the specifications, requirements and commitments of the project with the intent of conducting a high quality service. The quality system introduced in the Plan identifies key responsibilities, lists the procedures and work practices to be followed and links all the documents and forms used during the project into a common system.

Fugro's Quality System has recently been streamlined and made more accessible by issuing the regularly referred to work practices and flow charts as a Microsoft Internet Explorer based system available at everyone's work station in the office and on CD whilst offshore.

10.1.3 Emergency Response Plan

The Emergency Response Plan incorporated contact information and included components of the Undersea Marine Emergency Response Procedures. To prepare personnel in the event of an emergency situation whilst offshore the Emergency Response Plan provided an easy reference for actions that should take place in an emergency to ensure rescue or assistance is timely and efficient and that the correct personnel/organisations are informed.

Key emergency numbers/addresses were listed for ready access in addition to an emergency contact matrix.

10.1.4 Other Pre-Mobilisation Preparations

All Fugro personnel and offshore survey contractors involved with this project were in receipt of offshore survival/HUET safety certificates.

As an integral part of the project a pre-mobilisation meeting held on 15 September, 2003, (from the previous project) at the Caledonian Inn in Port Fairy involving all the survey and marine crew personnel. The project work scope, safety systems, and obligations were introduced. Safety responsibilities were discussed in detail and any specific issues raised were addressed with a list of action items. The minutes of this meeting are enclosed in Appendix I.

10.2 Mobilisation HSE Issues

There were controls in place to further manage the mobilisation process. These include:

- All survey personnel working on the *MV Lauren* undertook a vessel induction that included a talk about vessel safety systems and the location of safety apparatus.

- Prior to any mobilisation task being undertaken a job hazard analysis discussion was carried out covering all the activities and risks involved.

The Vessel Master, Client Representative (from the previous project) and Fugro Party Chief conducted a vessel safety inspection and safety audit on the survey systems at the conclusion of the mobilisation phase. The inspection consisted of a visual check of all equipment installed, identifying any items that needed to be rectified prior to the vessel setting out to sea. The Vessel Master confirmed vessel integrity was not compromised by the survey installations.

A survey Vessel Integrity Check form as well as a Survey Vessel Safety Checklist are included in Appendix I.

10.2.1 Safety Meetings & Drills

On 27 September, 2003, a weekly safety meeting was held, attended by all personnel, where vessel related safety issues were discussed. All personnel were reminded of the HSE objectives that were set up as part of the induction. A further meeting held on

2 October, 2003, involving all survey and marine personnel, reviewed the safety performance of the project prior to the commencement of the Benaris work schedule..

Minutes of the safety meetings are included as Appendix I.

10.2.2 Toolbox Meetings

Informal toolbox meetings were held at regular intervals throughout the project. At the start of each day an informal toolbox meeting was held by relevant parties to plan the day ahead and ensure the safe continuation of the project. Toolbox meetings were also held, in conjunction with JHA's, prior to the deployment and recovery of equipment. Toolbox meetings were not minuted but were documented in the logbook.

10.2.3 Reported Hazards & Incidents

There were no reportable lost time incidents. A reportable incident is defined as an incident referred to the Department of Minerals Primary Resources and/or Worksafe under the requirement of law, typically involving a lost time incident (LTI). Non-reportable incidents are those kept within the Fugro safety system, whilst a hazard is recorded and typically closed out in the confines of the vessel. A hazard register generated onboard the vessel, with all items closed out onboard the vessel is enclosed in Appendix I.

APPENDIX A
SERVICE WARRANTY

1. This report and the geophysical interpretation and assessment carried out in connection with the report (together with the "Services") were compiled and carried out by Fugro Survey Pty Ltd (FSPL) for Benaris Energy NV (the "Client") in accordance with the terms of a contract between FSPL and the Client. The Services were performed by FSPL with the skill and care ordinarily exercised by a reasonable geophysical survey contractor, at the time the Services were performed. Further, and in particular, the Services were performed by FSPL taking into account the limits of the scope of works required by the Client, the time scale involved and the resources, including financial, equipment and manpower resources, agreed between FSPL and the Client.

2. Other than that expressly contained in paragraph 1 above, FSPL provides no other representation or warranty whether expressed or implied, in relation to the Services and all warranties and conditions implied by law are hereby expressly excluded.

3. The Services were performed by FSPL exclusively for the purposes of the Client. FSPL is not aware of any interest of or reliance by any party other than the Client in or on the Services. Unless stated in the contract or report for the Services or expressly provided in writing, FSPL does not authorise, consent or condone any party other than the Client relying upon the services. Should this report or any part of this report, or otherwise details of the Services or any part of the services be made known to any such party and such party relies thereon that party does so wholly at its own and sole risk and FSPL disclaims any liability to such parties. Any such party would be well advised to seek (*independent*) advice from a competent (*geophysical survey contractor/consultant*) and/or lawyer.

4. It is FSPL's understanding that this report is to be used for the purpose described in Section 1 - "Introduction" of the report. That purpose was a significant factor in determining the scope and level of the Services. Should the purpose for which the report is used, or the Client's proposed development or activity change, this report may no longer be valid and any further use of or reliance upon the report in those circumstances by the Client without FSPL's review and advice shall be at the Client's sole and own risk. Should FSPL be requested to review the report after the date hereof, FSPL shall be entitled to additional payment at the then existing rates or such other terms as agreed between FSPL and the Client.

5. The passage of time may result in man-made and/or natural changes in site conditions and changes in regulatory or other legal provisions, technology or economic conditions which could render the report inaccurate or unreliable. The information and conclusions contained in this report should be not relied upon if any such changes have taken place and in any event after a period not greater than two years (or typically six months in the case of seabed features information) from the date of this report or as stated in the report without the written advice of FSPL. In the absence of such written advice from FSPL, reliance on the report after the specified time period shall be at the Client's own and sole risk. Should FSPL be asked to review the report after the specified time period, FSPL shall be entitled to additional payment at the then existing rate or such other terms as may be agreed upon between FSPL and the Client.

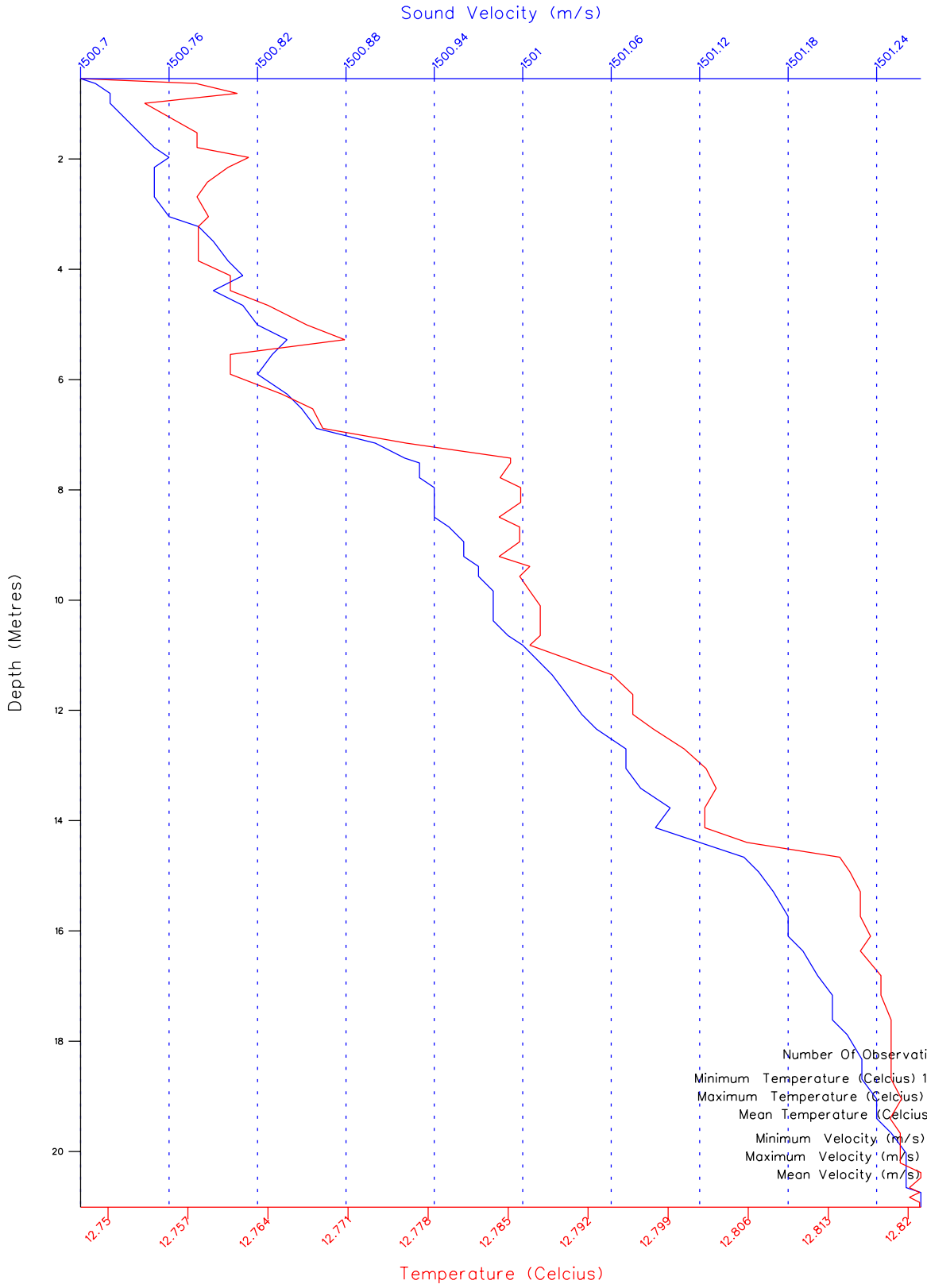
6. The observations and conclusions described in this report are based solely upon the Services which were provided pursuant to the agreement between the Client and FSPL. FSPL has not performed any observations, investigations, studies or testing not specifically set out or required by the contract between the Client and FSPL. FSPL is not liable for the existence of any condition, the discovery of which would require performance of services not otherwise contained in the Services.

7. Where the Services have involved the use of any information provided by third parties or the Client and upon which FSPL was reasonably entitled to rely then the Services clearly are limited by the accuracy of such information. Unless otherwise stated, FSPL was not authorised and did not attempt to independently verify the accuracy or completeness of information, documentation or materials received from the Client or third parties, including laboratories and information services, during the performance of the services. FSPL is not liable for any inaccurate information or conclusions, the discovery of which inaccuracies required the doing of any act including the gathering of any information which was not reasonably available to FSPL and including the doing of any independent investigation of the information provided to FSPL save as otherwise provided in the terms of the contract between the Client and FSPL.

8. Neither FSPL nor any director, officer, agent, or employee of FSPL shall have any liability (whether direct or indirect, in contract or in tort or breach of statutory duty or otherwise) to the Client (nor to any body corporate related to the Client within the meaning of section 50 of the Corporations Law, nor to any director, officer, agent, or employee of the Client or of any such body) for or in connection with the engagement of FSPL for the provision of the Services, except to the extent to which it is not permissible by law to exclude, restrict or modify liability and except for any such liability for losses, claims, damages, liabilities or expenses incurred by the Client (or any of them) that are determined by a final judgement of a court of competent jurisdiction to have resulted primarily from actions taken or omitted to be taken by such person illegally or in bad faith from such person's gross negligence.

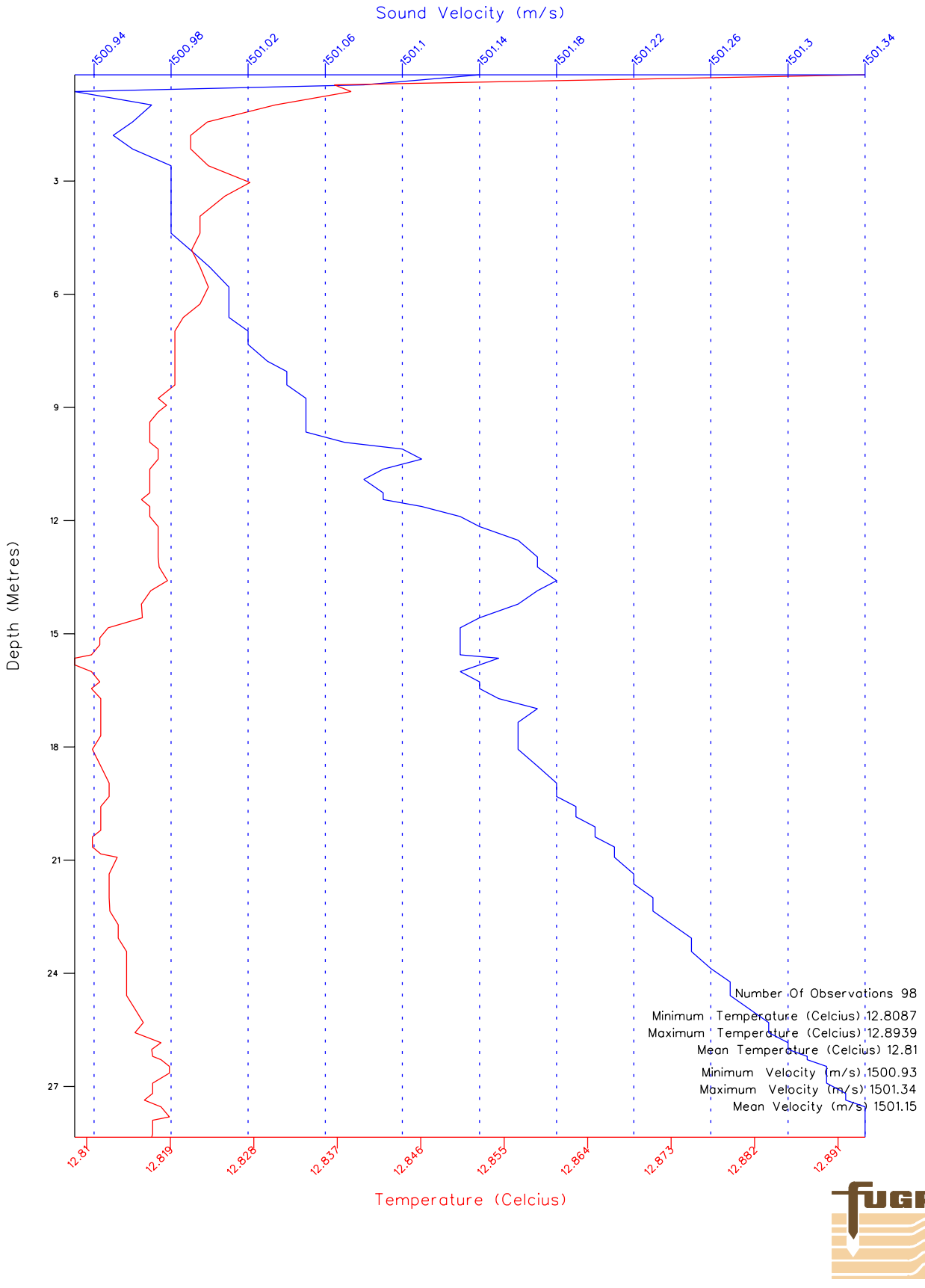
The above provisions will survive any termination of FSPL's engagement to provide the Services.

APPENDIX B
SOUND VELOCITY PROFILE RESULTS



0410a03_temperature.vel

U:\hy16611\report\appendices\appendix_A-svp\svp04_10a.dgn



0410d03_temperature.vel

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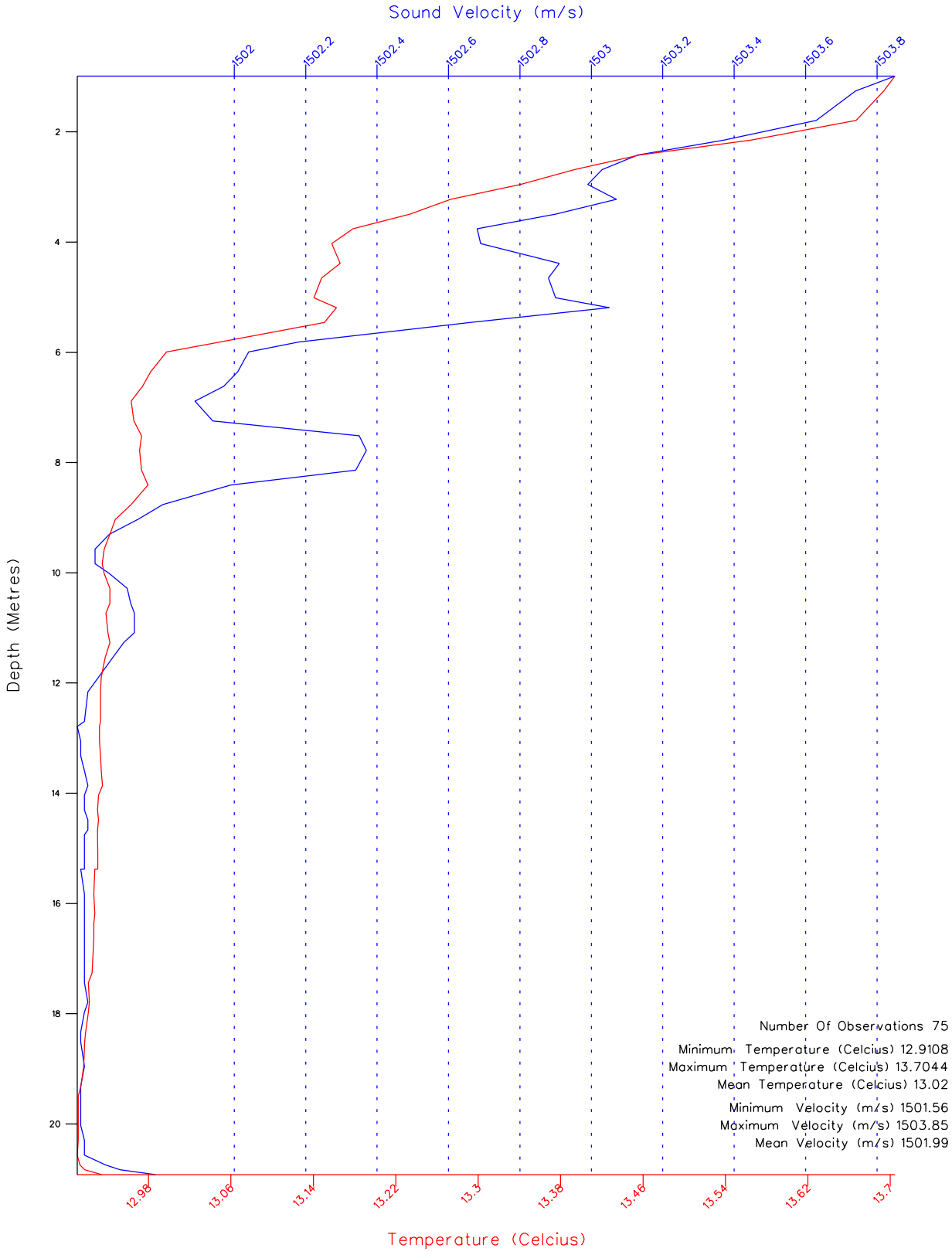

0610a03_temperature.vel

u:\hy16611\report\appendices\appendix_A-svp\svp02.dgn

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1808 136th Place N.E., Bellevue, Washington 98005 USA
Phone: (425) 643 - 9866 Fax: (425) 643 - 9954 Internet: seabird@seabird.com

SENSOR SERIAL NUMBER = 2699
CALIBRATION DATE: 19-Dec-02

TEMPERATURE CALIBRATION DATA
ITS-90 TEMPERATURE SCALE

ITS-90 COEFFICIENTS

g = 4.22160292e-03
h = 6.12836137e-04
i = 7.35318526e-06
j = -1.22127365e-06
f_0 = 1000.000

IPTS-68 COEFFICIENTS

a = 3.64763917e-03
b = 5.95720409e-04
c = 1.08563045e-05
d = -1.22061547e-06
f_0 = 2583.321

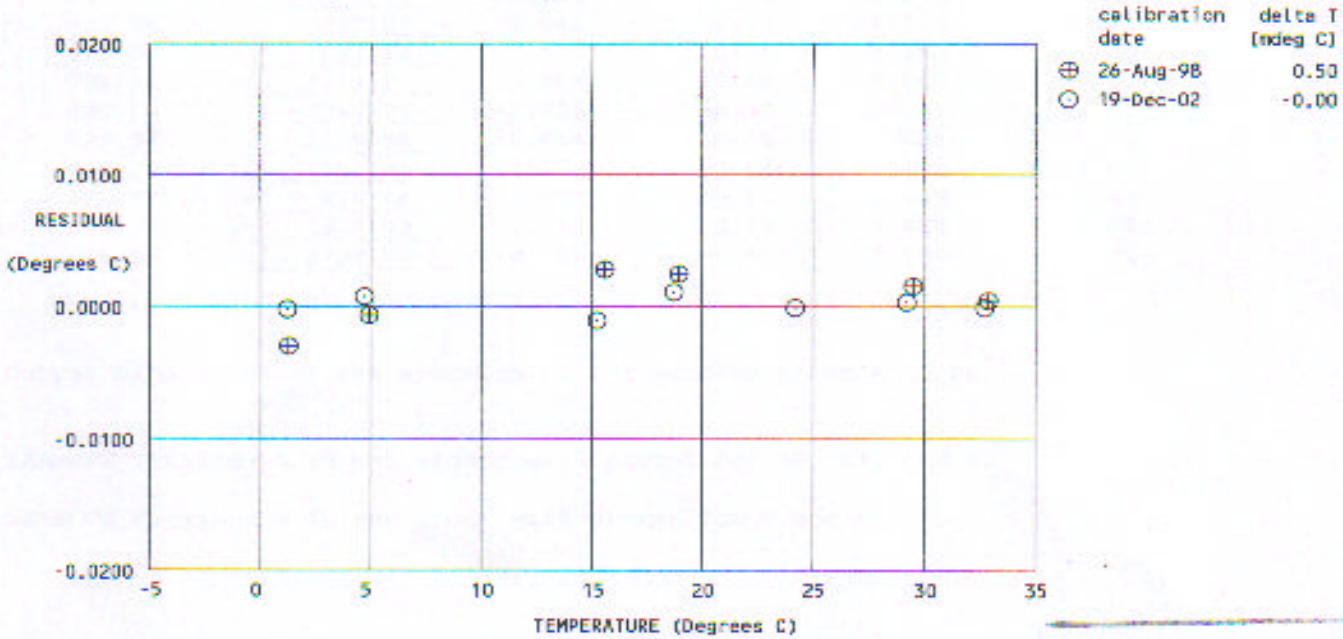
BATH TEMP (ITS-90 °C)	INSTRUMENT FREQ (Hz)	INST TEMP (ITS-90 °C)	RESIDUAL (ITS-90 °C)
1.0000	2583.321	0.9997	-0.00032
4.5000	2791.030	4.5006	0.00062
15.0000	3484.442	14.9988	-0.00115
18.5000	3740.389	18.5010	0.00096
24.0001	4168.345	23.9999	-0.00019
29.0000	4586.057	29.0002	0.00025
32.5000	4895.088	32.4998	-0.00017

Temperature ITS-90 $= 1/\{g + h[\ell n(f_0/f)] + i[\ell n^2(f_0/f)] + j[\ell n^3(f_0/f)]\} - 273.15$ (°C)

Temperature IPTS-68 $= 1/\{a + b[\ell n(f_0/f)] + c[\ell n^2(f_0/f)] + d[\ell n^3(f_0/f)]\} - 273.15$ (°C)

Following the recommendation of JPOTS: T_{68} is assumed to be 1.00024 * T_{90} (-2 to 35 °C).

Residual = instrument temperature - bath temperature



POST CRUISE CALIBRATION

Sea-Bird Electronics, Inc.
1808 136th Place NE, Bellevue, Washington 98005 USA
Website: http://www.seabird.com

FAX: (425) 643-9954
Tel: (425) 643-9866
Email: seabird@seabird.com

SBE S/N 1919203-2699 26 December 2002

Pressure calibration: PAINE 211-75-710-03 1000 psia S/N 186615

Temperature Compensation (TC) value = 497

Straight Line Fit:

Pressure(psia) = M * N + B (N = Binary output)

M = -0.13053 B = 509.13

Quadratic Fit:

Pressure(psia) = A0 + A1 * N + A2 * N * N (N = binary output)

A0 = 508.29108 A1 = -1.305419e-001 A2 = 1.255029e-007

		Straight Line Fit		Quadratic Fit	
Pressure (psi)	Output (N)	error, psi	error, %FS	error, psi	error, %FS
14.62	3795.96	-0.989	-0.10	-0.048	-0.00
199.74	2373.42	-0.424	-0.04	-0.575	-0.06
399.76	837.57	0.041	0.00	-0.718	-0.07
599.77	-697.52	0.412	0.04	-0.363	-0.04
799.74	-2225.97	-0.044	-0.00	-0.247	-0.02
999.55	-3749.20	-1.021	-0.10	-0.071	-0.01
799.74	-2230.88	0.604	0.06	0.404	0.04
599.77	-704.89	1.376	0.14	0.602	0.06
399.76	828.46	1.227	0.12	0.467	0.05
199.75	2365.70	0.579	0.06	0.424	0.04
14.65	3793.82	-0.741	-0.07	0.197	0.02

Output binary values are averages of 101 samples taken at 2 Hz.

SEASOFT Versions 3.3M and higher will prompt for A0, A1, and A2

SEASOFT Versions 3.3L and lower will prompt for M and B

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Conductivity Calibration Report

Customer:	Imbros		
Job Number:	31040R	Date of Report:	19-Dec-02
Model Number:	SBE 19-03	Serial Number:	1919203-2699

Conductivity sensors are normally calibrated 'as received', without cleaning or adjustments, allowing a determination of sensor drift. If the calibration identifies a problem or indicates cell cleaning is necessary, then a second calibration is performed after work is completed. The 'as received' calibration is not performed if the sensor is damaged or non-functional, or by customer request.

An 'as received' calibration certificate is provided, listing the coefficients used to convert sensor frequency to conductivity. Users must choose whether the 'as received' calibration or the previous calibration better represents the sensor condition during deployment. In SEASOFT enter the chosen coefficients using the program SEACON. The coefficient 'slope' allows small corrections for drift between calibrations (consult the SEASOFT manual). Calibration coefficients obtained after a repair or cleaning apply only to subsequent data.

'AS RECEIVED' CALIBRATION ☑ *Performed* ☐ *Not Performed*

Date: 19-Dec-02 *Drift since last cal:* -.00020 *PSU/month**

Comments:

'CALIBRATION AFTER CLEANING & REPLATINIZING' ☐ *performed* ☑ *Not Performed*

Date: *Drift since last cal:* *PSU/month**

Comments:

**Measured at 3.0 S/m*

Cell cleaning and electrode replatinizing tend to 'reset' the conductivity sensor to its original condition. Lack of drift in post-cleaning-calibration indicates geometric stability of the cell and electrical stability of the sensor circuit.

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Phone: (425) 643 - 9866 Fax: (425) 643 - 9954 Internet: seabird@seabird.com

SENSOR SERIAL NUMBER = 2699
CALIBRATION DATE: 19-Dec-02

CONDUCTIVITY CALIBRATION DATA
PSS 1978: C(35,15,0) = 4.2914 Siemens/meter

GHIJ COEFFICIENTS

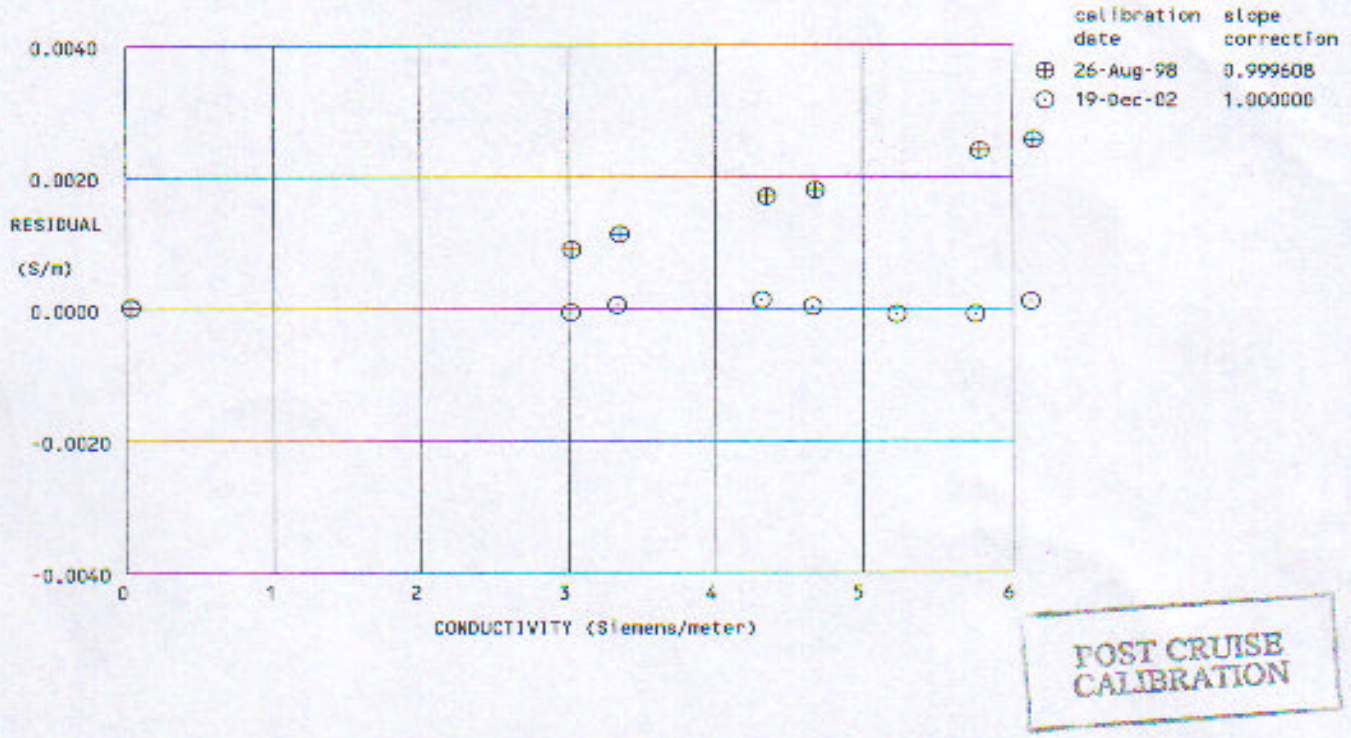
g = -4.10223342e+00
h = 4.89374371e-01
i = 1.25866611e-03
j = -2.93089670e-05
CPcor = -9.57e-08 (nominal)
CTcor = 3.25e-06 (nominal)

ABCDM COEFFICIENTS

a = 5.58569052e-02
b = 4.28494249e-01
c = -4.08201981e+00
d = -1.05098024e-04
m = 2.1
CPcor = -9.57e-08 (nominal)

BATH TEMP (ITS-90 °C)	BATH SAL (PSU)	BATH COND (Siemens/m)	INST FREQ (kHz)	INST COND (Siemens/m)	RESIDUAL (Siemens/m)
22.0000	0.0000	0.00000	2.88531	0.00000	0.00000
1.0000	34.9151	2.98360	8.25709	2.98353	-0.00007
4.5000	34.9141	3.29304	8.62306	3.29307	0.00003
15.0000	34.9143	4.28236	9.69944	4.28247	0.00011
18.5000	34.9150	4.63004	10.04989	4.63006	0.00002
24.0001	34.9156	5.19176	10.59134	5.19166	-0.00010
29.0000	34.9151	5.71668	11.07321	5.71658	-0.00010
32.5000	34.9134	6.09100	11.40443	6.09110	0.00010

Conductivity = $(g + hf^2 + if^3 + jf^4) / [10(1 + \delta t + \epsilon p)]$ Siemens/meter
Conductivity = $(af^m + bf^2 + c + dt) / [10(1 + \epsilon p)]$ Siemens/meter
t = temperaure [deg C]; p = pressure [decibars]; δ = CTcor; ϵ = CPcor;
Residual = (instrument conductivity - bath conductivity) using g, h, i, j coefficients



POST CRUISE CALIBRATION

APPENDIX C
TIDES

HY16611

PREDICTED TIDAL DATA FOR HYDROGRAPHIC RECONNAISSANCE SURVEY FOR THE MOONLIGHT HEAD 3D SEISMIC CAMPAIGN FROM WARRNAMBOOL CONSTITUENTS (ATT)

Date / Time	Height
04/10/03,00:00:00	0.188
04/10/03,00:10:00	0.207
04/10/03,00:20:00	0.227
04/10/03,00:30:00	0.247
04/10/03,00:40:00	0.269
04/10/03,00:50:00	0.292
04/10/03,01:00:00	0.315
04/10/03,01:10:00	0.339
04/10/03,01:20:00	0.363
04/10/03,01:30:00	0.388
04/10/03,01:40:00	0.413
04/10/03,01:50:00	0.438
04/10/03,02:00:00	0.463
04/10/03,02:10:00	0.488
04/10/03,02:20:00	0.512
04/10/03,02:30:00	0.536
04/10/03,02:40:00	0.559
04/10/03,02:50:00	0.582
04/10/03,03:00:00	0.604
04/10/03,03:10:00	0.625
04/10/03,03:20:00	0.644
04/10/03,03:30:00	0.663
04/10/03,03:40:00	0.681
04/10/03,03:50:00	0.697
04/10/03,04:00:00	0.712
04/10/03,04:10:00	0.725
04/10/03,04:20:00	0.737
04/10/03,04:30:00	0.748
04/10/03,04:40:00	0.757
04/10/03,04:50:00	0.764
04/10/03,05:00:00	0.770
04/10/03,05:10:00	0.775
04/10/03,05:20:00	0.777
04/10/03,05:30:00	0.779
04/10/03,05:40:00	0.779
04/10/03,05:50:00	0.777
04/10/03,06:00:00	0.774
04/10/03,06:10:00	0.770
04/10/03,06:20:00	0.765
04/10/03,06:30:00	0.758
04/10/03,06:40:00	0.750
04/10/03,06:50:00	0.741
04/10/03,07:00:00	0.732
04/10/03,07:10:00	0.721
04/10/03,07:20:00	0.710
04/10/03,07:30:00	0.698
04/10/03,07:40:00	0.686
04/10/03,07:50:00	0.673
04/10/03,08:00:00	0.660
04/10/03,08:10:00	0.647
04/10/03,08:20:00	0.634
04/10/03,08:30:00	0.620
04/10/03,08:40:00	0.607
04/10/03,08:50:00	0.594
04/10/03,09:00:00	0.581

Date / Time	Height
04/10/03,09:10:00	0.569
04/10/03,09:20:00	0.557
04/10/03,09:30:00	0.546
04/10/03,09:40:00	0.536
04/10/03,09:50:00	0.526
04/10/03,10:00:00	0.517
04/10/03,10:10:00	0.508
04/10/03,10:20:00	0.501
04/10/03,10:30:00	0.494
04/10/03,10:40:00	0.489
04/10/03,10:50:00	0.484
04/10/03,11:00:00	0.480
04/10/03,11:10:00	0.477
04/10/03,11:20:00	0.475
04/10/03,11:30:00	0.474
04/10/03,11:40:00	0.474
04/10/03,11:50:00	0.475
04/10/03,12:00:00	0.476
04/10/03,12:10:00	0.479
04/10/03,12:20:00	0.482
04/10/03,12:30:00	0.486
04/10/03,12:40:00	0.490
04/10/03,12:50:00	0.495
04/10/03,13:00:00	0.500
04/10/03,13:10:00	0.506
04/10/03,13:20:00	0.512
04/10/03,13:30:00	0.518
04/10/03,13:40:00	0.525
04/10/03,13:50:00	0.531
04/10/03,14:00:00	0.537
04/10/03,14:10:00	0.544
04/10/03,14:20:00	0.550
04/10/03,14:30:00	0.556
04/10/03,14:40:00	0.561
04/10/03,14:50:00	0.566
04/10/03,15:00:00	0.570
04/10/03,15:10:00	0.574
04/10/03,15:20:00	0.577
04/10/03,15:30:00	0.580
04/10/03,15:40:00	0.581
04/10/03,15:50:00	0.582
04/10/03,16:00:00	0.582
04/10/03,16:10:00	0.581
04/10/03,16:20:00	0.579
04/10/03,16:30:00	0.576
04/10/03,16:40:00	0.572
04/10/03,16:50:00	0.567
04/10/03,17:00:00	0.561
04/10/03,17:10:00	0.555
04/10/03,17:20:00	0.547
04/10/03,17:30:00	0.538
04/10/03,17:40:00	0.528
04/10/03,17:50:00	0.518
04/10/03,18:00:00	0.507
04/10/03,18:10:00	0.494

Date / Time	Height
04/10/03,18:20:00	0.482
04/10/03,18:30:00	0.468
04/10/03,18:40:00	0.454
04/10/03,18:50:00	0.440
04/10/03,19:00:00	0.425
04/10/03,19:10:00	0.410
04/10/03,19:20:00	0.394
04/10/03,19:30:00	0.379
04/10/03,19:40:00	0.363
04/10/03,19:50:00	0.347
04/10/03,20:00:00	0.332
04/10/03,20:10:00	0.316
04/10/03,20:20:00	0.301
04/10/03,20:30:00	0.287
04/10/03,20:40:00	0.273
04/10/03,20:50:00	0.259
04/10/03,21:00:00	0.246
04/10/03,21:10:00	0.234
04/10/03,21:20:00	0.223
04/10/03,21:30:00	0.212
04/10/03,21:40:00	0.203
04/10/03,21:50:00	0.195
04/10/03,22:00:00	0.187
04/10/03,22:10:00	0.181
04/10/03,22:20:00	0.176
04/10/03,22:30:00	0.172
04/10/03,22:40:00	0.170
04/10/03,22:50:00	0.168
04/10/03,23:00:00	0.168
04/10/03,23:10:00	0.170
04/10/03,23:20:00	0.172
04/10/03,23:30:00	0.176
04/10/03,23:40:00	0.181
04/10/03,23:50:00	0.187
05/10/03,00:00:00	0.195
05/10/03,00:10:00	0.203
05/10/03,00:20:00	0.213
05/10/03,00:30:00	0.224
05/10/03,00:40:00	0.236
05/10/03,00:50:00	0.249
05/10/03,01:00:00	0.263
05/10/03,01:10:00	0.277
05/10/03,01:20:00	0.292
05/10/03,01:30:00	0.308
05/10/03,01:40:00	0.325
05/10/03,01:50:00	0.342
05/10/03,02:00:00	0.359
05/10/03,02:10:00	0.377
05/10/03,02:20:00	0.395
05/10/03,02:30:00	0.413
05/10/03,02:40:00	0.432
05/10/03,02:50:00	0.450
05/10/03,03:00:00	0.468
05/10/03,03:10:00	0.486
05/10/03,03:20:00	0.503

05/10/03,12:30:00,0.520

05/10/03,21:30:00,0.326
05/10/03,21:40:00,0.317

Date / Time Height

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05/10/03,03:50:00,0.553
05/10/03,04:00:00,0.569
05/10/03,04:10:00,0.584
05/10/03,04:20:00,0.598
05/10/03,04:30:00,0.612
05/10/03,04:40:00,0.624
05/10/03,04:50:00,0.636
05/10/03,05:00:00,0.647
05/10/03,05:10:00,0.657
05/10/03,05:20:00,0.666
05/10/03,05:30:00,0.674
05/10/03,05:40:00,0.681
05/10/03,05:50:00,0.687
05/10/03,06:00:00,0.691
05/10/03,06:10:00,0.695
05/10/03,06:20:00,0.698
05/10/03,06:30:00,0.700
05/10/03,06:40:00,0.701
05/10/03,06:50:00,0.701
05/10/03,07:00:00,0.701
05/10/03,07:10:00,0.699
05/10/03,07:20:00,0.697
05/10/03,07:30:00,0.693
05/10/03,07:40:00,0.689
05/10/03,07:50:00,0.685
05/10/03,08:00:00,0.680
05/10/03,08:10:00,0.674
05/10/03,08:20:00,0.668
05/10/03,08:30:00,0.661
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05/10/03,08:50:00,0.647
05/10/03,09:00:00,0.640
05/10/03,09:10:00,0.632
05/10/03,09:20:00,0.624
05/10/03,09:30:00,0.616
05/10/03,09:40:00,0.609
05/10/03,09:50:00,0.601
05/10/03,10:00:00,0.593
05/10/03,10:10:00,0.586
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05/10/03,10:30:00,0.572
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05/10/03,10:50:00,0.559
05/10/03,11:00:00,0.553
05/10/03,11:10:00,0.548
05/10/03,11:20:00,0.542
05/10/03,11:30:00,0.538
05/10/03,11:40:00,0.534
05/10/03,11:50:00,0.530
05/10/03,12:00:00,0.527
05/10/03,12:10:00,0.524
05/10/03,12:20:00,0.522

Date / Time Height

05/10/03,12:40:00,0.518
05/10/03,12:50:00,0.517
05/10/03,13:00:00,0.517
05/10/03,13:10:00,0.517
05/10/03,13:20:00,0.517
05/10/03,13:30:00,0.517
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05/10/03,13:50:00,0.519
05/10/03,14:00:00,0.520
05/10/03,14:10:00,0.522
05/10/03,14:20:00,0.523
05/10/03,14:30:00,0.525
05/10/03,14:40:00,0.526
05/10/03,14:50:00,0.528
05/10/03,15:00:00,0.530
05/10/03,15:10:00,0.531
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05/10/03,15:40:00,0.534
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05/10/03,16:40:00,0.533
05/10/03,16:50:00,0.531
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05/10/03,17:50:00,0.511
05/10/03,18:00:00,0.506
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05/10/03,19:50:00,0.421
05/10/03,20:00:00,0.411
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05/10/03,21:00:00,0.353
05/10/03,21:10:00,0.344
05/10/03,21:20:00,0.335

Date / Time Height

05/10/03,21:50:00,0.309
05/10/03,22:00:00,0.301
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05/10/03,23:00:00,0.266
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06/10/03,01:30:00,0.289
06/10/03,01:40:00,0.296
06/10/03,01:50:00,0.304
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06/10/03,02:10:00,0.322
06/10/03,02:20:00,0.331
06/10/03,02:30:00,0.342
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06/10/03,02:50:00,0.363
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06/10/03,04:20:00,0.471
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06/10/03,04:40:00,0.496
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06/10/03,06:20:00,0.599

06/10/03,06:30:00,0.607
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06/10/03,06:50:00,0.621

06/10/03,15:30:00,0.494
06/10/03,15:40:00,0.492
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06/10/03,16:00:00,0.489

Date / Time Height

06/10/03,07:00:00,0.627
06/10/03,07:10:00,0.633
06/10/03,07:20:00,0.638
06/10/03,07:30:00,0.642
06/10/03,07:40:00,0.646
06/10/03,07:50:00,0.649
06/10/03,08:00:00,0.651
06/10/03,08:10:00,0.653
06/10/03,08:20:00,0.655
06/10/03,08:30:00,0.656
06/10/03,08:40:00,0.656
06/10/03,08:50:00,0.656
06/10/03,09:00:00,0.655
06/10/03,09:10:00,0.653
06/10/03,09:20:00,0.652
06/10/03,09:30:00,0.649
06/10/03,09:40:00,0.647
06/10/03,09:50:00,0.644
06/10/03,10:00:00,0.640
06/10/03,10:10:00,0.636
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06/10/03,14:30:00,0.510
06/10/03,14:40:00,0.507
06/10/03,14:50:00,0.504
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06/10/03,15:10:00,0.498
06/10/03,15:20:00,0.496

Date / Time Height

06/10/03,16:10:00,0.487
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06/10/03,16:30:00,0.485
06/10/03,16:40:00,0.484
06/10/03,16:50:00,0.483
06/10/03,17:00:00,0.482
06/10/03,17:10:00,0.481
06/10/03,17:20:00,0.480
06/10/03,17:30:00,0.479
06/10/03,17:40:00,0.478
06/10/03,17:50:00,0.478
06/10/03,18:00:00,0.477
06/10/03,18:10:00,0.476
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06/10/03,18:50:00,0.471
06/10/03,19:00:00,0.470
06/10/03,19:10:00,0.468
06/10/03,19:20:00,0.466
06/10/03,19:30:00,0.464
06/10/03,19:40:00,0.462
06/10/03,19:50:00,0.460
06/10/03,20:00:00,0.457
06/10/03,20:10:00,0.455
06/10/03,20:20:00,0.452
06/10/03,20:30:00,0.449
06/10/03,20:40:00,0.445
06/10/03,20:50:00,0.442
06/10/03,21:00:00,0.438
06/10/03,21:10:00,0.434
06/10/03,21:20:00,0.430
06/10/03,21:30:00,0.426
06/10/03,21:40:00,0.422
06/10/03,21:50:00,0.417
06/10/03,22:00:00,0.413
06/10/03,22:10:00,0.408
06/10/03,22:20:00,0.403
06/10/03,22:30:00,0.398
06/10/03,22:40:00,0.393
06/10/03,22:50:00,0.388
06/10/03,23:00:00,0.384
06/10/03,23:10:00,0.379
06/10/03,23:20:00,0.374
06/10/03,23:30:00,0.369
06/10/03,23:40:00,0.364
06/10/03,23:50:00,0.360

APPENDIX D
DAILY OPERATIONS REPORTS

DAILY OPERATIONS REPORT

CLIENT:BENARIS	LOCATION:PT FAIRY	DATE:02/10/03
PROJECT:MOONLIGHT BATHY SURVEY	VESSEL:MV LAUREN	JOB#HY16611

FROM	TO	SUMMARY OF OPERATIONS
1300	2400	Standby on land, waiting on weather

EQUIPMENT	NO.	EQUIPMENT	NO.	PERSONNEL	TITLE
SG Brown gyro	2	Velocity probes	2	J.Richards	Party Chief/surv
Nav PC suite	2	SSS suite	2	A.Janczewski	
TSS DMS05	2	Geoswath	1	G.Laurent	Swath operator
Octapus F180	1	Helmsman mon	1	S.Hyde	Processor
Trimble GPS	2	Processing PC suit6e	2		
Starfix demods	2	Odom echosounder	2		
		[#'s include spares]			

VEHICLES:2

CONSUMABLES:

ACCOMMODATION:CALEDONIA INN

AUTHORISED CONTRACT CHANGES / COMMENTS:

Party Chief Signature:	Client Representative Signature:	D O R Number
		1

Fugro Marine Division
FSHY01-1
DAILY OPERATIONS REPORT

CLIENT:BENARIS	LOCATION:PT FAIRY	DATE:03/10/03
PROJECT:MOONLIGHT BATHY SURVEY	VESSEL:MV LAUREN	JOB#HY16611

FROM	TO	SUMMARY OF OPERATIONS
0000	2400	Standby on land, waiting on weather
1130		Bar check, Nav config/equipment check
1400		Survey runlines created with client rep

EQUIPMENT	NO.	EQUIPMENT	NO.	PERSONNEL	TITLE
SG Brown gyro	2	Velocity probes	2	J.Richards	Party Chief/surv
Nav PC suite	2	SSS suite	2	A.Janczewski	
TSS DMS05	2	Geoswath	1	G.Laurent	Swath operator
Octapus F180	1	Helmsman mon	1	S.Hyde	Processor
Trimble GPS	2	Processing PC suit6e	2		
Starfix demods	2	Odom echosounder	2		
		[#'s include spares]			
VEHICLES:2					
CONSUMABLES:					
ACCOMMODATION:CALEDONIA INN					

AUTHORISED CONTRACT CHANGES / COMMENTS:

Party Chief Signature:	Client Representative Signature:	D O R Number
		2

DAILY OPERATIONS REPORT

CLIENT:BENARIS	LOCATION:PT FAIRY	DATE:4/10/03
PROJECT:MOONLIGHT BATHY SURVEY	VESSEL:MV LAUREN	JOB#HY16611

FROM	TO	SUMMARY OF OPERATIONS
0000	0530	Standby on land
0530		Arrive at vessel
0550		Depart wharf, begin transit to survey area
0745		Arrive survey area, deploy poles
0815		Velocity probe taken
0840		Begin survey lines
1255		At eastern end of survey area, velocity probe taken,
		continue survey
1510		End survey for the day
1512		Raise poles
1517		Begin transit to Port Fairy
1800	2400	Arrive Port Fairy, standby on land [processing of
		data commence

EQUIPMENT	NO.	EQUIPMENT	NO.	PERSONNEL	TITLE
SG Brown gyro	2	Velocity probes	2	J.Richards	Party Chief/surv
Nav PC suite	2	SSS suite	2	A.Janczewski	
TSS DMS05	2	Geoswath	1	G.Laurent	Swath operator
Octapus F180	1	Helmsman mon	1	S.Hyde	Processor
Trimble GPS	2	Processing PC suit6e	2		
Starfix demods	2	Odom echosounder	2		
		[#'s include spares]			

VEHICLES:2

CONSUMABLES:

ACCOMMODATION:CALEDONIA INN

AUTHORISED CONTRACT CHANGES / COMMENTS:

Party Chief Signature:	Client Representative Signature:	D O R Number
		3

Fugro Marine Division
FSHY01-1
DAILY OPERATIONS REPORT

CLIENT:BENARIS	LOCATION:PT FAIRY	DATE:5/10/03
PROJECT:MOONLIGHT BATHY SURVEY	VESSEL:MV LAUREN	JOB#HY16611

FROM	TO	SUMMARY OF OPERATIONS
0000	0530	Standby on land
0530		Arrive at vessel
0532		Depart wharf, begin transit to survey area
0734		Arrive survey area, deploy poles
0757		Begin survey lines
1402		End survey for the day
1403		Raise poles
1406		Begin transit to Port Fairy
1705	2400	Arrive Port Fairy, standby on land [processing of
		data continue]

EQUIPMENT	NO.	EQUIPMENT	NO.	PERSONNEL	TITLE
SG Brown gyro	2	Velocity probes	2	J.Richards	Party Chief/surv
Nav PC suite	2	SSS suite	2	A.Janczewski	Engineering tech
TSS DMS05	2	Geoswath	1	G.Laurent	Swath operator
Octopus F180	1	Helmsman mon	1	S.Hyde	Processor
Trimble GPS	2	Processing PC suite	2		
Starfix demods	2	Odom echosounder	2		
		[#'s include spares]			

VEHICLES:2

CONSUMABLES:

ACCOMMODATION:CALEDONIA INN

AUTHORISED CONTRACT CHANGES / COMMENTS:

Party Chief Signature:	Client Representative Signature:	D O R Number
		4

Fugro Marine Division
FSHY01-1
DAILY OPERATIONS REPORT

CLIENT:BENARIS	LOCATION:PT FAIRY	DATE:6/10/03
PROJECT:MOONLIGHT BATHY SURVEY	VESSEL:MV LAUREN	JOB#HY16611

FROM	TO	SUMMARY OF OPERATIONS
0000	0525	Standby on land
0525		Arrive at vessel
0530		Depart wharf, begin transit to survey area
0825		Arrive survey area, deploy poles
0900		Begin survey lines
1432		End survey for the day
1440		Raise poles, deploy sound velocity probe
1445		Begin transit to Port Fairy
1750	2400	Arrive Port Fairy, standby on land [processing of
		data continue

EQUIPMENT	NO.	EQUIPMENT	NO.	PERSONNEL	TITLE
SG Brown gyro	2	Velocity probes	2	J.Richards	Party Chief/surv
Nav PC suite	2	SSS suite	2	A.Janczewski	Engineering tech
TSS DMS05	2	Geoswath	1	G.Laurent	Swath operator
Octopus F180	1	Helmsman mon	1	S.Hyde	Processor
Trimble GPS	2	Processing PC suite	2		
Starfix demods	2	Odom echosounder	2		
		[#'s include spares]			

VEHICLES:2
CONSUMABLES:
ACCOMMODATION:CALEDONIA INN

AUTHORISED CONTRACT CHANGES / COMMENTS:

Party Chief Signature:	Client Representative Signature:	D O R Number
		45

Fugro Marine Division
FSHY01-1
DAILY OPERATIONS REPORT

CLIENT:BENARIS	LOCATION:PT FAIRY	DATE:7/10/03
PROJECT:MOONLIGHT BATHY SURVEY	VESSEL:MV LAUREN	JOB#HY16611

FROM	TO	SUMMARY OF OPERATIONS
0000	0600	Standby on land
0600		Processing continue
0830		Client begins review of data collected (some concern over
		data coverage). Additional analysis carried out to fully
		Evaluate data set.
1030		Client approve sufficient data collection. Begin de-mob
		of vessel.
1230		S.Hyde depart for Mt Gambier Airport (enroute to Adelaide)
1800		Survey equipment removed from vessel. Vessel off hire.
		Demob cease for the day.
1800	2400	Standby

EQUIPMENT	NO.	EQUIPMENT	NO.	PERSONNEL	TITLE
SG Brown gyro	2	Velocity probes	2	J.Richards	Party Chief/surv
Nav PC suite	2	SSS suite	2	A.Janczewski	Engineering tech
TSS DMS05	2	Geoswath	1	G.Laurent	Swath operator
Octopus F180	1	Helmsman mon	1	S.Hyde	Processor
Trimble GPS	2	Processing PC suite	2		
Starfix demods	2	Odom echosounder	2		
		[#'s include spares]			

VEHICLES:2

CONSUMABLES:

ACCOMMODATION:CALEDONIA INN

AUTHORISED CONTRACT CHANGES / COMMENTS:

Party Chief Signature:	Client Representative Signature:	D O R Number
		6

DAILY OPERATIONS REPORT

CLIENT:BENARIS	LOCATION:PT FAIRY	DATE:8/10/03
PROJECT:MOONLIGHT BATHY SURVEY	VESSEL:MV LAUREN	JOB#HY16611

FROM	TO	SUMMARY OF OPERATIONS
0000	0700	Standby on land
0700		Continue demob
0900		Fugro container loaded onto transport
1100		Depart Pt Fairy for Melbourne Airport
1800		Depart Melbourne (AEST)
2030		Arrive Perth (WAST). Demobilisation complete.

EQUIPMENT	NO.	EQUIPMENT	NO.	PERSONNEL	TITLE
SG Brown gyro	2	Velocity probes	2	J.Richards	Party Chief/surv
Nav PC suite	2	SSS suite	2	A.Janczewski	Engineering tech
TSS DMS05	2	Geoswath	1	G.Laurent	Swath operator
Octopus F180	1	Helmsman mon	1		
Trimble GPS	2	Processing PC suite	2		
Starfix demods	2	Odom echosounder	2		
		[#'s include spares]			
VEHICLES:1					
CONSUMABLES:					
ACCOMMODATION:					

AUTHORISED CONTRACT CHANGES / COMMENTS:

Party Chief Signature:	Client Representative Signature:	D O R Number
		7

APPENDIX E
GYROCOMPASS CALIBRATION

GYRO COMPASS CALIBRATION - CALCULATION SUMMARY

COMPASS TYPE :	SG Brown	**VESSEL :**	Lauren
FUGRO ASSET NOS. :		**DATE :**	17th September, 2003
LOCATION :	Moyne Wharf, Port Fairy	**WHARF ALIGNMENT :**	(Grid)
PROJECT :	Moonlight 3D Bathy Reconn.	(Input either Grid or True)	(True) 121 35 43
JOB NOS.:	HY16611	**GRID CONVERGENCE :**	000° 46' 17.90"
CLIENT:	Benaris Energy	**APP. POSITION:**	608506.34 E 5750246.94 N

GEODETIC PARAMETERS :				**DATUM :**	GDA94	**SPHEROID :**	GRS80
Origin Latitude :	0	0	0	**False Easting :**	500000	**Semi Major Axis (a) :**	6378137
Origin Longitude :	141	0	0	**False Northing :**	10000000	**Inverse Flattening (1/f) :**	298.2572221
				Scale Factor on C.M. :	0.9996		

PROJECTION : UTM

Assumes obs at sea level

Obs. No.	Time	Observations: Offset Bow	Offset Stern	Baseline Dist.	Angle to Wharf(Degs)	Wharf Alignment (G) Deg Mts Secs	Wharf Alignment(T) Deg Mts Secs	Calc'd Vessel Hdg (T)	Obs. Vessel Hdg (T)	**Diff. C-O Degrees**
1	4 45 45	0.15	0.16	7.10	00.08070		121 35 43	121.68	120.20	**1.48**
2	4 46 30	0.10	0.15	7.10	00.40348		121 35 43	122.00	120.50	**1.50**
3	4 47 00	0.17	0.15	7.10	-00.16140		121 35 43	121.43	119.80	**1.63**
4	4 47 30	0.26	0.18	7.10	-00.64556		121 35 43	120.95	119.30	**1.65**
5	4 48 00	0.11	0.15	7.10	00.32279		121 35 43	121.92	120.30	**1.62**
6	4 48 30	0.12	0.16	7.10	00.32279		121 35 43	121.92	120.30	**1.62**
7	4 49 00	0.11	0.16	7.10	00.40348		121 35 43	122.00	120.20	**1.80**
8	4 49 30	0.11	0.15	7.10	00.32279		121 35 43	121.92	120.50	**1.42**
9	4 51 30	0.30	0.22	7.10	-00.64556		121 35 43	120.95	119.70	**1.25**
10	4 52 00	0.16	0.14	7.10	-00.16140		121 35 43	121.43	120.00	**1.43**
11	4 52 30	0.10	0.15	7.10	00.40348		121 35 43	122.00	120.70	**1.30**
12	4 53 00	0.10	0.15	7.10	00.40348		121 35 43	122.00	120.50	**1.50**
13	4 53 30	0.19	0.15	7.10	-00.32279		121 35 43	121.27	119.80	**1.47**
14	4 54 00	0.11	0.15	7.10	00.32279		121 35 43	121.92	120.50	**1.42**
15	4 54 30	0.19	0.14	7.10	-00.40348		121 35 43	121.19	119.50	**1.69**
16										
17										
18										
19										
20										
									Mean	**1.52**
									Std Dev.	**0.15**

NOTES : 1. Ensure that gyro offset in nav system / software is reset to zero before commencing observations.
2. True Bearing = Grid Bearing - Convergence (Convergence is -ve in WA/NT;add to Grid)

APPENDIX F
STATIC DGPS VERIFICATION

DGPS STATIC Verification Sheet
Navigation System 1 - MRDGPS

Client :	**Benaris Energy NV**			**Job No.:**	**HY16611**
Project :	**Moonlight Head 3D Bathy Recon.**			**Vessel :**	**Lauren**
Survey Station :	**Moyne Wharf, Port Fairy (Victoria)**			**Date :**	**17 Sep. 2003**
Wharf Alighment :	**121° 35' 43" (True)**			**Surveyor :**	**TH/GM**
Datum :	**GDA94**	**Spheroid :**	**GRS80**	**Projection :**	**UTM (Zone 54)**
Offset: CRP to DGPS_Check (X-Axis) : 2.50m		**Offset: CRP to DGPS_Check (Y-Axis) : 5.40m**			

UTC		Observed		Calculated		C - O	
Time	Fix	Easting	Northing	Easting	Northing	dE	dN
7:35:58	86	608506.9	5750247.0	608506.3	5750246.9	-0.5	-0.1
7:36:13	87	608507.0	5750247.0	608506.3	5750246.9	-0.6	-0.1
7:36:28	88	608507.0	5750247.1	608506.3	5750246.9	-0.7	-0.1
7:36:43	89	608507.0	5750247.1	608506.3	5750246.9	-0.6	-0.2
7:36:58	90	608507.1	5750247.2	608506.3	5750246.9	-0.7	-0.3
7:37:13	91	608507.1	5750247.3	608506.3	5750246.9	-0.7	-0.4
7:37:28	92	608507.2	5750247.5	608506.3	5750246.9	-0.9	-0.5
7:37:43	93	608507.0	5750247.4	608506.3	5750246.9	-0.7	-0.4
7:37:58	94	608507.0	5750247.2	608506.3	5750246.9	-0.6	-0.2
7:38:13	95	608506.9	5750247.2	608506.3	5750246.9	-0.6	-0.3
7:38:28	96	608507.1	5750247.4	608506.3	5750246.9	-0.8	-0.5
7:38:43	97	608507.1	5750247.6	608506.3	5750246.9	-0.8	-0.7
7:38:58	98	608507.1	5750247.7	608506.3	5750246.9	-0.7	-0.8
7:39:13	99	608506.8	5750247.4	608506.3	5750246.9	-0.4	-0.4
7:39:28	100	608506.8	5750247.5	608506.3	5750246.9	-0.5	-0.6
7:39:43	101	608506.9	5750247.6	608506.3	5750246.9	-0.5	-0.6
7:39:58	102	608507.1	5750247.8	608506.3	5750246.9	-0.8	-0.9
7:40:13	103	608506.9	5750247.4	608506.3	5750246.9	-0.6	-0.5
7:40:28	104	608506.7	5750247.3	608506.3	5750246.9	-0.4	-0.3
7:40:43	105	608506.7	5750247.5	608506.3	5750246.9	-0.4	-0.6
7:40:58	106	608506.4	5750247.5	608506.3	5750246.9	-0.1	-0.6
7:41:13	107	608506.6	5750247.9	608506.3	5750246.9	-0.2	-1.0
7:41:28	108	608506.5	5750248.0	608506.3	5750246.9	-0.2	-1.1
7:41:43	109	608506.4	5750247.7	608506.3	5750246.9	-0.1	-0.7
7:41:58	110	608506.3	5750247.5	608506.3	5750246.9	0.0	-0.6
7:42:13	111	608506.3	5750247.5	608506.3	5750246.9	0.0	-0.6
7:42:28	112	608506.8	5750248.1	608506.3	5750246.9	-0.5	-1.2
7:42:43	113	608506.6	5750248.0	608506.3	5750246.9	-0.3	-1.0
7:42:58	114	608506.6	5750248.0	608506.3	5750246.9	-0.3	-1.0
7:43:13	115	608506.3	5750247.5	608506.3	5750246.9	0.0	-0.5
7:43:28	116	608506.1	5750247.3	608506.3	5750246.9	0.2	-0.3
7:43:43	117	608506.2	5750247.3	608506.3	5750246.9	0.1	-0.4
7:43:58	118	608506.3	5750247.6	608506.3	5750246.9	0.0	-0.7
7:44:13	119	608506.2	5750247.5	608506.3	5750246.9	0.1	-0.6
7:44:28	120	608506.3	5750247.6	608506.3	5750246.9	0.0	-0.7
7:44:43	121	608506.3	5750247.6	608506.3	5750246.9	0.0	-0.6
7:44:58	122	608506.4	5750247.7	608506.3	5750246.9	-0.1	-0.7
					Mean	**-0.4**	**-0.6**

DGPS STATIC Verification Sheet
Navigation System 1 - MRDGPS

Client :	**Benaris Energy NV**			**Job No.:**	**HY16611**
Project :	**Moonlight Head 3D Bathy Recon.**			**Vessel :**	**Lauren**
Survey Station :	**Moyne Wharf, Port Fairy (Victoria)**			**Date :**	**07 Oct. 2003**
Wharf Alighment :	**121° 35' 43" (True)**			**Surveyor :**	**TH/GM**
Datum :	**GDA94**	**Spheroid :**	**GRS80**	**Projection :**	**UTM (Zone 54)**
Offset: CRP to DGPS_Check (X-Axis) : 2.50m		**Offset: CRP to DGPS_Check (Y-Axis) : 5.40m**			

UTC		Observed		Calculated		C - O	
Time	Fix	Easting	Northing	Easting	Northing	dE	dN
01:37:44.0	3626	608506.56	5750246.6	608506.3	5750246.9	-0.2	0.3
01:37:48.0	3627	608506.602	5750246.7	608506.3	5750246.9	-0.3	0.2
01:37:52.0	3628	608506.475	5750246.8	608506.3	5750246.9	-0.1	0.2
01:37:56.0	3629	608506.461	5750246.7	608506.3	5750246.9	-0.1	0.2
01:38:00.0	3630	608506.442	5750246.7	608506.3	5750246.9	-0.1	0.3
01:38:04.0	3631	608506.422	5750246.6	608506.3	5750246.9	-0.1	0.3
01:38:08.0	3632	608506.377	5750246.6	608506.3	5750246.9	0.0	0.3
01:38:12.0	3633	608506.38	5750246.6	608506.3	5750246.9	0.0	0.4
01:38:16.0	3634	608506.481	5750246.7	608506.3	5750246.9	-0.1	0.2
01:38:20.0	3635	608506.608	5750246.8	608506.3	5750246.9	-0.3	0.1
01:38:24.0	3636	608506.766	5750247.0	608506.3	5750246.9	-0.4	-0.1
01:38:28.0	3637	608506.739	5750247.0	608506.3	5750246.9	-0.4	-0.1
01:38:32.0	3638	608506.637	5750246.8	608506.3	5750246.9	-0.3	0.1
01:38:36.0	3639	608506.57	5750246.8	608506.3	5750246.9	-0.2	0.1
01:38:40.0	3640	608506.572	5750246.8	608506.3	5750246.9	-0.2	0.1
01:38:44.0	3641	608506.625	5750247.0	608506.3	5750246.9	-0.3	0.0
01:38:48.0	3642	608506.728	5750247.1	608506.3	5750246.9	-0.4	-0.2
01:38:52.0	3643	608506.765	5750247.1	608506.3	5750246.9	-0.4	-0.2
01:38:56.0	3644	608506.628	5750247.0	608506.3	5750246.9	-0.3	-0.1
01:39:00.0	3645	608506.545	5750246.8	608506.3	5750246.9	-0.2	0.1
01:39:04.0	3646	608506.427	5750246.6	608506.3	5750246.9	-0.1	0.3
01:39:08.0	3647	608506.425	5750246.6	608506.3	5750246.9	-0.1	0.4
01:39:12.0	3648	608506.504	5750246.7	608506.3	5750246.9	-0.2	0.2
01:39:16.0	3649	608506.688	5750246.8	608506.3	5750246.9	-0.3	0.2
01:39:20.0	3650	608506.697	5750246.9	608506.3	5750246.9	-0.4	0.0
01:39:24.0	3651	608506.697	5750247.0	608506.3	5750246.9	-0.4	0.0
01:39:28.0	3652	608506.683	5750247.0	608506.3	5750246.9	-0.3	0.0
01:39:32.0	3653	608506.653	5750246.9	608506.3	5750246.9	-0.3	0.1
01:39:36.0	3654	608506.703	5750246.9	608506.3	5750246.9	-0.4	0.1
01:39:40.0	3655	608506.482	5750246.7	608506.3	5750246.9	-0.1	0.2
01:39:44.0	3656	608506.459	5750246.6	608506.3	5750246.9	-0.1	0.3
01:39:48.0	3657	608506.557	5750246.7	608506.3	5750246.9	-0.2	0.2
01:39:52.0	3658	608506.527	5750246.7	608506.3	5750246.9	-0.2	0.2
01:39:56.0	3659	608506.514	5750246.8	608506.3	5750246.9	-0.2	0.1
01:40:00.0	3660	608506.573	5750247.0	608506.3	5750246.9	-0.2	0.0
01:40:04.0	3661	608506.712	5750247.1	608506.3	5750246.9	-0.4	-0.1
01:40:08.0	3662	608506.732	5750247.1	608506.3	5750246.9	-0.4	-0.2
01:40:12.0	3663	608506.655	5750247.0	608506.3	5750246.9	-0.3	-0.1
01:40:16.0	3664	608506.618	5750246.9	608506.3	5750246.9	-0.3	0.1
01:40:20.0	3665	608506.507	5750246.7	608506.3	5750246.9	-0.2	0.3
01:40:24.0	3666	608506.386	5750246.7	608506.3	5750246.9	0.0	0.2
01:40:28.0	3667	608506.404	5750246.8	608506.3	5750246.9	-0.1	0.1
01:40:32.0	3668	608506.565	5750247.0	608506.3	5750246.9	-0.2	-0.1
01:40:36.0	3669	608506.587	5750247.2	608506.3	5750246.9	-0.2	-0.2
01:40:40.0	3670	608506.597	5750247.2	608506.3	5750246.9	-0.3	-0.2
01:40:44.0	3671	608506.52	5750247.0	608506.3	5750246.9	-0.2	-0.1
01:40:48.0	3672	608506.492	5750246.9	608506.3	5750246.9	-0.2	0.1
01:40:52.0	3673	608506.392	5750246.7	608506.3	5750246.9	-0.1	0.2
01:40:56.0	3674	608506.421	5750246.8	608506.3	5750246.9	-0.1	0.2
01:41:00.0	3675	608506.638	5750246.9	608506.3	5750246.9	-0.3	0.0
01:41:04.0	3676	608506.684	5750247.0	608506.3	5750246.9	-0.3	0.0
01:41:08.0	3677	608506.657	5750247.0	608506.3	5750246.9	-0.3	0.0
01:41:12.0	3678	608506.676	5750247.0	608506.3	5750246.9	-0.3	0.0

01:41:16.0	3679	608506.688	5750247.0	608506.3	5750246.9	-0.3	-0.1
01:41:20.0	3680	608506.7	5750247.0	608506.3	5750246.9	-0.4	-0.1
01:41:24.0	3681	608506.674	5750247.0	608506.3	5750246.9	-0.3	0.0
01:41:28.0	3682	608506.672	5750246.9	608506.3	5750246.9	-0.3	0.0
01:41:32.0	3683	608506.562	5750246.9	608506.3	5750246.9	-0.2	0.0
01:41:36.0	3684	608506.594	5750247.0	608506.3	5750246.9	-0.3	0.0
01:41:40.0	3685	608506.7	5750247.0	608506.3	5750246.9	-0.4	-0.1
01:41:44.0	3686	608506.669	5750247.0	608506.3	5750246.9	-0.3	0.0
01:41:48.0	3687	608506.686	5750247.0	608506.3	5750246.9	-0.3	-0.1
01:41:52.0	3688	608506.546	5750246.8	608506.3	5750246.9	-0.2	0.2
01:41:56.0	3689	608506.464	5750246.7	608506.3	5750246.9	-0.1	0.3
01:42:00.0	3690	608506.534	5750246.8	608506.3	5750246.9	-0.2	0.1
01:42:04.0	3691	608506.687	5750247.1	608506.3	5750246.9	-0.3	-0.1
01:42:08.0	3692	608506.733	5750247.2	608506.3	5750246.9	-0.4	-0.3
01:42:12.0	3693	608506.679	5750247.1	608506.3	5750246.9	-0.3	-0.2
01:42:16.0	3694	608506.588	5750246.9	608506.3	5750246.9	-0.2	0.0
01:42:20.0	3695	608506.544	5750246.8	608506.3	5750246.9	-0.2	0.1
01:42:24.0	3696	608506.468	5750246.7	608506.3	5750246.9	-0.1	0.2
01:42:28.0	3697	608506.473	5750246.8	608506.3	5750246.9	-0.1	0.2
01:42:32.0	3698	608506.54	5750246.9	608506.3	5750246.9	-0.2	0.1
01:42:36.0	3699	608506.593	5750246.9	608506.3	5750246.9	-0.3	0.0
01:42:40.0	3700	608506.644	5750247.0	608506.3	5750246.9	-0.3	0.0
01:42:44.0	3701	608506.58	5750246.9	608506.3	5750246.9	-0.2	0.0
01:42:48.0	3702	608506.614	5750246.9	608506.3	5750246.9	-0.3	0.1
01:42:52.0	3703	608506.577	5750247.0	608506.3	5750246.9	-0.2	0.0
01:42:56.0	3704	608506.436	5750246.8	608506.3	5750246.9	-0.1	0.1
01:43:00.0	3705	608506.436	5750246.8	608506.3	5750246.9	-0.1	0.2
01:43:04.0	3706	608506.403	5750246.8	608506.3	5750246.9	-0.1	0.1
01:43:08.0	3707	608506.48	5750246.9	608506.3	5750246.9	-0.1	0.0
01:43:12.0	3708	608506.561	5750247.0	608506.3	5750246.9	-0.2	0.0
01:43:16.0	3709	608506.615	5750247.0	608506.3	5750246.9	-0.3	-0.1
01:43:20.0	3710	608506.583	5750247.0	608506.3	5750246.9	-0.2	-0.1
01:43:24.0	3711	608506.618	5750247.0	608506.3	5750246.9	-0.3	-0.1
01:43:28.0	3712	608506.64	5750247.0	608506.3	5750246.9	-0.3	-0.1
01:43:32.0	3713	608506.574	5750246.9	608506.3	5750246.9	-0.2	0.0
01:43:36.0	3714	608506.599	5750246.9	608506.3	5750246.9	-0.3	0.1
01:43:40.0	3715	608506.597	5750246.8	608506.3	5750246.9	-0.3	0.2
01:43:44.0	3716	608506.547	5750246.7	608506.3	5750246.9	-0.2	0.2
01:43:48.0	3717	608506.589	5750246.8	608506.3	5750246.9	-0.2	0.2
01:43:52.0	3718	608506.618	5750246.8	608506.3	5750246.9	-0.3	0.2
01:43:56.0	3719	608506.507	5750246.6	608506.3	5750246.9	-0.2	0.3
01:44:00.0	3720	608506.541	5750246.6	608506.3	5750246.9	-0.2	0.3
01:44:04.0	3721	608506.597	5750246.7	608506.3	5750246.9	-0.3	0.2
01:44:08.0	3722	608506.7	5750246.8	608506.3	5750246.9	-0.4	0.1
01:44:12.0	3723	608506.656	5750246.7	608506.3	5750246.9	-0.3	0.2
01:44:16.0	3724	608506.637	5750246.7	608506.3	5750246.9	-0.3	0.2
01:44:20.0	3725	608506.568	5750246.6	608506.3	5750246.9	-0.2	0.4
01:44:24.0	3726	608506.49	5750246.5	608506.3	5750246.9	-0.2	0.5
01:44:28.0	3727	608506.528	5750246.5	608506.3	5750246.9	-0.2	0.4
01:44:32.0	3728	608506.677	5750246.6	608506.3	5750246.9	-0.3	0.3
01:44:36.0	3729	608506.625	5750246.6	608506.3	5750246.9	-0.3	0.3
01:44:40.0	3730	608506.638	5750246.7	608506.3	5750246.9	-0.3	0.3
01:44:44.0	3731	608506.645	5750246.6	608506.3	5750246.9	-0.3	0.3
01:44:48.0	3732	608506.635	5750246.6	608506.3	5750246.9	-0.3	0.3
01:44:52.0	3733	608506.63	5750246.7	608506.3	5750246.9	-0.3	0.3
01:44:56.0	3734	608506.576	5750246.6	608506.3	5750246.9	-0.2	0.4
01:45:00.0	3735	608506.625	5750246.6	608506.3	5750246.9	-0.3	0.3
01:45:04.0	3736	608506.615	5750246.6	608506.3	5750246.9	-0.3	0.3
01:45:08.0	3737	608506.712	5750246.7	608506.3	5750246.9	-0.4	0.2
01:45:12.0	3738	608506.715	5750246.7	608506.3	5750246.9	-0.4	0.2
01:45:16.0	3739	608506.733	5750246.8	608506.3	5750246.9	-0.4	0.1
01:45:20.0	3740	608506.741	5750246.7	608506.3	5750246.9	-0.4	0.2
01:45:24.0	3741	608506.659	5750246.5	608506.3	5750246.9	-0.3	0.4
01:45:28.0	3742	608506.672	5750246.6	608506.3	5750246.9	-0.3	0.3
01:45:32.0	3743	608506.765	5750246.7	608506.3	5750246.9	-0.4	0.3
01:45:36.0	3744	608506.756	5750246.8	608506.3	5750246.9	-0.4	0.2
01:45:40.0	3745	608506.726	5750246.7	608506.3	5750246.9	-0.4	0.2
01:45:44.0	3746	608506.706	5750246.7	608506.3	5750246.9	-0.4	0.3

01:45:48.0	3747	608506.692	5750246.7	608506.3	5750246.9	-0.4	0.3
01:45:52.0	3748	608506.662	5750246.5	608506.3	5750246.9	-0.3	0.4
01:45:56.0	3749	608506.593	5750246.4	608506.3	5750246.9	-0.3	0.5
01:46:00.0	3750	608506.610	5750246.5	608506.3	5750246.9	-0.3	0.5
01:46:04.0	3751	608506.617	5750246.5	608506.3	5750246.9	-0.3	0.4
01:46:08.0	3752	608506.633	5750246.5	608506.3	5750246.9	-0.3	0.4
01:46:12.0	3753	608506.618	5750246.5	608506.3	5750246.9	-0.3	0.4
01:46:16.0	3754	608506.613	5750246.5	608506.3	5750246.9	-0.3	0.4
01:46:20.0	3755	608506.636	5750246.6	608506.3	5750246.9	-0.3	0.4
01:46:24.0	3756	608506.675	5750246.7	608506.3	5750246.9	-0.3	0.3
01:46:28.0	3757	608506.682	5750246.5	608506.3	5750246.9	-0.3	0.4
01:46:32.0	3758	608506.655	5750246.5	608506.3	5750246.9	-0.3	0.4
01:46:36.0	3759	608506.717	5750246.6	608506.3	5750246.9	-0.4	0.3
01:46:40.0	3760	608506.750	5750246.7	608506.3	5750246.9	-0.4	0.2
01:46:44.0	3761	608506.838	5750246.8	608506.3	5750246.9	-0.5	0.1
01:46:48.0	3762	608506.829	5750246.7	608506.3	5750246.9	-0.5	0.2
01:46:52.0	3763	608506.687	5750246.5	608506.3	5750246.9	-0.3	0.4
01:46:56.0	3764	608506.716	5750246.6	608506.3	5750246.9	-0.4	0.4
01:47:00.0	3765	608506.783	5750246.6	608506.3	5750246.9	-0.4	0.3
01:47:04.0	3766	608506.764	5750246.6	608506.3	5750246.9	-0.4	0.3
01:47:08.0	3767	608506.739	5750246.7	608506.3	5750246.9	-0.4	0.3
					Mean	**-0.3**	**0.2**

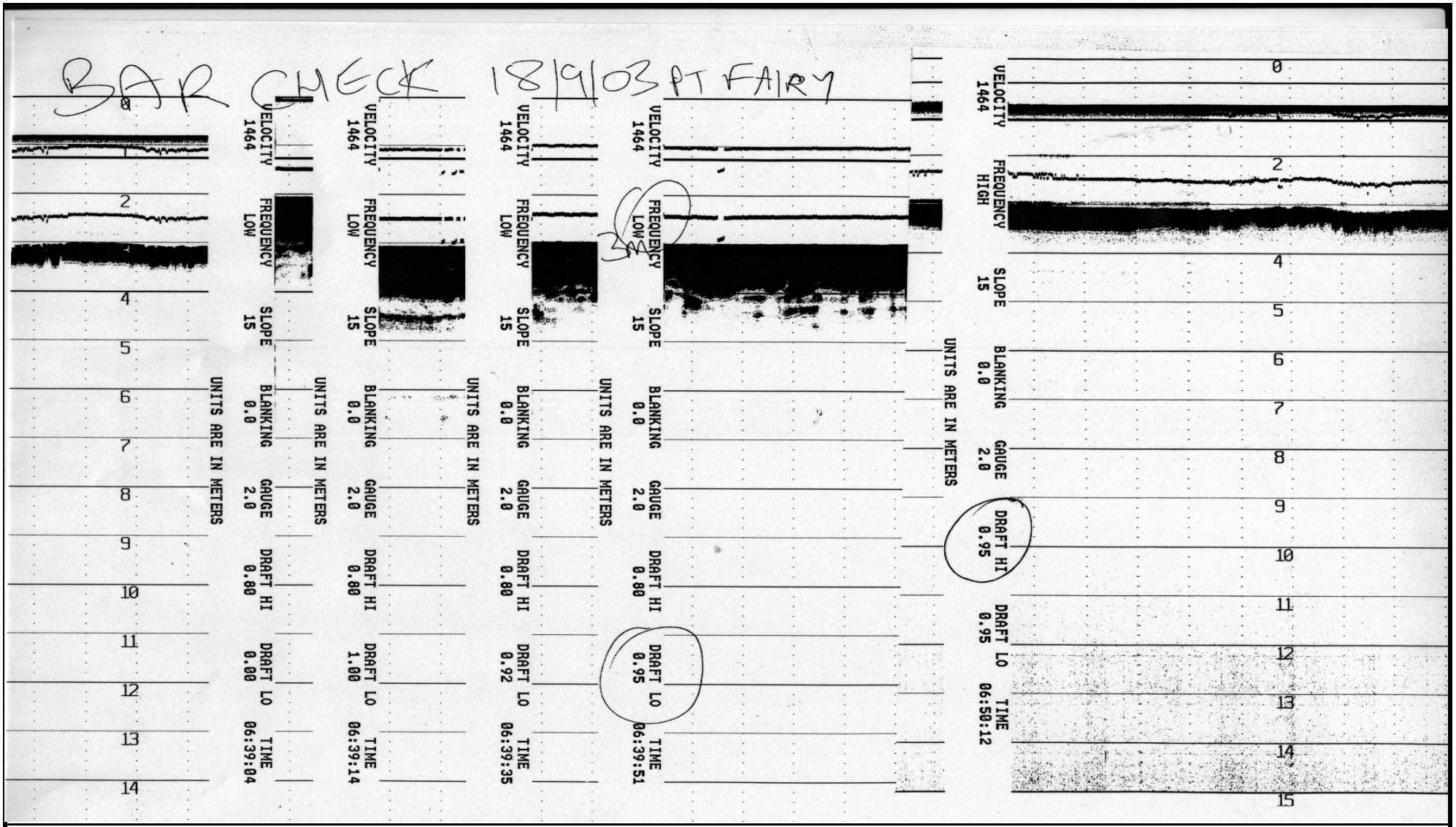
APPENDIX G
SINGLE BEAM ECHO SOUNDER

Fugro Marine Division
FSHY26-2
BAR CHECK LOG

Client: Woodside **Job No:** HY16603 **Location:** Antares - Otway Basin

DATE	TIME	Trans-ducer	Min Depth	Max Depth	Gain Setting	Echo Roll No.	Heave ON/OFF	RESULTS		COMMENTS	Survey Initial
								TX (m)	Speed(m/sec)		
18/09/2003	14:45	hi					off	0.95			GTM
18/09/2003	14:45	lo					off	0.95			GTM
3/10/2003	14:30	hi					off	0.94			GTM
3/10/2003	14:30	lo					off	0.94			GTM

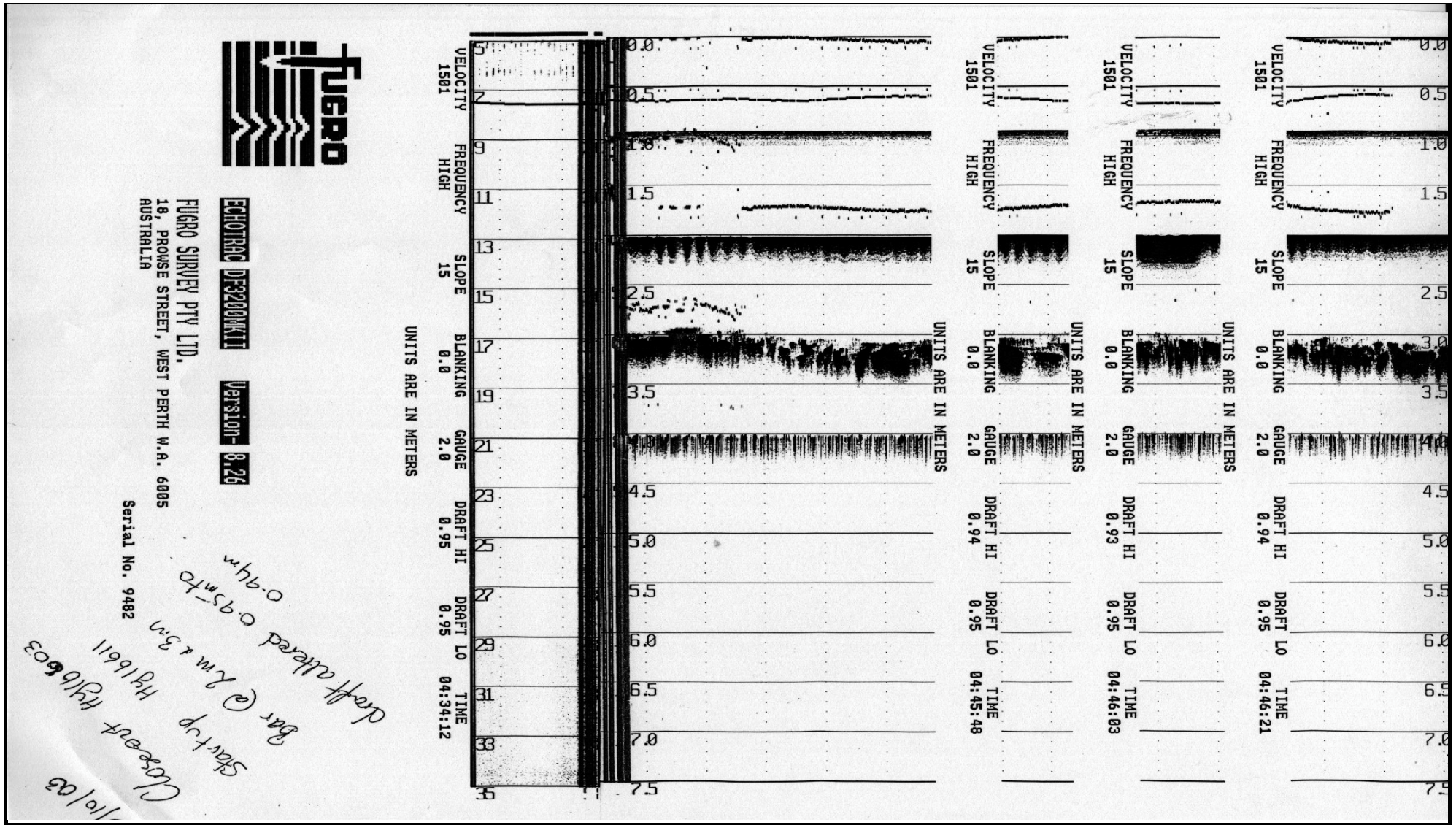
Approved by Dave Scott, Operations Manager - 1/08/01
Note - To ensure that this is the latest version check Electronic Master File



GENERAL INFORMATION

Survey tool:	ODOM Echotrac DF3200	Scaling:	Not to scale
Vessel:	MV Lauren	Frequency:	High (200kHz)
Survey date:	September 18, 2003		Low (24khz)

BAR CHECK RECORD - Dual Frequency Transducer



GENERAL INFORMATION

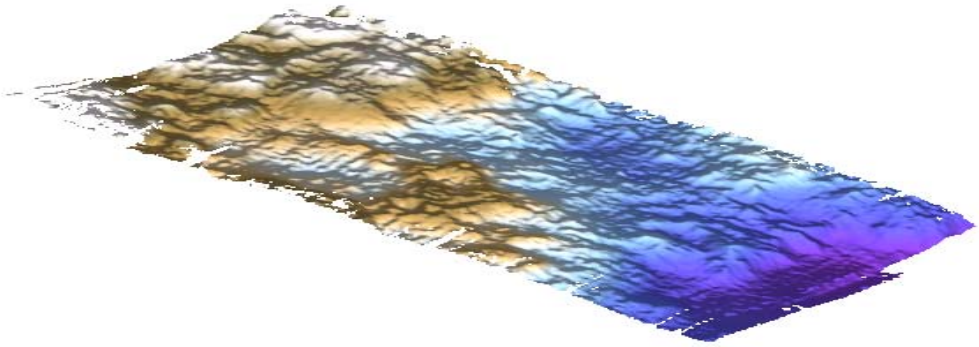
Survey tool:	ODOM Echotrac DF3200	Scaling:	Not to scale
Vessel:	MV Lauren	Frequency:	High (200kHz)
Survey date:	October 3, 2003		Low (24khz)

BAR CHECK RECORD - Dual Frequency Transducer

APPENDIX H
GEOSWATH CALIBRATION

1 Multibeam Calibration

A 4-line multibeam calibration, as per Fugro Pty. Ltd. normal routine was carried out on the 20 August 2003 on an outcrop at the northwest end of the proposed seismic vessel's turning area. Calibration values were then calculated using GeoSwath's Calibrator32 and then checked manually.



1.1 Calibration Procedure

Prior to commencing the calibration procedure the velocity of sound through the water column was measured using a Sea-Bird profiler probe and the results entered into the processing program Swath32. The draft of the transducer was measured along with all offsets relative to processing.

The Patch Test line configuration was as follows;

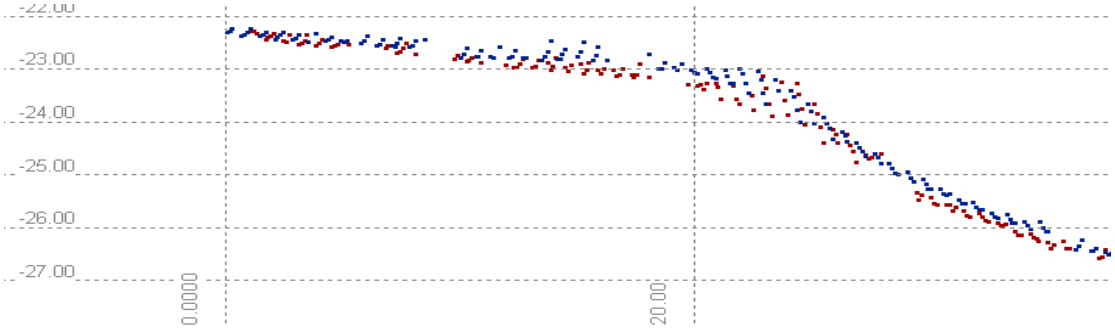
Line Name	Direction	Speed (ms^{-1})	Offset (m)
Cal06	305°	4.9	0
Cal07	125°	5.2	40
Cal08	305°	7.1	0
Cal09	125°	5.2	40

1.2 Calibration Results

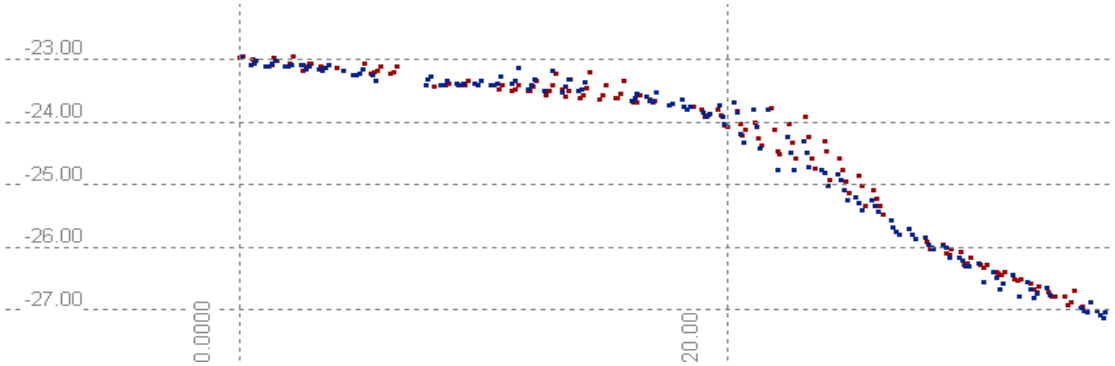
1.2.1 Navigation Latency

Calibration for latency is required due to the electronic delay between Geoswath and the navigation package when time tagging the depth and position values. The latency is determined by measuring the along track separation of the seabed feature observed on the centre line surveyed twice in the same direction but at two different speeds, lines Cal06 and Cal08.

Below is a cross section of lines Cal06 and Cal08 over a slope, with a lateral offset due to latency evident.



Using Geoswath's Calibrator32 application, a latency correction value was determined and then included in processing. The value obtained was **0.79 seconds.** Below is the corrected cross section of lines Cal06 and Cal08 over the same area of seabed.

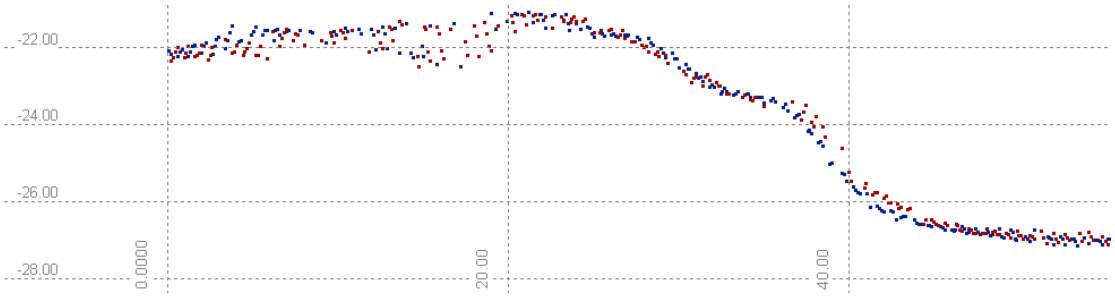


1.2.2 Heading (Yaw)

The heading is the offset between the two Geoswath transducers (port and starboard) and the gyrocompass used as the primary heading device. The heading offset factor was determined by running a centre-line and an offset line in the same direction and at the same speed, lines Cal06 and Cal07 for the port transducer, and Cal06 and Cal09 for the starboard transducer.

Any yaw offset present shows as an along track separation of the plotted position of the seabed feature.

Using Geoswath's Calibrator32 application, a heading correction value was determined for the two transducers and the mean included in processing. The value obtained for the port transducer was **+6.8°**, and the value for the starboard transducer was **-4.0°**. Hence the calculated mean is **+1.4°**. Below is the corrected cross section of lines Cal06 and Cal07 over our calibration feature.

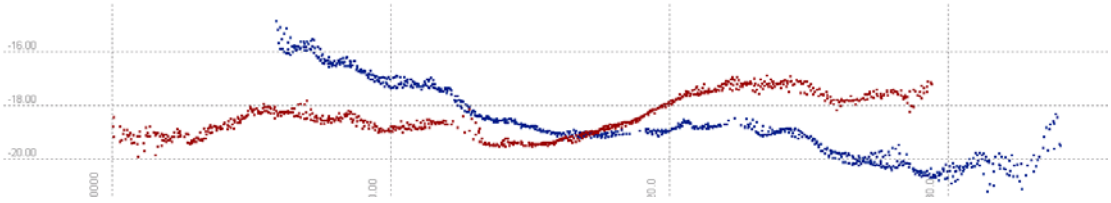


1.2.3 Roll

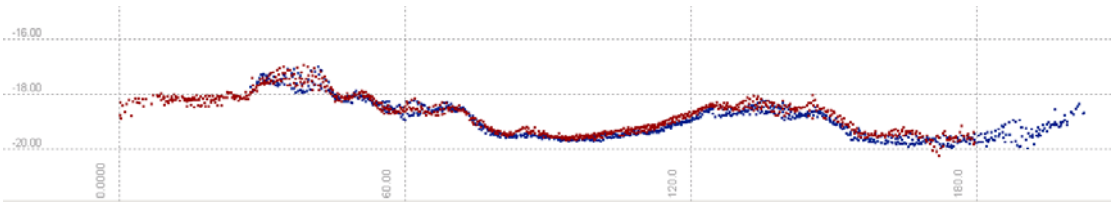
The roll calibration factor was determined by running two adjacent lines in opposite directions but at the same speed over the same section of uniform seabed and comparing the relevant overlapping areas, lines Cal06 and Cal07 for the port transducer, and Cal06 and Cal09 for the starboard transducer.

When a cross section, cut across track, containing both data sets is viewed, and roll offset will cause the data to appear as an 'X'. The roll offset is half of the angle between the two lines viewed in the cross section.

Below is a cross section of lines Cal06 and Cal09 over a flat section of seabed, used to determine the starboard's transducer roll correction.



Using Geoswath's Calibrator32 application, a roll correction value was determined for the two transducers and applied in processing. The value obtained for the port transducer was **–0.58°**, and the value for the starboard transducer was **+1.34°**. The two roll corrections of each of the transducers are independent from each other. Below is the corrected cross section of lines Cal06 and Cal09 over a flat section of seabed.

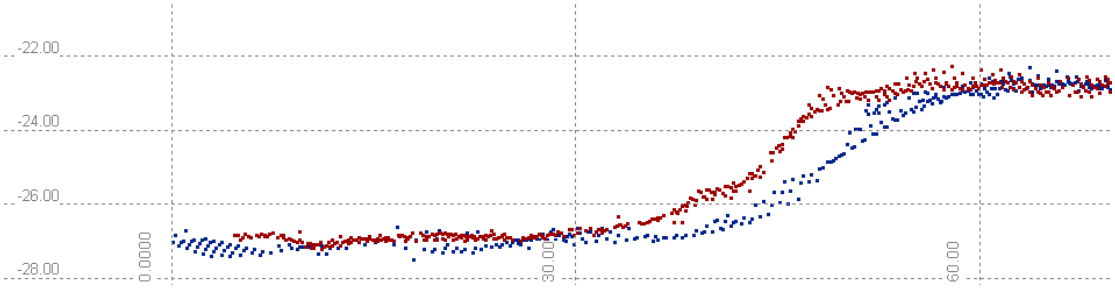


1.2.4 Pitch

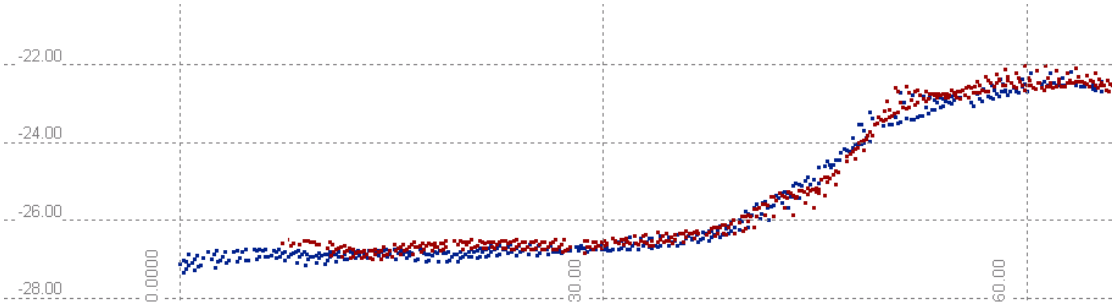
The pitch calibration factor was determined by running two adjacent lines in opposite directions but at the same speed over the same section of uniform seabed and comparing the relevant overlapping areas, lines Cal06 and Cal07 for the port transducer, and Cal06 and Cal09 for the starboard transducer.

Any pitch offset present shows as a separation in the along track direction of the plotted positions of the seabed feature. The pitch offset is effectively half of the angle between, the feature on the first line to the transducer and then to the feature on the second line. Only the overlapping data on the relevant side of the swath was utilized for the equivalent transducer.

Below is a cross section of lines Cal06 and Cal07 over the calibration feature.



Using Geoswath's Calibrator32 application, a pitch correction value was determined for the two transducers and the mean included in processing. The value obtained for the port transducer was **+0.19°**, and the value for the starboard transducer was **-0.25°**. Hence the calculated mean is **–0.03°**. Below is the corrected cross section of lines Cal06 and Cal07 over our calibration feature.



1.2.5 Summary of Results

	Automatic
Navigation Latency	**0.79s**
Roll (Port Transducer)	**-0.58°**
Roll (Stbd Transducer)	**1.34°**
Pitch (mean)	**-0.03°**
Heading (mean)	**1.4°**

Calibrator32 was run various times after the initial session to ensure that the calibration variables were acceptable, the calibration was then computed manually and then the corrected datasets were viewed in Starfix.Surface. These checks proved that the calibration variables were correct.

APPENDIX I
HS&E MEETING RECORDS

Fugro Marine Division
FSSM19-1
SURVEY VESSEL SAFETY INTEGRITY CHECK

PROJECT: ANTARES RECONNAISSANCE	**VESSEL:** MV LAUREN
CLIENT: WOODSIDE	**MASTER:** ROY CARSTAIRS
JOB NUMBER: HY 16603	**PARTY CHIEF:** GREG MOORE

PURPOSE:

The purpose of this form is for the Master to confirm that the mobilisation of the survey spread has not had a detrimental impact on the safe integrity of the vessel. It is important that any changes caused during the mobilisation do not impact on the following:

DETRIMENTAL IMPACT CAUSED TO?

1	The stability of the vessel	YES	(NO)
2	The operation and access to safety systems	YES	(NO)
3	Emergency exits	YES	(NO)
4	Electrical systems	YES	(NO)
5	Class certificate requirements	YES	(NO)

I have carried out the vessel integrity check on completion of the survey equipment mobilisation and confirm that the vessel is seaworthy and fit to proceed to sea.

Signature of Master: R. Carstairs	**Date:** 15-9-2003
Signature of Party Chief: Greg J Moore	**Date:** 15-9-03

Fugro Marine Division
FSSM11-1
SURVEY VESSEL SAFETY CHECKLIST

PROJECT: ANTARES RECONNAISSANCE	**VESSEL:** MV LAUREN
CLIENT: WOODSIDE	**MASTER:** ROY CARSTAIRS
JOB NUMBER:	**PARTY CHIEF:** GREG MOORE

DOCUMENTATION				
1	Copy of the Vessel Safety Manual onboard?	(YES)	NO	N/A
2	All Survey Crew received a Vessel Safety Induction?	(YES)	NO	N/A
3	Copy of the Fugro HS&E Management System (FSSM01) onboard?	(YES)	NO	N/A
4	All Survey Crew received a Fugro Induction?	(YES)	NO	N/A
5	Copy of Fugro Offshore Safety Practices (FSSM06) onboard?	(YES)	NO	N/A
6	Copy of Seismic and Coring Safety Practices (FSSM08) onboard?	(YES)	NO	N/A
7	All Survey Crew read and understood FSSM006&8?	(YES)	NO	N/A
8	Copy of the Project Safety Plan (FSSA**) onboard?	(YES)	NO	N/A
9	All personnel on the vessel read and understood the Safety Plan?	(YES)	NO	N/A
10	Copies of all appropriate Fugro Safety Report forms on board?	(YES)	NO	N/A
11		YES	NO	N/A
SAFETY EQUIPMENT				
12	All survey and vessel deck crew have safety boots and overalls?	(YES)	NO	N/A
13	Enough floatation vests available for ondeck work?	(YES)	NO	N/A
14	Enough hard hats available on deck?	(YES)	NO	N/A
15	Enough glasses and ear protectors available if required?	(YES)	NO	N/A
16	Safety harness available for working on the mainmast?	YES	NO	(N/A)
17	Lifejackets available on deck as well as in the cabins?	(YES)	NO	N/A
18	Appropriate fire extinguishers close to the survey room?	(YES)	NO	N/A
19	All personnel familiar with emergency equipment and lifeboat station?	(YES)	NO	N/A
20	Safety chain/rail in position across the stern?	(YES)	NO	N/A
21	Life Ring located near the stern work area?	(YES)	NO	N/A
22	Alarms heard in all work areas and accommodation on the vessel?	(YES)	NO	N/A
23		YES	NO	N/A
SURVEY EQUIPMENT				
24	Survey equipment properly installed and firmly secured?	(YES)	NO	N/A
25	Senior technician approved all electrical connections?	(YES)	NO	N/A
26	All spares, boxes and consumables suitably stored?	(YES)	NO	N/A
27	All work areas clear and free from obstructions?	(YES)	NO	N/A
28	Generators/Compressors properly secured and fuelling systems arranged?	(YES)	NO	N/A
29	Boomer bang boxes isolated and protected from accidental contact?	(YES)	NO	N/A

SURVEY VESSEL SAFETY CHECKLIST

30	Areas of High Pressure Activities have restricted access?	YES	NO	N/A
SURVEY PROCEDURES				
31	Transducer(s) deployment and recovery been demonstrated as safe?	(YES)	NO	N/A
32	Sidescan deployment and recovery been demonstrated as safe?	(YES)	NO	N/A
33	Boomer deployment and recovery been demonstrated as safe?	(YES)	NO	N/A
34	Airgun/Streamer deployment and recovery been demonstrated as safe?	YES	NO	(N/A)
35	Operation of the Bang Boxes and associated dangers been understood by all crew?	(YES)	NO	N/A
36	Operation of the Air System and associated dangers been understood by all crew?	YES	NO	(N/A)
37	Sampling Equipment deployment and recovery been demonstrated as safe?	YES	NO	(N/A)
38	All crew familiar with their work station and with their safety responsibilities?	(YES)	NO	N/A
39		YES	NO	N/A
40		YES	NO	N/A
41		YES	NO	N/A
TRAINING AND DRILLS				
42	All Survey Crew been conducted on a Safety Tour of the Vessel?	(YES)	NO	N/A
43	All Survey Crew been allocated Lifeboat Stations?	(YES)	NO	N/A
44	Initial Vessel Safety meeting been held and minuted onboard?	(YES)	NO	N/A
45	MOB, Fire and Abandonment drills planned during the survey?	(YES)	NO	N/A
46	Has Client onsite induction taken place?	(YES)	NO	N/A
47		YES	NO	N/A
48		YES	NO	N/A

ADDITIONAL COMMENTS:

Signature of Party Chief: Greg J Moore	Date: 25/9/03
Signature of Client Rep:	Date: 25/09/2003

HEALTH, SAFETY & ENVIRONMENT MEETING RECORD

Date: 15/09/2003	Time: 08:00
Location: Port Fairy	Job Number: HY16603

Personnel Present:

Fugro Survey: T. Hansen, A. Janczewski, G. Moore, J. Richards

Woodside: D. Myers PGS: D. Duel

Undersea Marine: E. Beddome, R. Carstairs, R. Stewart

Items Discussed:

- Outline of the project
- Project survey plan
- Woodside's HSE policies.
- Project emergency response plan.
- Project HSE plan.
- Vessel's safety plan and emergency response plan.
- Fugro's Alcohol and Drug policy.

Specific Issues

- Working near a lee shore.
- Suitability of generator.
- Life jackets worn on back deck during transit.

Action Items:	Action by:	Target date
• Talk to Chris - Bhagwan K re Emergency assistance if required. • Source a diesel generator •		

Signature of Site HS&E Rep: Greg T Moore **Date:** 15/09/03

PLEASE FORWARD ORIGINAL TO FUGRO SURVEY HS&E MANAGER

Fugro Marine Division
FSSM01-6
HEALTH, SAFETY & ENVIRONMENT MEETING RECORD

Date: 27/09/2003	**Time: 09:00**
Location: Port Fairy	**Job Number: HY16603**

Personnel Present:

Fugro Survey: A. Janczewski, G. Moore, J. Richards

Woodside: D. Myers

Undersea Marine: R. Carstairs, R. Stewart

Items Discussed:

- Minutes from project induction including action items.
- Project operations - remaining work
- Method for Geoswathe pole deployment.
- Posting a lookout while operating near reef/waves.
- Future boomer work
    - loading heavy equipment
    - location of generator
    - need for deployment JHA prior to operations.
-
-

	Action by:	Target date

Signature of Site HS&E Rep: Greg T Moore **Date: 27/09/03**

PLEASE FORWARD ORIGINAL TO FUGRO SURVEY HS&E MANAGER

HEALTH, SAFETY & ENVIRONMENT MEETING RECORD

Date: 02/10/2003	Time: 09:45
Location: Port Fairy	Job Number: HY16603

Personnel Present:

Fugro Survey: A. Janczewski, G. Moore, G. Laurent

Woodside: D. Myers

Undersea Marine: R. Carstairs, R. Stewart

Items Discussed:

- Client reported that good bathymetry data was collected to satisfy the project objectives.
- Client particularly happy with the efforts to collect near shore boomer data.
- Project objectives were achieved.
- Discussed the poor weather, wrong time of the year.
- Uncomfortable transits - beware of open window.
- Discussed pole deployment - good system was developed.
- No need to stand on side during pole deployment.
- Discussed the transit securing method for Geoswathe pole.
- Discussed problem with VHF radio power supply.
- Refueling procedure went well.
- Improvements required with hygiene in wheel house - cleaning up after meals, placing rubbish in bins.
- JHAs and toolbox useful at start of job when people not familiar with procedures.
- Highlighted excessive working hours for processor - difficulty in fulfilling expectations of processed data the morning after data collection.

	Action by:	Target date
Repair P/S to VHF Radio Improve transit hang off for Geoswathe transducer pole	RC/RS RC/Ski	02/10/03 02/10/03

Signature of Site HS&E Rep: Greg J Moore **Date: 02/10/03**

PLEASE FORWARD ORIGINAL TO FUGRO SURVEY HS&E MANAGER

MV LAUREN

HEALTH, SAFETY AND ENVIRONMENT HAZARDS

No.	Date	H/S/E Hazard	Hazard	Comments / Response Actioned	Response to be Actioned	Closed Out
1.	20/9/03	S	Person observed at stern without floatation vest.	Reminded person to put on vest.	Remind all personnel at next safety meeting.	✓
2.	22/9/03	S	Echo sounder secured on deck with transducer at base of steps - potential trip hazard.	Moved sounder pole to a safer place and re-secured.	No further action.	✓
3	28/9/03	S	Vessel motion during transit in rough weather. Potential damage to survey equipment or injury to personnel.	Keep personnel movements to a minimum during transit. Ensure all survey equipment is secured prior to each transit commencing. Adjust engine revs if required.	No further action.	✓
4	30/9/03	S	Person feeling unwell at side of vessel during vessel transit. Potential man overboard.	Put a floatation vest on person, got them to sit on a box and kept a close watch.	No further action.	✓

APPENDIX J
JOB CONFIGURATION PRINTOUT

07/10/2003 01:30:39 UTC
*** FUGRO SURVEY STARFIX.SEIS ***

```
Header : Project Name                      :   Moonlight
         Project Number                    :   hy16611
         Project Description               :   Bathy Recon
         Project Location                  :   Port Campbell
         Client                            :   Benaris
         Client Representative             :   Des Duel
         Client Reference Number           :
         Geophysical Contractor            :   Ski/Gerard
         Positioning Contractor            :   Jamie
         Positioning Processing Contractor:   Sam
         Setup By                          :   Jamie
         On                                :   07/10/2003 01:30:39 UTC
         Time Source                       :   9 GPS Raw Data Trimble
         Time Offset                       :   10:00 (Using UTC)
         Vessel                            :   MVLauren

Files    Runline       :   C:\hy16611\seis_files\hy16611.srn
         Centreline    :   (None)
         Database      :   C:\hy16611\seis_files\hy16611.sdb
         CAD           :   C:\hy16611\seis_files\dgn\4_5oct03_15_all.dgn
         Waypoint      :   C:\hy16611\seis_files\hy16611.swy

Logging: Directory     :   C:\\hy16611\NonSession\SEIS\

Fixing : Mode          :   Distance
         Start Mode    :   Manual
         Stop Mode     :   Manual
         Fix Devices   :
           Auto-Fix    :   SEIS
           Manual      :   SEIS
           External    :   (None)
           Offset      :   (None)
           MOB         :   (None)
         Fix Interval  :    50.000m
         Reset at SOL  :   No
         Next Fix No.  :     3626
         Fix Increment :        1
         Start FFID    :     3626
         Start Man. Fix:        3
         Early Start   :       10s
         Logging Start :        5s

Datum 1: Datum         :  GDA94 (Australia-AUSLIG)
         Spheroid      :  GRS80
         SemiMajor Axis:  6378137.000
         1/Flattening  :  298.2572221010
         Eccentricity^2:  0.006694380022901

         Projection    :  Transverse Mercator (UTM)
         Grid Name     :
         Lat. Origin   :    0d00'00.0000"N
         Lon. Origin   :  141d00'00.0000"E
         False East    :    500000.000m
         False North   :  10000000.000m
         Scale Factor  :  0.9996
         Convergence   :  Australia/New Zealand
```

```
Datum 2: Datum         :  WGS 84
         Spheroid      :  WGS 84
         SemiMajor Axis:  6378137.000
         1/Flattening  :  298.2572235630
         Eccentricity^2:  0.006694379990141

Datum2>1:Parameters    :  From WGS84 to GDA94 (Australia-AUSLIG)
         DX            :     0.0000m         RX            :     0.0000"
         DY            :     0.0000m         RY            :     0.0000"
         DZ            :     0.0000m         RZ            :     0.0000"
         D Scale       :     0.0000ppm       Rot Convention:  +RZ=-
         RLongitude

Sundry : Vertical Datum:
         Ell. Sep.     :     0.0000m
         Distances     :   Grid
         Bearings      :   Grid
         Units         :  metres
         Conversion    :     1.0000000000

Main Vessel            :  MVLauren
                       :  C:\HY16611\SEIS_FILES\MVLAUREN.SVS

Nav. 1 : System        :  MRDGPS    (In Use)
         Type          :  Lat - Long
         Priority      :     1
         Time-out      :     5.0s
         Offset Name   :  MVLauren        |GPS_Ant
         X Offset      :     0.63m
         Y Offset      :     0.00m
         Ant. Height   :     2.75m
Nav. 2 : System        :  NMEA GPS.GGA
         Type          :  Lat - Long
         Priority      :     2
         Time-out      :     5.0s
         Offset Name   :  MVLauren        |Swathe
         X Offset      :    -2.63m
         Y Offset      :     0.00m
         Ant. Height   :    -2.37m
Dead Reckoning: No   Timeout:  30.0s

Gyro 1 : System        :  SGBrown    (In Use)
         Priority      :     1
         Time-out      :     3.0s
         Offset Name   :  CRP
         X Offset      :     0.00m
         Y Offset      :     0.00m
         Z Offset      :     0.00m
         Correction    :     1.52 Degrees

Sounder 1: System      : EchoTrac.High    (In Use)
           Priority    :    1
           Time-out    :    5.0s
           Offset Name : CRP
           X Offset    :    0.00m
           Y Offset    :    0.00m
           Z Offset    :    0.00m
           Vel. Sound  : 1500.00m/s

Offsets: Name                     X         Y         Z
```

```
         GPS_Ant                   0.63      0.00      2.75
         F180                     -1.30      2.90      0.43
         Swathe                   -2.63      0.00     -2.37
         Odom                      2.35     -1.20      0.00
         DGPS_Check                2.50      5.40      0.00
         C_Stn                     0.00     -6.70      0.00

O/Ts   : Steered Point:  O/T 0
         Shot         :  O/T 0

O/T  0    PR CRP              Flt:    Pos Sys: Datum In-Use
O/T  1    PR Swathe           Flt:    Fxd Off: Swathe
O/T  2    PR Odom             Flt:    Fxd Off: Odom
O/T  3    PR NMEA GPS.GGA Dat Flt:    Pos Sys: NMEA GPS.GGA Datum

O/T Legend:   PR=Print LG=Log SN=Snap to line
V/O  1 CDP
Using:
100% vessel COG
  0% vessel heading
  0% offset bearing (from 0,0)
  0% line heading
 from O/T  3    15.0m@180.0G

Runline     : Moon6 (Sequence: 65)
Start       :  38d42'50.3998"S 143d09'15.0000"E    0.0m
                687291.378mE  5712757.757mN        0.0m
End         :  38d45'47.9998"S 143d13'12.6000"E    0.0m
                692897.458mE  5707145.446mN        0.0m
Azimuth     :      135.0 Degrees Grid
Length      :     7932.6 m
Start Chain.:        0.0 m
Run In      :        0.0 m
Run Out     :        0.0 m
Ghost Offset:        0.0 m
Turn radius :        0 m
Turn offset :        0 m
Turn angle  :      180.0 Degrees

Printing:
         Fix mark rate   :   1
         Weather Device  :   (None)
         Weather Interval:    60 minutes
         Weather Enabled :   No
         Config Changes  :   No
         System Timeouts :   No
         Concise Header  :   No

Software:Starfix Suite 5.1  (Service Pack 1)
         HF: SUPERIN HF1
         Seis       Ver 2.08.0003
         SeisEngine Ver 2.08.0003
         Display    Ver 2.13.0001
         Anchors    Ver 3.01.0016
         Print      Ver 2.03.0004

--------------------------------------------------------------------------------
-------------------------------------------
07/10/2003  01:30:45 UTC
Alarm: MVLauren, NMEA GPS.GGA timeout (age > 5)
```

APPENDIX K
SURVEY RUN LOGS

SURVEY RUN LOG

No. 3174

Client: BENARUS **Location:** MOONLIGHT **Vessel:** MV LAUREN **Job No.** MY 16611

Date	Line Name	Time Start	Time End	Fix No. Start	Fix No. End	Speed	Echo Roll No.	Line Heading	File Name		COMMENTS (Quality of data, nav problems etc.)	Sur. Init.
4/10/03	MOON1A	0840	0904	1	84	6.0	1	E				JR
"	MOON1B	0909	0934	85	169	6.0	1	E				
"	MOON2	0934	0957	170	250	6.0	1	E				
"	MOON3	0957		251		6.0	1	E				
"	MOON4		1115	~~328~~	523	6.0	1	E				
"	MOON5	1115	1151	524	527	6.0	1	E			LOGGING STUFF UP	
"	MOON6	1151	1232	528	683	6.3		E				
"	MOON6D	1308	1328	684	823	6.3	1/2	W				
"	MOON5D	1350	1424	834	961	6.3	2	W				
"	MOON4D	1425	1446	962	039	6.3	2	W				
"	MOON3D	1447	1510	1040		6.3	2	W				

FSHY26-3

FSV032

SURVEY RUN LOG

No. 3175

FUGRO

Client: BENARIS **Location:** MOONLIGHT **Vessel:** MV LAUREN **Job No.** H416611

Date	Line Name	Time Start	Time End	Fix No. Start	Fix No. End	Speed	Echo Roll No.	Line Heading	File Name		COMMENTS (Quality of data, nav problems etc.)	Sur. Init.
5/10/03	MOON1H	0757	0957	1128	1587	5.9	2	E				JR
"	MOON2H	0957	1011	1588	1636	6.0	2	E				
"	MOON2	1012	1038	1637	1737	6.0	2	E				
"	MOON3H	1039	1122	1734	1896	6.0	2	E				
"	MOON3	1123	1256	1897	2247	6.0	2	E				
"	MOON4H	1305	1402	2248	2466	6.3	2	E				

FSHY26-3

FSV032

SURVEY RUN LOG

No. 3176

FUGRO

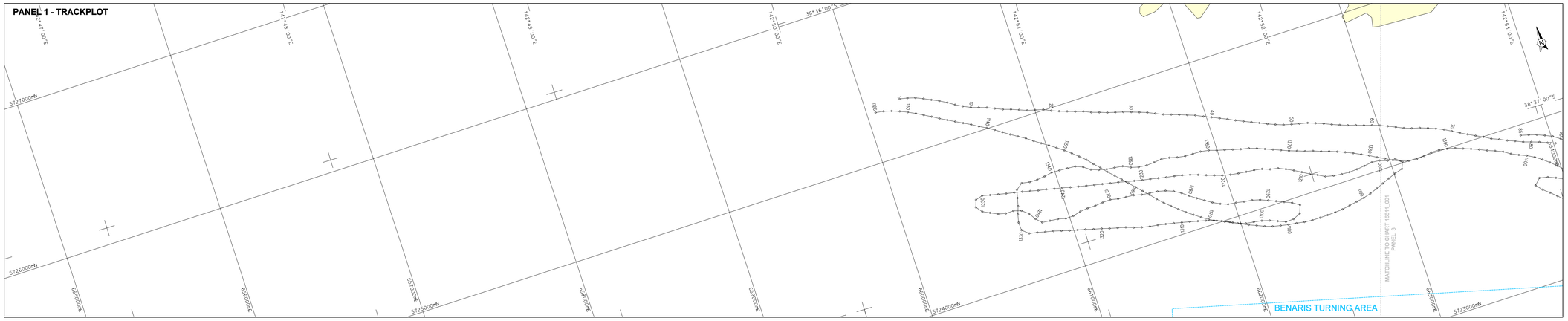
Client: Beavis **Location:** MOONLIGHT **Vessel:** MV LAUREN **Job No.** M716611

Date	Line Name	Time Start	Time End	Fix No. Start	Fix No. End	Speed	Echo Roll No.	Line Heading	File Name		COMMENTS (Quality of data, nav problems etc.)	Sur. Init.
05/10/03	MOON5H	0900	0916	2467	2531	6·3	2	140°				JR
05/10/03	MOON 6H	0917	1012	2532	2738	6·3	2	138°			Swath width 90m A	
	MOON7	1013	1033	2739	2814	6·5	2				SWATH WIDTH change → 180m	
	MOON 7B	1035	1043	2815	2842		2					
	MOON7C	1043	1051	2843			2					
	MOON 7	1053	1104		2912		2					
	MOON 7	1106	1113	2913	2955		2					
	MOON 7	1124		2955	2977		2					
	MOON7		1141	2978	3010		2				} Swath back down to 90m	
	MOON7		1150	3011	3036		2					
	MOON7	1151	1158	3037	3060		2					
	MOON7	1200	1207	3061	3084		2					
	MOON7			3085	3110		2					
	MOON7		1222	3111	3130		2					
	MOON7	1223		3131			2/3				Swath back out to 120m	
	MOON6	1248	1432		3624	6·1	3	NW			Swath 90m +60	

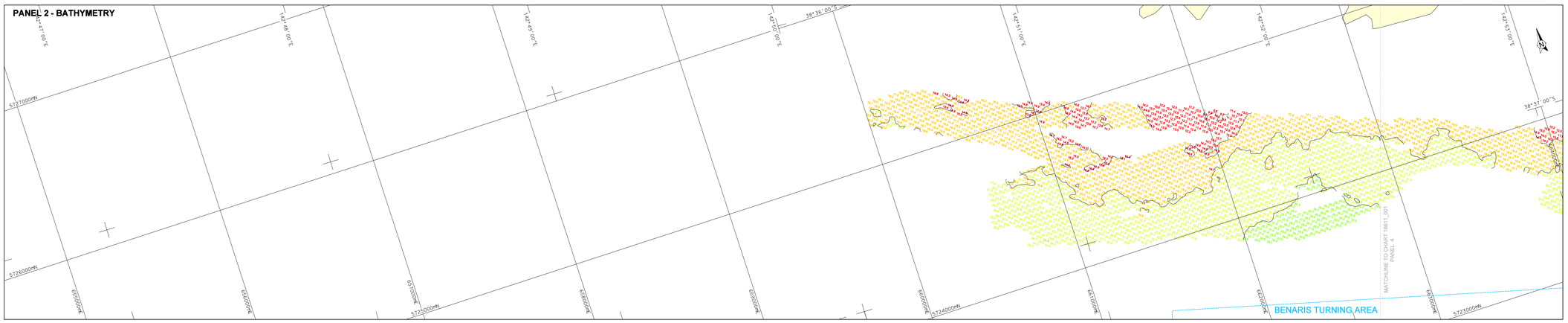
FSHY26-3

FSV032

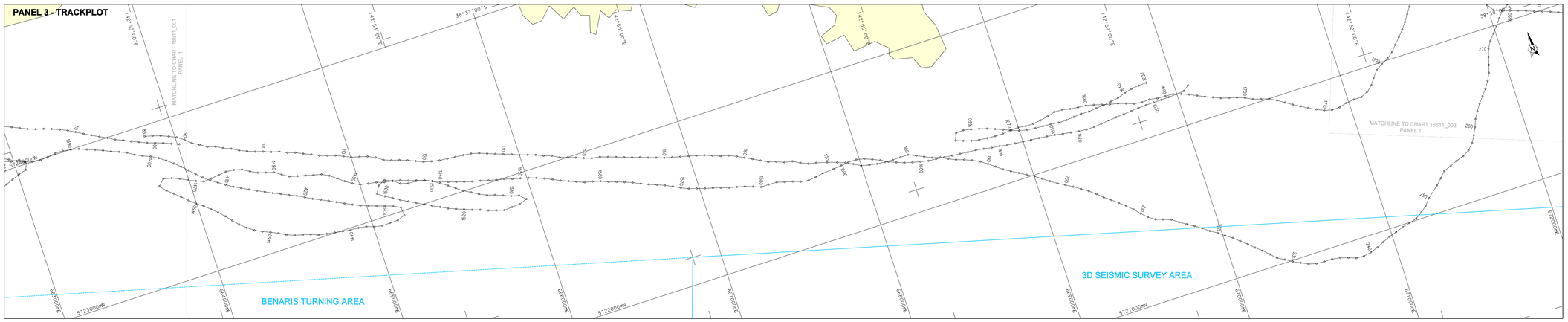
PANEL 1 - TRACKPLOT



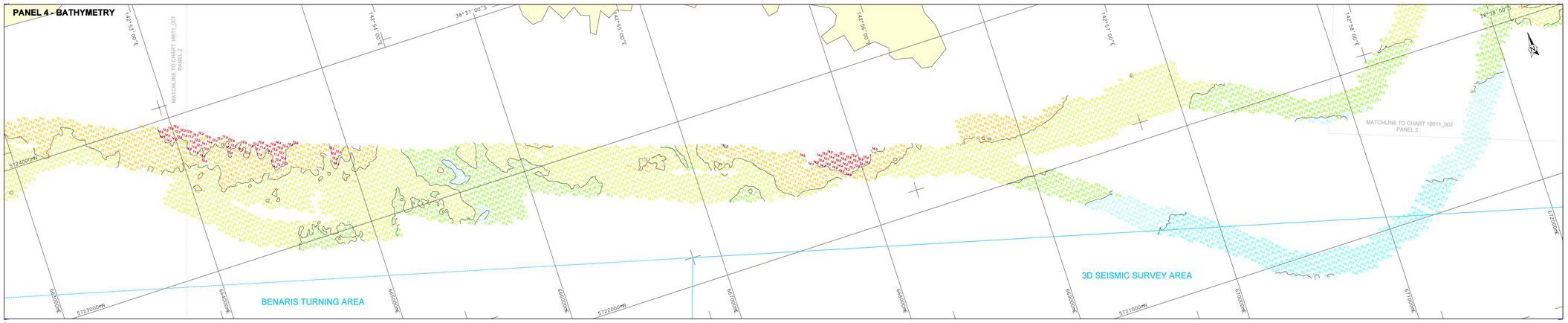
PANEL 2 - BATHYMETRY



PANEL 3 - TRACKPLOT



PANEL 4 - BATHYMETRY



LEGEND:

- The Arches Marine Sanctuary
- Twelve Apostles National Park
- Provisional Benaris Turning Area
- 3D Seismic Survey Area

PANEL 1 & 3 - TRACKPLOT

- Vessel track of the GeoSwath Transducer position, showing every tenth fix number

PANELS 2 & 4 - BATHYMETRY

- Bathymetric soundings in metres below LAT

0m 25m 50m 75m

- Bathymetric contours at 5m intervals - major contour (20m, as requested by client rep.) in bold

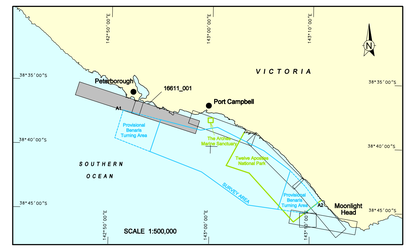
NOTES:

1) Positioning Systems: Starfix Spot & MRDGPS
2) Bathymetry data acquired using a GeoAcoustics GeoSwath (125kHz) wide swath bathymetry system
3) Raw bathymetry gridded to 1.0m bin size (accuracy : position +/- 3m, depth +/- 0.7m)
4) Bathymetry reduced to Lowest Astronomical Tide (LAT), using predicted tides derived from the simple harmonic method constituents published in Australian Tide Tables 2003 for Warrnambool (Port No. 61360, Lat 38° 24' S, Long 142° 29' E)
   LAT at this location is 0.50m below MSL
5) Data processing has been carried out at the level required for processing of reconnaissance quality coverage. Processing has been focussed on charting of the 20m isobathtyle required by client rep.). Accuracy is lower at the perimeter of survey coverage.

GEODETIC PARAMETERS:

HORIZONTAL COORDINATE SYSTEM

GEODETIC DATUM	:	Geocentric Datum of Australia 1994 (GDA94)
ELLIPSOID Semi major axis (inverse flattening)	:	Geocentric Reference System of 1980 (GRS80) 6378137.000 m (298.257222101)
PROJECTION	:	Universal Transverse Mercator (UTM)
Central Meridian (CM)	:	141°E (Zone 54)
Latitude of Origin	:	0°N
False Easting	:	500 000 m
False Northing	:	10 000 000 m
Scale factor at CM	:	0.9996
VERTICAL DATUM	:	Lowest Astronomical Tide (LAT)



Benaris Energy NV
273 Montaque Street
South Melbourne VIC 3205

FUGRO SURVEY PTY LTD
A.B.N. 81 009 172 990
18 Prowse Street, West Perth WA 6005
Australia
Tel : +61 8 9322 4955 Fax : +61 8 9322 1775

HYDROGRAPHIC RECONNAISSANCE SURVEY

MOONLIGHT HEAD 3D SEISMIC CAMPAIGN

GEOSWATH BATHYMETRY (1 of 3)

SCALE 1: 10,000

200m 0m 200m 400m 600m 800m 1000m

Vessel: MV LAUREN **Survey Date:** OCT 2003 **Project Ref:** HY16611

Issue No:	Date:	Description:	Surv:	Interpr:	Drawn:	Chkd:	Appr:
0	28/10/2003	Final	JR	N/A	RS		
1	04/11/2003	Legend, notes and bathy alterations	JR	N/A	RS		

Client Ref: **Drawing No:** 16611_001 **Chart:** 1 of 3 **Encl:** 4

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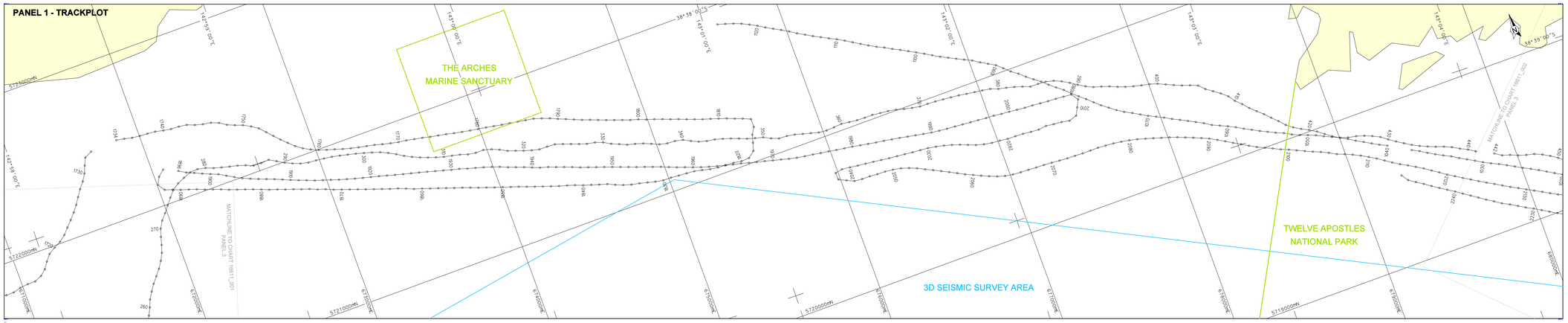

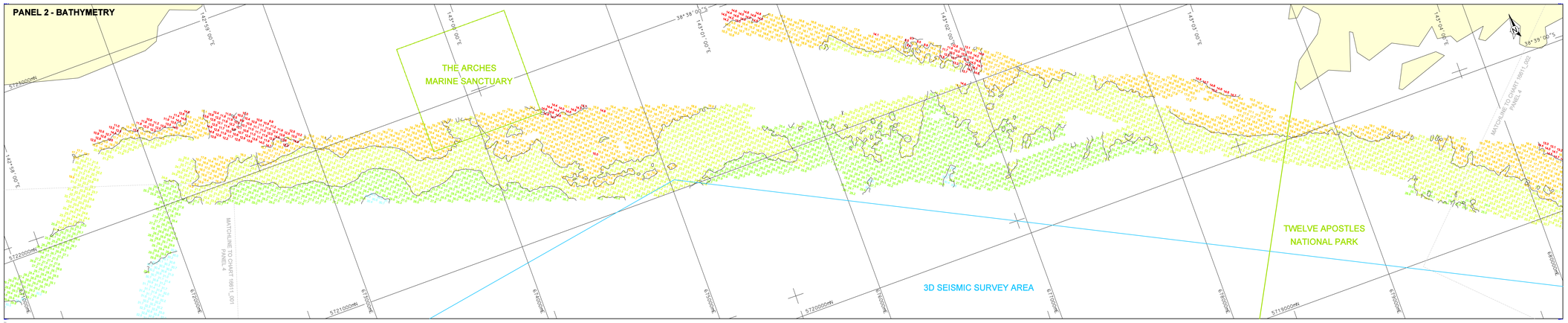

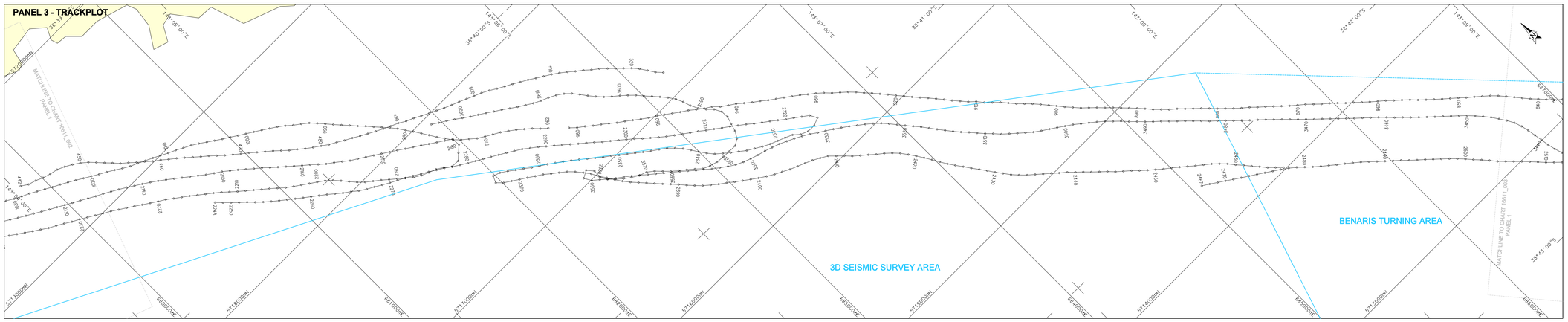

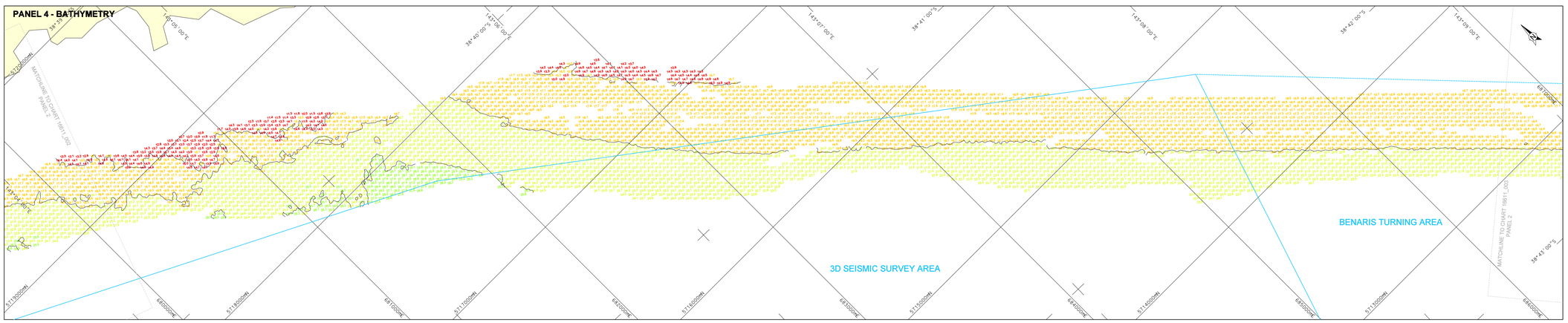

u:\hy16611\dgn\chart\16611_002.dgn

LEGEND:

- The Arches Marine Sanctuary
- Twelve Apostles National Park
- Provisional Benaris Turning Area
- 3D Seismic Survey Area

PANEL 1 & 3 - TRACKPLOT

Vessel track of the GeoSwath Transducer position, showing every tenth fix number

PANELS 2 & 4 - BATHYMETRY

Bathymetric soundings in metres below LAT

0m 25m 50m 75m

Bathymetric contours at 5m intervals - major contour (20m, as requested by client rep.) in bold

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   LAT at this location is 0.50m below MSL
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ELLIPSOID Semi major axis (inverse flattening)	:	Geocentric Reference System of 1980 (GRS80) 6378137.000 m (298.257222101)
PROJECTION	:	Universal Transverse Mercator (UTM)
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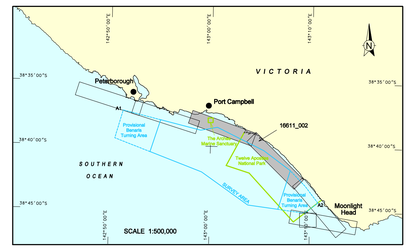
Latitude of Origin	:	0°N
False Easting	:	500 000 m
False Northing	:	10 000 000 m
Scale factor at CM	:	0.9996
VERTICAL DATUM	:	Lowest Astronomical Tide (LAT)



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HYDROGRAPHIC RECONNAISSANCE SURVEY

MOONLIGHT HEAD 3D SEISMIC CAMPAIGN

GEOSWATH BATHYMETRY (2 of 3)

SCALE 1: 10,000

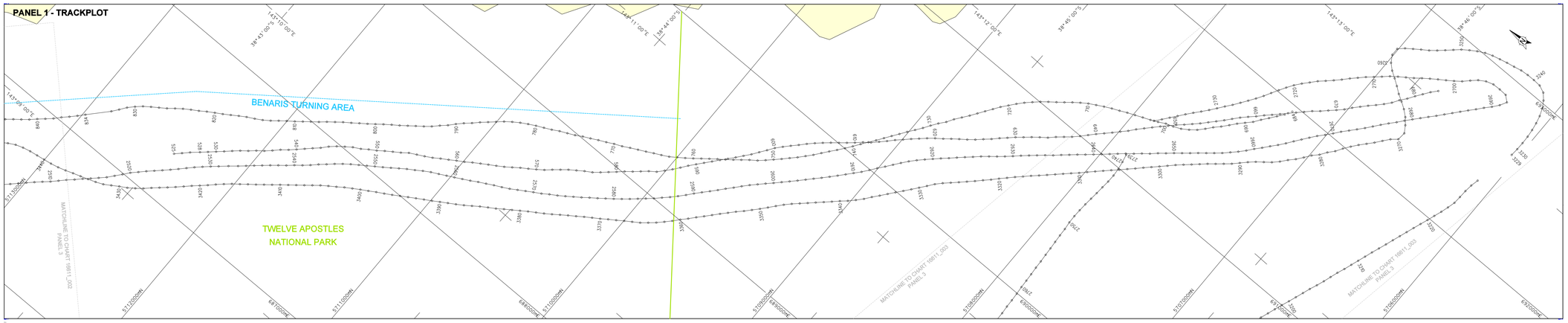
200m 0m 200m 400m 600m 800m 1000m

Vessel: MV LAUREN | **Survey Date:** OCT 2003 | **Project Ref:** HY16611

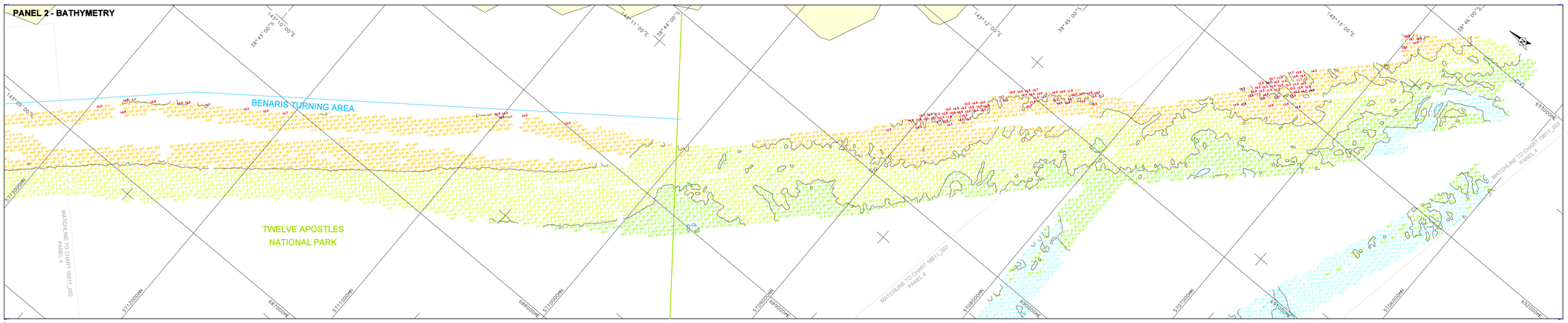
Issue No:	Date:	Description:	Surv:	Interpr:	Drawn:	Chkd:	Appr:
0	28/10/2003	Final	JR	N/A	RS		
1	04/11/2003	Legend, notes and bathy alterations	JR	N/A	RS		

Client Ref:	Drawing No:	Chart:	Encl:
	16611_002	2 of 3	4

PANEL 1 - TRACKPLOT

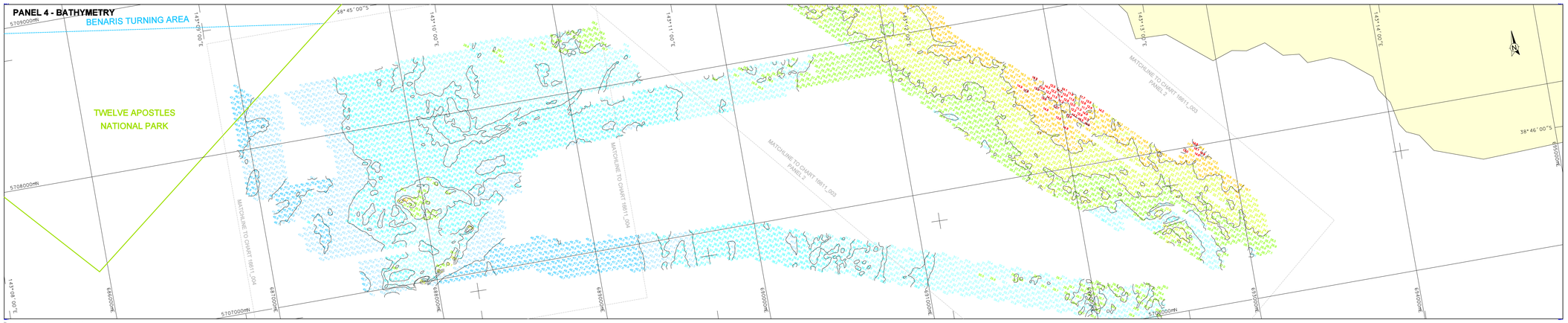


PANEL 2 - BATHYMETRY



PANEL 3 - TRACKPLOT

PANEL 4 - BATHYMETRY



LEGEND:

- The Arches Marine Sanctuary
- Twelve Apostles National Park
- Provisional Benaris Turning Area
- 3D Seismic Survey Area

PANEL 1 & 3 - TRACKPLOT

- Vessel track of the GeoSwath Transducer position, showing every tenth fix number

PANELS 2 & 4 - BATHYMETRY

Bathymetric soundings in metres below LAT

0m 25m 50m 75m

Bathymetric contours at 5m intervals - major contour (20m, as requested by client rep.) in bold

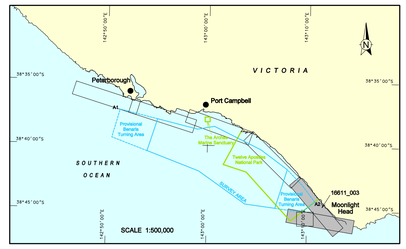
NOTES:

1) Positioning Systems: Starfix Spot & MRDGPS
2) Bathymetry data acquired using a GeoAcoustics GeoSwath (125kHz) wide swath bathymetry system
3) Raw bathymetry gridded to 1.0m bin size (accuracy : position +/- 3m, depth +/- 0.7m)
4) Bathymetry reduced to Lowest Astronomical Tide (LAT), using predicted tides derived from the simple harmonic method constituents published in Australian Tide Tables 2003 for Warrnambool (Port No. 61360, Lat 38° 24' S, Long 142° 29' E)
   LAT at this location is 0.50m below MSL
5) Data processing has been carried out at the level required for processing of reconnaissance quality coverage. Processing has been focussed on charting of the 20m isobath/use required by client rep.). Accuracy is lower at the perimeter of survey coverage.

GEODETIC PARAMETERS:

HORIZONTAL COORDINATE SYSTEM

GEODETIC DATUM	:	Geocentric Datum of Australia 1994 (GDA94)
ELLIPSOID Semi major axis (inverse flattening)	:	Geocentric Reference System of 1980 (GRS80) 6378137.000 m (298.257222101)
PROJECTION	:	Universal Transverse Mercator (UTM)
Central Meridian (CM)	:	141°E (Zone 54)
Latitude of Origin	:	0°N
False Easting	:	500 000 m
False Northing	:	10 000 000 m
Scale factor at CM	:	0.9996
VERTICAL DATUM	:	Lowest Astronomical Tide (LAT)



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HYDROGRAPHIC RECONNAISSANCE SURVEY

MOONLIGHT HEAD 3D SEISMIC CAMPAIGN

GEOSWATH BATHYMETRY (3 of 3)

SCALE 1: 10,000

200m 0m 200m 400m 600m 800m 1000m

Vessel: MV LAUREN | **Survey Date:** OCT 2003 | **Project Ref:** HY16611

Issue No:	Date:	Description:	Surv:	Interpr:	Drawn:	Chkd:	Appr:
0	28/10/2003	Final	JR	N/A	RS		
1	04/11/2003	Legend, notes and bathy alterations	JR	N/A	RS		

Client Ref: | **Drawing No:** 16611_003 | **Chart:** 3 of 3 | **Encl:** 4

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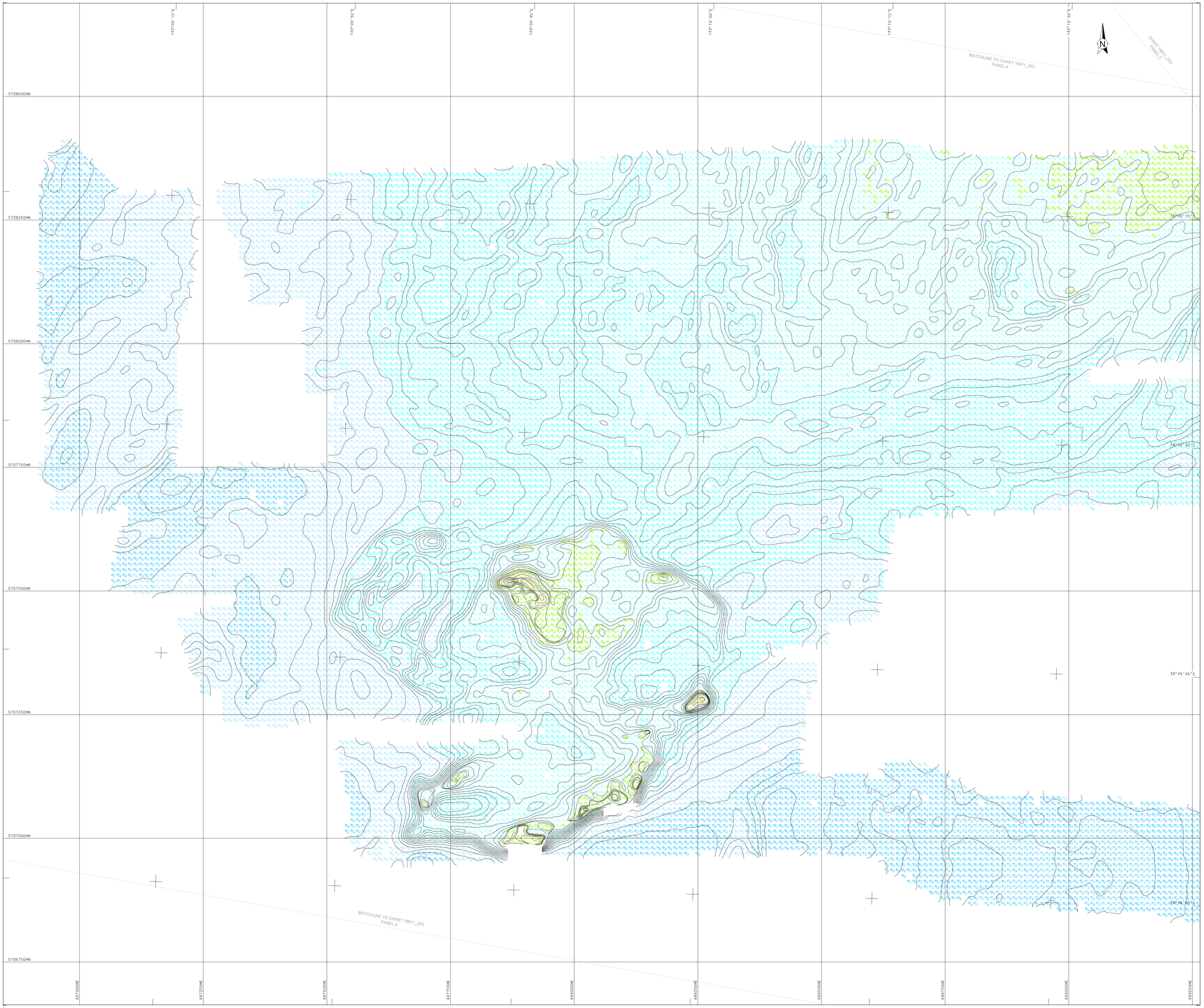

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LEGEND:

BATHYMETRY

Bathymetric soundings in metres below LAT
Contours at 1m intervals - major contour (5m) in bold

0m 25m 50m 75m

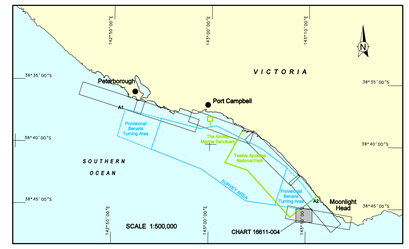
NOTES:

1) Positioning Systems: Starfix Spot & MRDGPS
2) Bathymetry data acquired using a GeoAcoustics GeoSwath (125kHz) wide swath bathymetry system
3) Raw bathymetry gridded to 1.0m bin size
4) Bathymetry reduced to Lowest Astronomical Tide (LAT), using predicted tides derived from the simple harmonic method constituents published in Australian Tide Tables 2003 for Warrnambool (Port No. 61360, Lat 38° 24' S, Long 142° 29' E) LAT at this location is 0.50m below MSL
5) Data processing has been carried out at the level required for processing of reconnaissance quality coverage. Processing has been focussed on charting of the 20m isobath(as required by client rep.). Accuracy is lower at the perimeter of survey coverage.

GEODETIC PARAMETERS:

HORIZONTAL COORDINATE SYSTEM

GEODETIC DATUM	:	Geocentric Datum of Australia 1994 (GDA94)
ELLIPSOID	:	Geocentric Reference System of 1980 (GRS80)
Semi major axis (inverse flattening)	:	6378137.000 m (298.257222101)
PROJECTION	:	Universal Transverse Mercator (UTM)
Central Meridian (CM)	:	141°E (Zone 54)
Latitude of Origin	:	0°N
False Easting	:	500 000 m
False Northing	:	10 000 000 m
Scale factor at CM	:	0.9996
VERTICAL DATUM	:	Lowest Astronomical Tide (LAT)



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HYDROGRAPHIC RECONNAISSANCE SURVEY

MOONLIGHT HEAD 3D SEISMIC CAMPAIGN

GEOSWATH BATHYMETRY - EXTENSION OF TURNING AREA

SCALE 1: 2,500

50m 0m 50m 100m 150m 200m 250m

Vessel: MV LAUREN | **Survey Date:** OCT 2003 | **Project Ref:** HY16611

Issue No:	Date:	Description:	Surv:	Interpr:	Drawn:	Chkd:	Appr:
0	28/10/2003	Final	JR	N/A	JR		
1	04/11/2003	Contour alterations	JR	N/A	JR		

Client Ref:	Drawing No:	Chart:	Encl:
	16611_004	1 of 1	4