SHIPBORNE GRAVITY, MAGNETIC AND BATHYMETRIC SURVEY

MIDAS 2D - EAST GIPPSLAND BASIN

OFFSHORE AUSTRALIA

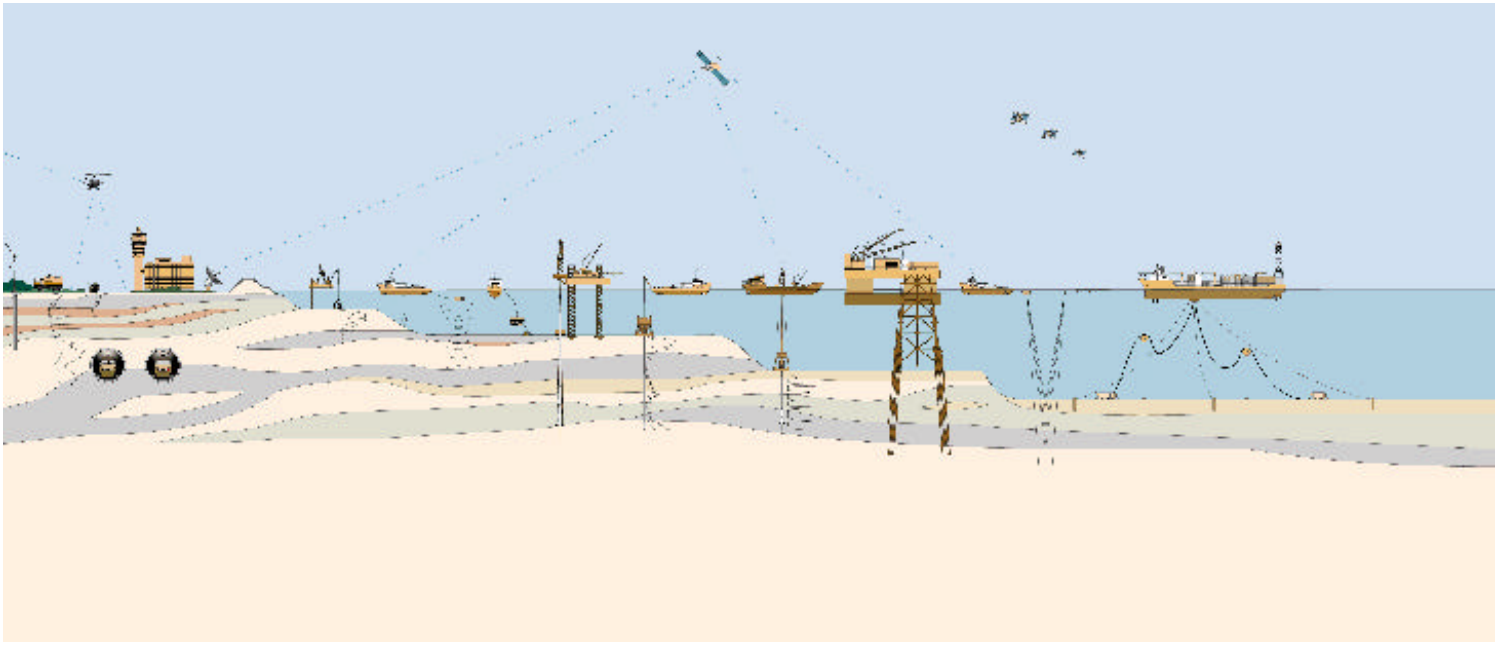
DATA PROCESSING REPORT

FOR

PANCANADIAN ENERGY CORPORATION

FEBRUARY 2002

FUGRO-LCT LTD



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I. INTRODUCTION

A shipborne geophysical survey was conducted offshore Australia, by Fugro-Geoteam AS, for PanCanadian Energy Corporation. Fugro-LCT Limited was responsible for the acquisition and processing of the gravity and magnetic data to compliment the seismic data.

The area consists of approximately 822 kilometres of navigation data. Of this total there are 822 kilometres of gravity data, 822 kilometres of magnetic data and 726 kilometres of bathymetry data. The gravity, magnetic, bathymetry, and navigation data were acquired on-board the Geo Arctic. This vessel was operated by Fugro-Geoteam AS, who acted as the primary acquisition contractor for this work. The survey production period was from 19th December 2001 to 08th January 2002. Figure 1 shows an Index map of the survey area. A brief line report is included in Appendix 1.

The products resulting from the work described herein include: 1) Colour shaded relief maps on paper of bathymetry, free-air gravity, Bouguer gravity (2.0g/cc correction density) and magnetic anomaly; 2) raw and reduced line-oriented data and final grids, in ASCII format; 3) processing report as hardcopy and in .pdf format.

When discussion in this report pertains to specific lines, the seismic line name is given along with the Fugro-LCT-assigned sequential line number. This line number is useful because it is generally sequenced in chronological order. Also, it is unique; the seismic name may be duplicated due to line segments and re-shoots. This work was performed under Fugro-LCT job number 4135.

II. FIELD OPERATIONS

The gravity data were acquired using a LaCoste & Romberg air-sea gravity meter, owned by Fugro-LCT, serial number S-65. This meter is equipped with an Ultrasys control system. The Ultrasys control system is fully digital and uses a real-time multitasking environment. A calibration factor of 0.9909 is used to convert counter units to milligal values. The gravity data were recorded at one-second intervals and delivered to Fugro-LCT's office on the UNISON™ data logger hard disk drive.

The primary and secondary navigation systems used on board were Fugro Starfix Spot Differential and Fugro Starfix MN8 DGPS respectively. This navigation data was recorded at one-second intervals and delivered to Fugro-LCT's office on a UNISON™ data logger hard disk drive.

A marine magnetometer system consisting of a Elsec 7706 magnetometer, data collection computer, deck cable, floating cable, and a 3 coil marine sensor were used for the survey. The sensor is a proton precession device that measures the total magnetic field intensity via the precession frequency of spinning protons in a hydrogen rich fluid (paraffin or seismic cable fluid).

Fugro-LCT was also supplied with final processed navigation and bathymetry data recorded at each shot point. These data were provided by Fugro-Geoteam on 8mm Exabyte tapes in P1/90 format.

The following projection parameters were used for the line-oriented data sets:

Datum:	ADG84
Projection:	Universal Transverse Mercator
Spheroid:	ADG84
Central Meridian:	147° East
Latitude Origin:	0.0
False Easting:	500000.0
False Northing	10000000.0
Units:	Metres
Scale Factor:	0.9996000

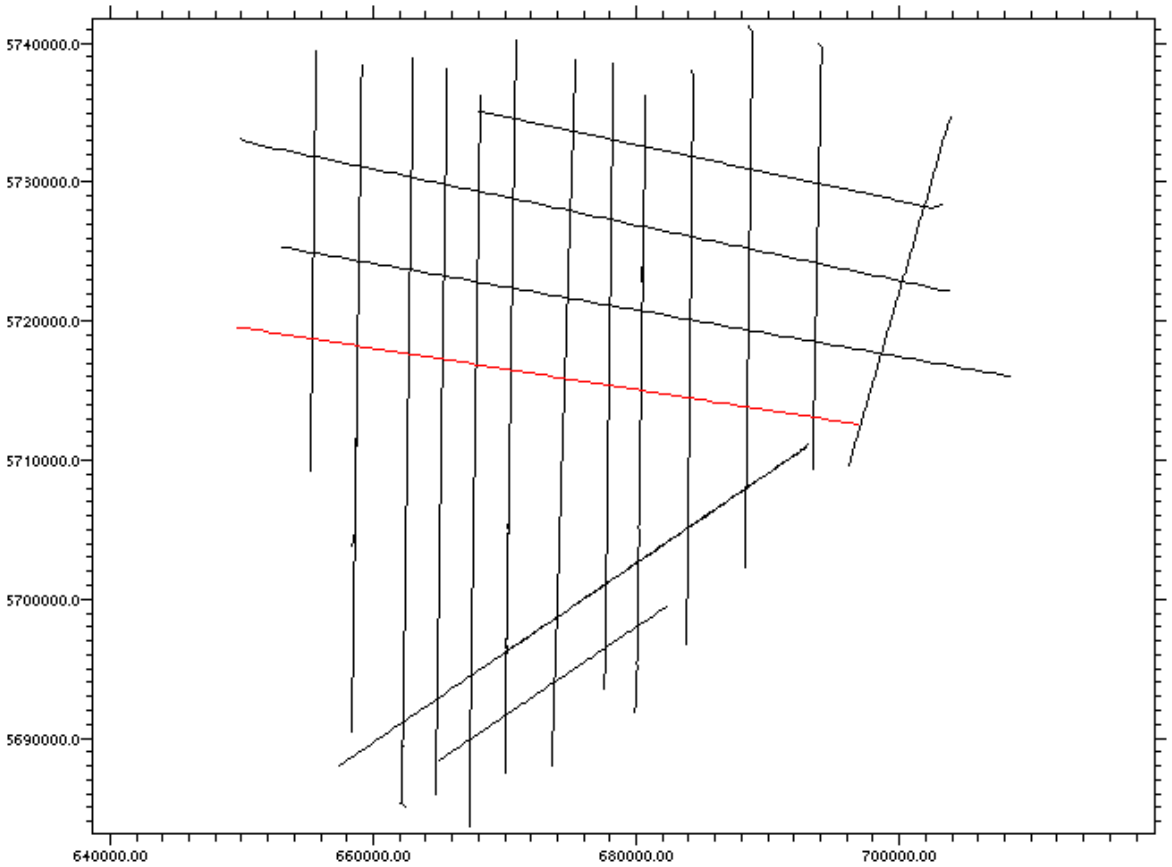


Figure 1: Index Map

III. DATA PREPARATION

Fugro-LCT read navigation data contained on the P1/90 data tapes. These data were recorded on the AGS84 datum at the antenna position in ASCII format. This format consisted of latitude, longitude, bathymetry, Julian day, shot point, x and y co-ordinates and time. These data were input to Fugro-LCT's line-oriented database DATAPRO™ at a time increment of one second.

Fugro-LCT read the gravity data contained on the unison hard drive, which are input to Fugro-LCT's line-oriented database DATAPRO™ and merged with the navigation data.

All original recorded data were scanned with the use of interactive display software on Fugro-LCT's workstations. Spurious points were edited by checking against the analogue data records when necessary and available.

A complete description of the data processing parameters and the line characteristics for each line is included in Appendix 2. The survey data production reports for both the raw and processed data are included in Appendix 3.

IV. BATHYMETRY DATA PROCESSING

Fugro-LCT received bathymetry data in digital form. Each line of data was displayed and carefully checked for validity. The data were adjusted using zero order levelling to produce a consistent dataset. Details of the levelling procedure and intersection mistie analysis are given in section VIII. Figure 2 is a colour image of the bathymetry grid.

No bathymetry data was included for lines 0015D021 and 0008T026. The data for these lines recorded by Fugro-Geoteam AS was unusable due to excessive noise. This was reported to be due to large water depths in rough weather conditions.

For the final archive tape, bathymetry for these lines was sampled back from the bathymetry grid.

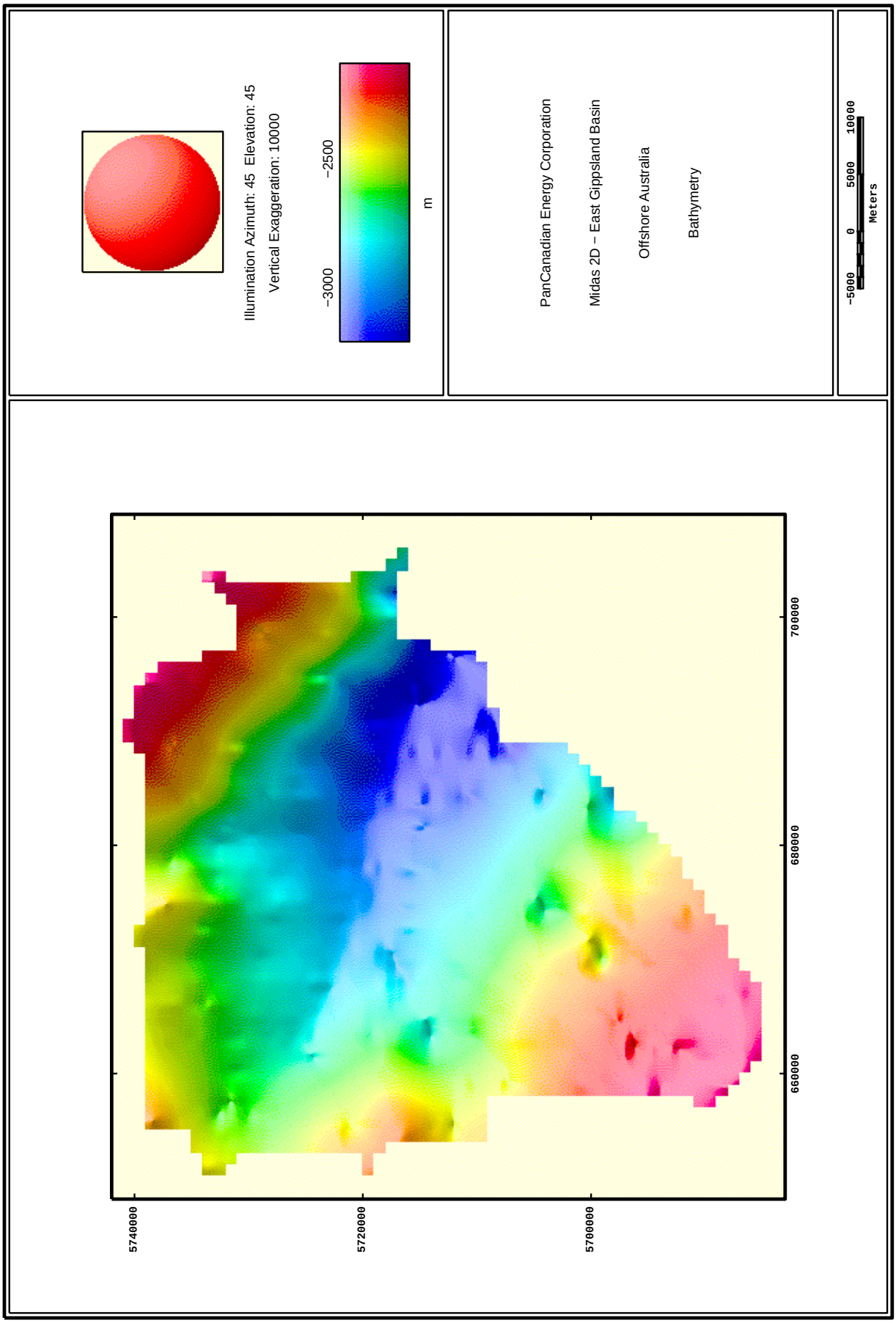


Figure 2: Bathymetry Grid

V. GRAVITY DATA PROCESSING

A. Reconstruction Of Gravity Data

Gravity data were acquired using a LaCoste & Romberg Air/Sea dynamic gravity meter with the real-time digital Ultrasys control system. This system samples all raw data at 200 times per second. This sampling is more than adequate to capture all the necessary information in the data without aliasing. These data are then averaged to produce raw one-second samples that are output to the digital file. Cross coupling channels are calculated using beam position, beam slope, cross accelerometer and long accelerometer that were digitally logged using a one-second sample rate.

For purposes of real-time quality control, digital filters are applied to emulate the conventional “analog meter gravity” produced by older analog control systems. This is performed by applying multiple stages of RC filtering to the one-second data. Three minutes of RC filters are applied to meter gravity, which is then updated and output at a ten-second sample interval.

To obtain maximum signal from the data, Fugro-LCT recomputed digital meter gravity from the raw components of: 1) Spring Tension, 2) Beam Slope and 3) Total cross coupling correction. This allows the level of digital filtering to be chosen based on the noise level of the data. Also, by performing the filtering during final post processing, digital filters can be applied which are superior to RC filtering applied for real time quality control purposes. The derivation of meter gravity is as follows:

Reconstructed Meter Gravity = S + kB' + CC

where,

S = spring tension
B' = slope of the averaged beam position
k = gain factor to calibrate beam slope to mGal
CC = total cross coupling correction

This reconstructed meter gravity is then used for all subsequent processing and analyses.

B. Cross-Correlation Procedure

A method for evaluating and correcting shipboard gravity data was suggested by LaCoste (LaCoste, L., August 1973, Geophysics, Vol.38, P.701-709). This method makes use of the assumption that there should be no cross-correlation between ship’s motion and variations in observed gravity (corrected for Eötvös effects). Ship's motions are described by several monitors, which consist of ship accelerations and velocities and products of two or more such accelerations and velocities. These monitor channel data are recorded simultaneously with gravity data. Monitor channels include:

Cross-coupling correction (VCC) - proportional to the product of the vertical velocity times the long acceleration;

Vertical correction (VE) - proportional to the vertical acceleration squared;

Cross-coupling correction (AL) - proportional to the product of vertical acceleration times the long acceleration;

Cross-coupling correction (AX) - proportional to the product of vertical acceleration times the cross acceleration;

Second order cross-coupling correction (AX2) - proportional to the product of vertical acceleration times the cross acceleration squared;

The cross-correlation between the curvature (second derivative) of gravity and each monitor channel are used to construct a gain factor for each channel. These gain factors, when applied to the respective channel, minimise the curvature of the corrected meter gravity data. This procedure is used by the meter manufacturer to adjust the gain settings for each channel. The same method can also be used to improve the quality of recorded data, particularly when data are acquired in high sea states. In low sea states, maladjusted gains may not be apparent because cross-coupling effects are typically not significant. However, in high sea states improperly set gains can generate large errors in the cross-coupling correction computed by the analog computer. This system can be greatly improved through cross-correlation analysis.

C. Meter Calibration

The gravity data from a LaCoste and Romberg air-sea gravity meter is recorded in counter units. To convert counter units to milligals for the gravity meter S-65, a calibration factor of 0.9909 is used.

D. Earth Tides

Gravity meters are sensitive enough to respond to the gravitational attraction of the sun and moon and register the periodic variations in the attraction caused by movements of the earth with respect to these bodies. The waters of the earth are regularly raised and lowered by such forces in predictable tidal cycles. These tidal forces affect the earth itself. Gravity changes, as a result of these forces, vary with latitude, time of month, and time of year. The complete tidal cycle is accompanied by a gravity change of 0.2 to 0.3 mGal.

An earth tide correction was calculated using an algorithm based on the formulae given in: Longman, I.M., 1959: Formulas for computing the tidal acceleration due to the moon and the sun. J. Geoph. Res., 64, pp 2351-2355. This correction was calculated on a point by point basis and added to the calibrated gravity.

E. Gravity Drift Correction.

Gravity still readings are typically performed in port to assess the meter drift and to facilitate a tie to a world gravity network. Two still readings were acquired

during this survey. The following still reading values was calibrated and corrected to mean sea level. The location and value of the still reading is as follows:

Still Reading	Location	Latitude	Longitude	Julian Day/year	Still reading gravity value (mGal), corrected to mean sea level
1	Burnie	41.054681S	145.91061E	353/2001	11785.99
2	Hobart	42.879242S	147.33977E	006/2002	11956.98

The following gravity base station was used to tie the survey to the world gravity network. The value was corrected to mean sea level. See Gravity Base Station description in Appendix 5.

Location	Absolute gravity value
Hobart – Macquarrie Wharf	980437.08mGal

The corrected and calibrated still readings were used to yield base constants for the survey as follows:

Corrected base gravity value	980437.58	980437.58
Less calibrated still reading	11785.99	11956.98
Base constant	968451.59	968480.60

These base constants, when prorated by time and added to each calibrated meter reading, yield the absolute gravity values, corrected for meter drift, for each observation point.

F. Eötvös Correction

The Eötvös correction is generally the single most important factor limiting the accuracy of gravity data acquired on a moving platform. Dramatic improvements in navigation systems have reduced the error level in applying this correction, but it still remains a significant component of the data reduction process. The Eötvös effect is the result of the vector addition of the gravity meter's velocity and the earth's rotation velocity. This effect alters the component of angular velocity of normal gravity measured on a rotating Earth. The form of the Eötvös correction is:

$$E = 7.503\ V \cos\varnothing \sin\mu + 0.004154\ V^2$$

Where E is in milligals for a gravity meter whose speed is V knots at an azimuth angle of μ and latitude Ø.

A number of conditions exist which impair the removal of the Eötvös effect using this formula on a point to point basis. Errors in positioning or time of position fix, translate to errors in the determination of instantaneous ship's velocity and course producing an Eötvös correction different from the event measured by the gravity meter. An error of one knot in the ship's speed along an east-west course at the equator corresponds to an error in Eötvös correction of approximately 7.5 mGal. Likewise, for a constant ship's speed of ten knots and a near north-south course, an error in course of one degree corresponds to an error in Eötvös correction of approximately one milligal. Filters in both the gravity meter and the navigation system also alter the way each system measures the Eötvös effect. However, distortions due to filtering have been minimised as the Eötvös effect is calculated from the velocity and heading data obtained from the GPS receiver. These data are sampled at every one-second and are unfiltered.

Two main categories of corrections need to be addressed by the Eötvös removal algorithm: 1) Eötvös events measured by both the navigation data and the gravity meter may differ in amplitude and phase due to positioning errors and system filtering; 2) fictitious errors in Eötvös correction can be created by errors in position and are not related to real ship motion.

Fugro-LCT computes the Eötvös correction using a time-varying decorrelation procedure which, in general terms, presumes that correlation existing between observed gravity and computed Eötvös effect is true Eötvös effect and should be removed. Similarly, fictitious Eötvös events caused purely by errors in ship's position will not correlate with observed gravity and will not be used in the final correction.

Time windows of observed gravity and raw Eötvös are cross-correlated, and adjustments are made to the phase and amplitude spectra of the raw Eötvös so as to minimise the correlation between the output corrected gravity and the Eötvös effect. If the positioning data indicate an Eötvös anomaly that correlates with the gravity, the decorrelation process will shape the amplitude and phase components of the correction to eliminate said correlation. Similarly, if the positioning data indicate an Eötvös event that does not correlate with the observed gravity, the decorrelation process will remove the Eötvös event from the final Eötvös correction.

The decorrelation process is performed interactively by the project geophysicist on a workstation using Fugro-LCT's DPDCOR™ module. The geophysicist carefully selects the parameters on a line-by-line basis so as to retain as much signal as possible with the minimum of filtering to the data. DPDCOR™ also displays the water depth trace so that the geophysicist does not alter any high frequency events that may be caused by shallow geological features.

G. Computation Of Gravity Anomalies

Given the large effects of latitude, terrain, and density that are expressed in a gravity observation at a particular sample point, it is customary to compute a theoretical gravity field that gives an expected value of gravity at the point. This theoretical field is removed from the observed gravity field, and the resultant

anomaly field is then interpreted to determine the differences between the actual geologic environment and the assumptions built into the theoretical gravity field model.

Each of the corrections described below has assumptions inherent to it. It is important to understand that each successive step in the processing sequence changes the assumptions involved in producing the theoretical gravity field. Subsequent interpretations must, therefore, return to the correction assumptions for proper understanding of the anomaly field.

Two levels of corrections are generally used: 1) the free-air correction and 2) the Bouguer correction. The theoretical effects of these assumptions are calculated to yield theoretical free-air gravity and theoretical Bouguer gravity, respectively. Subtracting these theoretical fields from the absolute station gravity fields yields free-air anomaly and Bouguer anomaly, respectively.

THEORETICAL GRAVITY CORRECTION PROCEDURES

a) Theoretical Latitude Correction - using the 1967 Geodetic Reference System (GRS67): This formula gives the theoretical value of gravity at any latitude on the spheroid. The GRS67 value is the starting point for all subsequent correction steps.

$$G\phi = 978031.846\ (1.0 + 0.005278895\sin^2\phi + 0.000023462\sin^4\phi)$$

Where Ø is latitude in degrees and Gø is the theoretical value of gravity for that latitude.

b) Free-Air Gravity Correction: The free-air factor corrects the GRS67 theoretical gravity value for the height of the observation station above the spheroid. For conventional marine work, this is typically assumed to be 0.

c) 3-D Bouguer Correction: This correction incorporates in a single step the simple Bouguer slab correction and the terrain correction. The 3-D Bouguer correction adjusts the theoretical free-air gravity for the presence of mass between the observation station and the spheroid for land stations, and for the lower density of sea water compared with seafloor sediment densities for marine. Thus, it should be recognised that there is a change in definition in the Bouguer model at the shoreline. This factor is frequently mistaken both in the literature and in modelling work.

A density of 2.0g/cc was used to compute the 3-D Bouguer correction (actual density: 2.00 - 1.03 = 0.97).

d) Theoretical Free-Air Gravity is defined as:

Theoretical Free-Air Gravity = GRS67 - (Free-Air Correction)

e) Theoretical 3-D Bouguer Gravity is defined as:

Theoretical 3-D Bouguer Gravity =
(Theoretical Free-Air Gravity) + (3-D Bouguer Correction)

ANOMALY CALCULATIONS

a) Free-Air Anomaly (also referred to as Free-Air Gravity) is calculated as:

Free-Air Anomaly = (Absolute Station Gravity) -
(Theoretical Free-Air Gravity)

b) 3-D Bouguer Anomaly (also referred to as 3-D Bouguer Gravity) is calculated as:

3-D Bouguer Anomaly = (Absolute Station Gravity) -
(Theoretical 3-D Bouguer Gravity)

To compute a 3-D Bouguer correction, Fugro-LCT utilises a modified Talwani algorithm to calculate the effect of the water-rock interface. This algorithm models the interface as a polygon in cross-section, with infinite extension perpendicular to the strike direction. The correction was added to the free-air gravity data in line form to obtain 3-D Bouguer gravity.

TERRAIN CORRECTIONS

The following processing steps were performed with the free-air gravity and bathymetry grids:

- Compute a Terrain correction from the bathymetry grid using Fugro-LCT's MARTEFF™ program.
- Combine the free-air gravity grid with Terrain correction grid to yield a 3-D Bouguer gravity grid.
- Spline the 3-D Bouguer gravity grid back onto the database lines to yield 3-D Bouguer gravity on all lines.

The terrain model for gravity corrections was derived from the bathymetry data. This data was used as input to Fugro-LCT's MARTEFF™ program.

The Complete Bouguer correction for work in this area can be handled by Parker's (1973) algorithm for forward gravity computation. Parker's algorithm calculates the Fourier transform of the gravity field as a sum of filtered Fourier transforms of powers of the bathymetry. The infinite series is truncated at the term whose RMS value is less than some convergence tolerance, usually chosen as 0.01 mGal. Since the Fourier transforms are computed using the FFT (Fast Fourier Transform) method, the bathymetry must be extended and tapered to minimise edge effects from wraparound convolution. This is done using a wraparound implementation of the Smith and Wessel (1990) minimum curvature method (Smith, W. H. F., and Wessel, P., 1990, Gridding with continuous curvature splines in tension: Geophysics, 55, 293-305).

The complete Bouguer and terrain correction was calculated using a rock density of 2.0g/cc, which was computed using the terrain model discussed above. These grid data were subtracted from the free-air gravity grid to obtain the complete Bouguer gravity grid. Then the Bouguer gravity grid was interpolated back to the marine line data in the marine database to obtain the line Bouguer gravity data for all database lines.

H. Data Quality and VMON Values

The LaCoste & Romberg marine gravity systems provide a data quality assessment monitor called the Vertical Velocity Monitor (VMON). The VMON value aids in estimating the final processed gravity data quality expected from different operating conditions encountered during a survey. VMON is calculated from the one-second standard beam position value and is recorded as a velocity in centimetres per second.

In detailed studies of LaCoste & Romberg gravity meter data, it was found that the short-period vertical velocity measured by the gravity sensor is a definitive means of estimating processed gravity data quality. The vertical motion experienced by the gravity instrument is the main parameter controlling final data quality and the Vertical Velocity Monitor is a method of measuring quality that is related directly to that vertical motion.

Experience from previous surveys by FUGRO-LCT has established the following guidelines for relating the Vertical Velocity Monitor to the final processed gravity data quality:

Vertical Monitor Value	Expected Processed Gravity Data Quality
Less than 8 cm/sec	0.2 mGal at wavelengths of 500m and greater
8 - 24 cm/sec	0.2 to 0.5 mGal at wavelengths of 2km and greater
24 - 40 cm/sec	0.5 to 1.0 mGal at wavelengths of 4km and greater.

For ULTRASYS gravity systems, VMON values are calculated during the data processing. The average change in the VMON value is then evaluated for each line segment.

For this project, the gravity data were acquired during variable sea states. The maximum VMON values were less than 25 cm/s on 22 lines, or 91% of the survey. Figure 3 shows VMON statistics of the survey, and Figure 4 shows the distribution of VMON values over the survey line grid.

Low-pass filtering was performed on the reduced data to eliminate the extraneous noise without removing valid signal information. These filters were chosen on a line-by-line basis by the Fugro-LCT project geophysicist during a careful simultaneous analysis of the raw, reduced, and filtered data. Fugro-LCT uses a Butterworth filter with the 50% amplitude reduction point positioned at the specified cut-off point. A complete listing of filters applied is given in Appendix 2. The gravity data for this area were acquired with VMON values on average between 10 and 20. As is to be expected, lines acquired in low sea states required a minimum degree of filtering. The following list shows the percentage of lines with the amount of filtering used.

PERCENT OF LINES	FILTER CUTOFF(sec)	EFFECTIVE CUTOFF
70.8	240	600 metres
8.3	300	750 metres
8.3	420	1050 metres
4.1	480	1200 metres
8.3	600	1500 metres

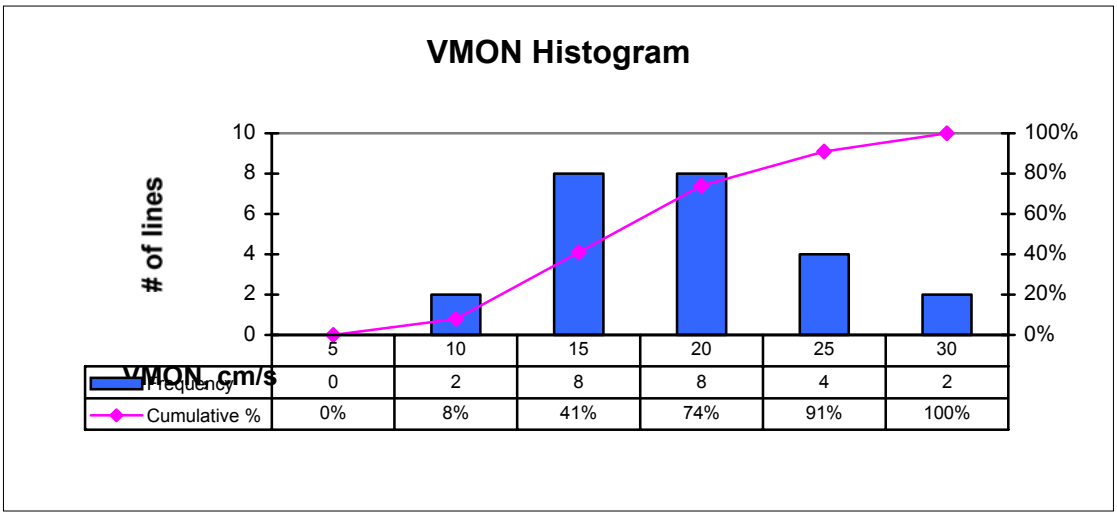


Figure 3: VMON statistics

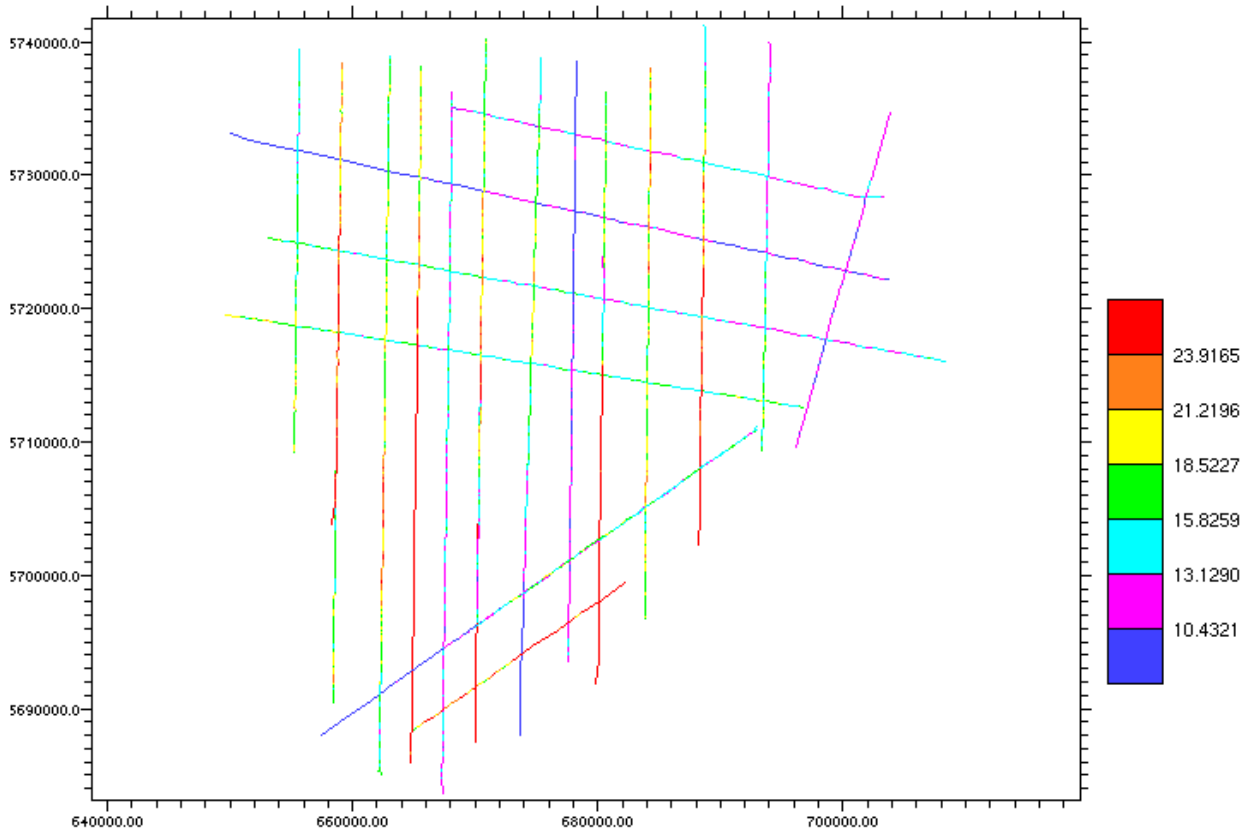


Figure 4: VMON Distribution

VI. MAGNETIC DATA PROCESSING

A. Cable Correction And Earth's Normal Field Removal

During the survey the magnetometer was towed at 235 meters astern of the vessel. This offset was applied to the magnetic data, to align the magnetometer observations with the navigation observations. The earth's normal magnetic field was computed for every sample point using the location and time of the point and the 2000 IGRF formula, updated to the survey dates. These theoretical earth's field values were then subtracted from the cable-offset corrected field values, to produce magnetic anomaly.

B. Diurnal Magnetic Data

Base magnetometer data was obtained from a magnetic observatory in Canberra, South East Australia. The data was supplied for the whole survey period in the form of daily ASCII data files sampled with 1 minute interval.

C. Magnetic Data Decorrelation with Base Magnetometer

Careful examination of the marine data showed that the data had been degraded by high frequency diurnal events. The base magnetometer data were thus decorrelated from the recorded magnetic data in an effort to remove the effects due to diurnal fluctuations in the surveyed magnetic field. Base station magnetometer data contained many anomalies that correlated well with marine magnetic data. An example of this is shown in Figure 5, which shows the correlation on line 7 (0015A009)

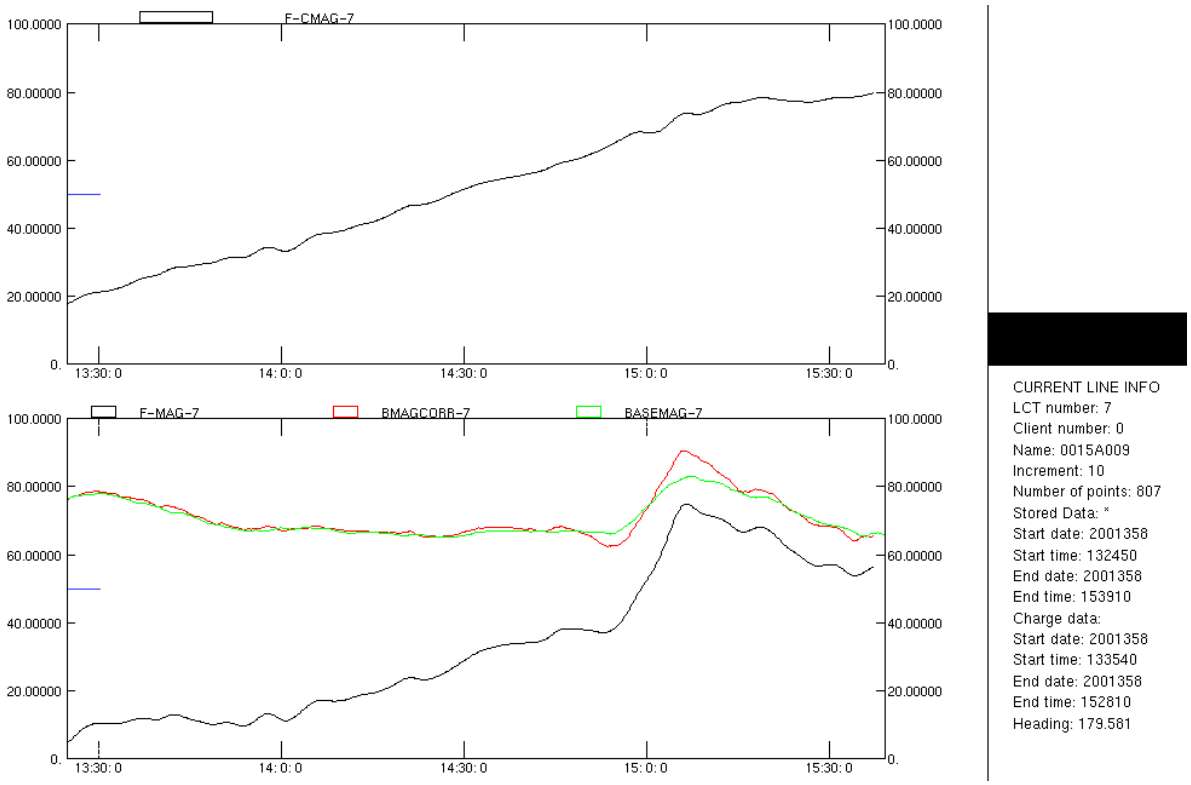


Figure 5: Basemag correlation example

The lower panel shows marine magnetic data and the base station diurnal magnetic data and the calculated diurnal correction. The upper panel shows the marine magnetic data after diurnal decorrelation.
Fugro-LCT performs the decorrelation on dedicated workstations that provide interactive control of the correction phase and amplitude shaping function. The original magnetics, corrected magnetics and the base station magnetics are provided on the archive tape.

VII. SURVEY NETWORK ADJUSTMENT PROCEDURES AND RESULTS

Fugro-LCT has developed specialised algorithms for adjusting gravity and magnetic data sets. The methods utilised are chosen on a case-by-case basis depending on the survey line layout, apparent data quality and type of survey equipment. Where there exist actual line intersections, a zero order systematic adjustment is applied as the initial step.

The initial survey network adjustment procedures are used to minimise the misties at line intersections using a systematic correction based on normalising the sum of the squares of the cross over errors. One example of a cause for systematic errors in the gravity data is positioning biases that are course dependent. This in turn leads to systematic differences in the average Eötvös correction for each of the intersecting lines. A one-degree error in position on a nearly north-south course causes a one-milligal error in calculating the Eötvös correction. Other causes for systematic errors include intentional or unintentional changes in system calibration (particularly gravity and bathymetry), improper assignment of gravity meter drift based on widely separated still readings, and cross-coupling errors related to course and sea states.

The principle cause for systematic errors in the magnetic data is the effect of diurnal magnetic variations. Whilst these are reduced by cross correlation of the marine data with observatory data, some errors remain due to different locations of the marine sensor and magnetic observatory.

The method used by Fugro-LCT to derive the systematic corrections assumes that, although there may be multiple sources of error, their net effect varies slowly over a single line, so that it may be described as a low-order polynomial. This is accomplished by a linear least-squares method for fitting orthogonal polynomials to minimise the sum of the squares of the crossover errors. This method has the advantage that it preserves the shapes of the original anomalies along individual profiles, while reducing the crossover error.

The misties after systematic adjustment are removed by assigning a weighting factor to each intersection. This factor is based on the statistical data quality of each line. The final value is determined for each intersection, and the correction is then prorated between adjacent intersections.

Of primary importance to the interpreter is the confidence level to apply during the quantitative evaluation of the processed data. The confidence level of line oriented geophysical data is typically determined using a statistical analysis of the survey misties. This analysis can be performed in a line oriented manner, i.e., a set of statistical values are formed for each line (such as average root mean square (rms) error of the misties on each line), and these line statistics are compared with each line to formulate a confidence level. In this approach, the number of intersections needs to be considered in

conjunction with the average value obtained. Lines with less than the average number of intersections per line are perhaps not as statistically valid as lines with a greater number of intersections. In particular, a line with only one intersection will have a rms error after systematic adjustment of zero regardless of the quality of the data along the line. Another approach is to inspect the misties without using any line dependencies, i.e., each intersection mistie is an individual value. The results summarised below are obtained from a combination of these approaches.

In this case, the survey line layout was such that a sufficient number of line intersections were available use in the data levelling procedure.

Figures 6 - 11 illustrate the network mistie statistics before and after systematic adjustment for the processed data types.

The following tables contain statistical data on the misties based on the line-oriented statistics. A more complete listing of this information is contained in Appendices 4 and 5. (BASA = before application of systematic adjustment; AASA = after application of systematic adjustment; ABS.MAX = absolute maximum mistie value; ABS.MEAN = mean absolute mistie value; RMS = root mean square mistie value.)

BATHYMETRY (metres)

	ABS. MAX	ABS.MEAN	RMS
BASA	43.40	4.05	8.14
AASA	26.90	3.91	5.96

FREE-AIR GRAVITY (mGal)

	ABS. MAX	ABS.MEAN	RMS
BASA	2.36	1.07	1.25
AASA	0.78	0.20	0.26

MAGNETIC ANOMALY (nT)

	ABS. MAX	ABS.MEAN	RMS
BASA	30.20	8.35	11.68
AASA	17.33	5.05	6.47

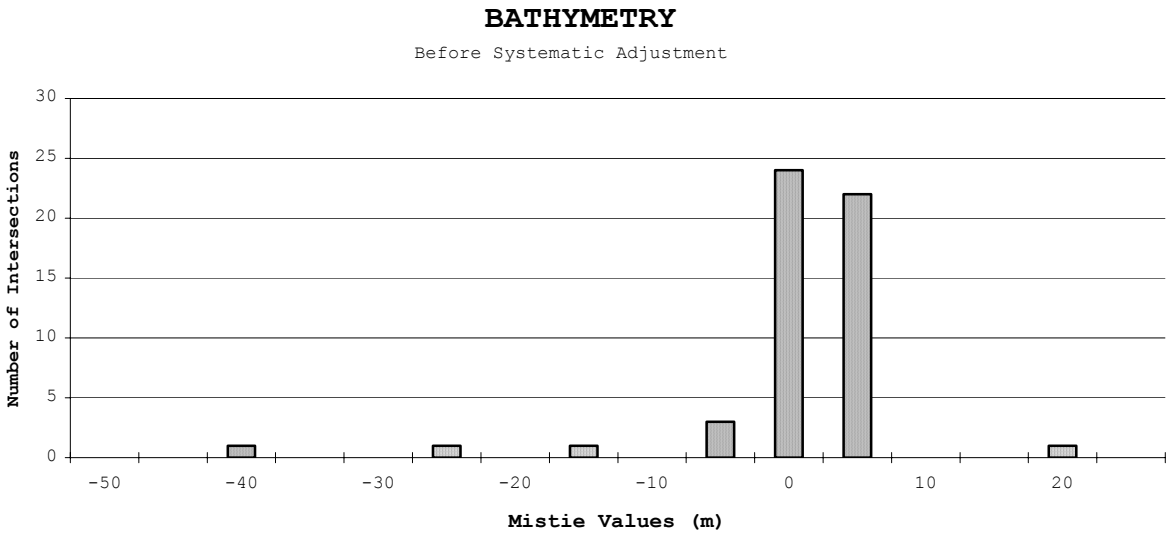


Figure 6: Histogram of Bathymetry Misties before Systematic Adjustment

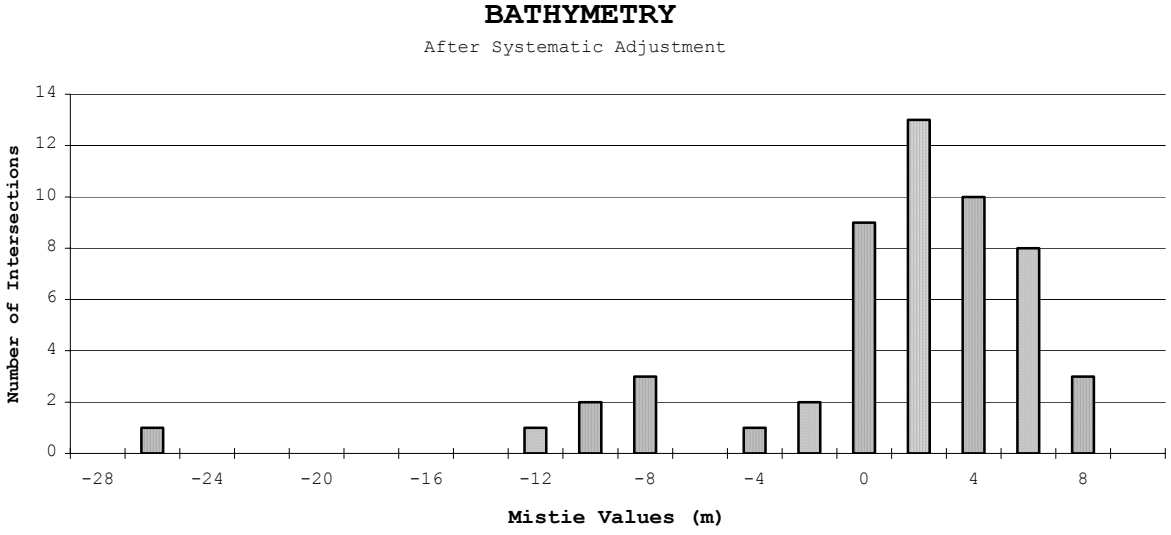


Figure 7: Histogram of Bathymetry Misties after Systematic Adjustment

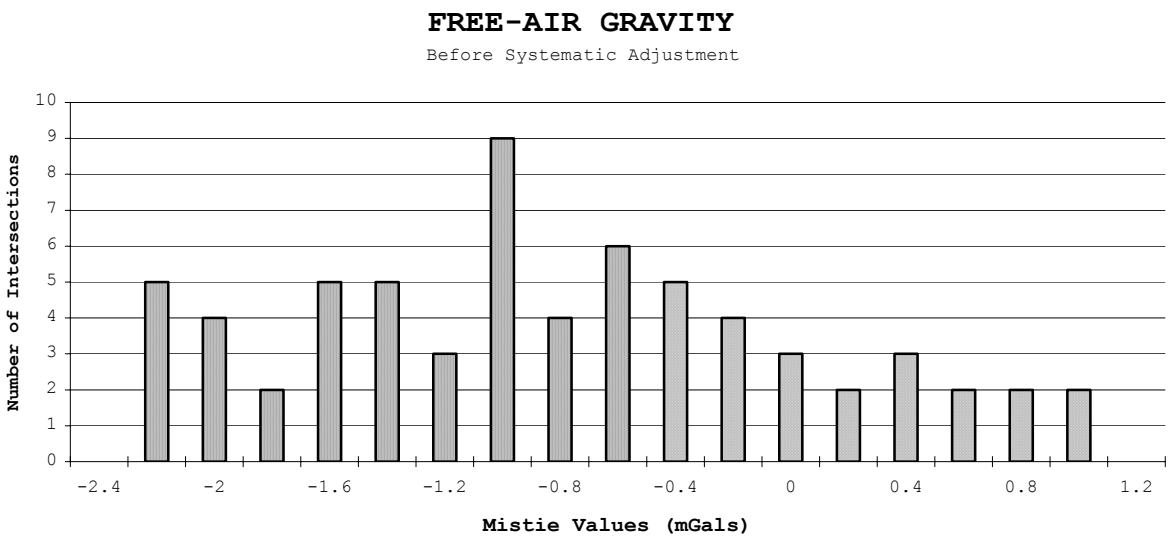


Figure 8: Histogram of Free-air Gravity Misties before Systematic Adjustment

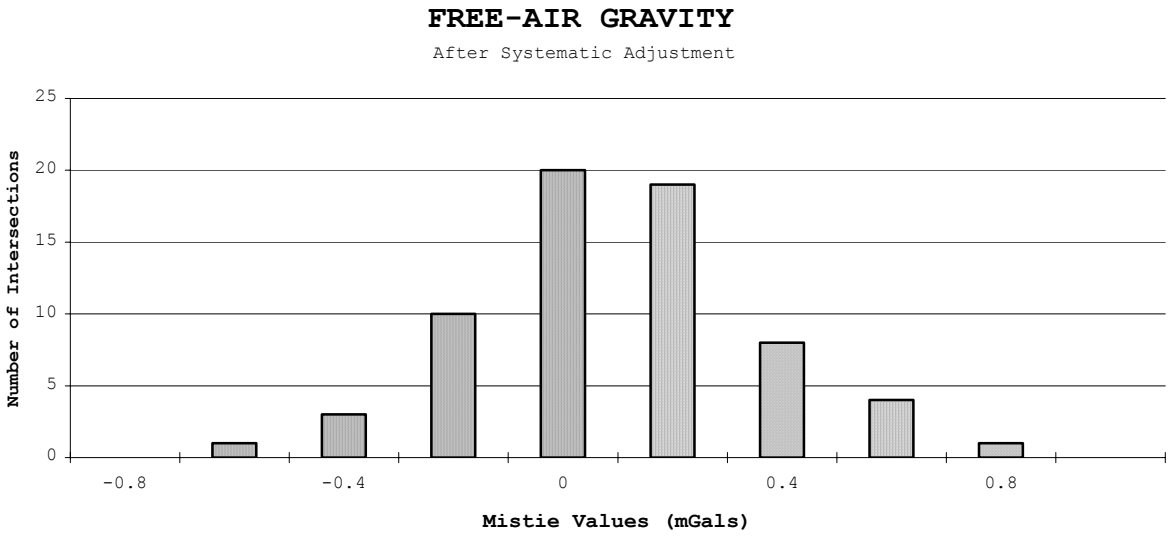


Figure 9: Histogram of Free-air Gravity Misties after Systematic Adjustment

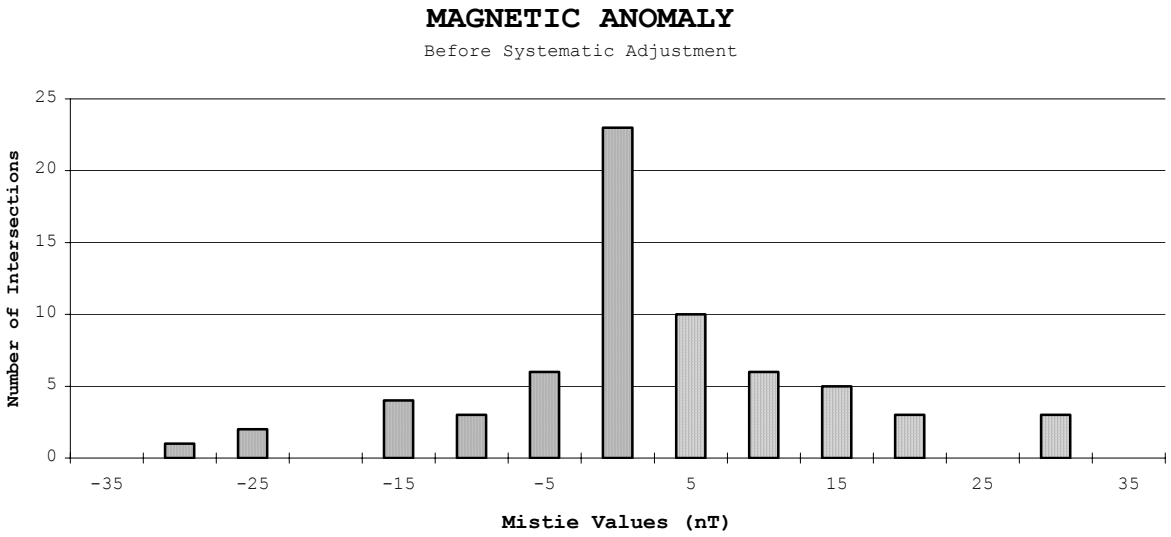


Figure 10: Histogram of Magnetic Anomaly Misties before Systematic Adjustment

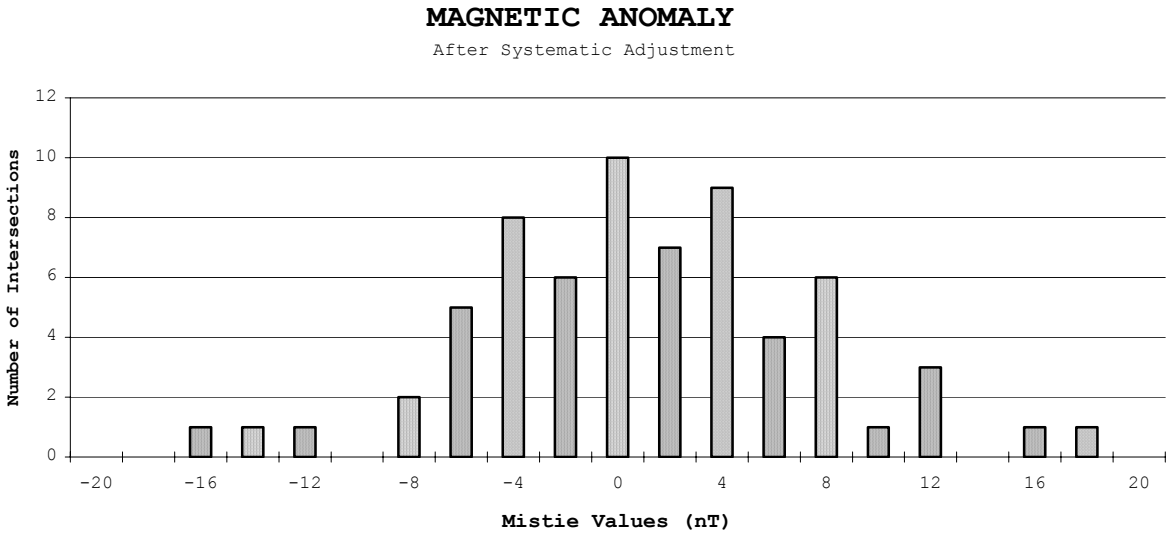


Figure 11: Histogram of Magnetic Anomaly Misties after Systematic Adjustment

VIII. GRIDDING AND MAPPING

The line-oriented survey data sets for adjusted bathymetry and adjusted free-air gravity were gridded with a grid increment of 1Km, using Fugro-LCT's minimum curvature gridding program MINCRV™.

A Bouguer gravity grid was produced by addition of a Bouguer correction grid to the free-air gravity grid. The Bouguer gravity grid also therefore has a 1km grid increment.

Figures 12, 13 and 14 are colour shaded relief maps of bathymetry, free-air gravity and Bouguer gravity respectively.

The following projection parameters were used for the line-oriented data sets and grids:

Projection:	Universal Transverse Mercator
Spheroid:	ADG84
Central Meridian:	147° East
Latitude Origin:	0.0
False Easting:	500000.0
False Northing	10000000.0
Units:	Metres
Scale Factor:	0.9996

IX. FINAL PRODUCTS

A. Maps

Colour shaded relief maps of bathymetry, free-air gravity, Bouguer gravity and magnetic anomaly were produced on paper. The maps were produced at a scale of 1:100,000. The data were plotted at the antenna position.

B. Magnetic Data Tape

Final archive data was prepared containing the raw and reduced line-oriented data, and grids of bathymetry, free-air gravity, Bouguer gravity and magnetic anomaly in ASCII format. A complete description of the final archive data ASCII format is included in Appendix 6.

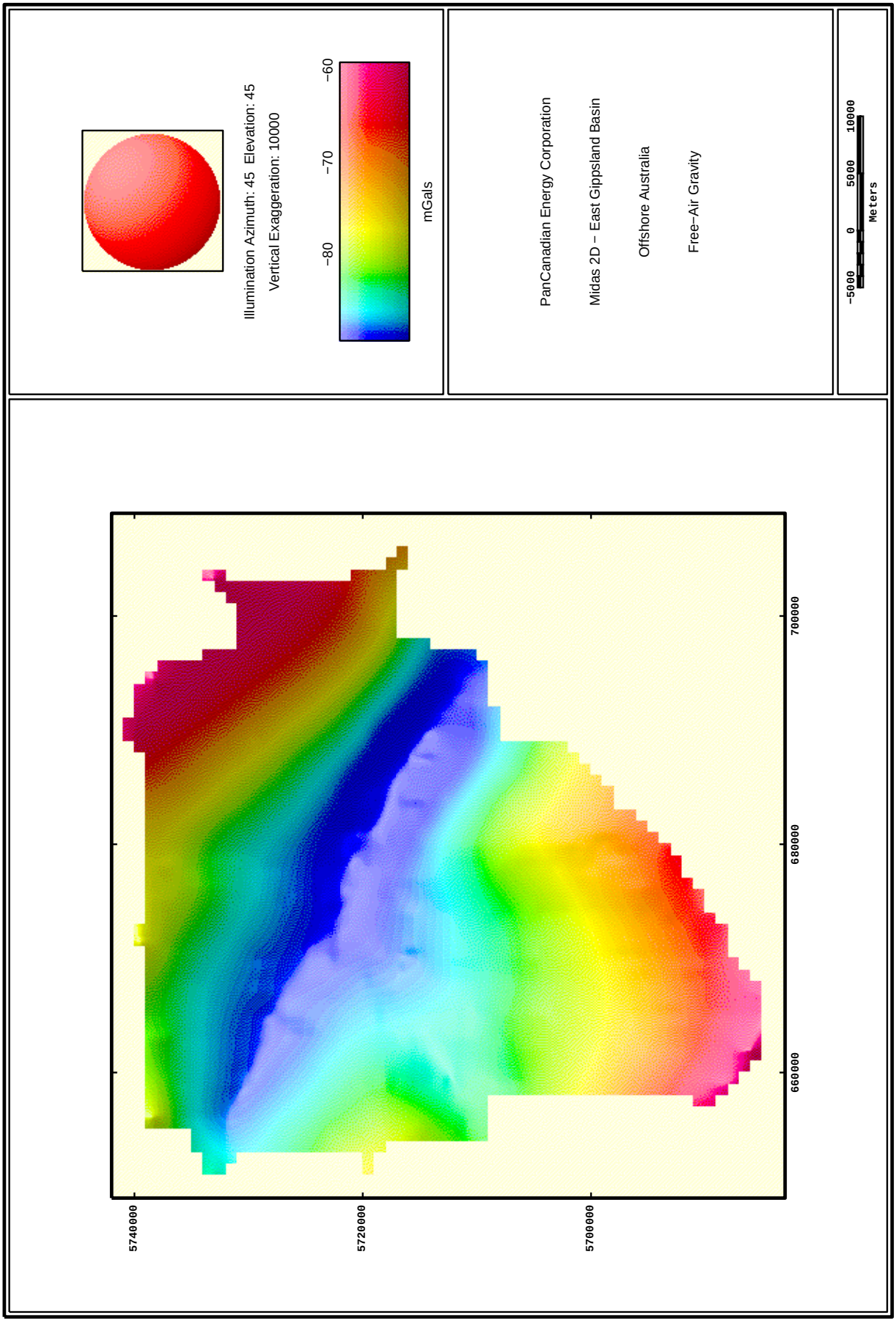


Figure 12: Free Air Gravity

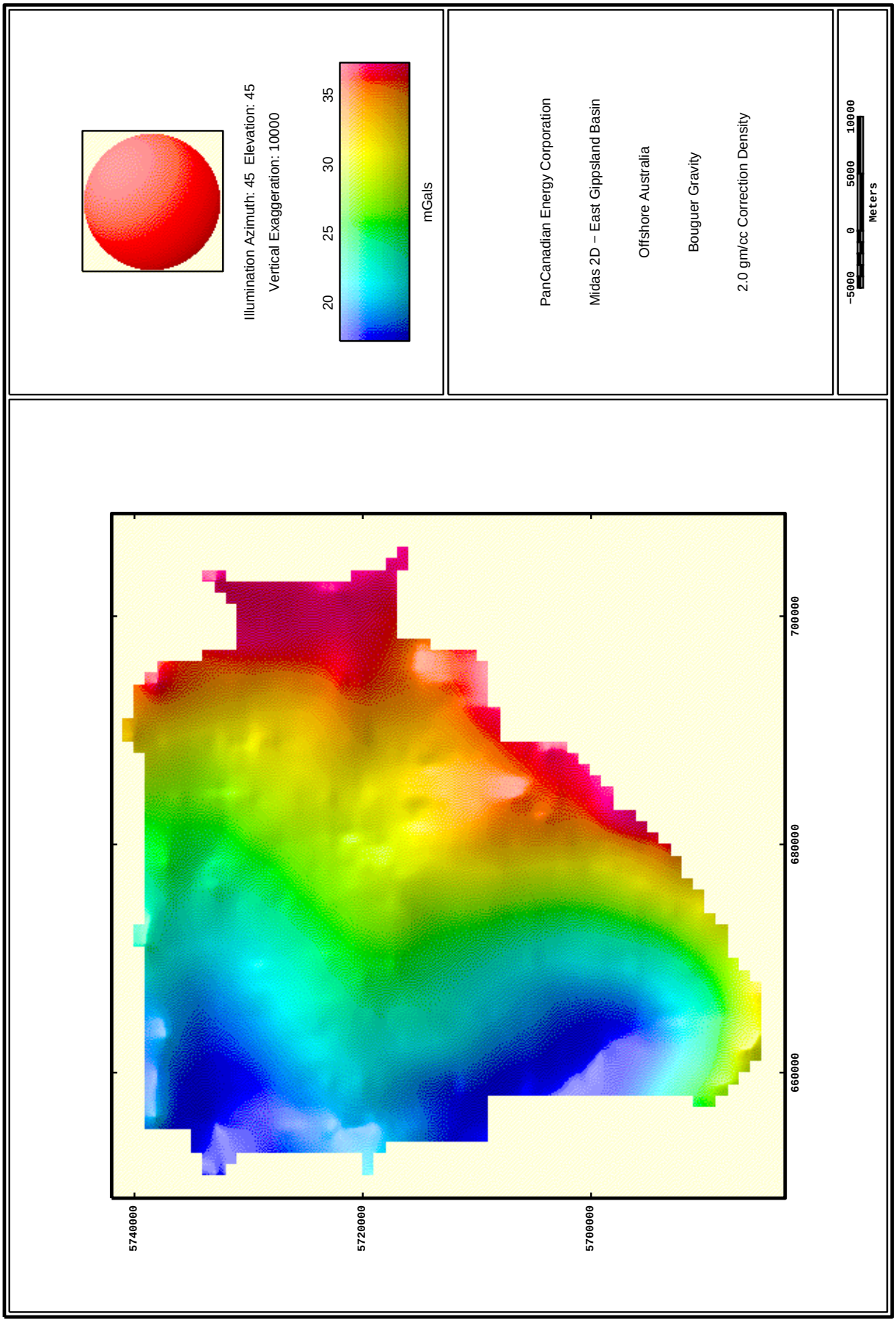


Figure 13: Bouguer Gravity (2.0g/cc correction density)

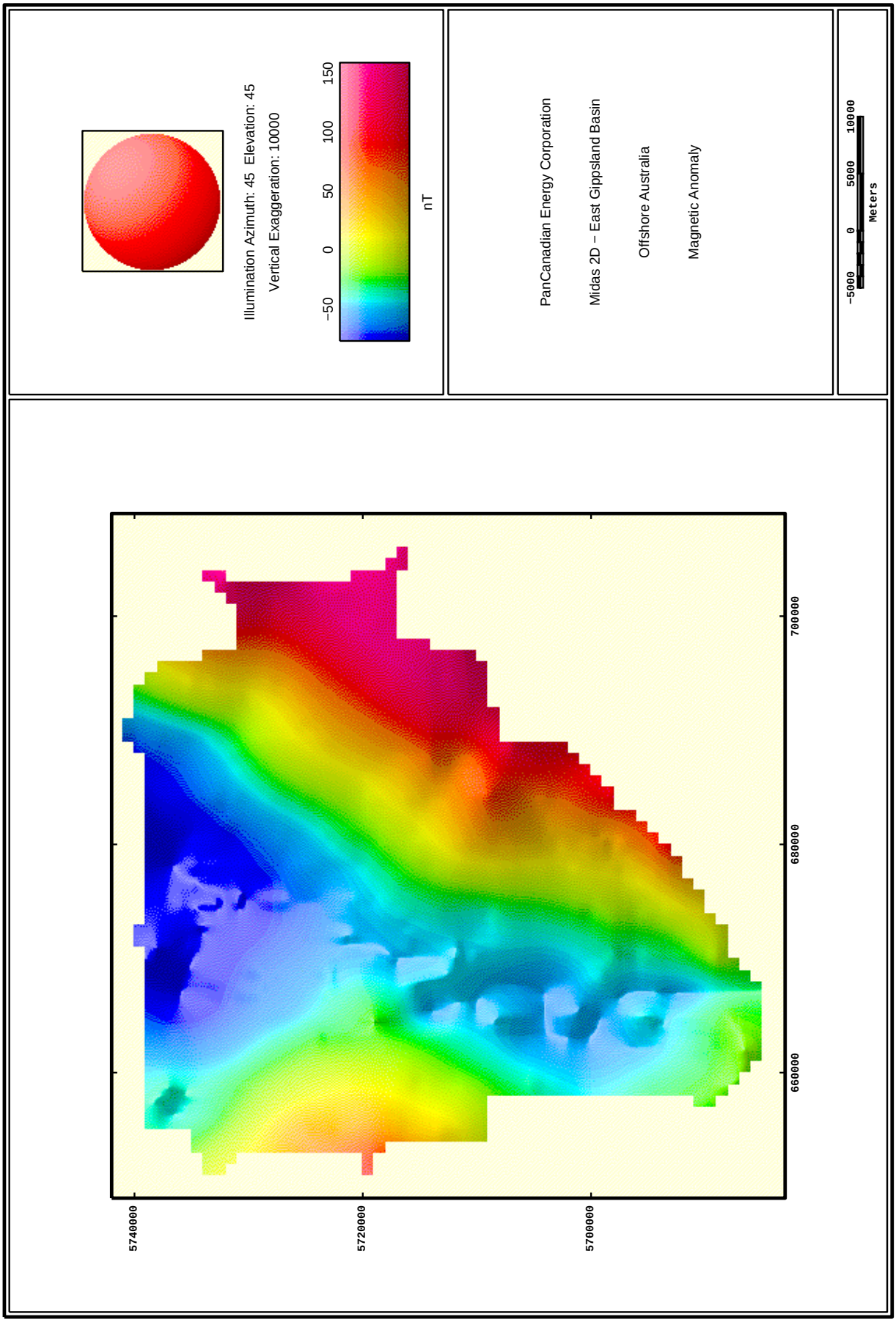


Figure 14: Magnetic Anomaly

X. SUMMARY

A ship borne geophysical survey was conducted offshore Australia, by Fugro-Geoteam AS, for PanCanadian Energy Corporation. Fugro-LCT Limited was responsible for the acquisition and processing of the gravity and magnetic data to compliment the seismic data.

The area consists of approximately 822 kilometres of navigation data. Of this total there are 822 kilometres of gravity data, 822 kilometres of magnetic data and 726 kilometres of bathymetry data. The gravity, magnetic, bathymetry, and navigation data were acquired on-board the Geo Arctic. This vessel was operated by Fugro-Geoteam AS, who acted as the primary acquisition contractor for this work. The survey production period was from 19th December 2001 to 08th January 2002. Figure 1 shows an Index map of the survey area. A brief line report is included in Appendix 1.

Fugro-LCT, Limited.

David Slack
Processing Geophysicist

Stewart Walter
Senior Geophysicist

Appendix 1: Brief Line Report

LCT Line#	Num Pts	Start Date YY/MM/DD	Time HHMMSS	Start Shot	End Date YY/MM/DD	Time HHMMSS	End Shot	Line Name
1	1904	2001 12 22	25310	1001	2001 12 22	81020	2779	0004A001
2	2201	2001 12 22	162930	999	2001 12 22	223610	3123	0003R003
3	2163	2001 12 23	31630	1000	2001 12 23	91650	3070	0002A004
4	1359	2001 12 23	122010	1000	2001 12 23	160630	2308	0001A005
5	976	2001 12 23	192330	1000	2001 12 23	220600	1927	0019A006
6	1505	2001 12 24	65110	1000	2001 12 24	110150	2436	0017B008
7	676	2001 12 24	133540	1000	2001 12 24	152810	1624	0015A009
8	1139	2001 12 28	35640	999	2001 12 28	70620	2104	0018A011
9	1601	2001 12 28	93040	1000	2001 12 28	135720	2532	0016A012
10	1835	2001 12 28	172400	1000	2001 12 28	222940	2688	0014A013
11	2081	2001 12 29	11710	1000	2001 12 29	70350	2976	0011A014
12	2021	2001 12 29	91740	1000	2001 12 29	145420	2918	0013A015
13	1136	2001 12 30	65920	999	2001 12 30	100830	2087	0007A018
14	2131	2001 12 30	140930	1000	2001 12 30	200430	3034	0009A019
15	1232	2001 12 31	143200	1497	2001 12 31	175710	2653	0015D021
16	2099	2001 12 31	211000	1000	2002 1 1	25940	2996	0012B022
17	2081	2002 1 1	52810	1000	2002 1 1	111450	2957	0010A023
18	813	2002 1 1	130940	999	2002 1 1	152500	1784	0008R024
19	1340	2002 1 3	230500	2795	2002 1 4	24810	1538	0008T026
20	1660	2002 1 4	62600	1000	2002 1 4	110230	2572	0005A027
21	759	2002 1 4	154200	999	2002 1 4	174820	1704	0006A028
22	572	2002 1 4	223820	1358	2002 1 5	1330	1897	0012R029
23	389	2002 1 5	33510	2664	2002 1 5	43950	3034	009R030
24	1021	2002 1 5	82750	1598	2002 1 5	111750	2573	0005R031

Appendix 2: Survey Line Description

LCT line number: 1
Client line name: 0004A001
Client line number: 0
Data base structure: TIME, Increment: 10 seconds
Number of points on line: 1904
Start shot: Null   End shot: Null
Survey date: DEC 22, 2001
Start time: 25310 End time: 81020
Average line heading (degrees azimuth from north): 277.16974
Navigation antenna to gravity meter distance: 13.680000
    (positive if antenna is astern of the gravity meter)
Vessel stern to navigation antenna distance: 33.520000
    (positive if stern is astern of the antenna)
CDP offset (Antenna pos - CDP pos.): Null
Gravity meter name: LRS-65
Magnetometer name: Elsec
Fathometer name: EA500
Gravity base level: 968478.364
Gravity latitude correction formula: 1967 GRS
Gravity final filter length (sec): 240.00000
Gravity preliminary filter length (sec): 120.00000
Eotvos correction type: Time Varying Decorrelation
Eotvos correction window width: 64
Eotvos correction step down: 4
Eotvos correction alignment width: 0
Eotvos correction maximum gain factor: 5.0000000
Eotvos correction phase parameter: 15.000000
Magnetic cable to stern length: 234.99998
 (Same units as projected distance)
Geomagnetic Reference Field: IGRF2000
Magnetic filter length (sec): 300.00000
Transducer depth (draft correction): Null

LCT line number: 2
Client line name: 0003R003
Client line number: 0
Data base structure: TIME, Increment: 10 seconds
Number of points on line: 2201
Start shot: Null   End shot: Null
Survey date: DEC 22, 2001
Start time: 162930 End time: 223610
Average line heading (degrees azimuth from north): 98.203690
Navigation antenna to gravity meter distance: 13.680000
    (positive if antenna is astern of the gravity meter)
Vessel stern to navigation antenna distance: 33.520000
    (positive if stern is astern of the antenna)
CDP offset (Antenna pos - CDP pos.): Null
Gravity meter name: LRS-65
Magnetometer name: Elsec
Fathometer name: EA500
Gravity base level: 968478.448
Gravity latitude correction formula: 1967 GRS
Gravity final filter length (sec): 240.00000
Gravity preliminary filter length (sec): 120.00000
Eotvos correction type: Time Varying Decorrelation
Eotvos correction window width: 64
Eotvos correction step down: 4
Eotvos correction alignment width: 0
Eotvos correction maximum gain factor: 10.000000
Eotvos correction phase parameter: 20.000000

Magnetic cable to stern length: 234.99998
 (Same units as projected distance)
Geomagnetic Reference Field: IGRF2000
Magnetic filter length (sec): 300.00000
Transducer depth (draft correction): Null

LCT line number: 3
Client line name: 0002A004
Client line number: 0
Data base structure: TIME, Increment: 10 seconds
Number of points on line: 2163
Start shot: Null   End shot: Null
Survey date: DEC 23, 2001
Start time: 31630 End time: 91650
Average line heading (degrees azimuth from north): 280.25464
Navigation antenna to gravity meter distance: 13.680000
    (positive if antenna is astern of the gravity meter)
Vessel stern to navigation antenna distance: 33.520000
    (positive if stern is astern of the antenna)
CDP offset (Antenna pos - CDP pos.): Null
Gravity meter name: LRS-65
Magnetometer name: Elsec
Fathometer name: EA500
Gravity base level: 968478.512
Gravity latitude correction formula: 1967 GRS
Gravity final filter length (sec): 480.00000
Gravity preliminary filter length (sec): 120.00000
Eotvos correction type: Time Varying Decorrelation
Eotvos correction window width: 128
Eotvos correction step down: 4
Eotvos correction alignment width: 0
Eotvos correction maximum gain factor: 10.000000
Eotvos correction phase parameter: 20.000000
Magnetic cable to stern length: 234.99998
 (Same units as projected distance)
Geomagnetic Reference Field: IGRF2000
Magnetic filter length (sec): 300.00000
Transducer depth (draft correction): Null

LCT line number: 4
Client line name: 0001A005
Client line number: 0
Data base structure: TIME, Increment: 10 seconds
Number of points on line: 1359
Start shot: Null   End shot: Null
Survey date: DEC 23, 2001
Start time: 122010 End time: 160630
Average line heading (degrees azimuth from north): 99.440010
Navigation antenna to gravity meter distance: 13.680000
    (positive if antenna is astern of the gravity meter)
Vessel stern to navigation antenna distance: 33.520000
    (positive if stern is astern of the antenna)
CDP offset (Antenna pos - CDP pos.): Null
Gravity meter name: LRS-65
Magnetometer name: Elsec
Fathometer name: EA500
Gravity base level: 968478.560
Gravity latitude correction formula: 1967 GRS
Gravity final filter length (sec): 300.00000

Gravity preliminary filter length (sec): 120.00000
Eotvos correction type: Time Varying Decorrelation
Eotvos correction window width: 64
Eotvos correction step down: 4
Eotvos correction alignment width: 0
Eotvos correction maximum gain factor: 5.0000000
Eotvos correction phase parameter: 20.000000
Magnetic cable to stern length: 234.99998
 (Same units as projected distance)
Geomagnetic Reference Field: IGRF2000
Magnetic filter length (sec): 300.00000
Transducer depth (draft correction): Null

LCT line number: 5
Client line name: 0019A006
Client line number: 0
Data base structure: TIME, Increment: 10 seconds
Number of points on line: 976
Start shot: Null   End shot: Null
Survey date: DEC 23, 2001
Start time: 192330 End time: 220600
Average line heading (degrees azimuth from north): 195.54297
Navigation antenna to gravity meter distance: 13.680000
    (positive if antenna is astern of the gravity meter)
Vessel stern to navigation antenna distance: 33.520000
    (positive if stern is astern of the antenna)
CDP offset (Antenna pos - CDP pos.): Null
Gravity meter name: LRS-65
Magnetometer name: Elsec
Fathometer name: EA500
Gravity base level: 968478.599
Gravity latitude correction formula: 1967 GRS
Gravity final filter length (sec): 240.00000
Gravity preliminary filter length (sec): 120.00000
Eotvos correction type: Time Varying Decorrelation
Eotvos correction window width: 64
Eotvos correction step down: 4
Eotvos correction alignment width: 0
Eotvos correction maximum gain factor: 3.0000000
Eotvos correction phase parameter: 10.000000
Magnetic cable to stern length: 234.99998
 (Same units as projected distance)
Geomagnetic Reference Field: IGRF2000
Magnetic filter length (sec): 300.00000
Transducer depth (draft correction): Null

LCT line number: 6
Client line name: 0017B008
Client line number: 0
Data base structure: TIME, Increment: 10 seconds
Number of points on line: 1505
Start shot: Null   End shot: Null
Survey date: DEC 24, 2001
Start time: 65110 End time: 110150
Average line heading (degrees azimuth from north): 359.09604
Navigation antenna to gravity meter distance: 13.680000
    (positive if antenna is astern of the gravity meter)
Vessel stern to navigation antenna distance: 33.520000
    (positive if stern is astern of the antenna)

CDP offset (Antenna pos - CDP pos.): Null
Gravity meter name: LRS-65
Magnetometer name: Elsec
Fathometer name: EA500
Gravity base level: 968478.671
Gravity latitude correction formula: 1967 GRS
Gravity final filter length (sec): 240.00000
Gravity preliminary filter length (sec): 120.00000
Eotvos correction type: Time Varying Decorrelation
Eotvos correction window width: 64
Eotvos correction step down: 4
Eotvos correction alignment width: 0
Eotvos correction maximum gain factor: 5.0000000
Eotvos correction phase parameter: 20.000000
Magnetic cable to stern length: 234.99998
 (Same units as projected distance)
Geomagnetic Reference Field: IGRF2000
Magnetic filter length (sec): 300.00000
Transducer depth (draft correction): Null

LCT line number: 7
Client line name: 0015A009
Client line number: 0
Data base structure: TIME, Increment: 10 seconds
Number of points on line: 676
Start shot: Null   End shot: Null
Survey date: DEC 24, 2001
Start time: 133540 End time: 152810
Average line heading (degrees azimuth from north): 179.58098
Navigation antenna to gravity meter distance: 13.680000
    (positive if antenna is astern of the gravity meter)
Vessel stern to navigation antenna distance: 33.520000
    (positive if stern is astern of the antenna)
CDP offset (Antenna pos - CDP pos.): Null
Gravity meter name: LRS-65
Magnetometer name: Elsec
Fathometer name: EA500
Gravity base level: 968478.705
Gravity latitude correction formula: 1967 GRS
Gravity final filter length (sec): 240.00000
Gravity preliminary filter length (sec): 120.00000
Eotvos correction type: Time Varying Decorrelation
Eotvos correction window width: 64
Eotvos correction step down: 4
Eotvos correction alignment width: 0
Eotvos correction maximum gain factor: 5.0000000
Eotvos correction phase parameter: 15.000000
Magnetic cable to stern length: 234.99998
 (Same units as projected distance)
Geomagnetic Reference Field: IGRF2000
Magnetic filter length (sec): 300.00000
Transducer depth (draft correction): Null

LCT line number: 8
Client line name: 0018A011
Client line number: 0
Data base structure: TIME, Increment: 10 seconds
Number of points on line: 1139
Start shot: Null   End shot: Null

Survey date: DEC 28, 2001
Start time: 35640 End time: 70620
Average line heading (degrees azimuth from north): 359.51743
Navigation antenna to gravity meter distance: 13.680000
    (positive if antenna is astern of the gravity meter)
Vessel stern to navigation antenna distance: 33.520000
    (positive if stern is astern of the antenna)
CDP offset (Antenna pos - CDP pos.): Null
Gravity meter name: LRS-65
Magnetometer name: Elsec
Fathometer name: EA500
Gravity base level: 968479.225
Gravity latitude correction formula: 1967 GRS
Gravity final filter length (sec): 240.00000
Gravity preliminary filter length (sec): 120.00000
Eotvos correction type: Time Varying Decorrelation
Eotvos correction window width: 64
Eotvos correction step down: 4
Eotvos correction alignment width: 0
Eotvos correction maximum gain factor: 5.0000000
Eotvos correction phase parameter: 15.000000
Magnetic cable to stern length: 234.99998
 (Same units as projected distance)
Geomagnetic Reference Field: IGRF2000
Magnetic filter length (sec): 300.00000
Transducer depth (draft correction): Null

LCT line number: 9
Client line name: 0016A012
Client line number: 0
Data base structure: TIME, Increment: 10 seconds
Number of points on line: 1601
Start shot: Null   End shot: Null
Survey date: DEC 28, 2001
Start time: 93040 End time: 135720
Average line heading (degrees azimuth from north): 179.28400
Navigation antenna to gravity meter distance: 13.680000
    (positive if antenna is astern of the gravity meter)
Vessel stern to navigation antenna distance: 33.520000
    (positive if stern is astern of the antenna)
CDP offset (Antenna pos - CDP pos.): Null
Gravity meter name: LRS-65
Magnetometer name: Elsec
Fathometer name: EA500
Gravity base level: 968479.262
Gravity latitude correction formula: 1967 GRS
Gravity final filter length (sec): 240.00000
Gravity preliminary filter length (sec): 120.00000
Eotvos correction type: Time Varying Decorrelation
Eotvos correction window width: 64
Eotvos correction step down: 4
Eotvos correction alignment width: 0
Eotvos correction maximum gain factor: 5.0000000
Eotvos correction phase parameter: 15.000000
Magnetic cable to stern length: 234.99998
 (Same units as projected distance)
Geomagnetic Reference Field: IGRF2000
Magnetic filter length (sec): 300.00000
Transducer depth (draft correction): Null

LCT line number: 10
Client line name: 0014A013
Client line number: 0
Data base structure: TIME, Increment: 10 seconds
Number of points on line: 1835
Start shot: Null   End shot: Null
Survey date: DEC 28, 2001
Start time: 172400 End time: 222940
Average line heading (degrees azimuth from north): 359.60721
Navigation antenna to gravity meter distance: 13.680000
    (positive if antenna is astern of the gravity meter)
Vessel stern to navigation antenna distance: 33.520000
    (positive if stern is astern of the antenna)
CDP offset (Antenna pos - CDP pos.): Null
Gravity meter name: LRS-65
Magnetometer name: Elsec
Fathometer name: EA500
Gravity base level: 968479.311
Gravity latitude correction formula: 1967 GRS
Gravity final filter length (sec): 240.00000
Gravity preliminary filter length (sec): 120.00000
Eotvos correction type: Time Varying Decorrelation
Eotvos correction window width: 64
Eotvos correction step down: 4
Eotvos correction alignment width: 0
Eotvos correction maximum gain factor: 5.0000000
Eotvos correction phase parameter: 20.000000
Magnetic cable to stern length: 234.99998
 (Same units as projected distance)
Geomagnetic Reference Field: IGRF2000
Magnetic filter length (sec): 300.00000
Transducer depth (draft correction): Null

LCT line number: 11
Client line name: 0011A014
Client line number: 0
Data base structure: TIME, Increment: 10 seconds
Number of points on line: 2081
Start shot: Null   End shot: Null
Survey date: DEC 29, 2001
Start time: 11710 End time: 70350
Average line heading (degrees azimuth from north): 179.55663
Navigation antenna to gravity meter distance: 13.680000
    (positive if antenna is astern of the gravity meter)
Vessel stern to navigation antenna distance: 33.520000
    (positive if stern is astern of the antenna)
CDP offset (Antenna pos - CDP pos.): Null
Gravity meter name: LRS-65
Magnetometer name: Elsec
Fathometer name: EA500
Gravity base level: 968479.359
Gravity latitude correction formula: 1967 GRS
Gravity final filter length (sec): 300.00000
Gravity preliminary filter length (sec): 120.00000
Eotvos correction type: Time Varying Decorrelation
Eotvos correction window width: 128
Eotvos correction step down: 4
Eotvos correction alignment width: 0
Eotvos correction maximum gain factor: 5.0000000
Eotvos correction phase parameter: 20.000000

Magnetic cable to stern length: 234.99998
 (Same units as projected distance)
Geomagnetic Reference Field: IGRF2000
Magnetic filter length (sec): 300.00000
Transducer depth (draft correction): Null

LCT line number: 12
Client line name: 0013A015
Client line number: 0
Data base structure: TIME, Increment: 10 seconds
Number of points on line: 2021
Start shot: Null   End shot: Null
Survey date: DEC 29, 2001
Start time: 91740 End time: 145420
Average line heading (degrees azimuth from north): 0.73871040
Navigation antenna to gravity meter distance: 13.680000
    (positive if antenna is astern of the gravity meter)
Vessel stern to navigation antenna distance: 33.520000
    (positive if stern is astern of the antenna)
CDP offset (Antenna pos - CDP pos.): Null
Gravity meter name: LRS-65
Magnetometer name: Elsec
Fathometer name: EA500
Gravity base level: 968479.406
Gravity latitude correction formula: 1967 GRS
Gravity final filter length (sec): 240.00000
Gravity preliminary filter length (sec): 120.00000
Eotvos correction type: Time Varying Decorrelation
Eotvos correction window width: 64
Eotvos correction step down: 4
Eotvos correction alignment width: 0
Eotvos correction maximum gain factor: 5.0000000
Eotvos correction phase parameter: 15.000000
Magnetic cable to stern length: 234.99998
 (Same units as projected distance)
Geomagnetic Reference Field: IGRF2000
Magnetic filter length (sec): 300.00000
Transducer depth (draft correction): Null

LCT line number: 13
Client line name: 0007A018
Client line number: 0
Data base structure: TIME, Increment: 10 seconds
Number of points on line: 1136
Start shot: Null   End shot: Null
Survey date: DEC 30, 2001
Start time: 65920 End time: 100830
Average line heading (degrees azimuth from north): 359.67270
Navigation antenna to gravity meter distance: 13.680000
    (positive if antenna is astern of the gravity meter)
Vessel stern to navigation antenna distance: 33.520000
    (positive if stern is astern of the antenna)
CDP offset (Antenna pos - CDP pos.): Null
Gravity meter name: LRS-65
Magnetometer name: Elsec
Fathometer name: EA500
Gravity base level: 968479.529
Gravity latitude correction formula: 1967 GRS
Gravity final filter length (sec): 240.00000

Gravity preliminary filter length (sec): 120.00000
Eotvos correction type: Time Varying Decorrelation
Eotvos correction window width: 64
Eotvos correction step down: 4
Eotvos correction alignment width: 0
Eotvos correction maximum gain factor: 5.0000000
Eotvos correction phase parameter: 15.000000
Magnetic cable to stern length: 234.99998
 (Same units as projected distance)
Geomagnetic Reference Field: IGRF2000
Magnetic filter length (sec): 300.00000
Transducer depth (draft correction): Null

LCT line number: 14
Client line name: 0009A019
Client line number: 0
Data base structure: TIME, Increment: 10 seconds
Number of points on line: 2131
Start shot: Null   End shot: Null
Survey date: DEC 30, 2001
Start time: 140930 End time: 200430
Average line heading (degrees azimuth from north): 179.50287
Navigation antenna to gravity meter distance: 13.680000
    (positive if antenna is astern of the gravity meter)
Vessel stern to navigation antenna distance: 33.520000
    (positive if stern is astern of the antenna)
CDP offset (Antenna pos - CDP pos.): Null
Gravity meter name: LRS-65
Magnetometer name: Elsec
Fathometer name: EA500
Gravity base level: 968479.580
Gravity latitude correction formula: 1967 GRS
Gravity final filter length (sec): 240.00000
Gravity preliminary filter length (sec): 120.00000
Eotvos correction type: Time Varying Decorrelation
Eotvos correction window width: 128
Eotvos correction step down: 4
Eotvos correction alignment width: 0
Eotvos correction maximum gain factor: 10.000000
Eotvos correction phase parameter: 20.000000
Magnetic cable to stern length: 234.99998
 (Same units as projected distance)
Geomagnetic Reference Field: IGRF2000
Magnetic filter length (sec): 300.00000
Transducer depth (draft correction): Null

LCT line number: 15
Client line name: 0015D021
Client line number: 0
Data base structure: TIME, Increment: 10 seconds
Number of points on line: 1232
Start shot: Null   End shot: Null
Survey date: DEC 31, 2001
Start time: 143200 End time: 175710
Average line heading (degrees azimuth from north): 179.70882
Navigation antenna to gravity meter distance: 13.680000
    (positive if antenna is astern of the gravity meter)
Vessel stern to navigation antenna distance: 33.520000
    (positive if stern is astern of the antenna)

CDP offset (Antenna pos - CDP pos.): Null
Gravity meter name: LRS-65
Magnetometer name: Elsec
Fathometer name: EA500
Gravity base level: 968479.718
Gravity latitude correction formula: 1967 GRS
Gravity final filter length (sec): 420.00000
Gravity preliminary filter length (sec): 120.00000
Eotvos correction type: Time Varying Decorrelation
Eotvos correction window width: 128
Eotvos correction step down: 4
Eotvos correction alignment width: 0
Eotvos correction maximum gain factor: 5.0000000
Eotvos correction phase parameter: 30.000000
Magnetic cable to stern length: 234.99998
 (Same units as projected distance)
Geomagnetic Reference Field: IGRF2000
Magnetic filter length (sec): 300.00000
Transducer depth (draft correction): Null

LCT line number: 16
Client line name: 0012B022
Client line number: 0
Data base structure: TIME, Increment: 10 seconds
Number of points on line: 2099
Start shot: Null   End shot: Null
Survey date: DEC 31, 2001
Start time: 211000 End time: 25940
Average line heading (degrees azimuth from north): 359.66370
Navigation antenna to gravity meter distance: 13.680000
    (positive if antenna is astern of the gravity meter)
Vessel stern to navigation antenna distance: 33.520000
    (positive if stern is astern of the antenna)
CDP offset (Antenna pos - CDP pos.): Null
Gravity meter name: LRS-65
Magnetometer name: Elsec
Fathometer name: EA500
Gravity base level: 968479.765
Gravity latitude correction formula: 1967 GRS
Gravity final filter length (sec): 600.00000
Gravity preliminary filter length (sec): 120.00000
Eotvos correction type: Time Varying Decorrelation
Eotvos correction window width: 128
Eotvos correction step down: 4
Eotvos correction alignment width: 0
Eotvos correction maximum gain factor: 10.000000
Eotvos correction phase parameter: 25.000000
Magnetic cable to stern length: 234.99998
 (Same units as projected distance)
Geomagnetic Reference Field: IGRF2000
Magnetic filter length (sec): 300.00000
Transducer depth (draft correction): Null

LCT line number: 17
Client line name: 0010A023
Client line number: 0
Data base structure: TIME, Increment: 10 seconds
Number of points on line: 2081
Start shot: Null   End shot: Null

Survey date: JAN 1, 2002
Start time: 52810 End time: 111450
Average line heading (degrees azimuth from north): 179.66347
Navigation antenna to gravity meter distance: 13.680000
    (positive if antenna is astern of the gravity meter)
Vessel stern to navigation antenna distance: 33.520000
    (positive if stern is astern of the antenna)
CDP offset (Antenna pos - CDP pos.): Null
Gravity meter name: LRS-65
Magnetometer name: Elsec
Fathometer name: EA500
Gravity base level: 968479.814
Gravity latitude correction formula: 1967 GRS
Gravity final filter length (sec): 600.00000
Gravity preliminary filter length (sec): 120.00000
Eotvos correction type: Time Varying Decorrelation
Eotvos correction window width: 128
Eotvos correction step down: 4
Eotvos correction alignment width: 0
Eotvos correction maximum gain factor: 10.000000
Eotvos correction phase parameter: 20.000000
Magnetic cable to stern length: 234.99998
 (Same units as projected distance)
Geomagnetic Reference Field: IGRF2000
Magnetic filter length (sec): 300.00000
Transducer depth (draft correction): Null

LCT line number: 18
Client line name: 0008R024
Client line number: 0
Data base structure: TIME, Increment: 10 seconds
Number of points on line: 813
Start shot: Null   End shot: Null
Survey date: JAN 1, 2002
Start time: 130940 End time: 152500
Average line heading (degrees azimuth from north): 359.74701
Navigation antenna to gravity meter distance: 13.680000
    (positive if antenna is astern of the gravity meter)
Vessel stern to navigation antenna distance: 33.520000
    (positive if stern is astern of the antenna)
CDP offset (Antenna pos - CDP pos.): Null
Gravity meter name: LRS-65
Magnetometer name: Elsec
Fathometer name: EA500
Gravity base level: 968479.850
Gravity latitude correction formula: 1967 GRS
Gravity final filter length (sec): 240.00000
Gravity preliminary filter length (sec): 120.00000
Eotvos correction type: Time Varying Decorrelation
Eotvos correction window width: 64
Eotvos correction step down: 4
Eotvos correction alignment width: 0
Eotvos correction maximum gain factor: 5.0000000
Eotvos correction phase parameter: 15.000000
Magnetic cable to stern length: 234.99998
 (Same units as projected distance)
Geomagnetic Reference Field: IGRF2000
Magnetic filter length (sec): 300.00000
Transducer depth (draft correction): Null

LCT line number: 19
Client line name: 0008T026
Client line number: 0
Data base structure: TIME, Increment: 10 seconds
Number of points on line: 1340
Start shot: Null   End shot: Null
Survey date: JAN 3, 2002
Start time: 230500 End time: 24810
Average line heading (degrees azimuth from north): 180.12955
Navigation antenna to gravity meter distance: 13.680000
    (positive if antenna is astern of the gravity meter)
Vessel stern to navigation antenna distance: 33.520000
    (positive if stern is astern of the antenna)
CDP offset (Antenna pos - CDP pos.): Null
Gravity meter name: LRS-65
Magnetometer name: Elsec
Fathometer name: EA500
Gravity base level: 968480.200
Gravity latitude correction formula: 1967 GRS
Gravity final filter length (sec): 240.00000
Gravity preliminary filter length (sec): 120.00000
Eotvos correction type: Time Varying Decorrelation
Eotvos correction window width: 64
Eotvos correction step down: 4
Eotvos correction alignment width: 0
Eotvos correction maximum gain factor: 5.0000000
Eotvos correction phase parameter: 25.000000
Magnetic cable to stern length: 234.99998
 (Same units as projected distance)
Geomagnetic Reference Field: IGRF2000
Magnetic filter length (sec): 300.00000
Transducer depth (draft correction): Null

LCT line number: 20
Client line name: 0005A027
Client line number: 0
Data base structure: TIME, Increment: 10 seconds
Number of points on line: 1660
Start shot: Null   End shot: Null
Survey date: JAN 4, 2002
Start time: 62600 End time: 110230
Average line heading (degrees azimuth from north): 55.898357
Navigation antenna to gravity meter distance: 13.680000
    (positive if antenna is astern of the gravity meter)
Vessel stern to navigation antenna distance: 33.520000
    (positive if stern is astern of the antenna)
CDP offset (Antenna pos - CDP pos.): Null
Gravity meter name: LRS-65
Magnetometer name: Elsec
Fathometer name: EA500
Gravity base level: 968480.247
Gravity latitude correction formula: 1967 GRS
Gravity final filter length (sec): 420.00000
Gravity preliminary filter length (sec): 120.00000
Eotvos correction type: Time Varying Decorrelation
Eotvos correction window width: 64
Eotvos correction step down: 4
Eotvos correction alignment width: 0
Eotvos correction maximum gain factor: 10.000000
Eotvos correction phase parameter: 25.000000

Magnetic cable to stern length: 234.99998
 (Same units as projected distance)
Geomagnetic Reference Field: IGRF2000
Magnetic filter length (sec): 300.00000
Transducer depth (draft correction): Null

LCT line number: 21
Client line name: 0006A028
Client line number: 0
Data base structure: TIME, Increment: 10 seconds
Number of points on line: 759
Start shot: Null   End shot: Null
Survey date: JAN 4, 2002
Start time: 154200 End time: 174820
Average line heading (degrees azimuth from north): 236.04495
Navigation antenna to gravity meter distance: 13.680000
    (positive if antenna is astern of the gravity meter)
Vessel stern to navigation antenna distance: 33.520000
    (positive if stern is astern of the antenna)
CDP offset (Antenna pos - CDP pos.): Null
Gravity meter name: LRS-65
Magnetometer name: Elsec
Fathometer name: EA500
Gravity base level: 968480.295
Gravity latitude correction formula: 1967 GRS
Gravity final filter length (sec): 240.00000
Gravity preliminary filter length (sec): 120.00000
Eotvos correction type: Time Varying Decorrelation
Eotvos correction window width: 64
Eotvos correction step down: 4
Eotvos correction alignment width: 0
Eotvos correction maximum gain factor: 5.0000000
Eotvos correction phase parameter: 15.000000
Magnetic cable to stern length: 234.99998
 (Same units as projected distance)
Geomagnetic Reference Field: IGRF2000
Magnetic filter length (sec): 300.00000
Transducer depth (draft correction): Null

LCT line number: 22
Client line name: 0012R029
Client line number: 0
Data base structure: TIME, Increment: 10 seconds
Number of points on line: 572
Start shot: Null   End shot: Null
Survey date: JAN 4, 2002
Start time: 223820 End time: 1330
Average line heading (degrees azimuth from north): 359.74915
Navigation antenna to gravity meter distance: 13.680000
    (positive if antenna is astern of the gravity meter)
Vessel stern to navigation antenna distance: 33.520000
    (positive if stern is astern of the antenna)
CDP offset (Antenna pos - CDP pos.): Null
Gravity meter name: LRS-65
Magnetometer name: Elsec
Fathometer name: EA500
Gravity base level: 968480.334
Gravity latitude correction formula: 1967 GRS
Gravity final filter length (sec): 240.00000

Gravity preliminary filter length (sec): 120.00000
Eotvos correction type: Time Varying Decorrelation
Eotvos correction window width: 64
Eotvos correction step down: 4
Eotvos correction alignment width: 0
Eotvos correction maximum gain factor: 5.0000000
Eotvos correction phase parameter: 15.000000
Magnetic cable to stern length: 234.99998
 (Same units as projected distance)
Geomagnetic Reference Field: IGRF2000
Magnetic filter length (sec): 300.00000
Transducer depth (draft correction): Null

LCT line number: 23
Client line name: 009R030
Client line number: 0
Data base structure: TIME, Increment: 10 seconds
Number of points on line: 389
Start shot: Null   End shot: Null
Survey date: JAN 5, 2002
Start time: 33510 End time: 43950
Average line heading (degrees azimuth from north): 180.17586
Navigation antenna to gravity meter distance: 13.680000
    (positive if antenna is astern of the gravity meter)
Vessel stern to navigation antenna distance: 33.520000
    (positive if stern is astern of the antenna)
CDP offset (Antenna pos - CDP pos.): Null
Gravity meter name: LRS-65
Magnetometer name: Elsec
Fathometer name: EA500
Gravity base level: 968480.362
Gravity latitude correction formula: 1967 GRS
Gravity final filter length (sec): 240.00000
Gravity preliminary filter length (sec): 120.00000
Eotvos correction type: Time Varying Decorrelation
Eotvos correction window width: 64
Eotvos correction step down: 4
Eotvos correction alignment width: 0
Eotvos correction maximum gain factor: 5.0000000
Eotvos correction phase parameter: 15.000000
Magnetic cable to stern length: 234.99998
 (Same units as projected distance)
Geomagnetic Reference Field: IGRF2000
Magnetic filter length (sec): 300.00000
Transducer depth (draft correction): Null

LCT line number: 24
Client line name: 0005R031
Client line number: 0
Data base structure: TIME, Increment: 10 seconds
Number of points on line: 1021
Start shot: Null   End shot: Null
Survey date: JAN 5, 2002
Start time: 82750 End time: 111750
Average line heading (degrees azimuth from north): 55.572136
Navigation antenna to gravity meter distance: 13.680000
    (positive if antenna is astern of the gravity meter)
Vessel stern to navigation antenna distance: 33.520000
    (positive if stern is astern of the antenna)

CDP offset (Antenna pos - CDP pos.): Null
Gravity meter name: LRS-65
Magnetometer name: Elsec
Fathometer name: EA500
Gravity base level: 968480.396
Gravity latitude correction formula: 1967 GRS
Gravity final filter length (sec): 240.00000
Gravity preliminary filter length (sec): 120.00000
Eotvos correction type: Time Varying Decorrelation
Eotvos correction window width: 64
Eotvos correction step down: 4
Eotvos correction alignment width: 0
Eotvos correction maximum gain factor: 15.000000
Eotvos correction phase parameter: 25.000000
Magnetic cable to stern length: 234.99998
 (Same units as projected distance)
Geomagnetic Reference Field: IGRF2000
Magnetic filter length (sec): 300.00000
Transducer depth (draft correction): Null

Appendix 3: Survey Data Production Summary

Channels Selected:
NEW-WTR : WATER DEPTH
CORRGRAV: CORRECTED CALIBRATED METER GRAVITY
MAG : MAGNETIC ANOMALY (CABLE,IGRF CORR.)

LCT Line#	Line Name	NEW-WTR Minimum	NEW-WTR Maximum	NEW-WTR Kilometer	CORRGRAV Minimum	CORRGRAV Maximum	CORRGRAV Kilometer	MAG Minimum	MAG Maximum	MAG Kilometer
1	0004A001	2311.12	3340.60	44.41	-12.10	0.77	44.46	-40.29	169.33	44.46
2	0003R003	2508.55	3223.00	53.05	-70.61	-45.63	53.06	-54.67	246.95	53.06
3	0002A004	2420.89	2947.77	51.73	-22.30	9.28	51.74	-80.05	180.82	51.74
4	0001A005	2210.23	2773.72	32.67	-75.60	-37.26	32.69	-87.51	152.29	32.69
5	0019A006	2031.09	3373.97	23.15	-27.86	2.12	23.16	130.95	207.64	23.16
6	0017B008	2134.41	3244.67	35.50	-40.06	-18.54	35.90	-48.11	173.78	35.90
7	0015A009	2657.08	3028.63	12.34	-45.10	-39.67	15.59	-79.97	-11.55	15.59
8	0018A011	2052.32	3327.77	27.55	-36.87	-18.22	27.58	-6.03	159.46	27.58
9	0016A012	2359.24	3154.92	38.27	-42.76	-5.58	38.29	-73.41	94.65	38.29
10	0014A013	2461.55	3055.59	40.78	-45.42	-0.57	42.20	-121.04	35.01	42.20
11	0011A014	2092.15	2900.24	48.58	-48.66	19.29	49.41	-93.65	66.05	49.41
12	0013A015	2281.29	3015.37	43.59	-46.11	9.89	47.96	-79.42	30.97	47.96
13	0007A018	2344.80	2617.16	27.02	-48.47	-24.08	27.15	-29.53	81.93	27.15
14	0009A019	2000.74	2801.00	50.85	-49.00	21.97	50.86	-68.00	-13.23	50.86
15	0015D021	null	null	0.00	-42.54	6.48	28.89	-34.86	97.10	28.89
16	0012B022	2308.30	2949.26	41.49	-46.21	12.23	49.90	-96.04	-24.42	49.90
17	0010A023	2062.10	2838.38	40.58	-48.13	16.33	48.97	-74.41	-15.21	48.97
18	0008R024	2024.41	2540.82	19.57	-28.44	7.40	19.58	-39.76	-3.27	19.58
19	0008T026	null	null	0.00	-49.14	-20.88	31.46	-59.39	-7.75	31.46
20	0005A027	1984.45	3278.23	37.85	-53.77	-5.16	39.31	-37.55	122.51	39.31
21	0006A028	2123.78	2484.22	11.57	14.43	34.30	17.59	-18.88	51.51	17.59
22	0012R029	2416.06	2722.54	12.91	-29.60	-7.18	13.45	-61.08	-47.08	13.45
23	009R030	2000.40	2210.43	9.17	-4.97	21.09	9.21	-43.50	3.67	9.21
24	0005R031	2369.14	3276.84	23.57	-54.76	-26.77	24.33	-20.29	125.78	24.33

Survey Kilometer Summary:

	NEW-WTR			CORRGRAV MAG		
	Minimum	Maximum	Kilometer	Minimum	Maximum	Kilometer
	1984.45	3373.97	726.20	-75.60	34.30	822.74
-121.04	246.95	822.74				

Total Navigation Data (Kilometers): 822.74

Appendix 4: Intersection Mistie Report

```
 Channel(s) Selected:
 NEW-WTR  =
 F-FAG    = FILTERED FREE-AIR GRAVITY
 F-CMAG1  =

 Number of Lines:         24

 Line: 0004A001
 LCT line number:          1
 Line Summary Statistics:
 Max-Abs-Mistie BSA ASA:          6.17         9.03         1.83         0.55
28.30        16.68
 Mean-Mistie BSA ASA:            -1.37         0.00        -0.71         0.00
7.03         0.00
 Mean-Abs-Mistie BSA ASA:         3.10         3.50         0.80         0.16
14.49         6.79
 Rms-Mistie BSA ASA:              3.63         4.70         0.94         0.22
16.38         8.83
 ------------------------------------------------------------------------------
-----------------------
                                   NEW-WTR   Mistie          F-FAG     Mistie
F-CMAG1   Mistie
   X-line          Time            BSA          ASA          BSA          ASA
BSA          ASA
 ------------------------------------------------------------------------------
-----------------------
      8           3: 5:17         1.37         0.53        -0.44         0.55
6.52        -0.08
      6           3:41:46        -0.17        -9.03        -0.78         0.00
10.36        16.68
      9           4:13:33         1.31         3.94         0.49        -0.15
26.50        11.18
     15           4:40: 0         null         null        -0.83        -0.08
14.19         2.38
     10           4:56:55         4.27         7.28        -0.48        -0.07
17.62         7.52
     12           5:21:11         null         null        -1.01        -0.02
10.24        -0.53
     16           5:50:39        -4.69         0.52        -1.83         0.15
18.48         2.98
     11           6: 9:38        -3.43         0.98         0.07        -0.19
-28.30       -15.18
     17           6:28:22         null         null        -1.14        -0.24
3.91        -6.64
     14           6:47:23        -6.17        -4.97        -0.40         0.10
3.63        -4.64
     19           7:15:32         null         null        -0.57         0.20
17.64        -0.87
     13           7:40:22        -3.43         0.76        -1.58        -0.24
-16.45       -12.80


 Line: 0003R003
 LCT line number:          2
 Line Summary Statistics:
 Max-Abs-Mistie BSA ASA:          4.90        10.39         2.35         0.61
29.03         6.58
 Mean-Mistie BSA ASA:            -1.23         0.00        -1.15         0.00
-3.78         0.00
 Mean-Abs-Mistie BSA ASA:         1.92         2.92         1.21         0.23
7.70         3.25
```

```
 Rms-Mistie BSA ASA:              2.53         3.95         1.39         0.28
10.51         3.76
 ------------------------------------------------------------------------------
-----------------------
                                    NEW-WTR   Mistie          F-FAG     Mistie
F-CMAG1   Mistie
   X-line          Time             BSA          ASA          BSA          ASA
BSA          ASA
 ------------------------------------------------------------------------------
-----------------------
     13          16:35:44        -4.69        -1.46        -1.73         0.28
-13.05         2.08
     19          16:59:58         null         null        -1.42         0.02
8.74         1.71
     14          17:27:14        -2.66        -2.42        -1.03         0.14
-5.00        -1.80
     17          17:45:50        -3.42         2.86        -1.29         0.29
0.64         1.56
     11          18: 3:38         0.24         3.70        -0.35         0.07
-29.03        -4.43
     16          18:22:43        -4.90        -0.63        -2.35         0.30
9.00         4.98
     12          18:52:44        -0.68         4.53        -1.86        -0.20
-2.09        -1.38
     10          19:15: 7        -0.39         1.67        -1.14        -0.06
1.50         2.88
      7          19:32:18         null         null        -0.22        -0.35
-4.48        -0.19
     15          19:32:24         null         null        -0.96         0.47
-2.20        -2.52
      9          19:57:48         1.23         2.91        -0.31        -0.27
7.56         3.72
      6          20:28:19        -0.58       -10.39        -1.56        -0.11
-12.01         5.78
      8          21: 3:45         0.61        -1.18        -2.27        -0.61
-10.70        -5.81
      5          21:38:42         1.67         0.40         0.37         0.03
-1.81        -6.58

 Line: 0002A004
 LCT line number:          3
 Line Summary Statistics:
 Max-Abs-Mistie BSA ASA:          5.28        10.87         2.13         0.21
30.20        10.73
 Mean-Mistie BSA ASA:            -1.30         0.00        -0.75         0.00
-2.66         0.00
 Mean-Abs-Mistie BSA ASA:         2.33         2.27         1.00         0.10
7.14         4.55
 Rms-Mistie BSA ASA:              2.87         3.58         1.13         0.12
10.68         5.31
 ------------------------------------------------------------------------------
-----------------------
                                    NEW-WTR   Mistie          F-FAG     Mistie
F-CMAG1   Mistie
   X-line          Time             BSA          ASA          BSA          ASA
BSA          ASA
 ------------------------------------------------------------------------------
-----------------------
      5           3:31:22         0.85        -0.40         0.68        -0.03
12.79         6.58
```

```
      8           4:17:10         4.17         2.41        -1.27         0.02
2.95         6.40
      6           4:53:45        -1.10       -10.87        -0.95         0.12
-15.59         0.77
      9           5:25:56         1.11         2.82         0.29        -0.05
-1.26        -6.54
      7           5:51:39        -1.79        -0.12         0.61         0.10
-6.40        -3.55
     10           6: 8:44         0.05         2.14        -0.68         0.02
-3.48        -3.53
     12           6:30:25        -5.28        -0.04        -1.48        -0.19
-3.62        -4.34
     16           7: 1:25        -2.92         1.38        -2.13         0.15
1.70        -3.76
     11           7:20:14        -0.52         2.97        -0.13        -0.09
-30.20        -7.04
     17           7:38:29        -5.11         1.19        -1.03         0.17
4.05         3.55
     14           7:56:54        -2.44        -2.17        -0.75         0.04
-0.19         1.58
     19           8:24:27         null         null        -1.27        -0.21
7.62        -0.85
     13           8:48:27        -2.57         0.70        -1.69        -0.05
-2.96        10.73


 Line: 0001A005
 LCT line number:          4
 Line Summary Statistics:
 Max-Abs-Mistie BSA ASA:          2.16         9.12         2.36         0.51
15.50         5.08
 Mean-Mistie BSA ASA:            -1.11         0.00        -1.31         0.00
-2.83         0.00
 Mean-Abs-Mistie BSA ASA:         1.12         3.11         1.40         0.27
4.67         2.69
 Rms-Mistie BSA ASA:              1.35         4.19         1.65         0.32
6.83         3.07
 ------------------------------------------------------------------------------
-----------------------
                                   NEW-WTR   Mistie          F-FAG     Mistie
F-CMAG1   Mistie
   X-line          Time            BSA          ASA          BSA          ASA
BSA          ASA
 ------------------------------------------------------------------------------
-----------------------
     16          12:28: 0        -0.69         4.23        -2.36         0.41
-0.86        -5.08
     12          12:58:39        -1.94         3.92        -2.22        -0.44
-4.33        -3.82
     10          13:19:30        -1.73         0.98        -1.12         0.08
0.11         1.29
      7          13:36:35        -2.16         0.12         0.26         0.25
-0.35         3.74
      9          14: 2:18        -0.71         1.62         0.04         0.19
6.33         2.29
      6          14:33:39         0.04        -9.12        -2.07        -0.51
-15.50         2.09
      8          15:10:42        -0.61        -1.75        -1.73         0.04
-5.19        -0.51

 Line: 0019A006
```

```
 LCT line number:          5
 Line Summary Statistics:
 Max-Abs-Mistie BSA ASA:          1.67         0.40         0.68         0.03
12.79         6.58
 Mean-Mistie BSA ASA:            -1.26         0.00        -0.53         0.00
-5.49         0.00
 Mean-Abs-Mistie BSA ASA:         1.26         0.40         0.53         0.03
7.30         6.58
 Rms-Mistie BSA ASA:              1.33         0.40         0.55         0.03
9.14         6.58
 ------------------------------------------------------------------------------
-----------------------
                                   NEW-WTR   Mistie          F-FAG     Mistie
F-CMAG1   Mistie
   X-line          Time            BSA          ASA          BSA          ASA
BSA          ASA
 ------------------------------------------------------------------------------
-----------------------
      3          20:39:21        -0.85         0.40        -0.68         0.03
-12.79        -6.58
      2          21:17:40        -1.67        -0.40        -0.37        -0.03
1.81         6.58

 Line: 0017B008
 LCT line number:          6
 Line Summary Statistics:
 Max-Abs-Mistie BSA ASA:         43.40        26.90         2.07         0.51
29.30        16.68
 Mean-Mistie BSA ASA:           -11.32         0.00         0.59         0.00
14.99         0.00
 Mean-Abs-Mistie BSA ASA:        11.94        13.14         1.19         0.21
18.44         8.44
 Rms-Mistie BSA ASA:             20.73        14.55         1.28         0.27
19.88        10.34
 ------------------------------------------------------------------------------
-----------------------
                                   NEW-WTR   Mistie          F-FAG     Mistie
F-CMAG1   Mistie
   X-line          Time            BSA          ASA          BSA          ASA
BSA          ASA
 ------------------------------------------------------------------------------
-----------------------
     24           7:20:19       -26.35       -12.51        -1.01        -0.17
27.89        11.23
     20           7:20:20       -43.40       -26.90        -0.79        -0.34
29.30        14.09
      1           8: 1:17         0.17         9.03         0.78         0.00
-10.36       -16.68
      2           8:39:55         0.58        10.39         1.56         0.11
12.01        -5.78
      3           9:20:18         1.10        10.87         0.95        -0.12
15.59        -0.77
      4          10: 1: 5        -0.04         9.12         2.07         0.51
15.50        -2.09


 Line: 0015A009
 LCT line number:          7
 Line Summary Statistics:
 Max-Abs-Mistie BSA ASA:          2.16         0.12         0.61         0.35
6.40         3.74
```

```
 Mean-Mistie BSA ASA:             1.98         0.00        -0.22         0.00
3.74         0.00
 Mean-Abs-Mistie BSA ASA:         1.98         0.12         0.36         0.23
3.74         2.49
 Rms-Mistie BSA ASA:              1.98         0.12         0.40         0.25
4.51         2.98
 ------------------------------------------------------------------------------
----------------------
                                  NEW-WTR   Mistie          F-FAG     Mistie
F-CMAG1   Mistie
   X-line          Time            BSA          ASA          BSA          ASA
BSA          ASA
 ------------------------------------------------------------------------------
----------------------
      4          13:50:57         2.16        -0.12        -0.26        -0.25
0.35        -3.74
      3          14:32:31         1.79         0.12        -0.61        -0.10
6.40         3.55
      2          15:16:47         null         null         0.22         0.35
4.48         0.19

 Line: 0018A011
 LCT line number:          8
 Line Summary Statistics:
 Max-Abs-Mistie BSA ASA:          4.17         2.41         2.27         0.61
10.70         6.40
 Mean-Mistie BSA ASA:            -1.39         0.00         1.43         0.00
1.60         0.00
 Mean-Abs-Mistie BSA ASA:         1.69         1.47         1.43         0.30
6.34         3.20
 Rms-Mistie BSA ASA:              2.24         1.62         1.58         0.41
6.94         4.33
 ------------------------------------------------------------------------------
----------------------
                                  NEW-WTR   Mistie          F-FAG     Mistie
F-CMAG1   Mistie
   X-line          Time            BSA          ASA          BSA          ASA
BSA          ASA
 ------------------------------------------------------------------------------
----------------------
      1           4:12:27        -1.37        -0.53         0.44        -0.55
-6.52         0.08
      2           4:49:54        -0.61         1.18         2.27         0.61
10.70         5.81
      3           5:28:32        -4.17        -2.41         1.27        -0.02
-2.95        -6.40
      4           6: 8:21         0.61         1.75         1.73        -0.04
5.19         0.51

 Line: 0016A012
 LCT line number:          9
 Line Summary Statistics:
 Max-Abs-Mistie BSA ASA:          3.00         5.94         2.28         0.27
26.50        11.18
 Mean-Mistie BSA ASA:             0.17         0.00        -0.82         0.00
-6.65         0.00
 Mean-Abs-Mistie BSA ASA:         1.38         3.76         0.92         0.16
7.53         5.73
 Rms-Mistie BSA ASA:              1.57         4.05         1.30         0.19
11.60         6.40
```

X-line	Time	NEW-WTR Mistie BSA	Mistie ASA	F-FAG Mistie BSA	Mistie ASA	F-CMAG1 Mistie BSA	Mistie ASA
4	10: 3:20	0.71	-1.62	-0.04	-0.19	-6.33	-2.29
3	10:43:44	-1.11	-2.82	-0.29	0.05	1.26	6.54
2	11:25:15	-1.23	-2.91	0.31	0.27	-7.56	-3.72
1	12: 4:39	-1.31	-3.94	-0.49	0.15	-26.50	-11.18
24	13: 9:13	3.00	5.35	-2.28	-0.02	1.38	6.36
20	13: 9:14	0.93	5.94	-2.13	-0.27	-2.15	4.28

Line: 0014A013
LCT line number: 10
Line Summary Statistics:

Max-Abs-Mistie BSA ASA:	4.27	7.65	1.54	0.11	17.62	9.57
Mean-Mistie BSA ASA:	0.54	0.00	-0.01	0.00	-2.26	0.00
Mean-Abs-Mistie BSA ASA:	1.98	4.02	0.99	0.06	3.91	4.03
Rms-Mistie BSA ASA:	2.46	4.82	1.04	0.06	6.92	5.03

X-line	Time	NEW-WTR Mistie BSA	Mistie ASA	F-FAG Mistie BSA	Mistie ASA	F-CMAG1 Mistie BSA	Mistie ASA
21	17:33:53	null	null	-1.54	-0.11	2.31	9.57
24	18: 8: 9	2.43	4.41	-1.19	0.02	-2.16	-2.41
20	18: 8:14	3.01	7.65	-0.76	0.06	-0.20	1.01
1	19:54:38	-4.27	-7.28	0.48	0.07	-17.62	-7.52
2	20:36: 8	0.39	-1.67	1.14	0.06	-1.50	-2.88
3	21:20:32	-0.05	-2.14	0.68	-0.02	3.48	3.53
4	22: 0:21	1.73	-0.98	1.12	-0.08	-0.11	-1.29

Line: 0011A014
LCT line number: 11
Line Summary Statistics:

Max-Abs-Mistie BSA ASA:	4.29	7.52	2.18	0.19	30.20	17.33

```
 Mean-Mistie BSA ASA:              1.52         0.00        -0.68         0.00
19.78         0.00
 Mean-Abs-Mistie BSA ASA:         1.78         3.06         0.87         0.11
20.32        10.66
 Rms-Mistie BSA ASA:              2.48         4.00         1.22         0.12
23.32        11.72
 ------------------------------------------------------------------------------
----------------------
                                   NEW-WTR   Mistie          F-FAG     Mistie
F-CMAG1   Mistie
   X-line          Time            BSA          ASA          BSA          ASA
BSA          ASA
 ------------------------------------------------------------------------------
----------------------
      3           1:55: 9         0.52        -2.97         0.13         0.09
30.20         7.04
      2           2:40:56        -0.24        -3.70         0.35        -0.07
29.03         4.43
      1           3:22:30         3.43        -0.98        -0.07         0.19
28.30        15.18
     20           5:59:37         4.29         7.52        -1.61        -0.13
12.71        -9.31
     21           6:31:54        -0.41         0.12        -2.18        -0.08
-1.37       -17.33

 Line: 0013A015
 LCT line number:         12
 Line Summary Statistics:
 Max-Abs-Mistie BSA ASA:          5.28         5.80         2.22         0.44
10.24         9.52
 Mean-Mistie BSA ASA:             2.87         0.00         0.57         0.00
-2.93         0.00
 Mean-Abs-Mistie BSA ASA:         2.87         2.86         1.31         0.25
5.79         4.64
 Rms-Mistie BSA ASA:              3.35         3.58         1.41         0.29
6.73         5.47
 ------------------------------------------------------------------------------
----------------------
                                   NEW-WTR   Mistie          F-FAG     Mistie
F-CMAG1   Mistie
   X-line          Time            BSA          ASA          BSA          ASA
BSA          ASA
 ------------------------------------------------------------------------------
----------------------
     21           9:50:47         1.11        -0.12        -0.95        -0.09
-1.76         6.17
     24          10:23:52         3.91         2.74        -1.01        -0.38
-9.95        -9.52
     20          10:23:53         4.31         5.80        -0.64        -0.39
-8.58        -6.71
      1          12:23:37         null         null         1.01         0.02
-10.24         0.53
      2          13: 6: 1         0.68        -4.53         1.86         0.20
2.09         1.38
      3          13:49:15         5.28         0.04         1.48         0.19
3.62         4.34
      4          14:29: 8         1.94        -3.92         2.22         0.44
4.33         3.82


 Line: 0007A018
```

```
 LCT line number:         13
 Line Summary Statistics:
 Max-Abs-Mistie BSA ASA:          4.69         1.46         1.73         0.28
16.45        12.80
 Mean-Mistie BSA ASA:             3.56         0.00         1.67         0.00
10.82         0.00
 Mean-Abs-Mistie BSA ASA:         3.56         0.97         1.67         0.19
10.82         8.54
 Rms-Mistie BSA ASA:              3.67         1.03         1.67         0.22
12.24         9.72
 ------------------------------------------------------------------------------
-----------------------
                                   NEW-WTR   Mistie          F-FAG     Mistie
F-CMAG1   Mistie
   X-line          Time            BSA          ASA          BSA          ASA
BSA          ASA
 ------------------------------------------------------------------------------
-----------------------
      1           7:54: 7         3.43        -0.76         1.58         0.24
16.45        12.80
      2           8:37:50         4.69         1.46         1.73        -0.28
13.05        -2.08
      3           9:26: 4         2.57        -0.70         1.69         0.05
2.96       -10.73

 Line: 0009A019
 LCT line number:         14
 Line Summary Statistics:
 Max-Abs-Mistie BSA ASA:         16.01         9.56         1.03         0.28
5.00         4.87
 Mean-Mistie BSA ASA:            -1.18         0.00         0.43         0.00
-0.67         0.00
 Mean-Abs-Mistie BSA ASA:         6.82         4.78         0.66         0.14
3.27         3.22
 Rms-Mistie BSA ASA:              8.77         5.63         0.71         0.17
3.75         3.57
 ------------------------------------------------------------------------------
-----------------------
                                   NEW-WTR   Mistie          F-FAG     Mistie
F-CMAG1   Mistie
   X-line          Time            BSA          ASA          BSA          ASA
BSA          ASA
 ------------------------------------------------------------------------------
-----------------------
      3          14:59:38         2.44         2.17         0.75        -0.04
0.19        -1.58
      2          15:46: 5         2.66         2.42         1.03        -0.14
5.00         1.80
      1          16:27:46         6.17         4.97         0.40        -0.10
-3.63         4.64
     20          19:33: 5       -16.01        -9.56        -0.45         0.28
-4.24        -4.87

 Line: 0015D021
 LCT line number:         15
 Line Summary Statistics:
 Max-Abs-Mistie BSA ASA:          null         null         1.61         0.54
14.19         7.01
 Mean-Mistie BSA ASA:             null         null        -0.05         0.00
-5.09         0.00
```

```
 Mean-Abs-Mistie BSA ASA:         null         null         0.77         0.39
5.97         3.81
 Rms-Mistie BSA ASA:              null         null         0.93         0.43
7.48         4.37
 ------------------------------------------------------------------------------
-----------------------
                                   NEW-WTR   Mistie          F-FAG     Mistie
F-CMAG1   Mistie
   X-line          Time            BSA          ASA          BSA          ASA
BSA          ASA
 ------------------------------------------------------------------------------
-----------------------
      2          14:42:33         null         null         0.96        -0.47
2.20         2.52
      1          15:22:34         null         null         0.83         0.08
-14.19        -2.38
     20          16:50:24         null         null        -0.11         0.36
-4.39        -1.48
     24          16:50:25         null         null        -0.32         0.54
-7.13        -5.67
     21          17:23:13         null         null        -1.61        -0.52
-1.94         7.01


 Line: 0012B022
 LCT line number:         16
 Line Summary Statistics:
 Max-Abs-Mistie BSA ASA:          4.90         5.50         2.36         0.79
18.48         5.41
 Mean-Mistie BSA ASA:             3.25         0.00         1.76         0.00
-8.08         0.00
 Mean-Abs-Mistie BSA ASA:         3.25         2.45         1.76         0.33
8.36         4.46
 Rms-Mistie BSA ASA:              3.59         3.18         1.86         0.40
11.23         4.54
 ------------------------------------------------------------------------------
-----------------------
                                   NEW-WTR   Mistie          F-FAG     Mistie
F-CMAG1   Mistie
   X-line          Time            BSA          ASA          BSA          ASA
BSA          ASA
 ------------------------------------------------------------------------------
-----------------------
     21          21:28:41         null         null         0.93         0.79
-18.07        -5.41
     20          22: 0:54         3.07         5.50         0.96         0.21
-2.07         4.54
      1          24:23:34         4.69        -0.52         1.83        -0.15
-18.48        -2.98
      2          25: 4:31         4.90         0.63         2.35        -0.30
-9.00        -4.98
      3          25:48:42         2.92        -1.38         2.13        -0.15
-1.70         3.76
      4          26:29:20         0.69        -4.23         2.36        -0.41
0.86         5.08

 Line: 0010A023
 LCT line number:         17
 Line Summary Statistics:
 Max-Abs-Mistie BSA ASA:          5.11         4.05         1.29         0.29
4.05         6.64
```

```
 Mean-Mistie BSA ASA:             4.06         0.00         0.84         0.00
-2.94         0.00
 Mean-Abs-Mistie BSA ASA:         4.06         2.70         0.89         0.23
2.94         3.32
 Rms-Mistie BSA ASA:              4.13         2.95         1.00         0.23
3.25         3.92
 ------------------------------------------------------------------------------
----------------------
                                  NEW-WTR   Mistie          F-FAG     Mistie
F-CMAG1   Mistie
   X-line          Time           BSA          ASA          BSA          ASA
BSA          ASA
 ------------------------------------------------------------------------------
----------------------
      3           6:16:13         5.11        -1.19         1.03        -0.17
-4.05        -3.55
      2            7: 3:47        3.42        -2.86         1.29        -0.29
-0.64        -1.56
      1           7:46:32         null         null         1.14         0.24
-3.91         6.64
     20          10:37:53         3.64         4.05        -0.11         0.22
-3.18        -1.53

 Line: 0008R024
 LCT line number:         18
 Line Summary Statistics:
 Max-Abs-Mistie BSA ASA:          null         null         null         null
null         null
 Mean-Mistie BSA ASA:             null         null         null         null
null         null
 Mean-Abs-Mistie BSA ASA:         null         null         null         null
null         null
 Rms-Mistie BSA ASA:              null         null         null         null
null         null
 ------------------------------------------------------------------------------
----------------------
                                  NEW-WTR   Mistie          F-FAG     Mistie
F-CMAG1   Mistie
   X-line          Time           BSA          ASA          BSA          ASA
BSA          ASA
 ------------------------------------------------------------------------------
----------------------


 Line: 0008T026
 LCT line number:         19
 Line Summary Statistics:
 Max-Abs-Mistie BSA ASA:          null         null         1.42         0.21
17.64         1.71
 Mean-Mistie BSA ASA:             null         null         1.09         0.00
-11.33         0.00
 Mean-Abs-Mistie BSA ASA:         null         null         1.09         0.14
11.33         1.14
 Rms-Mistie BSA ASA:              null         null         1.15         0.17
12.19         1.21
 ------------------------------------------------------------------------------
----------------------
                                  NEW-WTR   Mistie          F-FAG     Mistie
F-CMAG1   Mistie
   X-line          Time           BSA          ASA          BSA          ASA
BSA          ASA
```

```
 ------------------------------------------------------------------------------
-----------------------
      3          23:45:24         null         null         1.27         0.21
-7.62         0.85
      2          24:33:57         null         null         1.42        -0.02
-8.74        -1.71
      1          25:17:51         null         null         0.57        -0.20
-17.64         0.87

 Line: 0005A027
 LCT line number:         20
 Line Summary Statistics:
 Max-Abs-Mistie BSA ASA:         43.40        26.90         2.13         0.39
29.30        14.09
 Mean-Mistie BSA ASA:             6.35         0.00         0.61         0.00
-2.03         0.00
 Mean-Abs-Mistie BSA ASA:        10.63         8.10         0.80         0.23
6.99         4.78
 Rms-Mistie BSA ASA:             16.66        10.78         1.01         0.26
10.77         6.31
 ------------------------------------------------------------------------------
-----------------------
                                  NEW-WTR   Mistie          F-FAG     Mistie
F-CMAG1   Mistie
   X-line          Time            BSA          ASA          BSA          ASA
BSA          ASA
 ------------------------------------------------------------------------------
-----------------------
     23           6:55:14        17.02         0.00         0.49         0.00
-3.13         0.00
     14           6:55:14        16.01         9.56         0.45        -0.28
4.24         4.87
     17           7:17: 0        -3.64        -4.05         0.11        -0.22
3.18         1.53
     11           7:38:51        -4.29        -7.52         1.61         0.13
-12.71         9.31
     16           8: 1:24        -3.07        -5.50        -0.96        -0.21
2.07        -4.54
     12           8:32:53        -4.31        -5.80         0.64         0.39
8.58         6.71
     10           9: 4:30        -3.01        -7.65         0.76        -0.06
0.20        -1.01
     15           9:25: 1         null         null         0.11        -0.36
4.39         1.48
      9           9:56:59        -0.93        -5.94         2.13         0.27
2.15        -4.28
      6          10:33:48        43.40        26.90         0.79         0.34
-29.30       -14.09

 Line: 0006A028
 LCT line number:         21
 Line Summary Statistics:
 Max-Abs-Mistie BSA ASA:          1.11         0.12         2.18         0.79
18.07        17.33
 Mean-Mistie BSA ASA:            -0.35         0.00         1.07         0.00
4.16         0.00
 Mean-Abs-Mistie BSA ASA:         0.76         0.12         1.44         0.32
5.09         9.10
 Rms-Mistie BSA ASA:              0.84         0.12         1.52         0.43
8.25        10.09
```

```
 ------------------------------------------------------------------------------
----------------------
                                    NEW-WTR   Mistie          F-FAG     Mistie
F-CMAG1   Mistie
   X-line          Time             BSA          ASA          BSA          ASA
BSA          ASA
 ------------------------------------------------------------------------------
----------------------
     15          15:49:59         null         null         1.61         0.52
1.94        -7.01
     10          16:11: 6         null         null         1.54         0.11
-2.31        -9.57
     12          16:43:36        -1.11         0.12         0.95         0.09
1.76        -6.17
     16          17:15:44         null         null        -0.93        -0.79
18.07         5.41
     11          17:38:14         0.41        -0.12         2.18         0.08
1.37        17.33


 Line: 0012R029
 LCT line number:         22
 Line Summary Statistics:
 Max-Abs-Mistie BSA ASA:          null         null         null         null
null         null
 Mean-Mistie BSA ASA:             null         null         null         null
null         null
 Mean-Abs-Mistie BSA ASA:         null         null         null         null
null         null
 Rms-Mistie BSA ASA:              null         null         null         null
null         null
 ------------------------------------------------------------------------------
----------------------
                                    NEW-WTR   Mistie          F-FAG     Mistie
F-CMAG1   Mistie
   X-line          Time             BSA          ASA          BSA          ASA
BSA          ASA
 ------------------------------------------------------------------------------
----------------------

 Line: 009R030
 LCT line number:         23
 Line Summary Statistics:
 Max-Abs-Mistie BSA ASA:         17.02         0.00         0.49         0.00
3.13         0.00
 Mean-Mistie BSA ASA:           -17.02         0.00        -0.49         0.00
3.13         0.00
 Mean-Abs-Mistie BSA ASA:        17.02         0.00         0.49         0.00
3.13         0.00
 Rms-Mistie BSA ASA:             17.02         0.00         0.49         0.00
3.13         0.00
 ------------------------------------------------------------------------------
----------------------
                                    NEW-WTR   Mistie          F-FAG     Mistie
F-CMAG1   Mistie
   X-line          Time             BSA          ASA          BSA          ASA
BSA          ASA
 ------------------------------------------------------------------------------
----------------------
     20           4: 7:53        -17.02         0.00        -0.49         0.00
3.13         0.00
```

Line: 0005R031
LCT line number: 24
Line Summary Statistics:

Max-Abs-Mistie BSA ASA:	26.35	12.51	2.28	0.54	27.89	11.23	
Mean-Mistie BSA ASA:	4.25	0.00	1.16	0.00	-2.01	0.00	
Mean-Abs-Mistie BSA ASA:	8.93	6.25	1.16	0.23	9.70	7.04	
Rms-Mistie BSA ASA:	13.46	7.28	1.32	0.31	13.67	7.68	

X-line	Time	NEW-WTR Mistie BSA	ASA	F-FAG Mistie BSA	ASA	F-CMAG1 Mistie BSA	ASA
12	8:49:45	-3.91	-2.74	1.01	0.38	9.95	9.52
10	9:21:49	-2.43	-4.41	1.19	-0.02	2.16	2.41
15	9:42:27	null	null	0.32	-0.54	7.13	5.67
9	10:13:39	-3.00	-5.35	2.28	0.02	-1.38	-6.36
6	10:49:20	26.35	12.51	1.01	0.17	-27.89	-11.23

Network Summary Statistics:

Max-Abs-Mistie BSA ASA:	43.40	26.90	2.36	0.79	30.20	17.33	
Mean-Abs-Mistie BSA ASA:	4.05	3.91	1.07	0.20	8.35	5.05	
Rms-Mistie BSA ASA:	8.14	5.96	1.25	0.27	11.68	6.48	
Avg-Rms-Mistie BSA ASA:	4.78	3.36	1.06	0.22	9.14	5.22	

Appendix 5: Systematic Adjustment Report

Systematic Adjustment Report

Database name : ../db10.new.padl/

Number of lines :   24

Channel name : NEW-WTR

Date : Feb 12 11:19:29 2002

Number of intersections in database :   66

Minimum number of intersections per line :   1

Intersection gradient penalty factor : 1.000

Line mistie standard deviation penalty factor : 1.000

Line mistie mean penalty factor : 1.000

Line mistie rms penalty factor : 1.000

Polynomial order for adjustment : 0

Following lines deleted for less than minimum intersections:
Line: 15 :   0 intersections
Line: 18 :   0 intersections
Line: 19 :   0 intersections
Line: 22 :   0 intersections

==========

Processing sub-network: 1

Number of lines adjusted: 20

Lines in sub-network:
      1   2   3   4   5   6   7   8   9
     10   11   12   13   14   16   17   20   21
     23   24

Number of intersections used: 53

Damping factor: 0.

network rms adjustment: 5.486

==========

Before-adjustment survey mistie statistics:
Absolute mean: 4.049
Standard deviation: 8.049
Rms: 8.141
Range: 60.42
Absolute maximum: 43.40

After-adjustment survey mistie statistics:
Absolute mean: 3.911
Standard deviation: 6.018
Rms: 5.961
Range: 34.55

Absolute maximum: 26.90

==========

Line detail report:

		Before adj					After adj				
Line	Int	Mean	Std dev	RMS	Range	Abs max	RMS adj	Mean	Std dev	RMS	Range	Abs max
1	8	-1.37	3.60	3.63	10.44	6.17	1.85	0.00	5.02	4.70	16.30	9.03
2	11	-1.23	2.32	2.53	6.57	4.90	0.90	0.00	4.14	3.95	14.92	10.39
3	12	-1.30	2.68	2.87	9.45	5.28	0.93	0.00	3.74	3.58	13.84	10.87
4	7	-1.11	0.83	1.35	2.20	2.16	1.54	0.00	4.53	4.19	13.34	9.12
5	2	-1.26	0.58	1.33	0.83	1.67	2.18	0.00	0.56	0.40	0.80	0.40
6	6	-11.32	19.03	20.73	44.50	43.40	10.70	0.00	15.94	14.55	37.77	26.90
7	2	1.98	0.26	1.98	0.37	2.16	0.74	0.00	0.17	0.12	0.24	0.12
8	4	-1.39	2.03	2.24	4.78	4.17	2.69	0.00	1.87	1.62	4.16	2.41
9	6	0.17	1.71	1.57	4.31	3.00	0.78	0.00	4.44	4.05	9.88	5.94
10	6	0.54	2.63	2.46	7.28	4.27	1.16	0.00	5.28	4.82	14.92	7.65
11	5	1.52	2.19	2.48	4.70	4.29	2.56	0.00	4.47	4.00	11.23	7.52
12	6	2.87	1.88	3.35	4.60	5.28	4.31	0.00	3.92	3.58	10.33	5.80
13	3	3.56	1.07	3.67	2.13	4.69	2.34	0.00	1.26	1.03	2.21	1.46
14	4	-1.18	10.03	8.77	22.18	16.01	0.65	0.00	6.50	5.63	14.53	9.56
16	5	3.25	1.70	3.59	4.21	4.90	3.37	0.00	3.56	3.18	9.73	5.50
17	3	4.06	0.92	4.13	1.70	5.11	5.38	0.00	3.61	2.95	6.92	4.05
20	9	6.35	16.34	16.66	47.71	43.40	5.80	0.00	11.43	10.78	34.55	26.90
21	2	-0.35	1.07	0.84	1.52	1.11	3.09	0.00	0.17	0.12	0.24	0.12
23	1	-17.02	0.00	0.00	0.00	17.02	11.22	0.00	0.00	0.00	0.00	0.00
24	4	4.25	14.75	13.46	30.26	26.35	3.14	0.00	8.41	7.28	17.86	12.51

Systematic Adjustment Report

Database name : ../db10.new.padl/

Number of lines :   24

Channel name : D-FAG

Date : Jan 31 12:05:28 2002

Number of intersections in database :   66

Minimum number of intersections per line :   1

Intersection gradient penalty factor : 1.000

Line mistie standard deviation penalty factor : 1.000

Line mistie mean penalty factor : 1.000

Line mistie rms penalty factor : 1.000

Polynomial order for adjustment : 0

Following lines deleted for less than minimum intersections:
Line: 18 :   0 intersections
Line: 22 :   0 intersections
Line: 23 :   0 intersections
Line: 24 :   0 intersections

==========

Processing sub-network: 1

Number of lines adjusted: 20

Lines in sub-network:
      1   2   3   4   5   6   7   8   9
     10   11   12   13   14   15   16   17   19
     20   21

Number of intersections used: 60

Damping factor: 0.

network rms adjustment: 1.224

==========

Before-adjustment survey mistie statistics:
Absolute mean: 1.067
Standard deviation: 0.8738
Rms: 1.257
Range: 3.317
Absolute maximum: 2.357

After-adjustment survey mistie statistics:
Absolute mean: 0.2028
Standard deviation: 0.2623
Rms: 0.2601

Range: 1.376
Absolute maximum: 0.7770

==========

Line detail report:

		Before adj					After adj				
Line	Int	Mean	Std dev	RMS	Range	Abs max	RMS adj	Mean	Std dev	RMS	Range	Abs max
1	12	-0.71	0.65	0.94	2.32	1.83	0.40	0.00	0.23	0.22	0.80	0.56
2	14	-1.15	0.80	1.39	2.72	2.35	1.08	0.00	0.27	0.26	0.92	0.60
3	13	-0.75	0.88	1.13	2.81	2.13	0.69	0.00	0.12	0.11	0.38	0.22
4	7	-1.31	1.08	1.65	2.62	2.36	1.17	0.00	0.33	0.30	0.88	0.49
5	2	-0.53	0.22	0.55	0.31	0.68	1.41	0.00	0.05	0.04	0.08	0.04
6	5	0.92	1.08	1.33	2.87	2.07	0.41	0.00	0.32	0.29	0.87	0.49
7	3	-0.22	0.42	0.40	0.83	0.61	1.20	0.00	0.30	0.25	0.58	0.34
8	4	1.43	0.78	1.58	1.83	2.27	0.59	0.00	0.47	0.41	1.16	0.60
9	5	-0.53	0.95	1.00	2.44	2.13	1.03	0.00	0.23	0.20	0.54	0.28
10	6	0.19	1.10	1.02	2.69	1.54	0.01	0.00	0.08	0.07	0.19	0.12
11	5	-0.68	1.14	1.22	2.53	2.18	0.66	0.00	0.14	0.12	0.32	0.19
12	6	0.83	1.32	1.47	3.17	2.22	0.65	0.00	0.30	0.27	0.86	0.46
13	3	1.67	0.08	1.67	0.15	1.73	0.95	0.00	0.26	0.22	0.52	0.29
14	4	0.43	0.64	0.71	1.48	1.03	0.10	0.00	0.19	0.16	0.42	0.28
15	4	0.02	1.19	1.03	2.57	1.61	0.21	0.00	0.43	0.37	0.90	0.50
16	6	1.76	0.66	1.86	1.43	2.36	1.58	0.00	0.43	0.39	1.17	0.78
17	4	0.84	0.64	1.00	1.40	1.29	0.50	0.00	0.27	0.23	0.53	0.29
19	3	1.09	0.46	1.15	0.85	1.42	0.37	0.00	0.21	0.17	0.42	0.22
20	9	0.63	0.89	1.05	3.09	2.13	0.82	0.00	0.33	0.31	0.96	0.50
21	5	1.07	1.20	1.52	3.11	2.18	1.43	0.00	0.45	0.40	1.17	0.78

Systematic Adjustment Report

Database name : ../db10.new.padl/

Number of lines :   24

Channel name : F-CMAG1

Date : Feb 12 11:21:52 2002

Number of intersections in database :   66

Minimum number of intersections per line :   1

Intersection gradient penalty factor : 1.000

Line mistie standard deviation penalty factor : 1.000

Line mistie mean penalty factor : 1.000

Line mistie rms penalty factor : 1.000

Polynomial order for adjustment : 0

Following lines deleted for less than minimum intersections:
Line: 18 :   0 intersections
Line: 22 :   0 intersections

==========

Processing sub-network: 1

Number of lines adjusted: 22

Lines in sub-network:

1	2	3	4	5	6	7	8	9
10	11	12	13	14	15	16	17	19
20	21	23	24					

Number of intersections used: 66

Damping factor: 0.

network rms adjustment: 9.860

==========

Before-adjustment survey mistie statistics:
Absolute mean: 8.349
Standard deviation: 11.77
Rms: 11.68
Range: 59.50
Absolute maximum: 30.20

After-adjustment survey mistie statistics:
Absolute mean: 5.052
Standard deviation: 6.525
Rms: 6.476
Range: 34.01
Absolute maximum: 17.33

==========

Line detail report:

		Before adj					After adj				
Line	Int	Mean	Std dev	RMS	Range	Abs max	RMS adj	Mean	Std dev	RMS	Range	Abs max
1	12	7.03	15.46	16.38	54.80	28.30	7.66	0.00	9.22	8.83	31.85	16.68
2	14	-3.78	10.18	10.51	38.03	29.03	3.82	0.00	3.91	3.76	12.37	6.58
3	13	-2.66	10.76	10.68	43.00	30.20	2.39	0.00	5.52	5.31	17.76	10.73
4	7	-2.83	6.72	6.83	21.84	15.50	3.62	0.00	3.31	3.07	8.82	5.08
5	2	-5.49	10.32	9.14	14.60	12.79	8.60	0.00	9.31	6.58	13.17	6.58
6	6	14.99	14.31	19.88	39.66	29.30	13.97	0.00	11.32	10.34	30.76	16.68
7	3	3.74	3.09	4.51	6.05	6.40	0.47	0.00	3.65	2.98	7.28	3.74
8	4	1.60	7.79	6.94	17.21	10.70	1.06	0.00	5.00	4.33	12.21	6.40
9	6	-6.65	10.42	11.60	27.88	26.50	7.67	0.00	7.01	6.40	17.72	11.18
10	7	-2.26	7.06	6.92	21.09	17.62	2.44	0.00	5.44	5.03	17.09	9.57
11	5	19.78	13.82	23.32	31.57	30.20	20.78	0.00	13.10	11.72	32.51	17.33
12	7	-2.93	6.54	6.73	14.57	10.24	3.11	0.00	5.91	5.47	15.69	9.52
13	3	10.82	7.01	12.24	13.49	16.45	11.30	0.00	11.90	9.72	23.53	12.80
14	4	-0.67	4.26	3.75	9.25	5.00	0.62	0.00	4.12	3.57	9.51	4.87
15	5	-5.09	6.13	7.48	16.38	14.19	4.15	0.00	4.89	4.37	12.68	7.01
16	6	-8.08	8.55	11.23	19.34	18.48	7.84	0.00	4.97	4.54	10.49	5.41
17	4	-2.94	1.59	3.25	3.42	4.05	2.89	0.00	4.53	3.92	10.19	6.64
19	3	-11.33	5.49	12.19	10.02	17.64	10.85	0.00	1.48	1.21	2.58	1.71
20	10	-2.03	11.15	10.77	37.88	29.30	1.24	0.00	6.65	6.31	23.40	14.09
21	5	4.16	7.97	8.25	20.38	18.07	4.81	0.00	11.28	10.09	26.90	17.33

		Before adj					After adj				
Line	Int	Mean	Std dev	RMS	Range	Abs max	RMS adj	Mean	Std dev	RMS	Range	Abs max
23	1	3.13	0.00	0.00	0.00	3.13	1.89	0.00	0.00	0.00	0.00	0.00
24	5	-2.01	15.12	13.67	37.83	27.89	2.69	0.00	8.59	7.68	20.75	11.23

Appendix 6: Tape Data Format

Pan Canadain Energy

Midas 2D, East Gippsland Basin, offshore Australia

Marine gravity, magnetic and bathymetry survey

Date of creation: March 2002

Description of data files:

This data archive contains three ASCII files as follows.

File 1 - asc.grav+mag (ASCII database)
File 2 - asc.grids (ASCII grid data)
File 3 - data.fmt (this file)

```
=================================================================
**NOTE: This tape was created on a high density tape drive.
        To read this tape use the UNIX command 'tar'.
        i.e. -  "tar xvf /dev/rst1"  (On a SunOS 4 machine).
            or          "tar xvf /dev/rmt/0h" (On a solaris machine).
        where 'rst or 0' is the device name of your tape drive.
=================================================================
```

Projection parameters for X and Y coordinates are:

Projection	=	UTM
Spheroid	=	ADG84
Central Meridian	=	147 E
Base Latitude	=	0.0
False Northing	=	500000.0 metres
False Easting	=	10000000.0 metres
Scale Factor	=	0.9996 (along the central meridian)

File 1 Line data (asc.grav):

All data values for each observation are contained within a single record.
The record field structure for the line data is as follows:

	COLUMNS	NO DATA VALUE
Field 1 = LCT Line number	1-6	
Field 2 = Line Name	7-28	
Field 3 = Year	29-32	
Field 4 = Julian date	34-36	
Field 5 = Hour	38-39	
Field 6 = Minute	40-41	
Field 7 = Second	42-43	
Field 8 = Shot	44-54	999999.0
Field 9 = Latitude (decimal degrees)	57-67	999.0
Field 10 = Longitude (decimal degrees)	70-80	999.0
Field 11 = X-coordinate (metres)	83-91	999999.0
Field 12 = Y-coordinate (metres)	94-102	999999.0
Field 13 = VMON	103-112	999999.0
Filed 14 = Water depth	114-122	999999.0
Field 15 = Corrected Gravity	123-132	999999.0
Field 16 = Eotvos Correction	133-142	999999.0
Field 17 = Filtered Free-Air Gravity	143-152	999999.0
Field 18 = Final gridded Free-Air Gravity	153-162	999999.0
Field 19 = 3D Bouguer gravity (2.0g/cc)	163-172	999999.0
Field 20 = Final gridded 3D Bouguer gravity (2.0g/cc)	173-182	999999.0
Field 21 = Raw magnetic field data	183-192	999999.0
Field 22 = Magnetic anomaly	193-202	999999.0
Field 23 = Filtered magnetic anomaly	203-212	999999.0
Field 24 = Magnetic base station data	213-222	999999.0
Field 25 = Diurnal correction	223-232	999999.0
Field 26 = Magnetic anomaly (diurnally corrected)	233-242	999999.0
Field 27 = Filtered magnetic anomaly (diurnally corrected)	243-252	999999.0
Field 28 = Final gridded magnetic anomaly (diurnally corrected)	253-262	999999.0

The output format used to write these fields to
ASCII records was:

```
(i6,1x,a20,1x,i4,1x,i3,1x,3i2,1x,f10.1,1x,f12.8,1x,f12.8,2f11.1,1x,f9.2,1x,f9.2,1x,f9.2,1x,f9.2,1x,f9.2,1x,f9.2,1x,f9.2,1x,f9.2,1x,f9.2,1x,f9.2,1x,f9.2,1x,f9.2,
1x,f9.2,1x,f9.2,1x,f9.2,1x,f9.2)
```

The first five records are:

```
          1 0004A001             2001 356  25310   999999.0 -38.71146395 149.24466532   695168.2  5712835.3     15.48  -3346.39     -5.73    -28.61    -89.05
-88.71     35.64     35.97  60296.62    169.33    166.94  58327.34 -58327.32 -58157.99 -58160.37    183.55
     1 0004A001             2001 356  25320     1002.0 -38.71144660 149.24438184   695143.5  5712837.8     15.54  -3345.92     -5.75    -28.59    -89.05    -
88.72     35.64     35.97  60297.55    166.66    166.57  58327.37 -58327.34 -58160.68 -58160.80    183.10
     1 0004A001             2001 356  25330     1003.0 -38.71142680 149.24409643   695118.8  5712840.6     15.60  -3345.45     -5.84    -28.49    -89.05    -
88.72     35.65     35.97  60297.48    166.28    166.19  58327.40 -58327.38 -58161.09 -58161.21    182.65
     1 0004A001             2001 356  25340     1004.0 -38.71140429 149.24380887   695093.8  5712843.8     15.63  -3344.97     -6.02    -28.31    -89.05    -
88.73     35.65     35.97  60296.39    165.55    165.82  58327.43 -58327.41 -58161.86 -58161.64    182.19
     1 0004A001             2001 356  25350     1005.0 -38.71138111 149.24352241   695069.0  5712846.9     15.62  -3344.50     -6.27    -28.06    -89.05    -
88.74     35.66     35.97  60294.93    163.49    165.44  58327.47 -58327.46 -58163.97 -58162.06    181.75
```

The last five records are:

```
    24 0005R031             2002   5 111710     2568.7 -38.73635844 149.20554589   691699.9  5710155.1     14.97  -3272.78    -54.65     24.13 *********    -
88.26 *********     36.54  60263.40    123.46    123.33  58353.68 -58353.64 -58230.18 -58230.30    127.20
    24 0005R031             2002   5 111720     2569.6 -38.73623783 149.20578258   691720.8  5710168.0     15.08  -3273.35    -54.72     24.20 *********    -
88.27 *********     36.54  60264.42    123.25    123.64  58353.67 -58353.64 -58230.40 -58229.99    127.50
    24 0005R031             2002   5 111730     2570.6 -38.73611609 149.20601911   691741.7  5710181.0     15.15  -3273.93    -54.76     24.23 *********    -
88.28 *********     36.54  60266.39    122.89    123.95  58353.65 -58353.65 -58230.77 -58229.68    127.80
    24 0005R031             2002   5 111740     2571.6 -38.73599229 149.20625445   691762.4  5710194.2     15.22  -3274.51    -54.76     24.22 *********    -
88.29 *********     36.53  60265.29    124.98    124.28  58353.63 -58353.67 -58228.68 -58229.37    128.11
    24 0005R031             2002   5 111750     2572.6 -38.73586720 149.20648779   691783.1  5710207.6     15.26  -3275.09    -54.74     24.20 *********    -
88.30 *********     36.53  60263.49    125.78    124.61  58353.62 -58353.66 -58227.88 -58229.04    128.42
```

File2: Grid Data (asc.grids):

The second file contains the gridded data
used to generate the water depth, free-air gravity,
3-D Bouguer and magnetic anomaly grids.
The grid spacing is equal to 1000.0 meters.
Each record in the file describes a single
row-column grid intersection value for gridded water depth,
gridded Free-Air gravity, gridded 3-D Bouguer gravity and gridded
magnetic anomaly.
Null data values are represented by values equal to 1.0e20.
The data fields are placed in each record as follows:

Field 1 = X co-ordinate (metres)
Field 2 = Y co-ordinate (metres)

Field 3 = Latitude (decimal degrees)
Field 4 = Longitude (decimal degrees)
Field 5 = Bathymetry (milligals)
Field 6 = Free Air gravity (milligals)
Field 7 = 3D Bouguer gravity (2.00g/cc correction density) (milligals)
Field 8 = Magnetic anomaly (mGal)

The output format used to write these fields to ASCII
records was:

(4e18.10,4e16.8)

The first five records are:

```
  0.6490000000E+06  0.5683000000E+07 -0.3898919320E+02  0.1487203957E+03  0.10000000E+21  0.10000000E+21  0.10000000E+21  0.10000000E+21
  0.6500000000E+06  0.5683000000E+07 -0.3898902242E+02  0.1487319371E+03  0.10000000E+21  0.10000000E+21  0.10000000E+21  0.10000000E+21
  0.6510000000E+06  0.5683000000E+07 -0.3898885049E+02  0.1487434784E+03  0.10000000E+21  0.10000000E+21  0.10000000E+21  0.10000000E+21
  0.6520000000E+06  0.5683000000E+07 -0.3898867742E+02  0.1487550196E+03  0.10000000E+21  0.10000000E+21  0.10000000E+21  0.10000000E+21
  0.6530000000E+06  0.5683000000E+07 -0.3898850321E+02  0.1487665607E+03  0.10000000E+21  0.10000000E+21  0.10000000E+21  0.10000000E+21
```

The last five records are:

```
  0.7050000000E+06  0.5742000000E+07 -0.3844662980E+02  0.1493490830E+03  0.10000000E+21  0.10000000E+21  0.10000000E+21  0.10000000E+21
  0.7060000000E+06  0.5742000000E+07 -0.3844639956E+02  0.1493605330E+03  0.10000000E+21  0.10000000E+21  0.10000000E+21  0.10000000E+21
  0.7070000000E+06  0.5742000000E+07 -0.3844616820E+02  0.1493719828E+03  0.10000000E+21  0.10000000E+21  0.10000000E+21  0.10000000E+21
  0.7080000000E+06  0.5742000000E+07 -0.3844593573E+02  0.1493834325E+03  0.10000000E+21  0.10000000E+21  0.10000000E+21  0.10000000E+21
  0.7090000000E+06  0.5742000000E+07 -0.3844570213E+02  0.1493948820E+03  0.10000000E+21  0.10000000E+21  0.10000000E+21  0.10000000E+21
```

Appendix 7: Gravity Base Station Description

FUGRO-LCT Gravity Base

Client	Job #	Prospect	Vessel
Commonwealth of Australia	454-01	Offshore Antarctica	Geo Arctic

Date Run: 8 Jan 02 JD 008

Meter Operator: H Baker-Jones

Meter s/n LRG912

		Counter	Value	Interval Factor
Calibration	Min	3700	3795.23	1.02675
	Max	3700	3795.23	1.02675

Existing Gravity Base Information

City: Hobart, Tasmania
Country: Australia
Name and Identification Number: AGSO 6491.0260
Elizabeth Street Pier
Hobart Harbour

Station Location	D	M	S	Hem
Latitude (D°M'S")	42°	53.1'		S
Longitude (D°M'S")	147°	20.'		E
Elevation	2.4 m			

Datum	Gravity Value	Est Accuracy
IGSN1971	980437.25	±
Potsdam 1930		±

New Base Information

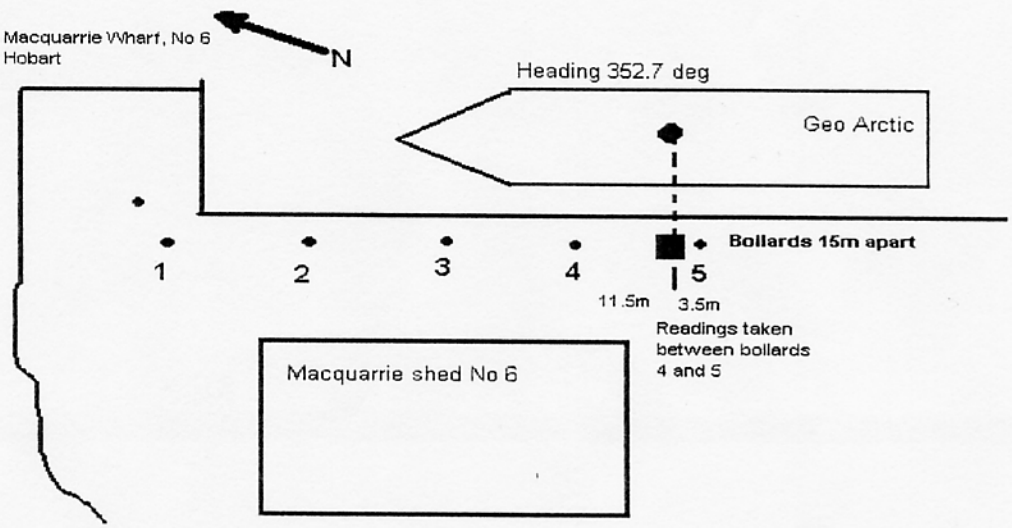
City: Hobart, Tasmania
Country: Australia
Dock Name / Identification
Macquarrie Wharf #6
Hobart Harbour

Station Location	D	M	S	Hem
Latitude (D°M'S")	42°	52.'	45."	S
Longitude (D°M'S")	147°	20.'	23."	E
Elevation	2.3 m			

Datum	Adopted Gravity Value	Est Accuracy
IGSN1971	980437.08	± 0.01
Potsdam 1930		±

Description or Sketch

Land Tie is located between bollards 4 and 5 on Macquarrie Wharf #6, 3.5 m from the blrd. 5, Bollards are 15 m apart



	Raw Data			Data Reduction						
	Location (Dock or Base)	Time (local)	Counter Reading	Value (mGal)	Earth Tide Correction (mGal)	Tide corrected Reading	Drift	D g	Loop Data Used in Average (1 = Yes, 0 = No)	
1	Base	15:26	3734.02	3830.16	-0.04	3830.12				
2	Dock	15:39	3733.86	3830.00	-0.04	3829.96	0.01	-0.18	Loop1	1
3	Base	15:49	3734.04	3830.18	-0.03	3830.15	0.01	-0.17	Loop2	1
4	Dock	15:58	3733.88	3830.02	-0.03	3829.99	0.01	-0.17	Loop3	1
5	Base	16:07	3734.06	3830.20	-0.03	3830.17	0.02	-0.17	Loop4	1
6	Dock	16:17	3733.91	3830.05	-0.02	3830.02	0.00	-0.15	Loop5	1
7	Base	16:27	3734.06	3830.20	-0.02	3830.18	0.00	-0.15	Loop6	1
8	Dock	16:36	3733.91	3830.05	-0.01	3830.03	0.00	0.00	Loop7	0
9				0.00	0.00	0.00				
							Average	-0.17		
							Standard Deviation	0.01		