Bureau of Mineral Resources, Geology & Geophysics

RECORD

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BMR MARINE SURVEY 82
GIPPSLAND AND BASS BASINS

EXPLANATORY NOTES TO ACCOMPANY RELEASE OF NON-SEISMIC DATA

by

E. John Mowat

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INTRODUCTION

The aims of BMR Survey 82 were:

(i) to better define the deep structure of the Gippsland and Bass Basins and so to assist future exploration by providing new information on potential "deep" structural and stratigraphic plays; and,

(ii) to evaluate tectonic models of the basins' evolution. This involved the collection of geophysical data between 37^{o} to 41^{o}S and 145^{o} and 150^{o}E (Figure 1).

The purpose of this report is to summarise the processing techniques applied to the non-seismic geophysical data on Survey 82. The cruise was conducted between 9 November to 8 December 1988.

GEOPHYSICAL SYSTEMS & PERFORMANCE

The following non-seismic geophysical systems were employed during Survey 82:

Navigation

Three totally independent navigation techniques were run simultaneously;

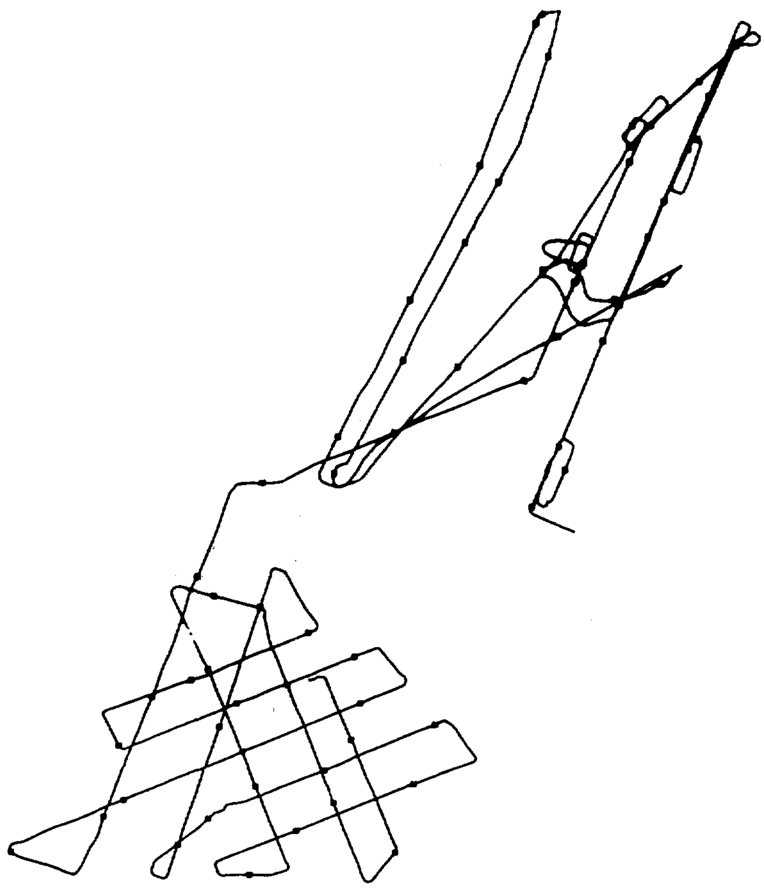
1. Global Positioning System (GPS) using a Magnavox T-Set, giving continuous positioning to within 30 metres RMS, during periods of satellite availability and good geometry.

2. Radio Navigation System, using a modified Decca HIFIX/6 with four shore based transmitters. This system has a potential accuracy of 5 metres under optimum operational conditions.

3. A dead reckoning (DR) system, incorporating TRANSIT satellite navigators, gyro compasses, and sonar dopplers. This system has a potential accuracy of 200 metres at fixes deteriorating to around 1 kilometre between fixes in deep water.

   3.1 The primary DR system consisted of a Magnavox MX1107RS dual-channel satellite navigator, with speed input from Magnavox MX610D sonar doppler and headings from an Arma-Brown gyro-compass.

   3.2 The secondary system consisted of a Magnavox MX1142 single channel satellite navigator, with speed input from Raytheon DSN 450 sonar doppler and headings from a Robertson gyro-compass.



BMR MARINE SURVEY 82

BATHYMETRIC DATA

Symbols at 3-hourly intervals

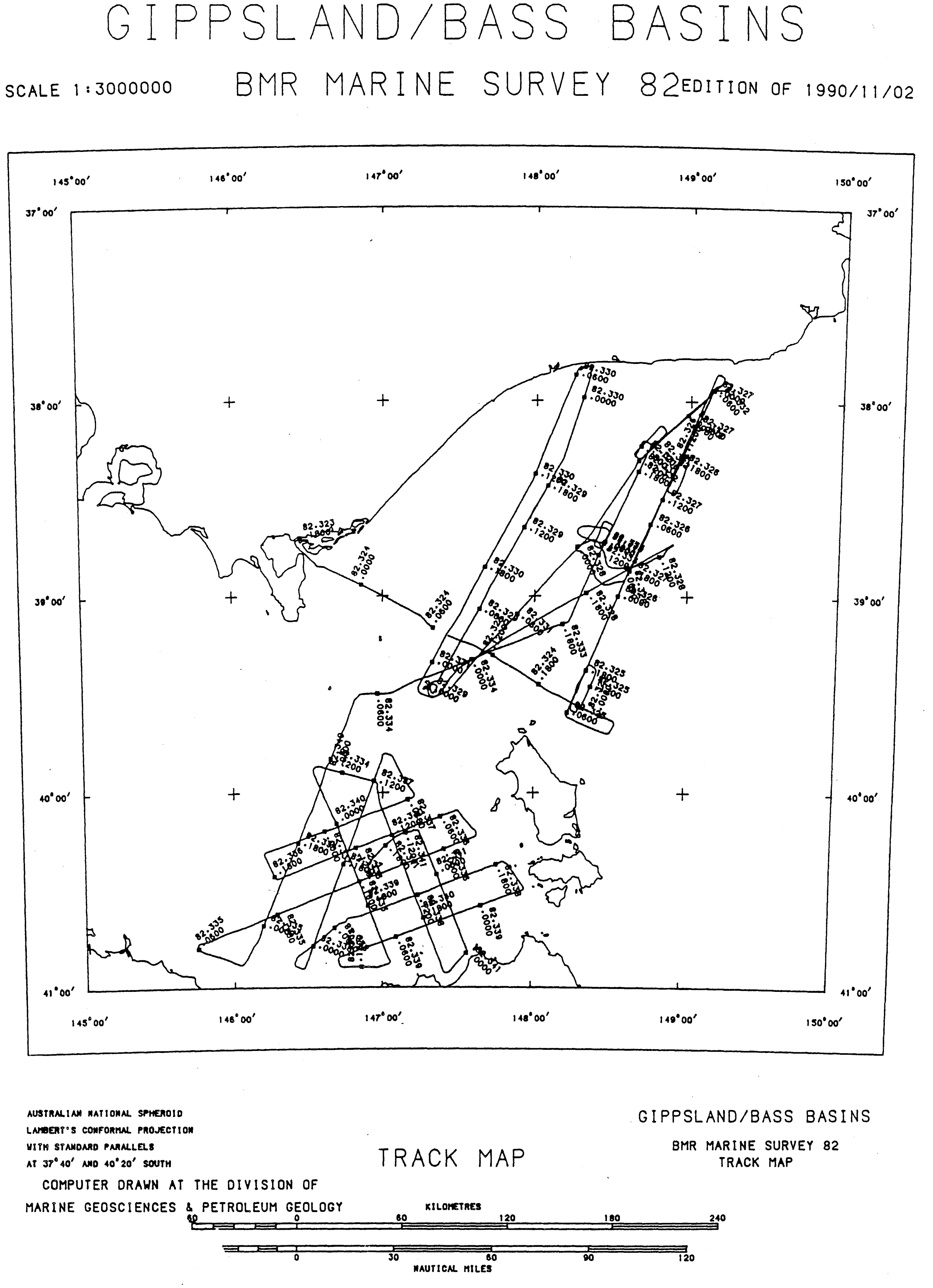
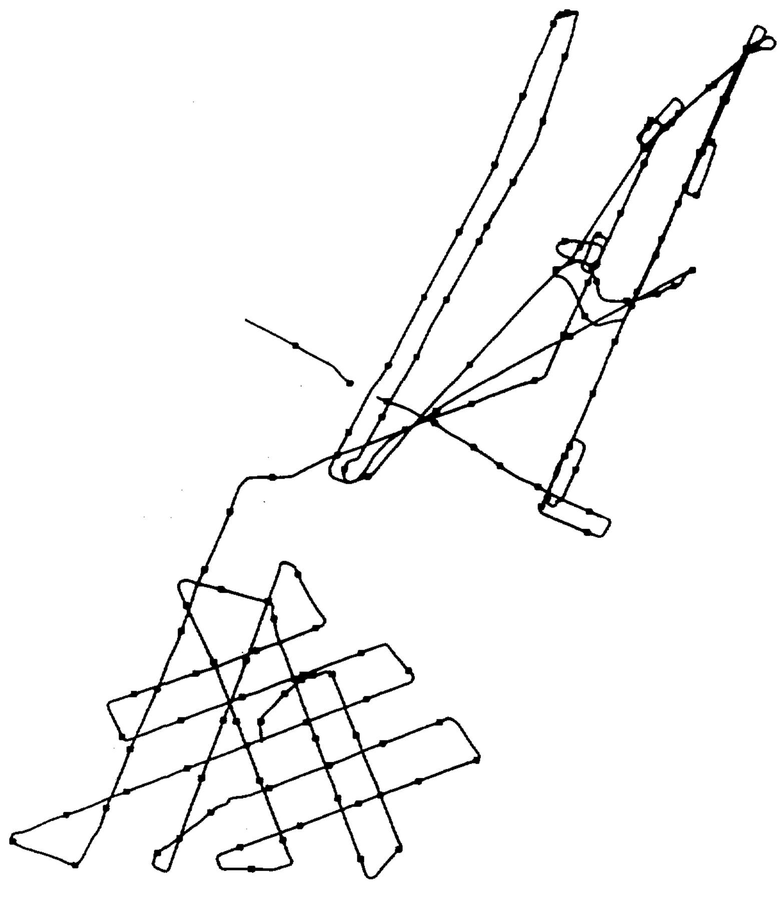


FIGURE 1. Track map of Survey 82.



BMR MARINE SURVEY 82
GRAVITY DATA

Symbols at 3-hourly intervals.

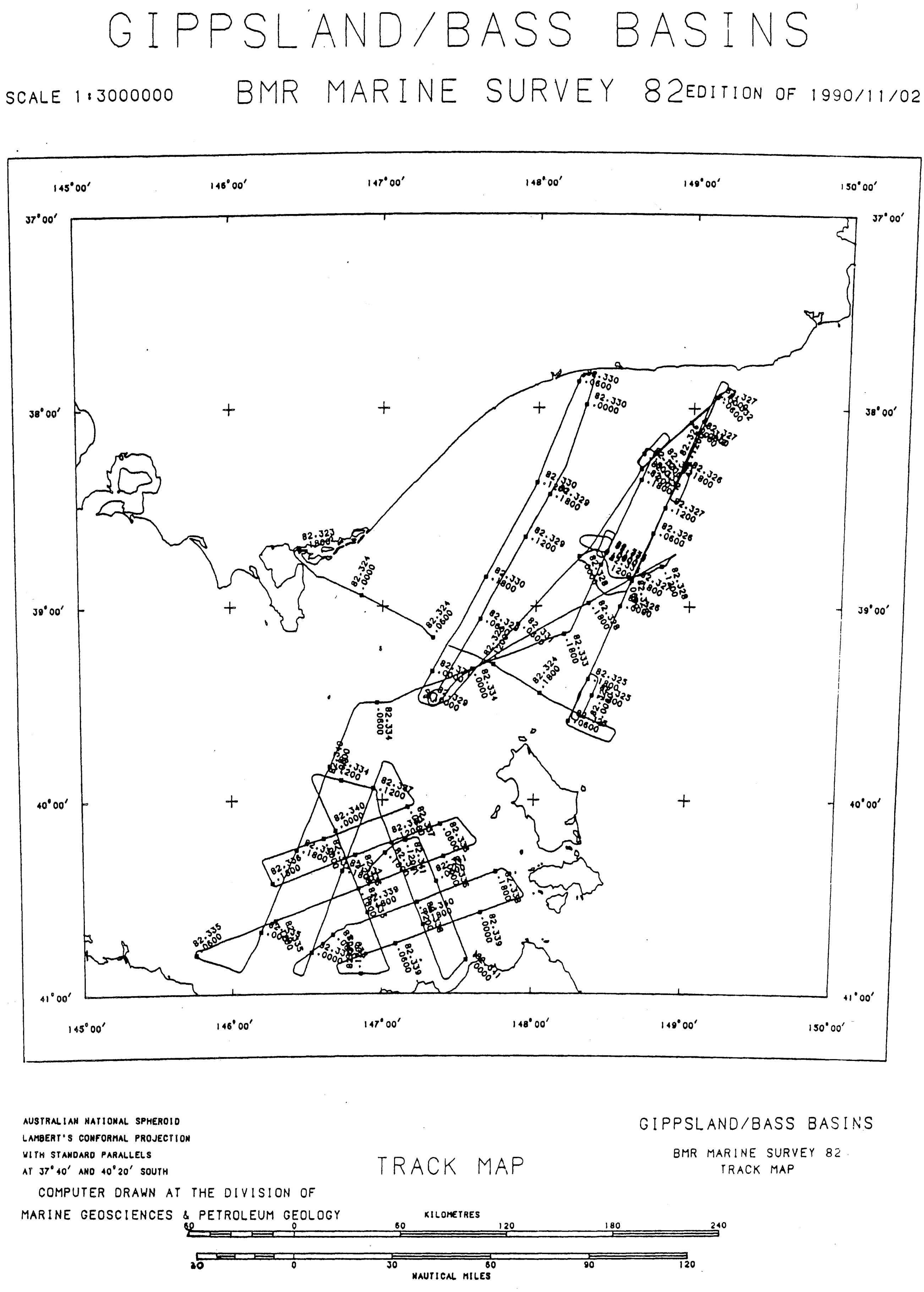


FIGURE 2. Track map of Survey 82.

3.3 A paddle log provided a third measure of ship speed.

Both TRANSIT satellite navigators performed reliably. The MX1107RS was interfaced to the Data Acquisition System (DAS) by which latitude, longitude, course, and speed were recorded every 10 seconds as well as all satellite fix details. The MX1142 was also interfaced to the DAS as backup.

Both gyro-compasses performed satisfactorily for the entire survey. Both sonar-dopplers performed fairly satisfactorily in low sea states but were generally erratic in high sea states.

The GPS (T-Set) navigation system was found to be unreliable during most of the survey. An excessive frequency bias was observed, possibly indicating problems with the internal oscillator. Hence the GPS was not used during most of the survey.

HIFIX data was acquired during the entire survey. However in the latter part of the survey, the poor quality of data limited the usefulness of the data.

The following table indicates the proportion of total survey time that each system was used for primary navigation:

T-Set	: 7%
Radio Nav	: 40%
Dead Reckoning	: 53%

Bathymetric Systems

Water depth data were obtained using a Raytheon Deep-Sea Bathymetric System, with a maximum power output of 2 kW at 12 kHz. This system, developed in the early 1970's, was of very sophisticated design for its day, providing in addition to digital and analogue depths and various alarm flags, an automatic tracking facility to provide usable bathymetric data even in marginal recording conditions.

Data quality was generally good with some poor quality data due to high sea states for short periods during the survey. The processing required to retrieve acceptable bathymetric data is described fully later in this report.

The extent and coverage of bathymetric data collected during the survey is indicated on the Bathymetric Data overlay to Figure 1.

Magnetics

No magnetometer data were collected during the survey.

Gravity

A Bodenseewerk KSS-31 marine gravity meter has been installed on *Rig Seismic*. The KSS-31 is a sophisticated single-axis marine gravity meter with microprocessor control. For gravity tie information see Table 4.

Gravity data were recorded for most of the survey. Satisfactory gravity data have been achieved with appropriate post-survey filtering, except where poor speed control and continuous vessel manoeuvring have produced erratic Eotvos corrections.

Due to a data aquisition shutdown, no gravity data were acquired from 82.323.212000 to 82.324.003300 and from 82.324.061000 to 82.324.082000.

The extent and coverage of gravity data collected during the survey is indicated by the Gravity Data overlay to Figure 2.

DATA ACQUISITION SYSTEM

The shipboard DAS is based on a Hewlett-Packard (HP) 1000 F-Series 16-bit minicomputer. Data were recorded using the HP Real Time Executive (RTE-6/VM) disc-based operating system, which allows a multiprogramming environment and a large number of interactive users. Data were acquired either directly from the appropriate device through an RS-232C interface (gravity, Magnavox MX1107RS and MX1142, etc,) or through a BMR-designed 16-bit digital multiplexer (gravity, bathymetry) and attached gyro-log interface (for both sonar dopplers and gyro-compasses). HIFIX data were recorded from three of the four land-based transmitter stations and GPS satellite fix data were recorded from a Magnavox TSet. After preliminary processing, data were then plotted on strip-chart recorders and track plotters, and listed on several printers. The data were recorded on 9-track, 1600 bpi, phase-encoded magnetic tape in HP's 32-bit floating-point format.

Data were acquired and saved at 10-second intervals, regardless of ship speed and independently of the seismic acquisition system. The data were written to tape in 1-minute (6 record) blocks with 128 channels. Due to technical faults, there is a gap in the data amounting to about 100 minutes. The channels that were recorded are listed in Table 1.

TABLE 1: Field tape channel allocations (Raw field data)

1	-	Clock (survey & day number)
2	-	GMT acquisition time from computer clock (hours, mins and secs)
3	-	Master clock time at acquisition (hours,minutes and seconds)
4	-	Latitude (radians)
5	-	Longitude (radians)
6	-	Speed (knots) - best estimate
7	-	Heading (degrees) - best estimate
8	-	Not used
9	-	Not used
10	-	Bathymetry No 1 (metres; 12KHz)
11	-	Not used
12	-	Magnavox sonar doppler - fore/aft
13	-	Magnavox sonar doppler - port/starboard
14	-	Raytheon sonar doppler - fore/aft
15	-	Raytheon sonar doppler - port/starboard
16	-	Paddle log (knots)
17	-	Not used
18	-	Arma-Brown gyro-compass (degrees)
19	-	Robertson gyro-compass (degrees)(Bridge)
20	-	Not used
21	-	Not used
22	-	Not used
23	-	Not used
24	-	Not used
25	-	HIFIX fine A
26	-	HIFIX fine B
27	-	HIFIX fine C
28	-	Not used
29	-	Not used
30	-	Not used
31	-	Not used
32	-	Not used
33	-	Not used
34	-	Not used
35	-	Not used
36	-	Not used
37	-	Not used
38	-	Not used
39	-	T-Set north std dev (metres)
40	-	T-Set east std dev (metres)
41	-	T-Set satellite numbers
42	-	T-Set Time (GMT seconds)
43	-	T-Set Dilution of Precision (DOP)
44	-	T-Set Latitude (Radians)
45	-	T-Set Longitude (Radians)
46	-	T-Set Height above Geoid (Metres)
47	-	T-Set Speed (Knots) x 10
48	-	T-Set Course (Degrees) x 10
49	-	T-Set frequecy bias
50	-	T-Set GMT (.hhmmss)

51 - Latitude (radians) calculated from Magnavox sonar-doppler
52 - Longitude (radians) calculated from Magnavox sonar-doppler
53 - Speed (knots) calculated from Magnavox sonar-doppler
54 - Course (degrees) calculated from Magnavox sonar-doppler
55 - Latitude (radians) calculated from Raytheon sonar-doppler
56 - Longitude (radians) calculated from Raytheon sonar-doppler
57 - Speed (knots) calculated from Raytheon sonar-doppler
58 - Course (degrees) calculated from Raytheon sonar-doppler
59 - Latitude from spare log (radians)
60 - Longitude from spare log (radians)
61 - Speed form spare log (knots)
62 - Course from spare log (degrees)
63 - Latitude from radio nav (redians)
64 - Longitude from radio nav (radians)
65 - Speed from radio nav (knots)
66 - Course from radio nav (degrees)
67 - GMT from MX1107RS satnav
68 - DR time from MX1107RS
69 - Latitude (radians) from 1107RS
70 - Longitude (radians) from 1107RS
71 - Speed (knots) from MX1107RS
72 - Heading (degrees) from MX1107RS
73 - GMT from MX1142 satnav
74 - DR time MX1142
75 - Latitude MX1142 (radians)
76 - Longitude MX1142 (radians)
77 - Speed (knots) MX1142
78 - Heading (degrees) MX1142
79 - Gravity (μms^{-2} x 10)
80 - ACX (ms^{-2} x 10000)
81 - ACY (ms^{-2} x 10000)
82 - Sea state
83 - Not used
84 - Not used
85 - Not used
86 - Shot times (.hhmmssdd)
87 - Shot point number
88-128 Not used

DATA PROCESSING

The data were processed on a Hewlett-Packard 1000 F-Series minicomputer utilising similar hardware and the same operating system as the DAS. The processing was applied in two phases, as follows:

Phase 1: Geophysical

Transcription of field tapes; correction of time errors; production of raw data plots; bulk editing (principally deletion of bad data segments); retrieval of water depth data; assessment and retrieval of velocities; median filtering of gravity; manual editing of problem areas; computation of incremental latitudes and longitudes; anti-alias filtering (smoothing) of gravity, incremental latitudes and longitudes; production of final check plots; final editing and resample 10-second data to 1-minute data.

Phase 2: Navigation

The basis of the DR processing is the summed latitude and longitude error vectors at each satellite fix and using a smoothing program, to compute error vectors at all times between satellite fixes. It is assumed that the ensuing smooth variation of the error vector is due to ocean currents, wind, etc. Poor quality fixes will produce unrealistic ocean currents and therefore are removed.

GPS processing involves examining the differences between GPS and processed DR positions. If this difference displays erratic behaviour, which is not attributed to variations in DR positions, then the GPS position is deemed suspect and the data not used. No filtering or other attempts at improving the quality of the TSet GPS positions is attempted.

For HIFIX processing a 10-second data discfile was collated of 9 channels from the initial part of the Phase 1 processing. Two parallel processes were involved to determine drift rate and lane jump errors. A filtering process was then used to remove some of the random noise. These corrections were then used to determine HIFIX station position.

Computation of final ship position from an appropriate mix of the available navigation systems; computation of final Eotvos-corrected gravity, including a correction for gravity meter drift; and final data editing (particularly gravity data during turns).

A brief summary of the processing steps of each phase follows, with some detail of the techniques applied.

TABLE 2: <u>Processing channel allocations</u>

1 - Clock (survey & day number)
2 - GMT acquisition time from computer clock (hours, mins and secs)
3 - Master clock time at acquisition (hours, mins and secs)
4 - Latitude (radians)
5 - Longitude (radians)
6 - Heading (degrees) - best estimate
7 - Speed (knots) - best estimate
8 - Bathymetry No 1 (metres; 12kHz)
9 - Not used
10 - Not used
11 - Not used
12 - Not used
13 - Gravity (μms^{-2} x 0.1)
14 - ACX (ms^{-2} x 10000)
15 - ACY (ms^{-2} x 10000)
16 - Magnavox sonar doppler - fore/aft
17 - Magnavox sonar doppler - port/starboard
18 - Raytheon sonar doppler - fore/aft
19 - Raytheon sonar doppler - port/starboard
20 - Paddle log of ship's speed (knots)
21 - T-Set Latitude (radians)
22 - T-Set Longitude (radians)
23 - Arma-Brown gyro-compass (degrees)
24 - Robertson gyro-compass (degrees)
25 - Shot times (.hhmmssdd)
26 - Shot point number
27 - Not used
28 - Not used
29 - Not used
30 - HIFIX Fine A
31 - HIFIX Fine B
32 - HIFIX Fine C
33 - Not used
34 - Not used
35 - Not used
36 - T-Set height above Geoid (metres)
37 - T-Set speed (knots)
38 - T-Set course (degrees)
39 - T-Set frequecy bias
40 - Latitude (radians) MX1107RS
41 - Longitude (radians) MX1107RS
42 - Speed (knots) MX1107RS
43 - Heading (degrees) MX1107RS
44 - Latitude (radians) MX1142
45 - Longitude (radians) MX1142
46 - Speed (knots) MX1142
47 - Heading (degrees) MX1142
48-64 Not used. Temporary processed data.

PHASE 1

The programs applied were as follows:

FCOPY: All field tapes were transcribed to processing tapes with several field tapes being combined into a single processing tape. Processing tapes were separated at obvious breaks (such as recording system crashes), or after about seven days recording. Time jumps (positive or negative) were reported for processing in the next phase.

FIXTM: Time jumps reported in FCOPY were corrected, either automatically, or with a file of manual time corrections. Data channels were re-ordered (Table 2) to simplify further processing.

VARPL: All raw data channels requiring processing were plotted as strip records on a drum plotter. These plots were used to determine where editing was required and as a first guide for the setting of filter parameters. These plots also confirm that editing is acceptable.

FTAPE: This program was used for a variety of tasks as follows:-

(1) Removal of hardware/software flags in the bathymetric data. The Raytheon echo-sounder system provides, in addition to digital bathymetry, 'flags' indicating that the echo-sounder has lost track or that the digitiser gate is searching for an echo. These flags were removed, as appropriate, and such values were replaced by the number 1.0E10 (10 raised to the power 10), to indicate absent data.

(2) 'Bulk' deletions were done of any large blocks of irretrievable data in particular channels.

(3) Automatic interpolations were done across data gaps of up to 120 seconds for selected data channels.

GMUL2: All raw gravity data were divided by 100 to reduce them to ums^{-2} * 0.1. All three speed logs (each of which outputs a fixed number of 'clicks' per nautical mile) were reduced to give speeds in knots.

SALVG (Water depth recovery): Briefly stated, the problem of water depth recovery is to fill in all the gaps left after the Raytheon flags were removed and to remove bad bathymetric values.

To accomplish this, a file of manually digitised water depths at selected points was first created. This file was then read in conjunction with the processing data file. SALVG then performs a straight line interpolation between adjacent tie points and compares the interpolated depth with the 10-second digital depth. If the difference is less than a user-specified threshold, then the digital depth is accepted and is used to replace the previous first tie point. If the difference is greater than the threshhold, then the 10-second digital depth is replaced by the interpolated depth.

In this way, the program tracks along the acceptable water depths, providing the threshold is small enough to reject bad data and large enough to accept good data.

In the case of good digital data being totally unacceptable, as during poor sea conditions, the threshold was set to a very small number (0.01m) and the process became one of very simple linear interpolation between adjacent tie points.

In practice, the interval between manually digitised tie points varied from several hours in the case of good digital 10-second data, to several minutes in the case of poor 10-second data or a very rugged sea bed. The success of this process, which is routinely applied to all *Rig Seismic* bathymetric data, can be seen in the 'before' and 'after' plots of Figure 3.

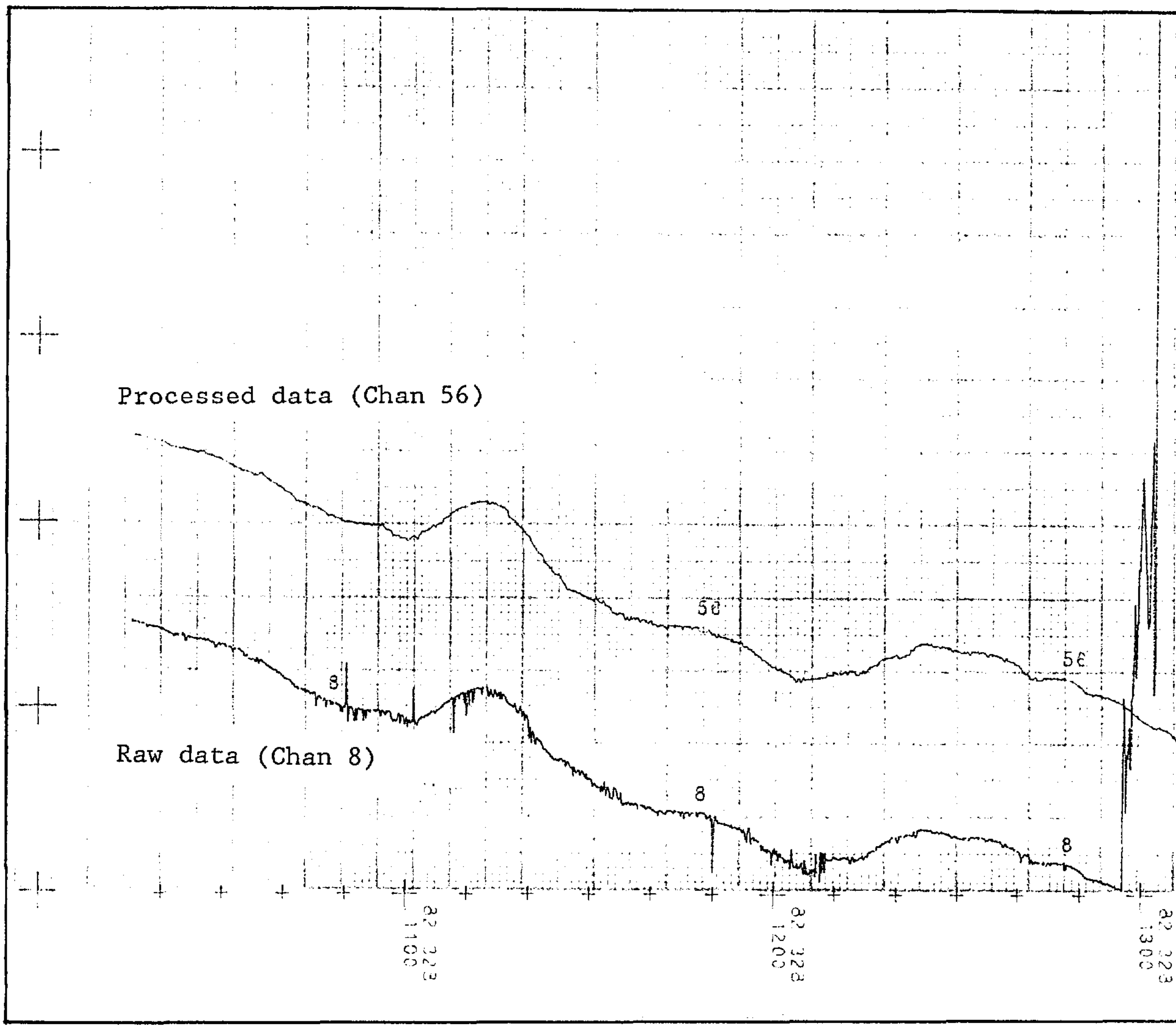


FIGURE 3. Bathymetry traces before and after processing by SALVG.

FDATA: The gravity, and Magnavox and Raytheon speed log data were filtered using a sophisticated form of the median filter, a highly successful spike deletion tool.

EDATA: This is a utility program used for the manual editing of problem areas that are not amenable to filtering or automatic editing.

MUFF: This program uses a SINC function filter to smooth selected data channels. All velocity channels were smoothed to provide acceptable speeds, while gravity data were filtered as an anti-aliasing measure prior to resampling to 60 sec.data.

DELTA: Incremental (delta) latitude/longitudes were produced every 10 seconds by combining the ship speed with the headings from the Arma-Brown and Robertson gyro-compasses. This effectively gave two distinct dead-reckoning (DR) systems.

INTEG: The filtered incremental latitude/longitudes were re-integrated over running 60-second intervals. These 60-second incremental distances are then used in the Phase 2 processing to compute the DR vector over each satellite fix interval.

VARPL/EDATA: As the final stage of the Phase 1 processing, all processed channels were plotted again as 'strip' plots with program VARPL. Program EDATA was then used to correct any minor residual data problems.

RESAM: The processed files are then resampled to 1-minute data files in preparation for Phase 2 processing.

CONCT: Concatenation of all parts of the data into a single 1-minute data file; FIXTM was then used to correct any time jumps.

PHASE 2

Phase 2 is navigation processing and map production, and encompasses the following steps -

(1) Re-formatting and production of assessment listings of TRANSIT satellite fixes;

(2) Assessment of satellite fixes and deletion of those considered dubious or unacceptable;

(3) Constrainment of DR track to remaining satellite fixes and computation of 1-minute positions for each DR system;

(4) HIFIX processing to locate and correct lane jumps, filter the random noise, and determine phase drift;

(5) GPS processing to determine optimum values from DR;

(6) Selection of a suitable mix of navigation systems to produce final positions;

(7) Application of Eotvos and drift corrections to gravity data and conversion to absolute values; and

(8) Final plots and editing as necessary.

The programs applied were as follows -

SATFX: Extraction of the satellite data from the original field tapes and produce two files of satfix data relevant to the two navigation systems (MX1107RS and MX1142).

M0742: Program to amalgamate the two satfix files and remove any duplicate entries.

RESAF: Re-format the ASCII parameter file of satellite fixes and adjust each fix to the nearest whole minute of survey time using the ship speed and heading applying at that time in the Phase-1 data file.

FIXES: Produce a listing of the satellite fixes for assessment purposes (Table 3).

FIX	FIX TIME	LAT	LONG	SYSTEM	SAT	OK	ELEV	COUNT	ITER	GEOM	ERROR	DIR	SLT	SLN	CODE	COURSE	SPEED
1	82.323.173800	38 42.450	146 26.939	1142	200	Y	7	20	2		.20	134	0	0		252.3	.1
2	82.323.175800	38 42.340	146 27.250	1142	500	N	82	34	3		.30	66	0	0	1	252.3	-.1
3	82.323.192400	38 42.340	146 26.920	1142	0	Y	0	0	0		0.00	0	0	0		252.5	-.1
4	82.323.194500	38 42.330	146 26.920	1107	500	Y	13	26	4	NW	.06	17	0	0		252.3	0.0
5	82.323.203300	38 42.330	146 26.977	1107	290	Y	17	26	3	SE	.06	92	0	0		253.0	.1
6	82.323.211000	38 42.356	146 26.910	1107	130	N	39	19	5	NW	.05	226	0	0	5	253.0	0.0
7	82.323.220000	38 45.886	146 27.045	1107	480	Y	11	24	4	SE	.79	188	0	0		124.5	10.2
8	82.323.221900	38 48.427	146 31.115	1107	290	N	83	39	4	SW	.44	85	0	0	1	133.8	10.7
9	82.323.224500	38 51.569	146 34.258	1142	240	N	3	14	*		1.30	222	0	0	5	90.8	10.6
10	82.323.234800	38 55.872	146 48.871	1107	480	N	74	38	3	SE	1.15	127	0	0	1	111.5	10.0
11	82.324.000700	38 56.954	146 51.670	1107	290	Y	13	26	3	SW	1.21	125	0	0		118.5	.3
12	82.324.003100	38 56.774	146 51.525	1107	240	Y	39	36	2	SE	.01	345	0	0		189.3	-.1
13	82.324.011100	38 56.458	146 51.051	1107	490	Y	16	26	4	SE	.19	323	0	0		179.3	-.1
14	82.324.013700	38 56.349	146 50.650	1107	490	Y	19	29	3	SW	.14	263	0	0		193.8	-.1
15	82.324.021900	38 58.928	146 57.133	1107	240	Y	40	36	2	SW	.26	124	0	0		115.8	8.4
16	82.324.025900	39 1.810	147 4.182	1107	490	N	80	38	3	SW	.16	140	0	0	1	115.5	8.2
17	82.324.042200	39 6.850	147 15.377	1107	500	Y	22	29	3	SE	.31	209	0	0		113.2	2.9

Table 3: Sample satellite fix listing from Survey 82.

Headings are as follows:-

FIX - fix number within file;
FIXTIME - time of fix to nearest minute;
LAT/LONG - fix position adjusted to nearest minute;
SYSTEM - indicates MX1107RS or MX1142 fix;
SAT - satellite ID code;
OK - Y or N indicates fix accepted or rejected by satellite navigator;
ELEV - maximum of elevation during fix, in degrees;
COUNT - number of doppler counts received during pass;
ITER - number of iterations required for fix to compute;
GEOM - geometry of pass;
ERROR - distance (nautical miles) of fix update;
DIR - bearing (degrees) of fix update (based on shipboard DR data);
SLT - standard deviation of latitude (metres);
SLN - standard deviation of longitude (metres);
CODE - error code, blank if fix accepted by MX1107RS or MX1142;
COURSE - course (degrees) of ship at time of fix;
SPEED - speed (knots) of ship at time of fix;

SAT12: During each pass of this program for each satellite fix assessment a number of options are called, as follows:

SATEL:-

Reads in the file of satellite fixes and stores them in memory. Any fix intervals with dubious speeds (too low or too high) or any intervals that are very short (<15 minutes) or very long (>120 minutes) are flagged in the output listing.

DRNAV: -

Uses the incremental latitude/longitudes stored on the Phase 1 file and the satellite fix information to compute the DR path (or DR vector) for each satellite fix interval. This is saved as an ASCII parameter file.

CALNV: -

Reads the DR file created by DRNAV and computes the ratio of the average DR velocity to the velocity computed from successive satellite fixes. This is done for each DR system used, and the results are listed.

CALPL: -

Produces a line printer plot of the velocity ratios for each satellite fix interval.

CFACT: -

Uses the DR file and a user-created file of calibration factor intervals to compute velocity calibration factors for each DR system.

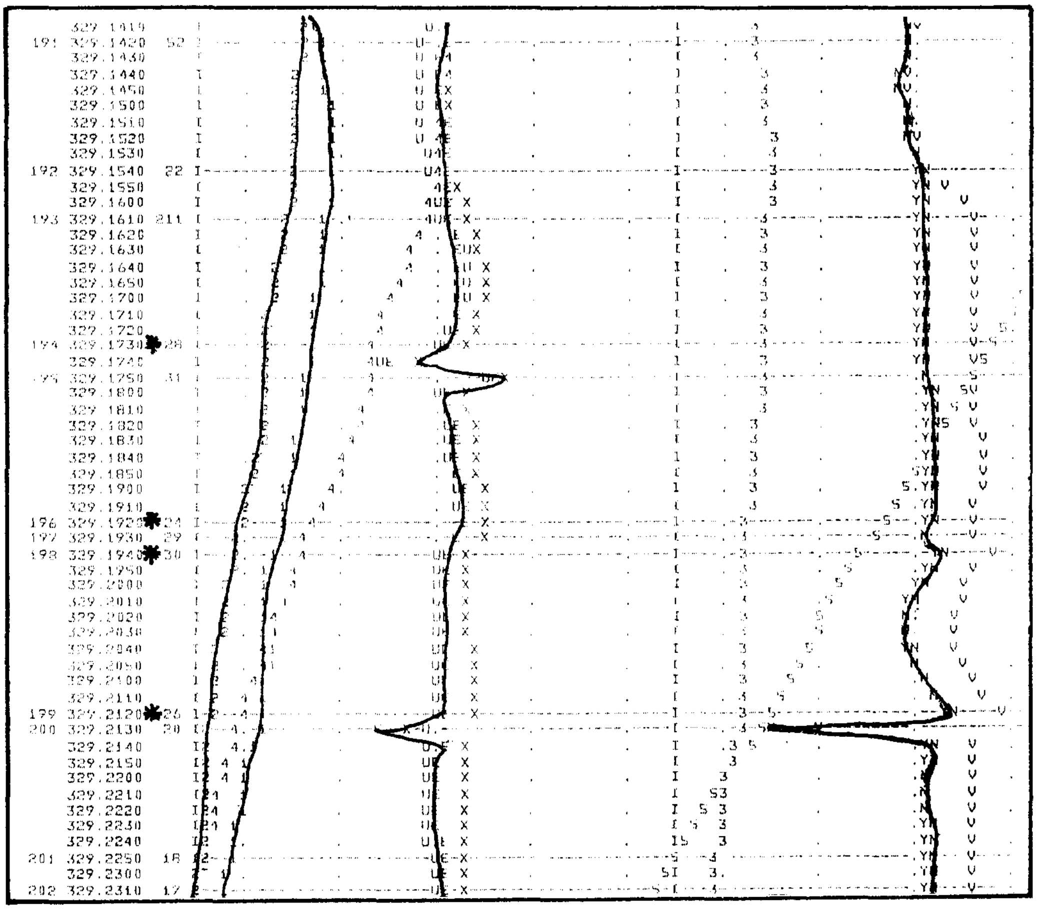
APPROX: -

Uses the calibration factors computed in CFACT and the DR file to produce an approximately calibrated DR file.

ASSES: -

Uses the approximately calibrated DR file created by APPROX to produce a line printer plot of the current and summed error vectors at and between satellite fixes. The plot is produced at a 10-minute sample interval.

At each pass of assessment (and usually at least three passes are required for each file), the satellite fixes are checked wherever the summed error and current vectors suggest a problem, and those fixes of poor quality are deleted for the next program run. The effect of this process can be seen in the example in Figures 4 and 5 where satellite fixes at 82.329.1730; 82.329.1920; 82.329.1940 and 82.329.2120 were removed.



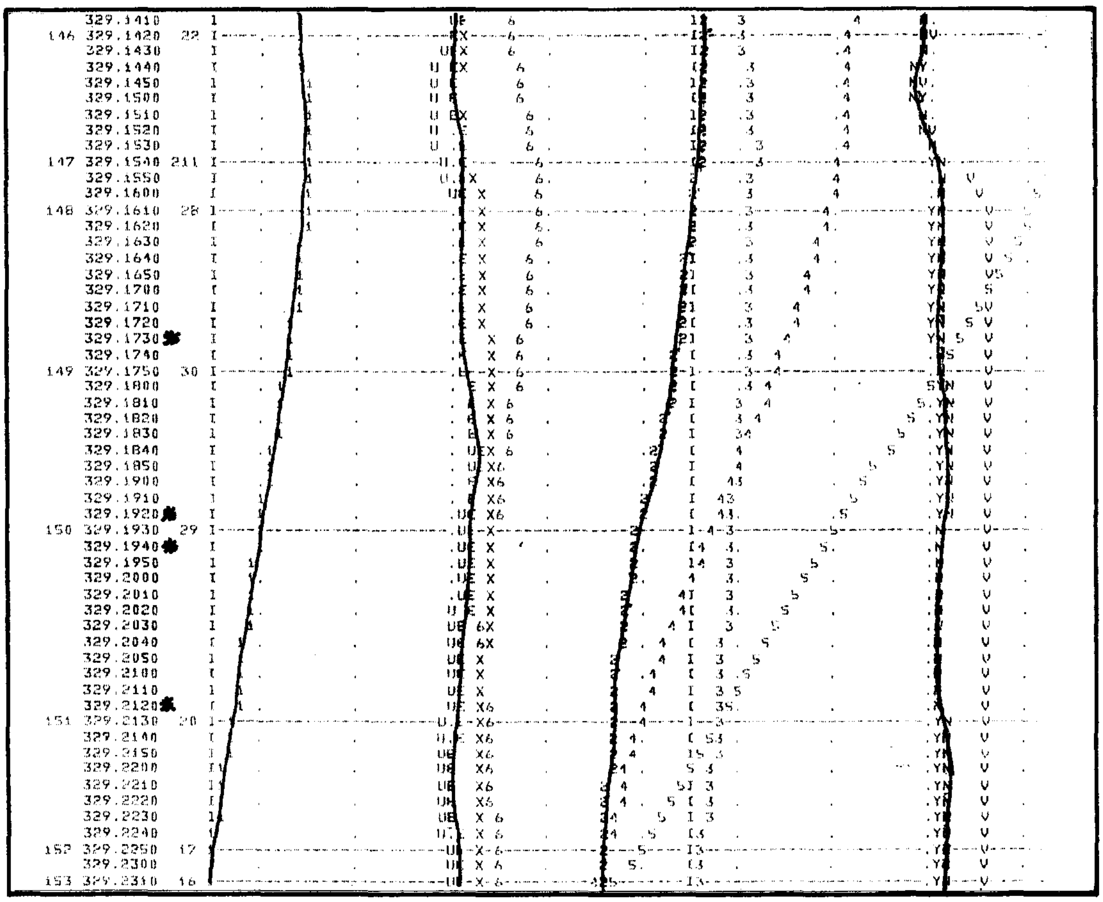
* Satellites to remove.

FIGURE 4. Satellite fix assessment plot - prior to processing.

Legend

N,V,Y,(North) and E,U,X (East) current vectors for DR systems 1,2 & 3. (1 divn = 1 n mile)

1,3,5 (North) and 2,4,6 (East) error vectors for DR systems 1,2 & 3. (1 divn = 1 n.mile)



* Satellites removed.

FIGURE 5. Satellite fix assessment plot - post processing. (After removal of bad satellite fixes at 329.1730,329.1920,329.1940 and 329.2120)

<u>Legend</u>

N,V,Y (North) and E,U,X (East) current vectors for DR systems 1,2 & 3. (1 divn = 1 n.mile)

1,3,5 (North) and 2,4,6 (East) error vectors for DR systems 1,2 & 3. (1 divn = 1 n.mile)

SAT3: Uses the final file of satellite fixes and the DR data to produce final positions for each DR system. This program again uses the Akima spline to compute the assumed currents acting at all times between satellite fixes and applies those currents to the DR data to compute positions.

LGYRO: Compares the T-Set and Satfix Latitude/Longitude channels (21, 22 and 48,49) to determine the position differences (in metres); This is used to evaluate the acceptable values for further computations in FINAV.

FINAV: Performs the following functions:-

(1) Computes final 1-minute positions based on a 'mix' of DR systems, Global Positioning System and HIFIX (radio nav) according to a file specified by the user. The final navigation is shown as a small scale track map in Figure 1.

(2) The gravity data (which was in μms^{-2} relative to an arbitrary datum) was converted to absolute values, relative to Isogal 84 datum, corrected for meter drift and with Eotvos corrections applied; no tidal corrections have been applied.

Gravity ties were performed prior to the survey in Adelaide, and in Melbourne, the end of the survey. A summary of gravity tie information is listed in Table 4.

Base Station (B.M.R.)	Gravity Value (μms^{-2})	Date	Time (local)	KSS-31 reading	Observed Gravity (μms^{-2})
8090.0108 Port Adelaide Wharf 29	9797054.3	09/11/88	1058	-6855.37	9797115.1
8520.0010 Melbourne Wharf 21	9799755.19	08/12/88	1106	-4017.83	9799755.65
Drift = 197.0 μms^{-2}. Over duration of survey (30 days)					

Table 4: Gravity tie information.

VARPL/EDATA : Verification plots of water depths and gravity data were plotted and editing applied as necessary. Program FIXTM was then used to re-block the data to 8 channels x 60 records per block. As a final editing stage of this part of the processing, the residual gravity spikes at turns are removed (EDATA) and the gravity channel is smoothed by a filter of 15-minute period to remove any remaining sea noise (MUFF).

At this stage of Phase 2, the processing of HIFIX data is reformatted into a 32 channel discfile of 10-second data with 12 records per block.

HIFIX processing then encompasses the following steps-

(1) Reformatting the data;

(2) Production of plots of raw HIFIX data;

(3) Determination of drift rates;

(4) Identification of HIFIX lane jumps;

(5) Filtering of preliminary data;

(6) Editing of gaps and small sections of data;

(7) Intermediate processing to optimise the quality of the data;

(8) Combining of the data processing parameters to produce final HIFIX latitudes and longitudes; and

(9) Merging HIFIX coordinates with GPS(TSet) and DR coordinates after minimal editing.

The programs applied for HIFIX were as follows:

FIXTM: Reformatting the data into 32-channel 10-second data.

VARPL: Produce data plots of HIFIX data to determine the acceptable usable quality of the data.

TESRO: There are two options to TESRO which were used in the processing of HIFIX data. These options were as follows:

DR Option: Used for determination of lane jumps and values.

SA Option: Used for the determination of drift rates of satellite fixes.

These two options were combined into a parameter file for further processing in optimising latitude and longitude coordinates for navigation.

FDATA: The HIFIX navigation data is then filtered using a median filter to remove excessive spikes.

EDATA: A utility program used for manually editing of small gaps and minor editing.

DHFIX: An intermediate processing step to enable channel differences, between succeding values of data, to be noted in optimising the quality of HIFIX channel data.

POSHI: Using the output information from TESRO(DR) and TESRO(SA) combined to produce final latitude and longitude values.

CHAP: Used to resample the processed data to 1-minute data and/or checks for anomalies in speed and course; gaps in data; and compares GPS(TSet) and HIFIX for processing assessment.

MERGE: At the end of HIFIX processing, the data is merged with the optimum of GPS(TSet) and DR.

On completion of all data processing, the final data is allocated to specific channels as per Table 5.

Channel No	(Ex Channel No)*	Contents
1		Time (SS.DDD)
2		Time (.HHMMSS)
3	(63)	Latitude (radians)
4	(64)	Longitude (radians)(relative to 100^{o}E)
5	(57)	Water depth (metres)
6	(62)	Gravity (μms^{-2})
7		Unused
8		Unused
* Intermediate processing channel.		

Table 5: Final channel allocations.

MAP PRODUCTION

Track Map

A track map was produced using Lambert Conformal projection at a scale of 1:1000000 covering the Gippsland/Bass Basins survey area.

Profile maps

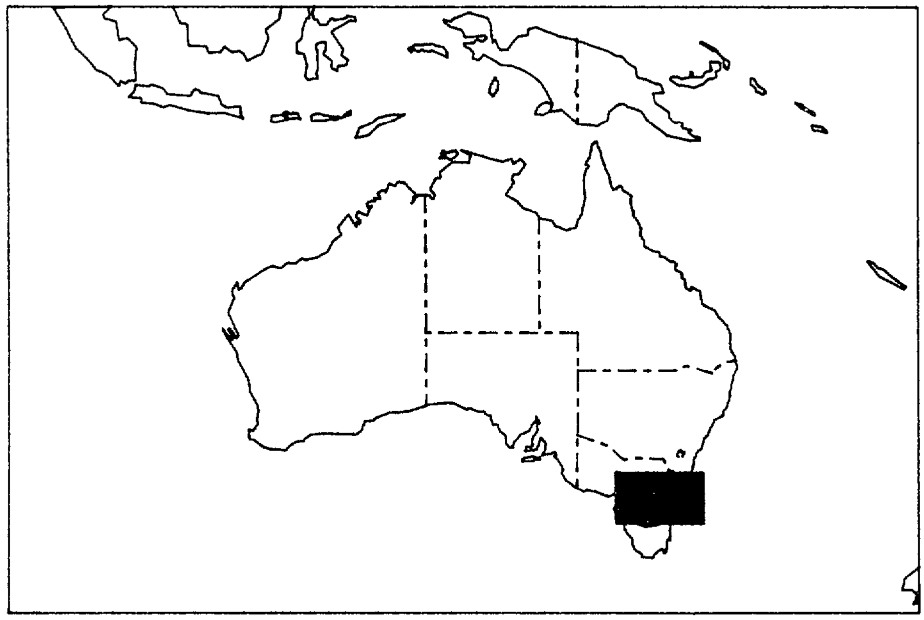
Profile maps were produced using Lambert Conformal projection at a scale of 1:400000. This covers the survey area in two maps for each set of profiles. Profile maps are: Free-air Anomaly and Bathymetry.

Posted Value Maps

Post maps were produced using the same scale, projection and area as the profile maps. These maps are: Observed Gravity Values; and, Bathymetry Values.

Map areas are shown in Figure 5, with map titles of available data listed under Data Availability.

General location.



Published maps (Outlined)

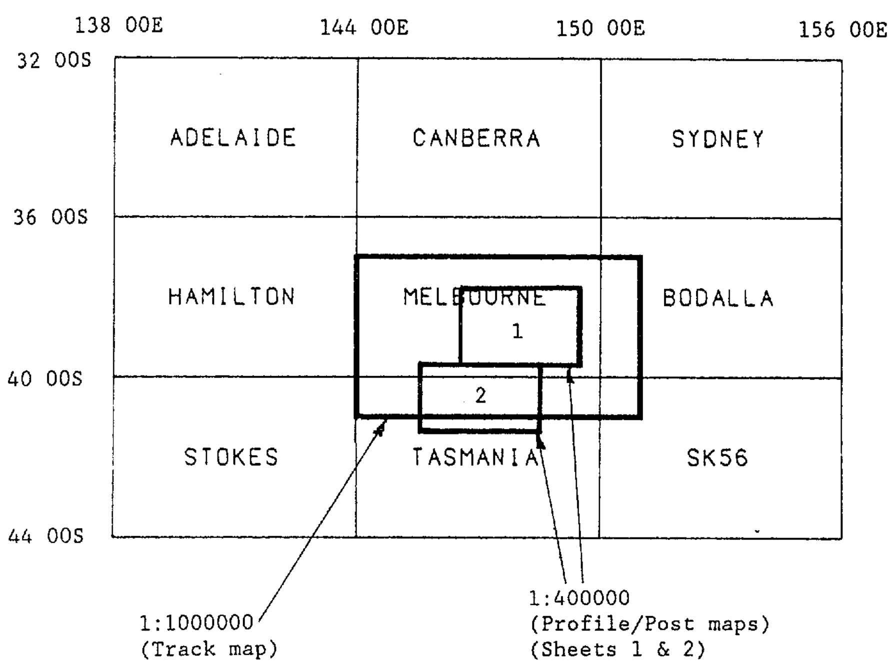


FIGURE 6. Index of Survey 82 maps.

DATA AVAILABILITY

The Gippsland/Bass Basins navigation, gravity, water depth and magnetic data are available in the form of digital data and maps.

Digital Data

Magnetic tape.

(1) Navigation Data only — Product Code: M-82N0001T
9-track, 1600 bpi, phase-encoded, ASCII records of 80 characters per record, 10x1-minute records per block; or

(2) Navigation and Geophysical Data — Product Code; M-82N0002T
9-track, 1600 bpi, phase-encoded, ASCII records of 80 characters per record, 10x1-minute records per block.

(3) Shot Point Location Data — Product Code: M-82N0003T
9-track, 1600 bpi, phase-encoded, ASCII records of 80 characters per record, 20 records per block.

Enquiries concerning this data should be addressed to :

Marketing Manager,
Division of Marine Geosciences & Petroleum Geology,
Bureau of Mineral Resources,
GPO Box 378
Canberra, ACT 2601, Australia

Maps

Maps are produced using Lambert Conformal projection and are available in both paper and film products.

	Sheet name	Sheet numbers	Product code
(1)	Track Maps (1:1000000)	1	M-82M0001F
(2)	Profile Maps (1:400000)		
	Bathymetric Profiles	1 & 2	M-82M0002F
	Free-Air Anomaly Profiles	1 & 2	M-82M0004F
(3)	Posted Value Maps (1:400000)		
	Bathymetric Values	1 & 2	M-82M0003F
	Observed Gravity Values	1 & 2	M-82M0005F

Enquiries concerning this report and these products should be addressed to :

Copy Service
Bureau of Mineral Resources
GPO Box 378
Canberra, ACT 2601, Australia