258001

T/15P

DURROON BASIN - TASMANIA

BRIDGE DURROON 1991 SEISMIC SURVEY

FINAL REPORT

by

BRIDGE OIL LIMITED

R PICKERING

July, 1992

521/64/RP

BRIDGE DURROON 1991 SEISMIC SURVEY
FINAL REPORT
T/15P - DURROON BASIN
OFFSHORE TASMANIA

SUMMARY

The Bridge Durroon 1991 Seismic Survey was recorded by Bridge Oil for and on behalf of the joint venture participants in the Boobyalla Sub-basin (Durroon Basin) Tasmanian off-shore permit, T/15P. The programme was recorded in September 1991 and collected 400.2 km of multi-fold seismic data at a cost of A$545,000.

The programme was designed to investigate the structural integrity of a number of interpreted features of Cretaceous age in the southeastern portion of the permit.

The data were recorded in September 1991 by the BMR marine vessel Rig Seismic, processed by Digital Exploration (Digicon) and interpreted by Bridge Oil personnel. The resulting interpretations have served to down grade the perceived prospectivity of this area of the permit.

The area in which the survey was recorded is remote from available well control at Durroon-1 which is located in the adjoining Anderson Sub-basin. The correlation of seismic events associated with rocks of Cretaceous age or older in Durroon-1 have been translated to the Boobyalla Sub-basin by inference. Seismic data correlations at Durroon-1 allow direct interpolation of the Tertiary (Bass Basin) reflections which thins to insignificance in this part of the permit. The Tertiary (Bass Basin) section is considered to be economically unprospective in this part of the permit because of the apparent shallow nature of the section coupled with the lack of discernible mapped structure closure.

The objectives of the Bridge Durroon 1991 Seismic Survey have been fulfilled in that decisions regarding continued exploration in this permit are now easier to make. Previously mapped structural features have been mapped with more confidence which in turn serves to provide an enhancement to regional geophysical knowledge.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF ENCLOSURES

LIST OF APPENDICES

LIST OF TABLES

BRIDGE DURROON 1991 SEISMIC SURVEY
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by

R Pickering

I INTRODUCTION

This report outlines the procedures and results of the Bridge Durroon 1991 Seismic Survey and includes discussions on the following topics:

- the regional geologic and geophysical attributes of the area in which the survey was recorded.

- the tectonic elements associated with the recording area.

- the objectives of this survey.

- the joint venture participants in the survey.

- the data recording parameters that were used for the survey.

- the inputs from various contractors retained to provide services pertaining to specific aspects of the survey.

- the interpretation procedures utilised in this survey.

- the relationship of previous work to the results of this survey.

- concluding statements that summarise the results of the survey.

- recommendations that may benefit future exploration in the area.

II REGIONAL GEOLOGY/GEOPHYSICS

The Durroon Basin, as described by Baillie (1991), is a Cretaceous Age sedimentary basin that underlies the southeastern extremities of the more extensive Tertiary Age Bass Basin. The southeastern portion of T/15P, as shown in Figure 1, covers the Durroon Basin almost in its entirety. Geologic interpretations within the Boobyalla Sub-basin are made by inference only as the sub-basin lacks well control.

The Early Cretaceous Otway Formation and the Durroon Megasequence are the horizons of interest in this survey. The seismic signature of the Otway Formation is interpreted by Edgerley (1990) as a sequence of parallel to sub-parallel events that converge to a feather edge at the basin margins. The inference is that this formation was deposited in a broad linear depression during that period of time when continental Australia was beginning to shear away from the continental landmass of the Antarctic (ca 113 ma). The rifting process (the sundering of Australia and Antarctic) is interpreted to have generated the broad linear basin in which the Otway Formation was deposited while the shearing action initiated the rotated half grabens that exemplify the southern areas of T/15P.

The seismic signature of the Durroon Megasequence in the Boobyalla Sub-basin is interpreted as a sequence of nondescript events that vary in two way time thickness from less than 100 milliseconds to greater than 1 second. The nature of the reflection sequence is generally indicative of sediments that have been deposited over a relatively short period of time. It is only in the deeper sections of each sub-basin that patterns of seismic sequences are readily recognised.

Veevers (1991) postulates that the Lord Howe Rise rotated away from the Australian land mass in a manner similar to that shown in Figure 2. The opening of the Tasman Sea (ca 84ma) is interpreted as having generated the only known rift system in the southern Bass Strait. This occurrence is also interpreted as having generated a second fault system that over printed the Otway Rift system which was still in its development stages. The work of Edgerley (Pickering 1991) indicates that the resultant tectonic systems, when coupled with the rapid deposition of sediments that were being shed from the uplifting land mass that accompanied the opening of the Tasman Sea, have created a minor rift system that is extremely complex in terms of its depositional and tectonic history. The seismic data thus far recorded gives testimony to that interpretation.

A Tectonic Elements

Enclosure 1 provides a schematic view of the tectonic elements associated with the Boobyalla Sub-basin as mapped at Otway Formation levels. The map confirms previous interpretations wherein a strong change in fault direction from north-south to east-west is indicated. This change in direction possibly related to the final stages of development of the Boobyalla Sub-basin.

III PROGRAMME RATIONALE

The Bridge Durroon Seismic Survey was conducted for the purpose of delineating a number of structural leads that were interpreted from the Bridge Bass 1990 Seismic Survey (see Figure 3). The leads, as mapped from the previous survey data, indicate the presence of several fault dependent structural closures.

The following companies participated in this survey:

Bridge Oil Limited (operator)	84.657%

Peko Oil Ltd	7.006%
Cluff Pacific Oil	5.211%
Weaver Oil and Gas Corporation	3.126%

IV CONTRACTOR SELECTION

In order to gain the assurance that the best possible drilling location was available for an April-May 1992 spud date time became a critical factor in this survey. All measures that would shorten data turn around time were carefully considered. For this reason preferences were given to contractors who had worked on previous surveys for Bridge Oil in the Durroon Basin.

A Data Recording

Requests for tenders to acquire the proposed seismic data were sent to the following data acquisition contractors:

Halliburton Geophysical Services
Western Geophysical Company Ltd
Digital (Digicon) Exploration

As the programme was comparatively small in terms of kilometres to be recorded, the cost of mobilisation to and from the recording area was resultantly sufficiently onerous so as to preclude the use of any vessel that was not in the programme area.

Halliburton Geophysical Services(HGS) were working in the Gippsland Basin and were subsequently offered the contract to record the data. HGS chose to reject the contract for reasons of prior commitments which led to contact with the Bureau of Mineral Resources (BMR) who had already scheduled the M/V Rig Seismic to be in the area for scientific reasons. An equitable commercial arrangement was subsequently drawn up with the BMR.

A1. Field Supervision

The contract to provide on-site recording supervision was awarded to Austral Geophysical Consultants Pty Ltd without entering into the tendering process. A report outlining the daily recording operations is provided in Appendix 1.

B Data Processing

The data processing contract was awarded to Digital Exploration (Digicon), Brisbane on the basis of previous work done in the area and a 'reasonable' cost proposal. This contract was awarded without benefit of the tender process.

C Data Interpretation

The data recorded by this survey were interpreted by Bridge Oil personnel.

V PARAMETER SELECTION

Data recording parameters were selected on the basis of parameters used to record previous surveys in coordination with the equipment that would be available on the recording vessel.

The M/V Rig Seismic utilised the following primary equipment to record this survey:

- Fjord Instruments analog streamer 2400m X 192 channels
- BMR SEG-Y recording format
- BMR time based recording system
- 2400 cu in X 1800 psi air gun array as shown in Figure 4
- Racal DGPS navigation system.

VI DATA RECORDING

A Recording Contractor

The BMR vessel M/V Rig Seismic commenced recording operations on September 21, 1991. Recording was completed on September 25, 1991. A total of 400.2km of 48 fold seismic data were recorded during this survey. A line by line listing of the lines recorded is provided in Table 1 . This table includes the AMG coordinates for the first and last shotpoint locations of each line.

In addition to seismic data recorded for Bridge Oil the BMR recorded magnetic data for their own use during this survey. This data is not presented or discussed in this report.

A final data recording report, submitted by the BMR, is attached to this report as Appendix 2.

B Navigation

The BMR utilised the Differential Global Positioning System (DGPS) as its prime navigational device. The application of this type of navigational control is fully discussed in Appendix 2.

VII DATA PROCESSING

Digital Exploration (Digicon) were selected to process the data recorded during this survey on the basis of their familiarity with the BMR time based data recording system as well as their previous experience in processing data from this area for Bridge Oil. The turn around time from raw data to final migrated section was greatly reduced that experienced from 'normal' projects as processing parameter tests were minimised.

Data processing commenced immediately upon arrival of the field data at Digicon's Brisbane Processing Centre. Final and migrated stack sections were delivered to Bridge Oil on January 2, 1992. A final data processing report as submitted by Digicon is included as Appendix 3. The standard data processing sequence used is attached as Figure 5.

Tape copies of the unfiltered final stack data were created for future post stack data processing operations. A line by line listing of the tape identification numbers is provided on Page 15 of Appendix 3.

Velocity analyses were run at 1km intervals. Paper copies of the analyses have been preserved in storage. The velocity analyses have also been stored on tape in an attempt to improve access to them as well as minimise storage costs.

VIII DATA INTERPRETATION

All of the seismic data associated with the lines shown on the map of Enclosure 2 were interpreted in order to update the existing permit maps. The maps of the Otway Formation have been merged with those of existing interpretations. The Intra-Durroon Megasequence map of this survey represents a different mapping horizon from any that have previously been produced.

A Data Quality

In general the quality of the data recorded during this survey is regarded as being as good as the data recorded in previous surveys. The tectonic complexities in conjunction with the lack of well control gives rise to a very complex and difficult data set to interpret.

B Maps

The Tertiary Age section throughout the recording area is very thin and very shallow and as such is considered to be of minimal prospectivity and therefore of little or no economic importance. For these reasons maps of the Tertiary section have not been made for this report.

The formations that are considered to have possible economic relevance to exploration in the Boobyalla Sub-basin have been mapped in two way time and are discussed below.

B1 Intra-Durroon Megasequence

The Intra-Durroon Megasequence Two Way Time Structure Contour Map included as Enclosure 3 is of a seismic event interpreted to be within the Durroon Formation at Durroon-1.

This sequence is interpreted to have been deposited as a separate unit on a flooding surface within the Durroon Formation, as may be seen down dip from Durroon-1 in Figure 6. This sequence at its thickest on line BB85-26, was then correlated to a similar sequence (or set of sequences) on line BB90-204 as shown in Figure 6.

The structure map of this event demonstrates the presence of several fault dependent features that overlie corresponding Otway Megasequence structures. The change in direction of the trending fault system is interpreted as having been created by an apparent compressional feature that is observed on several of the lines in this area. The seismic sections depict a greater level of detail than do the contour maps which is a function of the seismic line grid spacing, the digitising interval and the mapping contour interval. A contour interval of 50 milliseconds was selected as being the optimum interval necessary to define targets of economic size and relief. A smaller interval would undoubtedly provide greater detail and potentially a larger number of small closures.

The 'leads' map generated from the previous survey interpretations (Figure 3) indicates the presence of three structural leads namely; the Bridgewater Nose, the Kingsbridge lead and the Richmond lead. The tighter seismic grid and resultant mapping clearly demonstrates that these leads are not only structurally complex but may be somewhat difficult to map despite the increased amount of data control.

B2 Near Top Otway Megasequence

Enclosure 4 is a map of the Otway Megasequence interpreted to have been deposited in a broad linear depression during the early Otway Rift period which saw the separation of Australia from the Antarctic. The seismic signature of such deposition suggests parallel to sub-parallel units. The rocks penetrated in Durroon-1 indicate the presence of basalt flows on the Otway Megasequence surface. Seismic events that correspond to this phenomena are interpreted as being off-lap events onto the Otway Megasequence surface. The map of Enclosure 4 represents a map of the shallowest parallel set of reflections beneath the offlapping basaltic flow events as interpreted down dip from Durroon-1. These characteristics were thus carried into the Boobyalla Sub-basin with good confidence.

The map indicates the possible presence of several large fault dependent features much in agreement with the work done by Edgerley (Pickering, 1991). These features reflect the results of extensional forces that affected the basin during the Tasman Rift period.

C Discussion of Leads

C1 Bridgewater

Edgerley (Pickering, 1991) mapped a deep event within the Durroon Megasequence that indicated structural roll-over of a very complex nature as shown in Figure 7 and Figure 8. This lead is shown on the leads map of Figure 3.

With the addition of the Bridge Durroon 1991 Seismic Survey data these leads have been down graded. The Bridgewater lead remains as a structural 'nose' but clearly lacks mapped updip structural closure which severely degrades this as a viable lead.

C2 Kingsbridge

The programme was designed such that lines BD91-214 and BD91-207 intersected at the interpreted crest of the Kingsbridge Structure (Figure 8) . On individual seismic lines the feature closely resembles a collapsed anticline. When correlated and mapped, the feature appears to be a broad feature that lacks sufficient definition at the specified contour interval. Further delineation of this feature would likely improve the definition of its structural shape but is unlikely to increase structural relief. This lead is shown on the leads map of Figure 3.

C3 Richmond

The Richmond Lead, shown as Figure 9 as mapped by Edgerley (Pickering, 1991), has been interpreted as a structural roll-over that evolved as a result of basinal extension faulting induced collapse. Re-interpretation, with the benefit of increased control, indicates that this lead is reduced to a feature that is small in area with minor relief at a single fault boundary. Additional seismic, a shorter digitising interval and a smaller contouring interval would likely demonstrate that this feature consists of a series of juxtaposed minor blocks each with varying amounts of vertical displacements. This lead is shown on the leads map of Figure 3.

D Bathymetry

Enclosure 5 maps the water depth in the area as updated by this survey. the anomalous variations in the contours are probably surface expressions of deeper structural features. One might also interpret the clarity of the surface features as reflecting subsurface structures that are relatively shallow.

IX CONCLUSIONS

Although the survey accomplished the objectives that were set out there are a few minor considerations that might be investigated prior to the recording of subsequent surveys in the area.

Recording Parameters:
The application of symmetric sampling techniques may be of benefit insofar as the aliasing of multiples is concerned. Vermeer (1991) discusses the benefits that might be available through careful consideration of source length, receiver length and the spatial relationship of these to the common depth point. Experience indicates that maximisation of recording parameters leads to lower input energy, less subsurface redundancy, higher quality data and lower recording and processing costs. It would appear in comparison of this survey to previous surveys that the optimum subsurface redundancy is somewhat less than 48 fold. A reduction of this parameter would likely result in similar quality data at reduced cost.

Although problems with the source used in this survey were not identified (sources were tested for compliance with manufacturer specifications only), reference to work done by Fricke et al (1985) with regard to calibration of marine seismic sources may also be of benefit when selecting parameters for future surveys. Fricke describes a calibration methodology that achieves a quantitative estimate of source energy. The potential of reducing input energy may allow for shorter gun recharge time which could lead to increased production levels.

Data Processing Parameters:
The final display filters chosen for this data are considered optimum in terms of maintaining continuity of high frequency events. This, however; did not prove useful in terms of creating the interpretive maps of the data. A lower frequency display in addition to the application of a

method of enhancing relative amplitudes would have been of greater assistance in mapping the overall form of events through a very complex data set.

Increased Seismic Control:
As indicated previously the contour interval selected for the maps in this report were selected to allow economic sized structures to be mapped. Grid infilling and tighter digital control of the interpreted data would serve only to increase the mapping detail without increase to prospectivity.

X REFERENCES

Baillie P., and Pickering R., (1991). 'Tectonic evolution of the Durroon Basin, Tasmania'. Exploration Geophysics (1991) **22**, 13-18.

Edgerley D W, Taylor J, (1990). 'Seismic interpretation and basin analysis; Bass Basin T/15P'. Unpublished report for Bridge Oil Limited

Fricke J R, Davis J M, Reed D H, (1985). 'A standard quantitative calibration procedure for marine sources'. Geophysics (1985) **50**, #10, 1525-1532.

Pickering R., (1991). 'Final Report; 1990 Bridge Bass seismic survey, Tasmanian Exploration Permit T/15P;

Veevers J J, Powell C McA, Roots S R, (1991). Review of seafloor spreading around Australia. I. Synthesis of the patterns of spreading'. Australian Journal of Earth Sciences (1991) **38**, 374-389.

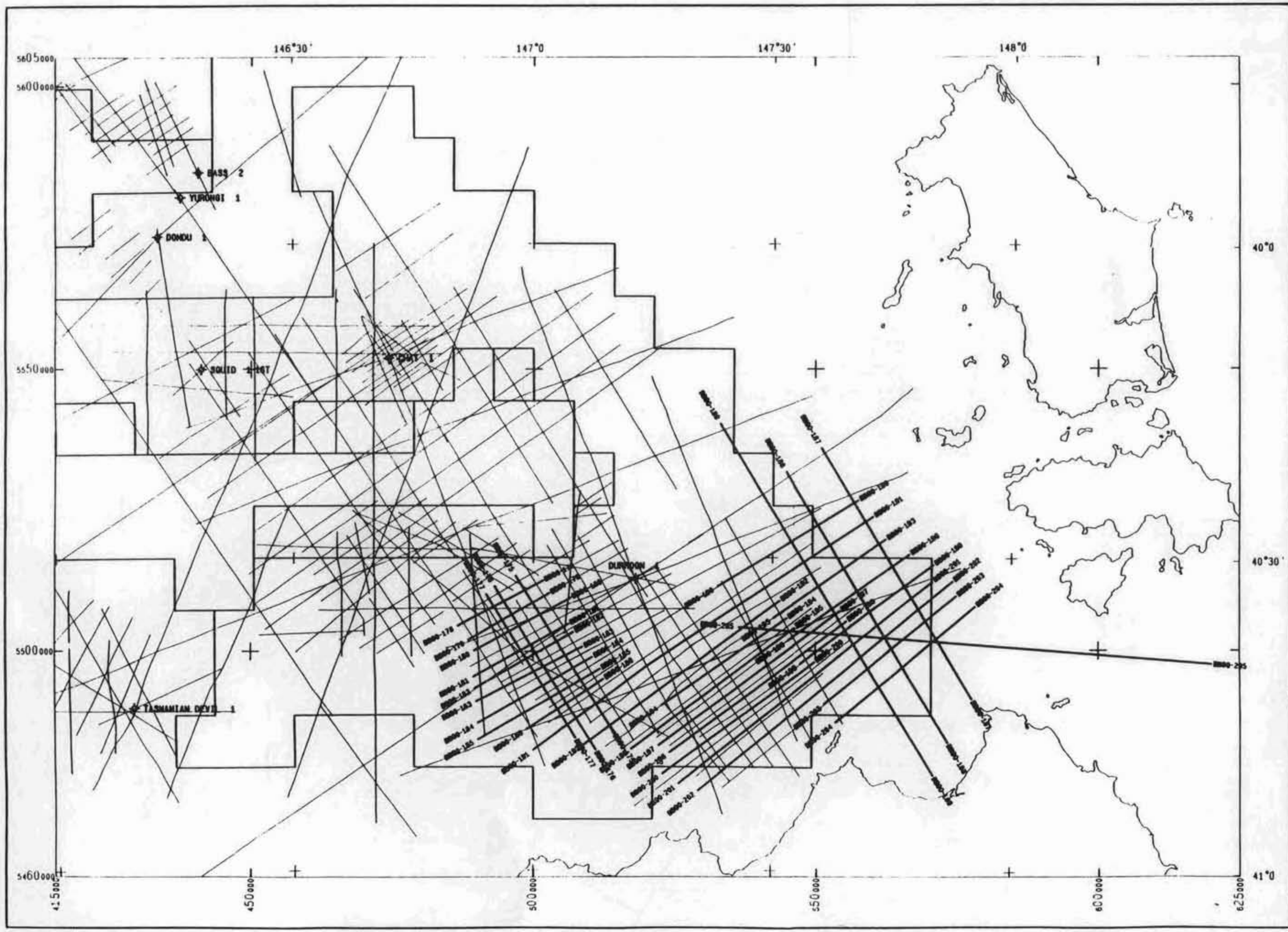
Vermeer G J O (1991). 'Symmetric sampling'. The Leading Edge (1991) **10**, #11, 21-27.

Table 1 Line Listing

line	easting	northing	fsp	easting	northing	lsp	km
BD91-206	544904.5	5523071	170	564639.4	5492877	1605	36.07
BD91-207	546333.9	5524105	128	553312.8	5513170	646	12.97
BD91-207	1552120.9	5514995	1023	566113.8	5492968	2064	26.10
BD91-208	566495.8	5494741	140	547006.1	5526101	1616	36.92
BD91-209	567760.9	5495772	129	549160.9	5526914	1584	36.27
BD91-210	1551430.9	5527966	249	570495.7	5496271	1719	36.99
BD91-211	543715.1	5515459	127	556144.4	5523686	720	14.91
BD91-212	543021.0	5510594	215	558154.8	5520726	943	18.21
BD91-213	542430.5	5508081	139	558708.3	5519223	928	19.73
BD91-214	559077.6	5515893	198	549881.1	5509457	649	11.22
BD91-215	563445.6	5516949	138	547110.9	5506114	906	19.60
BD91-216	552423.4	5505801	122	569327.2	5517562	942	20.59
BD91-217	553354.3	5503861	102	572202.1	5517591	1036	23.32
BD91-218	556701.0	5503602	202	572149.2	5515041	961	19.22
BD91-219	571346.9	5511376	101	556341.1	5499518	865	19.13
BD91-220	1558577.7	5497842	155	572526.1	5509499	879	18.18
BD91-221	570924.8	5504836	122	558554.5	5494592	762	16.06
BD91-222	562036.1	5492754	115	573577.7	5501921	708	14.74
							400.23

5 cm

258021



N

SCALE

1: 500000

KM 0 5 10 15 20 25 30 KM

Australian National Spheroid
U.T.M. Projection
Zone 55 C.M. 147 deg
Equatorial Origin 10,000,000 meters
Central Meridian Origin 500,000 meters
Central Meridian Scale Factor .9996

Location Map

Bridge Oil Limited

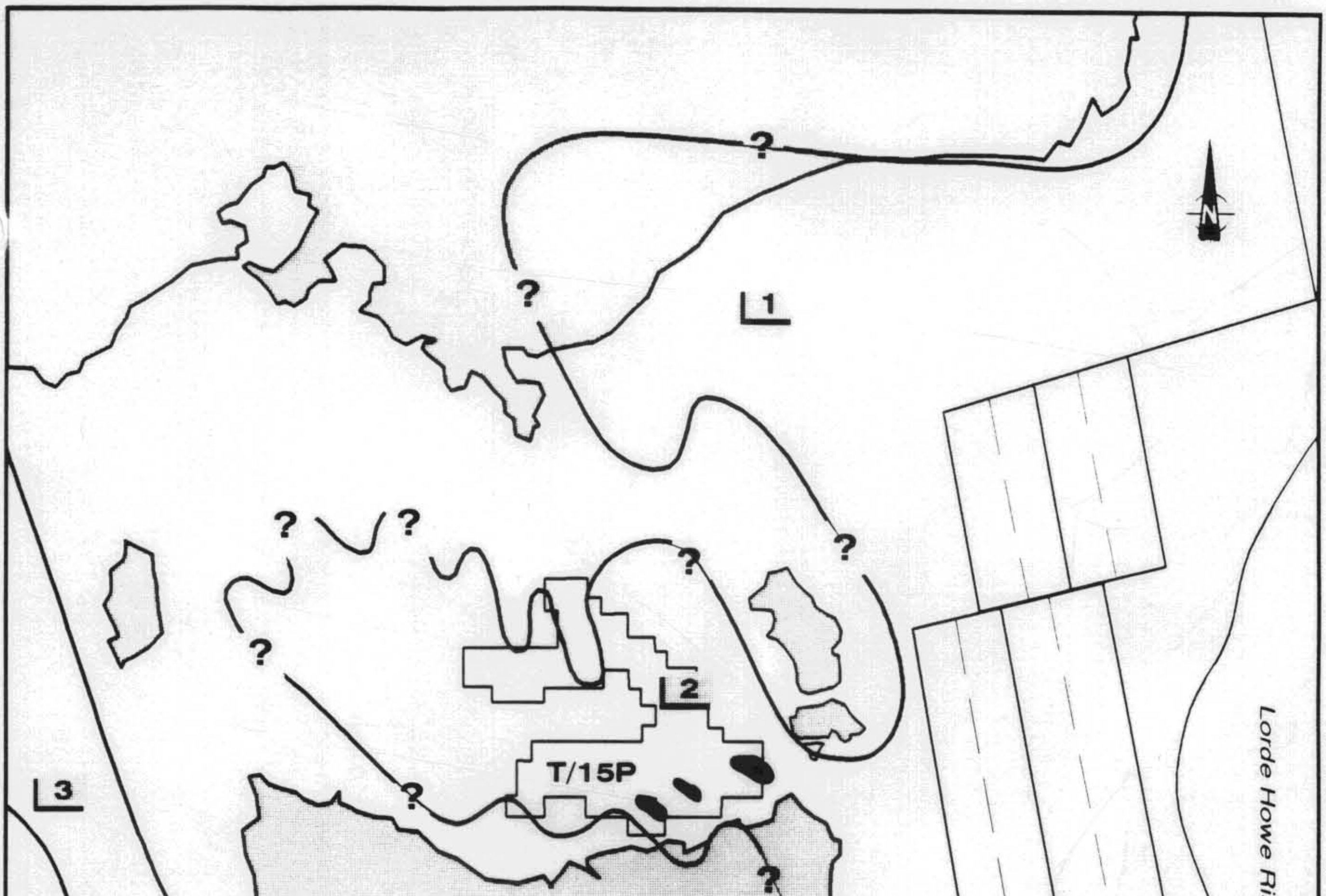
BASS BASIN
TASMANIA

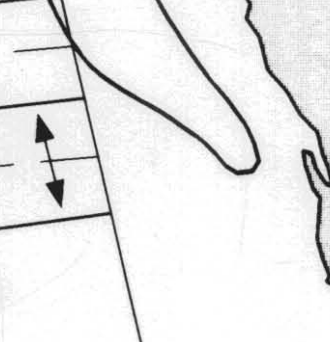
T/15P

BRIDGE BASS 1990
SEISMIC SURVEY

Author : RP	Date: 25-Sep-90
Drafted by: cjj	Revised:
File No.:	Fig.No.: 1

258022





LEGEND

DEPOSITIONAL LIMITS OF :

- 1 Golden Beach
- 2 Durroon
- 3 Part of Sherbrook

MEGASEQUENCES

- Prospects

BRIDGE OIL LIMITED

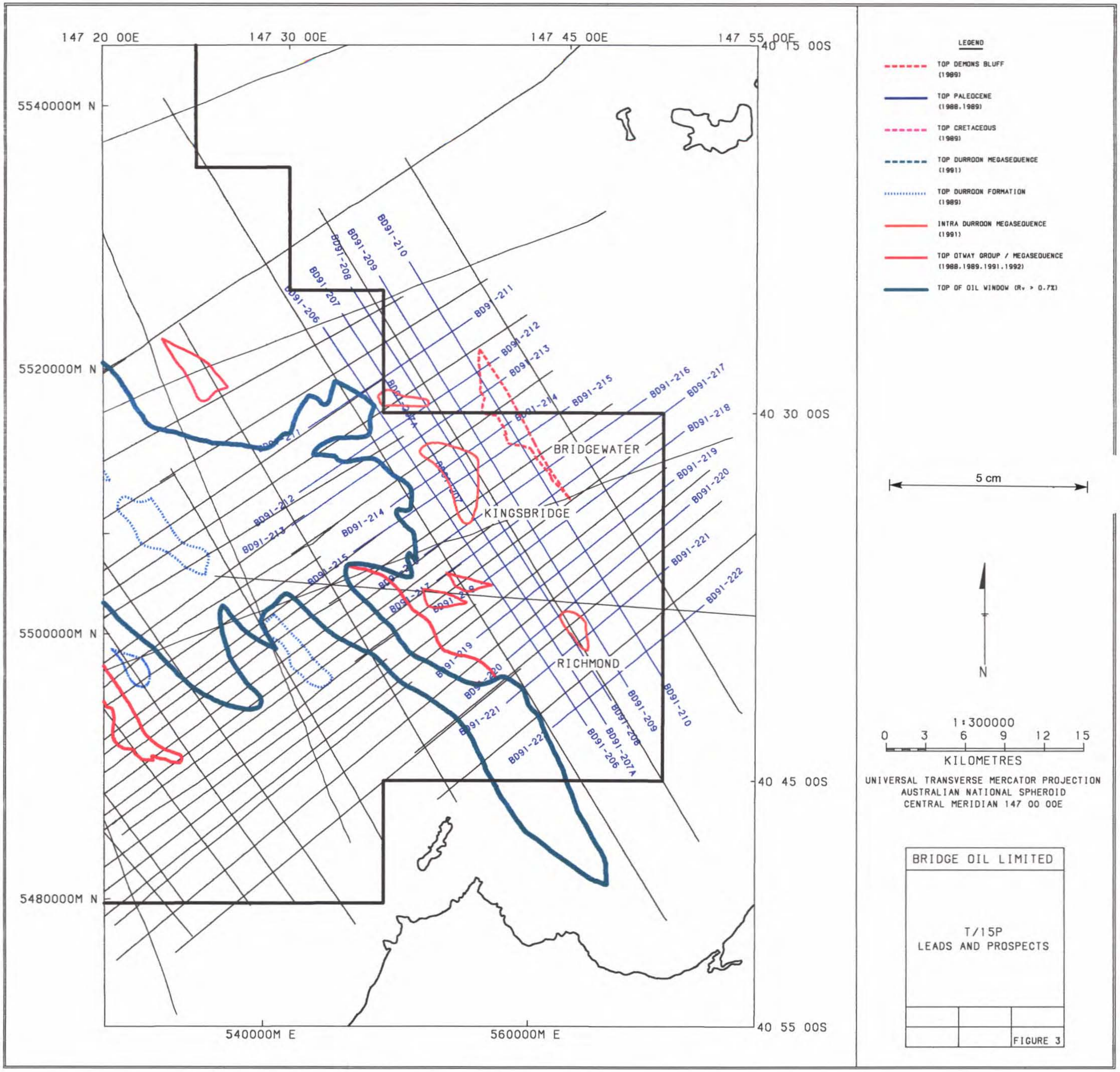
THE ENERGETIC AUSTRALIAN

TASMAN SEA
(circa 80 Ma)

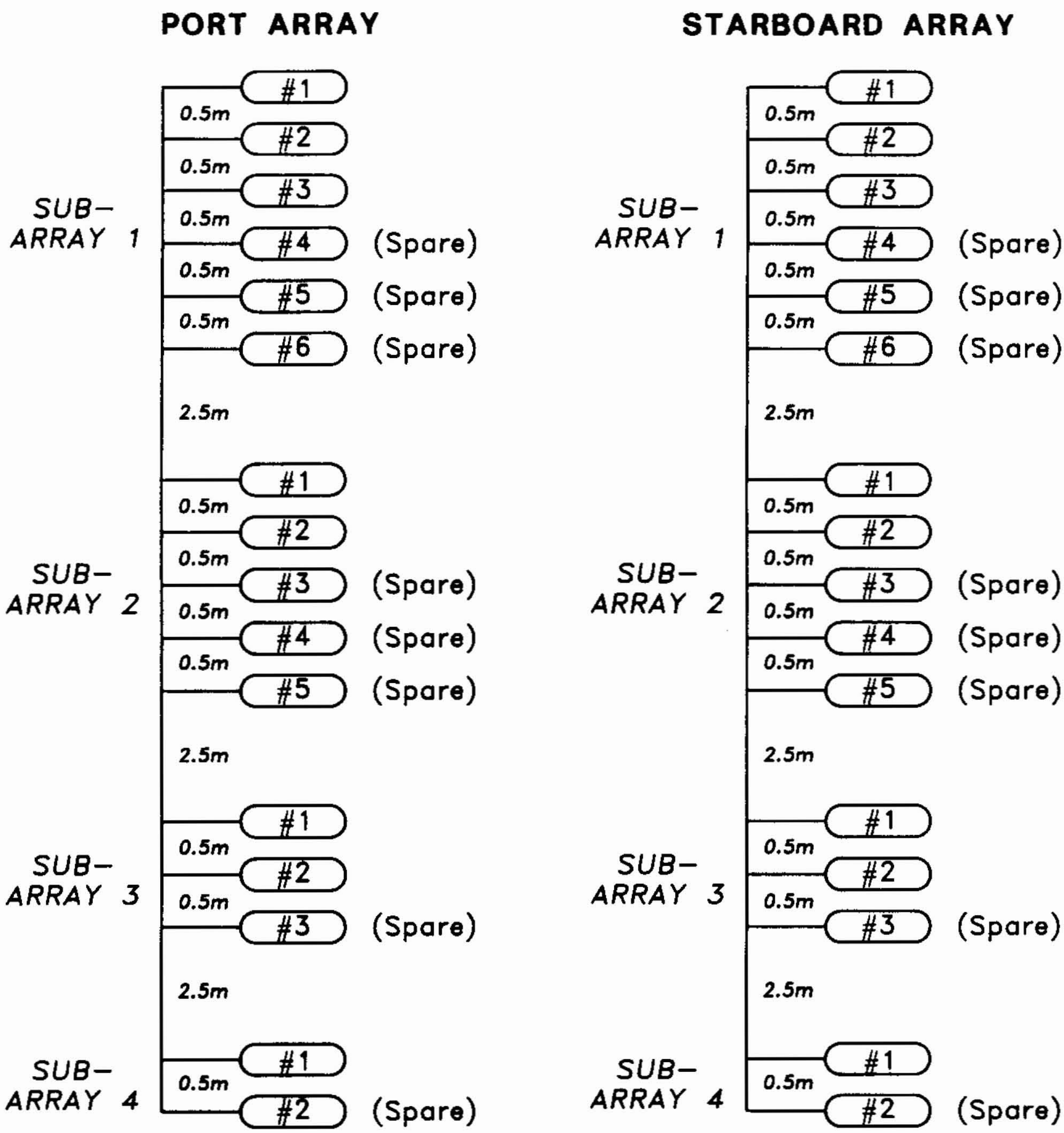
0 — 100 km

AUTHOR:	Bridge Oil	DATE:	August 1991
DRAWN BY:	C GRAPHICS	REF:	Figure 2

5 cm


147 20 00E
147 30 00E
147 45 00E
147 55 00E
40 15 00S
40 30 00S
40 45 00S
40 55 00S
5540000M N
5520000M N
5500000M N
5480000M N
540000M E
560000M E
BRIDGEWATER
KINGSBRIDGE
RICHMOND
BD91-206
BD91-207
BD91-207A
BD91-208
BD91-209
BD91-210
BD91-211
BD91-212
BD91-213
BD91-214
BD91-215
BD91-216
BD91-217
BD91-218
BD91-219
BD91-220
BD91-221
BD91-222
LEGEND
TOP DEMONS BLUFF (1989)
TOP PALEOCENE (1988, 1989)
TOP CRETACEOUS (1989)
TOP DURROON MEGASEQUENCE (1991)
TOP DURROON FORMATION (1989)
INTRA DURROON MEGASEQUENCE (1991)
TOP OTWAY GROUP / MEGASEQUENCE (1988, 1989, 1991, 1992)
TOP OF OIL WINDOW (Rv > 0.7%)
5 cm
N
1:300000
0 3 6 9 12 15
KILOMETRES
UNIVERSAL TRANSVERSE MERCATOR PROJECTION
AUSTRALIAN NATIONAL SPHEROID
CENTRAL MERIDIAN 147 00 00E
BRIDGE OIL LIMITED
T/15P
LEADS AND PROSPECTS
FIGURE 3

258024



Bridge Oil Limited

BRIDGE DURROON
1991 SEISMIC SURVEY

R/V RIG SEISMIC SOURCE
ARRAY SCHEMATIC

Author:R.P.	Date:SEPT.'91	Fig.No.: 4

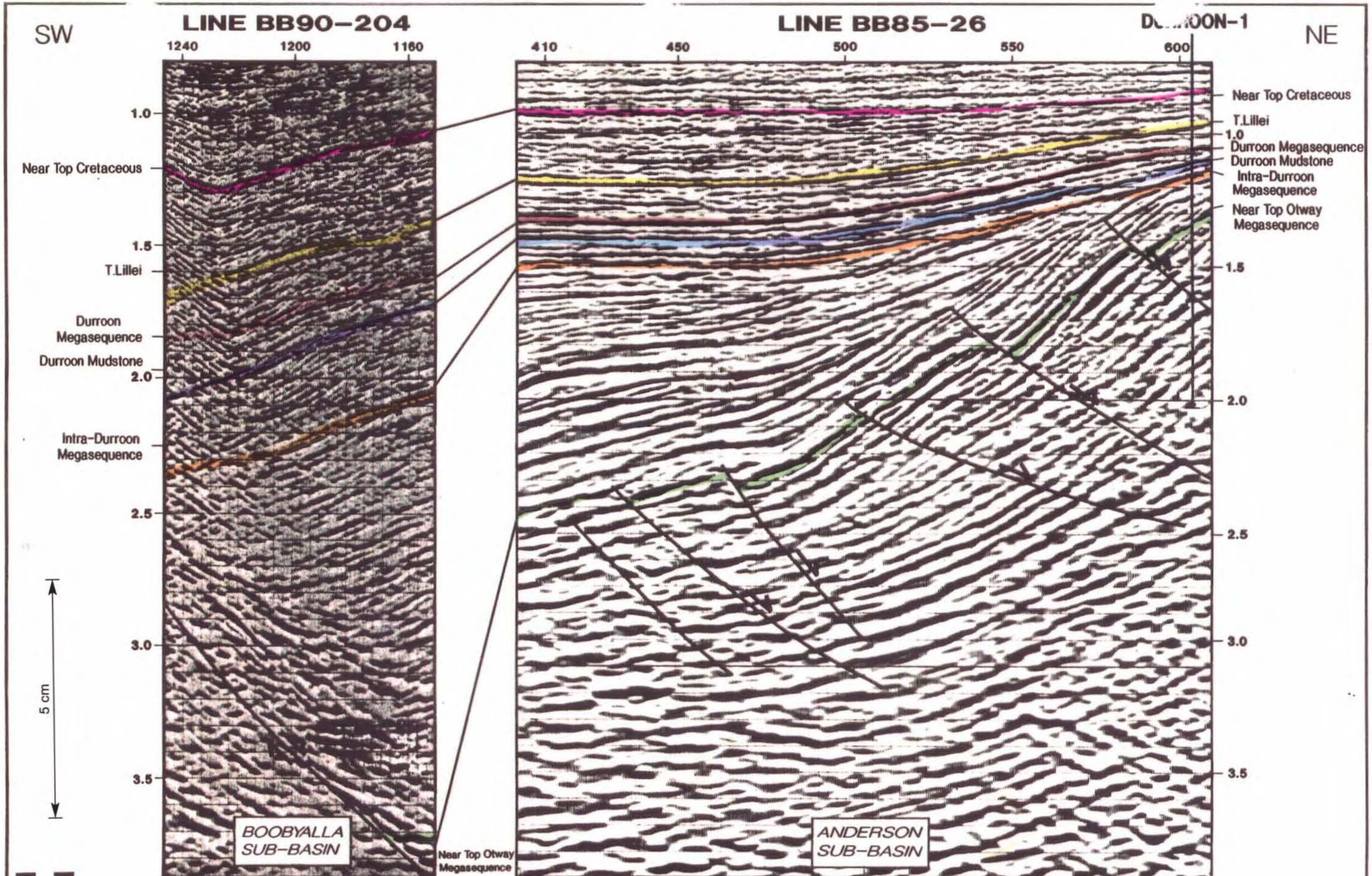
BRIDGE DURROON 1991 SEISMIC SURVEY

DATA PROCESSING SEQUENCE (as applied by Digital (Digicon) Exploration Ltd)

1. Transcription
2. True Amplitude Recovery
3. Shot Domain Velocity Filter
4. 2:1 Adjacent Trace Sum
5. Static Corrections
6. Wavelet Deconvolution
7. Predictive Deconvolution
8. Common Depth Point Gather
9. Velocity Analysis
10. Multiple Attenuation (ZMULT)
11. Dip Moveout Correction (DMO)
12. Velocity Analysis (post DMO)
13. NMO Correction
14. Pre Stack Mute
15. Common Depth Point Stack
16. Migration (Kirchoff)
17. Time Variant Filter
18. Time Variant Scaling
19. Display

Figure 5: Data Processing Sequence

258026



DURROON MEGASEQUENCE CORRELATIONS

FIGURE 6

258027

5 cm

T/15P
DURROON BASIN
BOOBYALLA SUB-BASIN
LINE BB90-189

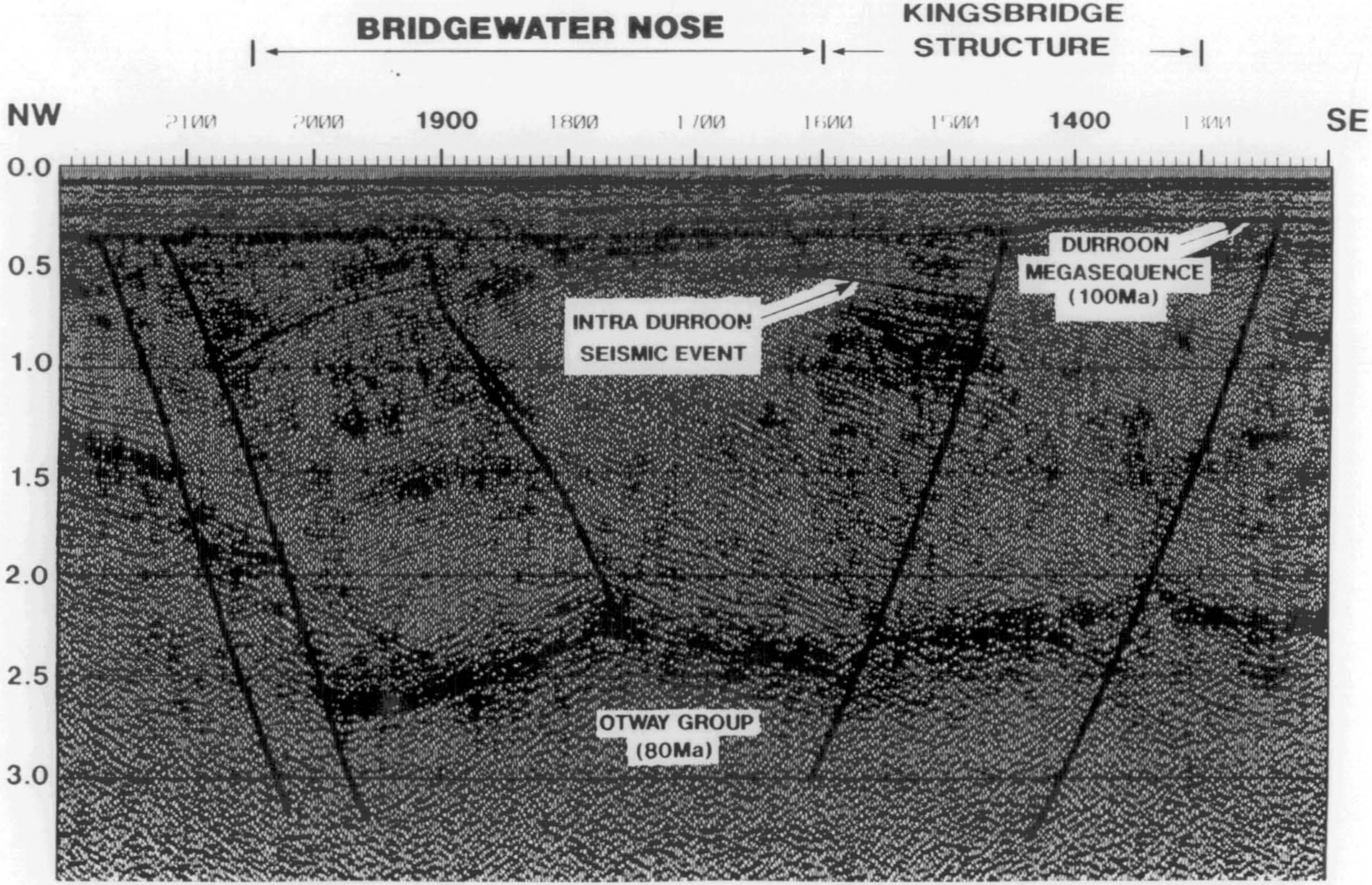


FIGURE 7

258028

T/15P

DURROON BASIN

BOOBYALLA SUB-BASIN

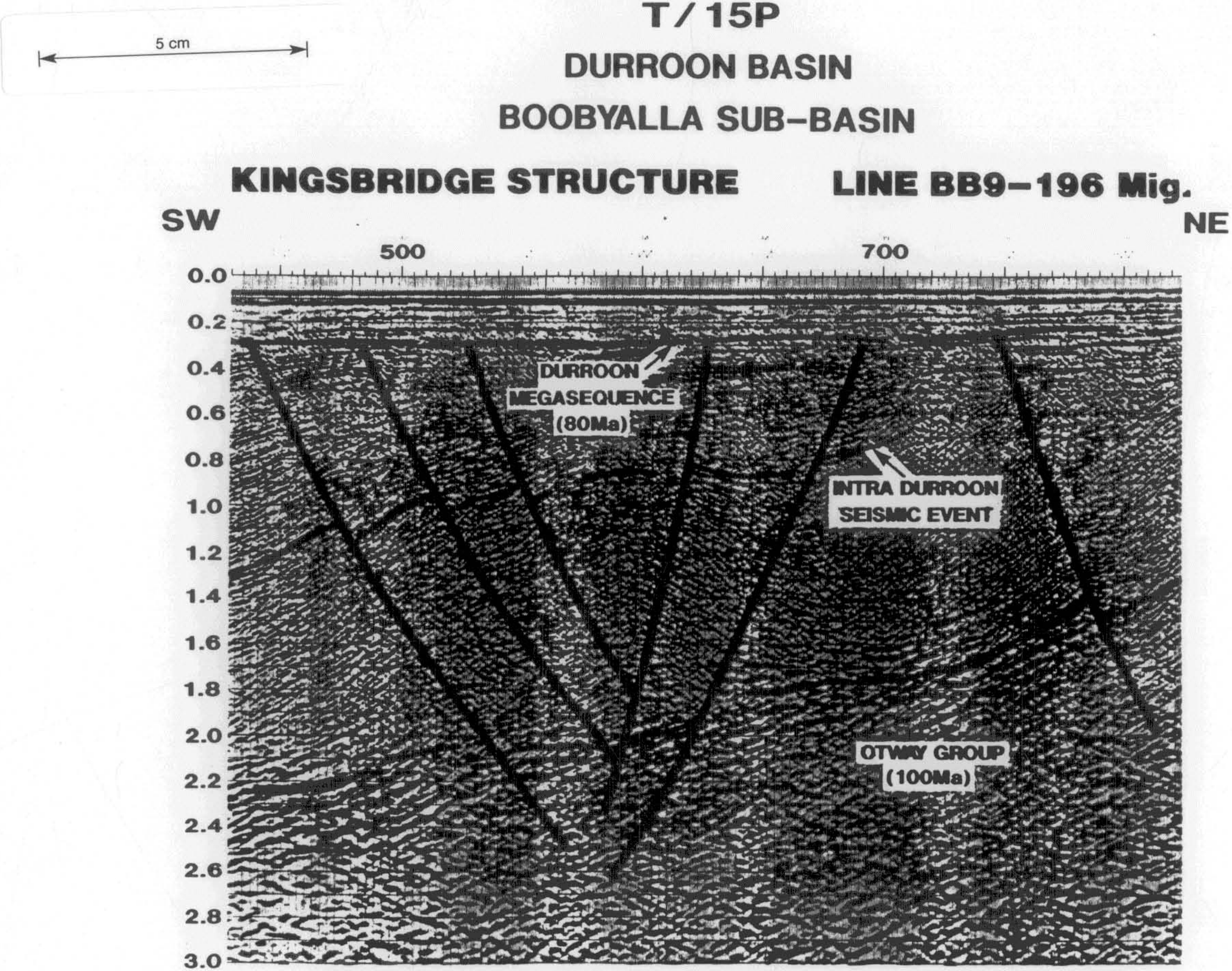


FIGURE 8

5 cm

T/15P
DURROON BASIN
BOOBYALLA SUB-BASIN
RICHMOND STRUCTURE LINE BB90-188

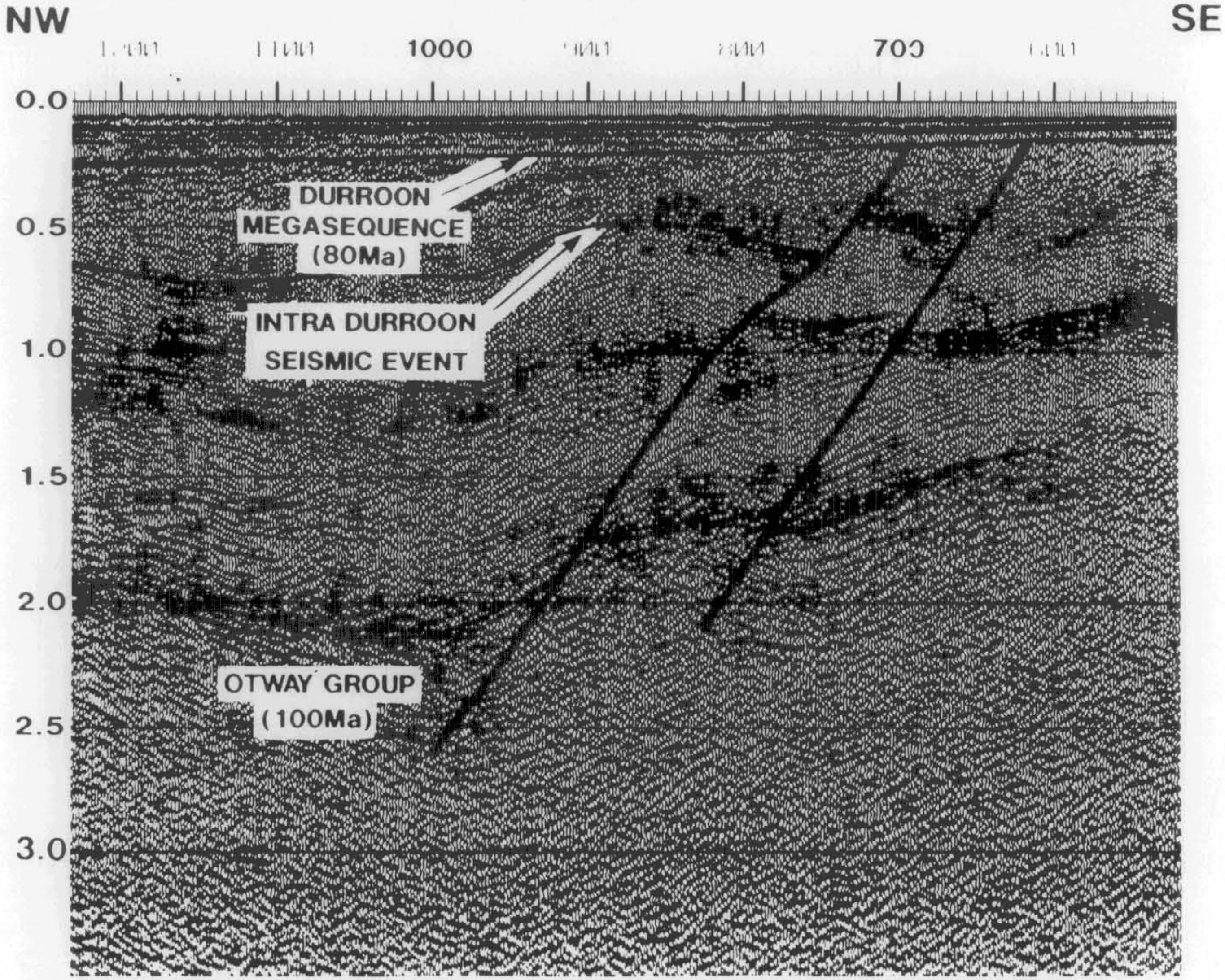
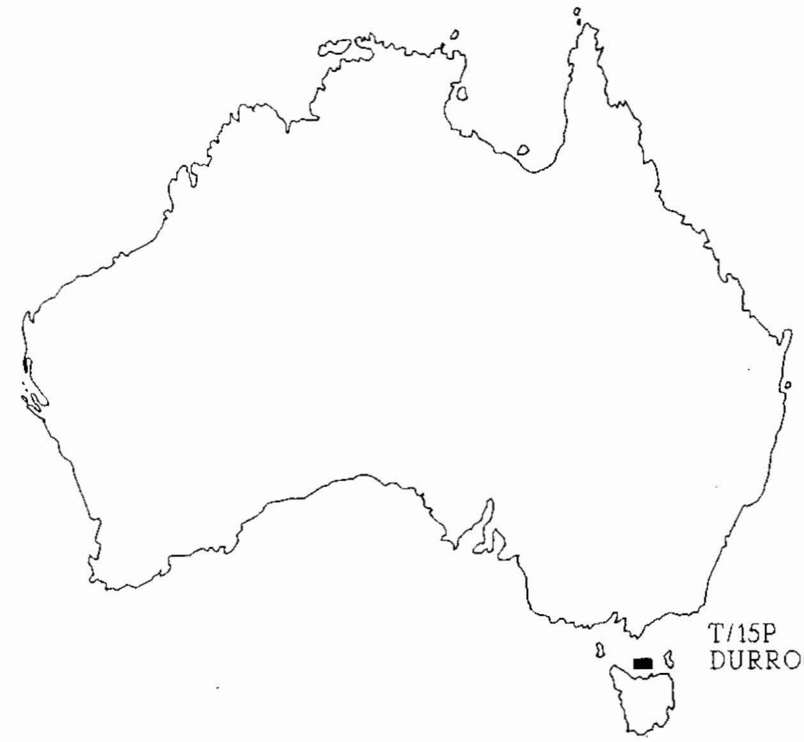


FIGURE 9

258030

AUSTRAL GEOPHYSICAL CONSULTANTS PTY. LTD.



Offshore Marine Survey T/15P DURROON BASIN

for

BRIDGE OIL Ltd.

TABLE OF CONTENTS

1 INTRODUCTION.

1.1 GENERAL

The T/15P DURROON BASIN Survey was conducted by Bridge Oil Pty. Ltd. between the 19th. September and 26th. September 1991. The survey was conducted in permit area T/15P in Bass Basin,offshore Tasmania.The BUREAU OF MINERAL RESOURCES (B.M.R.) was contracted to perform the survey using the BUREAU'S survey vessel R/V RIG SEISMIC.

The pre-plotted survey constituted a total of 354.1 full-fold kilometers,with line tapers adding a further 50.625 kilometers to the total.

Two Halliburton Geophysical Service gun arrays comprising sixteen guns per string divided into four sub arrays per string were deployed.It was proposed for this prospect to fire each sub-array with 3,2,2,and 1 gun groups to give a total volume of 2400 cubic inches.

The prime positioning system used was Differential G.P.S. utilizing the reference station situated in Adelaide

Bridge Oil contracted Austral Geophysical Consultants to provide onboard supervision of data acquisition and furnish a report on the survey.

1.2 SURVEY PARAMETERS

Number of Groups	:	192
Group Interval	:	12.50 Metres
Shotpoint Interval	:	25.00 Metres
Fold (Nominal)	:	48
Sample Rate	:	2 mSec
Record Length	:	5 Sec
Hi-Cut Filter	:	128 Hz/72 dB per Octave
Lo-Cut Filter	:	8 Hz/18 dB per Octave
Cable Depth	:	8 Metres (+/-1.5)
Cable Offset	:	250 Meters (+/- 30 Meters)
Energy Source Volume	:	2400 in^3
Energy Source Spread	:	2 x 12
Energy Source Depth	:	6 Metres (+/- 1.5 Meters)
Sound in Water Velocity (Fathometer)	:	1500 Metres/Second

1.3 STREAMER CONFIGURATION

SECTION	BIRD	COMPASS	WATER BREAK
Tow Leader			
Stretch #1			
Stretch #2			
Stretch #3			
Active #1	Bird #1		Water Break #1
Active #2			
Active #3		Compass #8	
Active #4			
Active #5	Bird #2		
Active #6			
Active #7			Water Break #2
Active #8			
Active #9	Bird #3		
Active #10			
Active #11			
Active #12			
Active #13	Bird #4		Water Break #3
Active #14			
Active #15		Compass #9	
Active #16			
Active #17	Bird #5		
Active #18			
Active #19			Water Break #4
Active #20			
Active #21	Bird #6		
Active #22			
Active #23		Compass #10	
Active #24			
Stretch #4	Bird #7		

With 12.5 m groups each section has 8 channels.
Pickup Coil for birds/compasses is in the front of each section.

1.4 SURVEY STATISTICS

CUMULATIVE SURVEY STATISTICS

ACTIVITY DESCRIPTION	HOURS	SURVEY %
RECORDING	43.518	19.20%
LINE CHANGE	47.931	21.15%
TRAVEL	37.283	16.45%
WEATHER DOWNTIME	4.583	2.02%
CREW CHANGE/RESUPPLY	32.167	14.19%
RECORDING INSTRUMENT FAILURE	3.600	1.59%
RADIOPOSITION SYSTEM FAILURE	7.433	3.28%
FEATHER ANGLE / CURRENTS	9.467	4.18%
STREAMER HANDLING	15.400	6.79%
ANCILLARY INSTRUMENT FAILURE	4.317	1.90%
STANDBY/OTHER	15.533	6.85%
SOURCE HANDLING	5.434	2.40%
TOTAL	226.666	

TOTAL CHARGEABLE KM	=	404.825
AVERAGE KM/DAY	=	42.864
TOTAL CHARGEABLE HRS	=	0.000
TOTAL WEATHER HOURS	=	4.583
TOTAL FIELD TAPES USED	=	194

2. SURVEY OPERATIONS

2.1 NARRATIVE DIARY

16 September 1991

The author departed Port Macquarie for Sydney and a 1630 hrs. meeting with Bob Pickering. Geophysical Advisor for BRIDGE OIL LIMITED. Conversion of line end coordinates from Australian elipsoid to WGS-84 was discussed.Contact was made with Haliburton Geophysical Singapore,they confirmed their ability to do the conversion. A fax of the conversion would then be sent to the R/V RIG SEISMIC while in transit to the survey area.

17 September 1991

0645 hrs. Author departed Sydney for Portland via Melbourne.On joining the R/V RIG SEISMIC at Portland the Author was introduced to the seismic crew and given a detailed tour of the vessel. A safety drill was held at 1300 hrs. comprising of abandon ship, man overboard ,launching of the carley float, a fire drill and instruction on the use of the foam deluge system. A safety meeting was convened later in the day. Sailing time was posted as 2000 hrs. this was put back to 0800 hrs on the 18th. September to allow work to be completed on the line amplifiers.

18 September 1991

R/V RIG SEISMIC departed portland at 0810 hrs. Weather was overcast and raining, wind was strong from the north east

19 September 1991

1000 hrs received the H.G.S. T15P- DURROON basin line end co-ordinate conversions. Streamer deployment commenced at 1445 hrs.

20 September 1991

Streamer fully deployed at 01:30 hrs. Cable testing and instrument evaluation tests were carried out. The guns were deployed by 04:56 hrs. At 05:17hrs. the DGPS nav system failed and was not fully operational till 12:43 hrs. By this time the weather had deteriated force 7 to 8. All shooting directions were tried with out success. The guns were retrieved to prevent damage to both the streamer and to the gunstrings.

21 September 1991

Weather had improved force 4 to 5 by 04:00 hrs, line BD91-218 was started 05:30 hrs. Half a kilometer of the line had been shot before the operator realized that the port gun string had not been activated. Both gun strings were firing from shotpoint 203. The weather conditions held for the rest of the day and three complete lines were shot. Line BD91-211 started 22:35 hrs.

22 September 1991

Completion of line BD91-211 at 00:11 hrs. Line BD91-210 was attempted from the north west but had to be abandoned in a rising sea, wind force 6 from the South West. Line BD91-213 was started from the North East in deteriating weather conditions. It was terminated after thirty two minutes.Wind from the West force 7. It was felt that weather conditions were slowly improving and it was advantageous to try BD91-213 from the South West.BD91-213A was terminated after sixty shotpoints when a tape change failed and too many shotpoints were lost.The vessel was turned back to BD91-213B and diagnostics run on the tape drive. BD91-213B was completed successfully. Transit to line BD91-216 was extended to overcome poor satellite coverage during the line.
Satellite information has come through that indicates vehicle # 20 has been switched on which will enhance coverage.

23 September 1991

Noise levels on line BD91-222 were higher than normal, shooting West to East, The weather conditions were improving and the decision was made to keep shooting. At the end of BD91-222 it was discovered that the starboard gun string had drifted over the lead-in, damaging both the gun string and the lead-in fairing. The vessel transited along line BD91-210 while repairs were carried out. Shooting started on line BD91-210, 8 kms from the North West end, the rest of this line is to be completed or completely reshot, time and weather permitting. 1610 hrs. shooting line BD91-207, centre of streamer down to 13 meters. Line terminated and vessel turned to port. There was no indication of any damage to the streamer. Streamer ballast will be checked while turning to pick up line BD91-207 again. Line to be called BD91-2071

24 September 1991

Weather still holding shot four lines. Reshot line BD91-210 in it's entirety, opportunity arose from line change being extended to facilitate gun repairs. Missed 22 shotpoints at beginning of line BD91-206 when amplifiers hung up in max gain.

25 September 1991

Line BD91-221 was aborted on the run-in strong currents put a 14 degree feather angle on the streamer. Turning to pick up the line gave an opportunity for a better nav window and tidal conditions. BD91-217 was completed without incident.
Feather angles created problems coming on to line BD91-220, it was terminated on the run-in. When this line was restarted it was with the quietest cable of the trip. At shotpoint #431 the aft 50% of the streamer started to sink, it proceeded to move in and out of spec. through to the end of the line. 90 shots from the end poor satellite configuration gave high horizontal diffs. With the prospect of good nav. and favourable sea conditions the decision was made to reshoot BD91-221.

26 September 1991

On completion of line BD91-2211 B.M.R. started source testing at 01:14 hrs. Tests were completed by 03:10 hrs. Streamer retrieval

began at 03:43 hrs. A large amount of seaweed was removed from cable leveller (bird) #4. Tailbuoy was onboard at 06:48 hrs. and the vessel started for Devonport.
The Devonport Pilot came aboard at 13:00hrs. R/V RIG SEISMIC was alongside starboard side to at 13:30hrs.
Navigation Technician Cameron Buchanan departed for Canberra at 13:45hrs. to commence processing the navigation data.
ANSETT AIR FREIGHT had been contracted to pick up and deliver the Seismic data tapes (20 boxes) plus the relevant paper work (3 boxes) to Mr.S. Khan DIGITAL EXPLORATION LTD. Brisbane Qld. The shipment was picked up from vessel at 14:00hrs. The Author departed for Sydney via Melbourne at 15:00hrs.

27 September 1991

10:00hrs. meeting with Bob Pickering of BRIDGE OIL to give an appraisal of the survey.

2.2 CONCLUSIONS AND RECOMMENDATIONS

This was the first commercial survey undertaken by the R\V RIG SEISMIC and her crew.It was carried out with a professional attitude, both the seismic crew and marine crew showing an indepth knowledge of the equipment.

One criticism is the lack of production mindfulness. Coupled with directions from Canberra on how turns would be carried out, made line changes take upto two hours longer than necessary. Equipment maintenance was undertaken at a fairly relaxed pace. Considering the prospect area and its reputation for bad weather, time constraints due to the RIG SEISMIC'S work commitments and periods of poor navigation a more production orientated attitude would have saved approximately 24 hours. If this vessel is to be truly capable of commercial work a more industry standard operating system would be an advantage. The current version of software had not been used by this crew proir to the survey. It was not possible for navigation to start the recording system at a predetermined lat. and long. nor stop the system at the end of the line. System start and stop was carried out manually watching the DPGS monitor.

There is no provision for calculating offset other than physical measurement.

An amazing array of printouts were available giving individual trace records in clear detail but nothing that showed the whole streamer clearly.

An oscilascope connected immediately after the demultiplex's would I believe give a real time view of the streamer this would also facilitate streamer monitoring.

Shotpoints are logged by time,with the nav print out giving lat and long every sixty seconds thus it is necessary to interpolate to pin point a shot point that does not fall on the minute.

As far as I'm aware the ability to run pre-plots does not exist.

A Q.C. log kept by the shift supervisor should be instigated along with more comprehensive line logs kept by the operators. It was only thru the excellent logs kept by the Bridge Officers that feather angles, wind direction and sea state were known for some lines. This information had not been logged by the operator. On a positive note the logs and information generated by the system was comprehensive and detailed.

The RACAL SKYFIX, DGPS navigation system gave consistant high accuracy but probably would have been more reliable if the Sydney ground station had been operational. This would have put the ground station and vessel on or close to the same longitude, satellites would then be seen by the vessel and ground station at similar times.

Times of poor coverage were predicted using an on board program. This permited line changes and maintainance to be planed around these periods.

3 MISCELLANEOUS

3.1 WEATHER

BEAUFORT WIND SCALE (For an effective height of 10 meters above sea level)

No	DESCRIPTION	MEAN WIND SPEED KNOTS	MEAN WIND SPEED M/SEC	DEEP SEA CRITERION	PROBABLE MEAN WAVE HT. (M.)
0	Calm	<1	0-0.2	Sea like a mirror	-
1	Light-air	1-3	0.3-1.5	Ripples with appearance of scales are formed, but without foam crests	0.1
2	Light breeze	4-6	1.6-3.3	Small wavelets, still short but more pronounced, crests have a glassy appearance but do not break	0.2
3	Gentle breeze	7-10	3.4-5.4	Large wavelets, crests begin to break, foam of glassy appearance perhaps scattered white horses.	0.6
4	Moderate breeze	11-16	5.5-7.9	Small waves becoming longer, fairly frequent white horses	1
5	Fresh breeze	17-21	8.0-10.7	Moderate waves, taking a more pronounced long form, many white horses are formed (chance of spray)	2
6	Strong breeze	22-27	10.8-13.8	Large waves beginning to form, white foam crests more extensive everywhere (probably some spray)	3
7	Near gale	28-33	13.9-17.1	Sea heaps up and white foam from breaking waves begins to be blown in streaks along direction of wind	4
8	Gale	34-40	17.2-20.7	Moderately high waves of greater length, edges of crests begin to break into spindrift,foam is blown in well marked streaks along direction of the wind	5.5
9	Strong gale	41-47	20.8-24.4	High waves, dense streaks of foam along the direction of wind, crests of spray begin to topple, tumble and roll over, spray may effect visibility	7
10	Storm	48-55	24.5-28.4	Very high waves with long overhanging crests, resulting foam in great patches, is blown in dense white streaks along direction of wind, surface of sea takes a white appearance,tumbling of sea becomes heavy and shock like.	9
11	Violent storm	56-63	28.5-32.6	Exceptionally high waves (small and medium sized ships might be lost to view behind the waves) sea completely covered with long white patches of foam lying along direction of wind everywhere the edges of the wave crests are blown into froth, visibility affected	11.5
12	Hurricane	>63	>32.7	The air is filled with foam and spray, sea completely white with driven spray, visibility very seriously affected	14

CODES TO SEA, SWELL AND VISIBILITY STATES

STATE	SEA	SWELL	HEIGHT (metres)	VISIBILITY (nm)
0	Glassy	No swell	<1	<0.03
1	Rippled	Very slight	<1	0.03
2	Wavelets	Slight	<1	0.1
3	Slight	Low	<1	0.3
4	Moderate	Moderate	1-4	0.5
5	Rough	Fairly heavy	1-4	1.1
6	Very Rough	Heavy	1-4	2.2
7	High	Very heavy	>4	5.4
8	Very High	Phenomenal	>4	11
9	Phenomenal		>4	>27

Weather forecasting was received via the MELBOURNE coastal radio station. In addition, a synoptic map was available at six hourly intervals on the weather facsimile receiver/recorder. This information was supplied by the Melbourne Bureau of Meteorology and transmitted from Canberra and on a standard set of radiofax frequencies. Table 1 above, may assist in the interpretation of wind and sea conditions which are given in Beaufort Scale values in the tables that follow as well as on the Q.A. Line Logs.

The following weather observations were logged in the ship's daily log by the Master or Mates on watch at the time at approximate four hourly intervals. Details are provided from the first recording day, 21st September 1991.

DATE	TIME CST.	WIND DIRN.	WIND FORCE
21/9	0400	WNW	16 Knts
	0800	WNW	15
	1200	WSW	23
	1600	W	21
	2000	WSW	12
	2400	SSW	18
22/9	0400	SSW	28
	0800	W	28
	1200	W	25
	1600	W	25
	2000	WNW	18
	2400	NNW	12
23/9	0400	NNW	10
	0800	WNW	15
	1200	NNW	15
	1600	W	12 Knts
	2000	W	12
	2400	W	18
24/9	0400	WSW	12
	0800	WSW	15
	1200	W	25
	1600	NNW	20
	2000	NNW	20
	2400	W	16
25/9	0400	NNW	18
	0800	W	15
	1200	NNW	18
	1600	NNW	25
	2000	W	25
	2400	W	22
26/9	0400	W	18

4 PERSONNEL

258045

4.1 PERSONNEL LISTS

4.1.1 SEISMIC CREW

17 September 1991

Cruise Leader	Garry Bickford	
Dep. Cruise Leader	Keith Lockwood	
Observers	Lachlan Hatch Tiernan McNamara	Jim Bedford
Navigators	Jim Reid Chris Lawson	Cameron Buchanan
Technicians	Lindsay Miller	Claude Saroch
Systems Engineers	Heather Miller	Noori Alavi
Compressor Mechanics	David Sewter Simon Milnes	John Roberts Ross Bodger
Geology Technicians	Femji Stradwick Jeremy Bishop	Martin Callaway Greg Sparksman
Client representative	Drew D. Murray	

4.1.2 MARINE CREW

17 September 1991

Master	Bob Hardinge	
Chief Mate	Lindsay Gillies	
Second Mate	Mike Gusterson	
Chief Engineer	John Scott	
Second Engineer	Tom Ireland	
Electrician	Wayne Hanson	
E.A./Seaman	Don Brown	
A.B. Seamen	Lucky Luscombe John Fraser	Mike Pitcher
Cook	Wasa Leary	
Chief Steward/Cook	Henk Dekker	
Second Steward	Steve Staveley	
Steward/Seaman	Steve O'rourke	

4.2 PERSONNEL DISCUSSION

All personnel showed a professional approach to their work and assisted the author wherever requested. A genuine interest in data quality was also displayed. Lack of commercial seismic experiance meant that not all deficiencies in standards were brought to the author's attention. About half of the seismic crew were quite new to the industry but this fact did not appear to create any problems with the running of equipment and execution of routine procedures.

The Cruise Leaders made sound operational and logistic decisions. They were also fairly compliant with any requests made and kept data quality in mind when making operational judgements.

The marine crew, were well suited to their appropriate tasks. The Master and Mates with the exception of Mike Gusterson had little experience in commercial seismic data collection. On-line steering was excellent with good repour between Instrument room and Bridge

The catering staff supplied good quality meals and the stewards kept the amenities clean and tidy. Able Seamen assisted willingly and efficiently and maintained deck areas in a clean and safe state.

5. VESSEL

5.1 VESSEL SPECIFICATIONS

The R/V RIG SEISMIC is a seismic research vessel with dynamic positioning capability,charted and equipped by BMR to carry out the the Continental Margins Program. The ship was built in Norway in 1982 and arrived in Australia to be fitted out for geoscientific research in October 1984. It is registered in Newcastle, New South Wales, and is operated for BMR by the Australian Maritime Safety Authority.

Gross Registered Tonnage:		1545 tonnes
Length Overall:		72.5 meters
Breadth:		13.8 meters
Draft:		6.0 meters
Engines: Main:	Norma KVMB-12	2640 H.P./825 rpm.
Aux:	3 x Caterpillar	564 H.P./482 KVA
	1 x Mercedes	75 H.P./56 KVA
Shaft generator:		AVK 1000 KVA;440 V/60 Hz
Side Thrusters:		2 forward, 1 aft.each 600 H.P.
Helicopter deck:		20 meters diameter
Accommodation:		39 single cabins and hospital

5.1.1 VESSEL DISCUSSION

The vessel has been in service with the BMR since 1984 and from the short period of time the author spent on her it was seen that the marine crew and seismic crew took the upkeep and safety of the vessel seriously.

Accommodation was spacious and clean as was the whole vessel, the attitude and obvious pride the personnel took in the ship along with the banning of work boots in the lounge, instrument room and accommodation went a long way to keeping the vessel in such good condition.

It was of interest that the RIG SEISMIC is a wet vessel, that is she has a bar on board, in contrast to supposedly dry boats were illicit drinking can be a problem. A drink after shift was as far as it went with no drunkenness displayed by any of the crew while on shift.

6 SEISMIC INSTRUMENTS

6.1 ARRAY DATA PROCESSOR AND RECORDING

Digital seismic acquisition system designed and built by BMR

	:	Max 320 data channels 16 bit floating point SEG-Y output at 6250 bpi
Recording Sample Rates	:	1,2 or 4 mSec
Antialias Filters	:	1 mSec, 3dB @ 256Hz 72 dB/oct
		2 mSec, 3dB @ 128Hz 72 dB/oct
		4 mSec, 3dB @ 64Hz 72 dB/oct
No. of Array Output Channels	:	288 max. - 1 min.
Recording sample interval:		1,2 and 4 millisecond

6.2 THE COMPUTER

The Seismic Data Acquisition system computer uses a MicroVAX CPU with a range of peripheral equipment.The operater controles the seismic acquisition system using a program package called MUSIC.

The Computer performs five essential functions:

- Reads the Seismic Data from the A/D converter
- Demultiplexes the data
- Writes the data out to magnetic tape
- Provides Data quality monitoring information
- Enables the observer to controle the system

The components of the computer system are:

1. The CPU
   Presently this is a MicroVAX, and runs an operating system called VMS. It is licensed for two concurrent users, one of whom is the seismic observer. The Systems engineer may also use the system concurrently.

2. A Clock.
   The internal clock is used for timing the critical components of the system. It is constantly compared to an external standard clock. This gives a measure of its reliability.

3. High Speed Input.
   This is a buffered interface which reads seismic data from the Analogue to Digital Converter. Seismic data volumes are very high and this card is built for very fast transfer.

4. Terminals.
   Normally, these are the VT220 type. They are used for interactive communication and display of information about the data aquisition system as data is being recorded.

They have identifiers in the form TXA0 ect. These identify the terminal port to the operating system. Terminals which form essential parts of the MUSIC system include.

- The Observer's Console
- The RMS Display
- The Gun Display
- The Time Break Display

There is a KAGA monitor display for presenting cable data.
A Televidio is used to display a log of recent information.

5. PRINTERS

These are used for plotting seismic data as it is being recorded, for logging the gun system, the shot records and the system interaction. plot output includes.

- Cycling Monitor
- Slow Monitor
- Fast Monitor
- Optional Monitor

6 MAGNETIC TAPES.

These save the data for later processing. Data are presently recorded on 9 track half inch tape at 6250 bpi.

6.3 THE SEISMIC CABLE.

The seismic cable is made by FJORD Instruments, a subsidiary of GECO in Norway.It is a 300 channel analogue cable comprised of 100 meter sections. Each section can be configured by means of a "Program Plug" to comprise any multiple of 6.25 meters as an individual group length. Obviously as the group length increases the number of groups per section decreases.

6.3.1 CABLE DEPTH CONTROLLERS.

The cable depth is controlled by the depth controllers, commonly called birds. They are SYNTRON RCL-3 models and have intergrated depth monitors. Each is programmed with an identifying number before it is attached to the cable, this number is used to controle and interrogate the bird during use. The birds, on request from the controller, send their current depth and wing angles back to the controller.This information is connected to the computer and printed out on the shot log.

6.4 THE AMPLIFIER/FILTER/CONVERTER

The signal coming from the seismic cable is an analoge signal, that is a continuously varying voltage. It goes through three steps before it gets to the computer - it is amplified, filtered, and then converted to a number or digitised. Physically the amplifiers and filters are closely connected, being mounted on boards each containing two amplifier/filter channels. All parameter settings and controle of the amplifier/filter system is computer controlled. There is a controle panel for manual controle, whih is used for trouble shooting.

6,4.1 AMPLIFIER.

The Amplifier boosts the signal to a level were it matches the characteristics of the converter. The gain used is set by the operator.
Gains are supplied as numbers which define the gain the amplifier applies to the signal. The range is from 2 - 256. Typical recording gains are in the order of 8 - 16. Higher settings are used in system testing and analysis.

6.4.2 FILTERS.

The filters remove unwanted frequencies from the amplified data. There are low cut and high cut filters. High cut filters are used as anti-alias filters, and are determined by the sample period.

Sample Period	High Cut Filter
1 millisecond	256 Hz
2 millisecond	128 Hz
4 millisecond	64 Hz

Low cut filters remove low frequency data under the assumption that it is more noise than useful signal. Options for this system listed below.

Out
4 Hz.
8 Hz.
12 Hz.

6.4.3 ANALOGUE TO DIGITAL CONVERTER

The converter converts the seismic signal from a voltage to a number and sends the number to the to the computer. The digitising is done at a rate of 4 microseconds/sample. This presents one limitation of system performance. For example, at 1 millisecond sampling, it is difficult to record more than about 200 channels without having timing problems.

The data is converted using an instantaneouse Floating Point (IFP) converter. This means that the converter applies a variable gain to each sample. Data is then recorded in a floating point format, which comprises a gain and a mantissa. It is important to be aware that the data is presented in a 16 bit floating format. This has a significant impact on display of data during recording, particularly on the multiplexed CRO display. The 16 bit format was designed so that it could be treated as a integer. This effects the way data is displayed. Effectively, most displays show a logarithmic amplitude scale.

6.4.4 DATA QUALITY MONITORING

The tools available for data quality monitoring are:

Multiplexed Channel Display.

This display is taken from the a/d converter output through a digital to analogue converter and displayed on the CRO. It represents the output of each channel across the screen, effectively, it is like looking down all channels simultaneously. This display is the most rapid guide to cable problems.

RMS Display.

This shows the RMS values of traces in a number of selectable presentations. The MUSIC programs have the ability to perform RMS and average calculations on every trace. The results of these can be shown as a histogram display or as a numerical display showing the data in millivolts. These displays are a general guide to the behaviour of channels.

Cycling Monitor.

This display shows a single channel from each shot, the channel being incremented each shot. It is a good diagnostic tool for dead, noisy and reversed traces.

Fast and Slow Monitors

These display a selected channel (usually 1 or 2) from each shot. The fast monitor shows a more expanded version of the data than the slow monitor.

6.5 SYSTEM TESTING AND EQUIPMENT CALIBRATION.

The tests below are carried out on a weekly basis. In addition some are recorded at the start and end of each line.

A hard copy of the data channels RMS values can be obtained using the program RMSPLOT.
The program produces a one page print showing RMS values for each channel plotted in millivolts and plotted in microbars. The millivolt print should should be equivalent to the numbers which appear on the RMS display. The microbars histogram plot shows equivalent microbars at the input to the amplifiers, with gain removed and the appropriate conversion applied. The microbar plot should enable comparison with specification standards.
The program is fully automated and requires no input from the user.

6.5.1 OSCILLATOR TESTS

The oscillator Test does the following:

1. Turns on the internal oscillator. The frequency is half the anti-alias frequency. i.e. for 2 millisecond sampling, the frequency is 64Hz.

2. Sets the gain to maximum (256)

3. Sets the RMS display to millivolts

4. The High Cut and Low Cut filters are as recorded.

6.5.2 NOISE TESTS

When the system is in Noise Test mode the following occures.

. Gain is set to max.(256)
. Shot Trigger is disabled
. Filters are as for recording
. RMS display is set to show millivolts.
. The input to the amplifiers is connected to the seismic cable

Results of the noise tests will show RMS signal levels and D.C. bias. RMS levels should be in the region of 200 - 250 Microvolts. D.C. Bias should be less than 1 millivolt, which is less than 10 % of the max resolution of the system.

6.5.3 AMPLIFIER TEST.

The amplifier test sets the input to the amplifiers to open circuit. The following conditions are set up in an AMP test:

. The gain is set to the lowest value (2).
. The RMS display is set to microvolts
. The Amplifiers are put into amplifier test mode.

Optimum RMS noise levels should be around 250 microvolts.

6.5.4 LEAKAGE TEST.

This test is of uncertain value in a charged coupled device. It may indicate incipient leaking inputs.

6.5.5 LOW CUT FILTER TEST.
This test tests the performance of the low cut filter. It sets the oscillator on the knee of the Low Cut Filter,e.g. an 8Hz filter sets an 8 Hz. oscillator. The output signal should be 6dB down, about 500 mV, from the normal oscillator test response. The display is set to millivolts. Running the cycling monitor through all channels will show phase distortions.

6.5.6 HIGH CUT FILTER TEST.
The oscillator is set to the knee point of the high cut filter. Output should be 70% of full scale (approx 700 mV).

6.6 GUNS AND GUN CONTROLLER SYSTEM.

There are two types of guns in use- airguns and water guns. Airguns are used for conventional and deep crustal shooting and can be deployed as one or two arrays. Water guns are used for high resolution studies and are deployed as a single array.

6.6.1 GUN CONTROLLER

The control of the guns is the same in principle for both types of guns. they are contolled by a BMR designed system called PUSSY (The reason for the name is a source of never ending speculation)
Compressed air is forced into the gun through the air line. On command from the computer, the gun is fired by a pulse through the Fire Line,called the trigger pulse. When the gun fires, a sensor within the gun detects the movement of the shuttle, this signl, called the shuttle pulse, is detected in the gun controller and is timed to a tenth of a millisecond.
Being a physical device, there is always a delay between the firing command and the actual firing. This will vary between guns and will change over time as temperature changes,components wear and contaminants
enter the system.
The gun controller measures the actual firing time of each gun from the shuttle pulse, and sends it to the computer. The computer saves the ten most recent values. It averages these and uses the shot average to compute the firing delay to apply to each gun. Thus, by applying different actual firing times to each gun based on its own average performance, it should be possible to tune the whole array to fire all guns simultaneously.
There are four gun controle parameters that the operator can observe via the gun controller that helps in the perfomance evaluation of individual guns.

1. Target Delay

to ensure that all guns do fire at the same time, a specific delay called the Target Delay, is built into the gun controle system. The time at which the computer initiates firing a shot is Time Zero. The Target Delay is the time after Time Zero which the guns are to be fired. It is 60 milliseconds for airguns and 30 milliseconds for waterguns. For an airgun array source, the intention is to fire the airguns 60 msecs after the computer initiates the shot. This delay is removed in processing.

2. Trigger Delay

Each gun takes a finite but variable amount of time between receiving a fire command and actually firing the gun. This is typically about 12 milliseconds for an airgun. Therfore, to ensure that the gun fires at the Target Delay time,the firesignal for an individual gun must be sent earlier. The delay applied is the Trigger Delay.
Trigger delay plus the intrinsic delay of the gun should equal the Target Delay. The Trigger Delay will be varied from shot to shot for each gun according to the change in the ten shot average of the measured shot firing times for that gun.

3. Firing Error

Given the physial limitations of individual guns, there will be some fluctuation in actual firing time from shot to shot, even in a gun that is performing well. This is the error between the Target Delay and the actual measured fire time. If the gun is performing well the error will be contained within a reasonable threshhold. If it is failing the error will beome large and variable. The size of the acceptable threshold will be determined by the survey specifications.

4. Target Window

The gun controller looks for the shuttle pulse within a preset time window. This is the Target Window, it is 90 milliseconds from Time Zero.

7 ENERGY SOURCE

7.1 ENERGY SOURCE DETAILS

Total Array Volume: 4800 cu. in

Sub-Array Volume (operating)
: 1 x 1200 in3
: 1 x 1200 in3

Array Length: 14.0 Metres

Sub-Array Spread: 12.0m

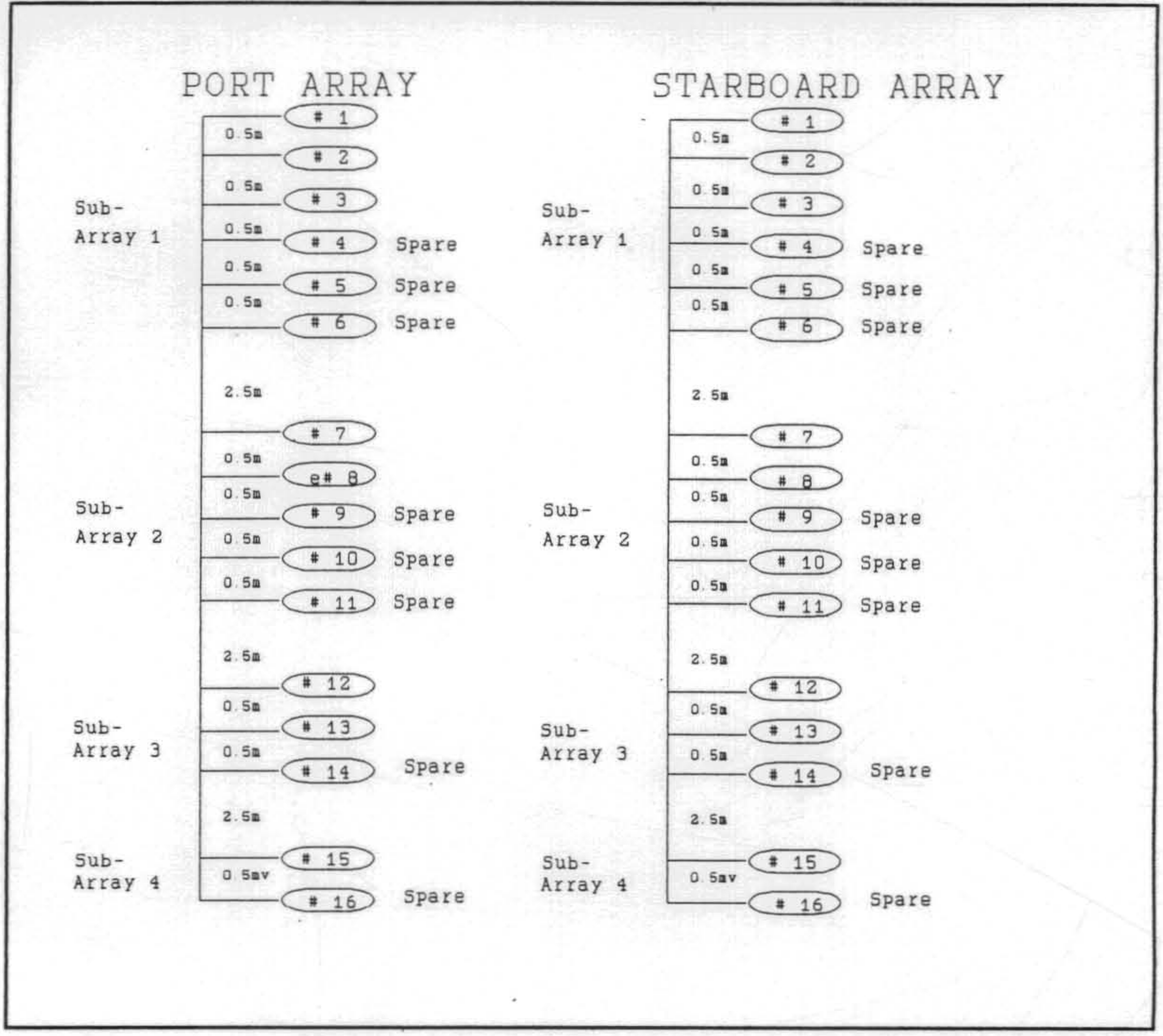
Number of Guns: 32 (including spares)

Operating Pressure: 1800 psi. +/- 100 psi

Operating Depth: 6 Metres

7.2 ENERGY SOURCE OVERVIEW

A two string array comprising 32 HALIBURTON SLEEVE GUNS was utilised for this survey. Each string consisted of sixteen guns giving a total capacity of 4800 cubic inches. Of the 32 guns in the array 16 were active, providing a total operating volume of 2400 cubic inches. The remaining sixteen guns were designated as spares. All sub-arrays were identically configured.



7.3 AIRGUN THEORY OF OPERATION

The airgun is designed to generate a discrete pulse of acoustic energy into the water on command from an electrical firing control device ; in our case the BMR Designed and developed gun control system (PUSSY) The generated energy pulse is obtained from high-pressure air admitted directly to the airgun reservoir through a hose from an air compressor. The supplied air pressure is stored in the fixed volume airgun reservoir. Release of this energy from the reservoir is accomplished by energising a solenoid valve mounted externally on the gun. A series of magnets in the lip of the external sleeve shuttle induces a voltage in a sensor coil which is used by PUSSY to indicate the exact firing time of the gun.

The energy sources, used for this survey were tuned arrays of "Sleeve Guns".The design of these guns was considered a major advance for a number of reasons but mainly because the relatively simple mechanical design meant very few moving parts, and a corresponding increase in reliability and firing accuracy. Recent development of higher capacity individual guns has also improved the overall performance of sources designed with these airguns.

8 POSITIONING SYSTEMS

8.1 NAVIGATION CONTROLE

Because of the wide ranging role of the RIG SEISMIC there is onboard a broad range of navigation systems. The latest system evaluated in June 1991 and installed in August 1991 is a differential G.P.S. navigation system, SKYFIX, the SKYFIX system is leased from Racal Survey.

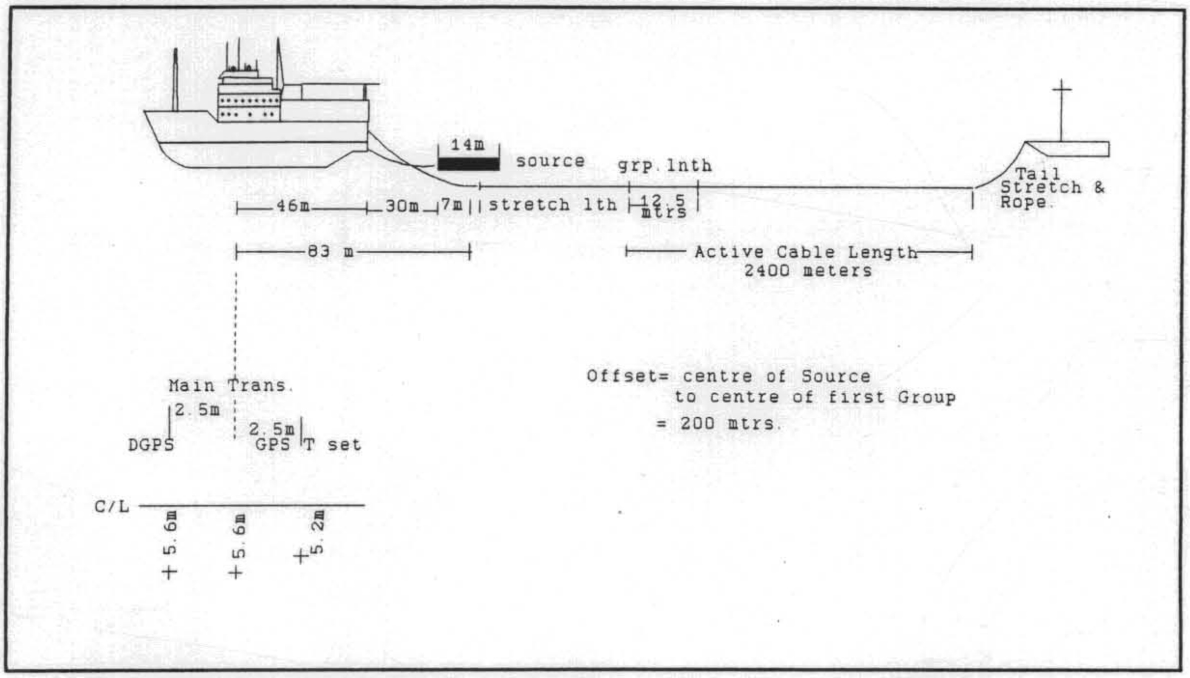
The variouse systems are utilised in a hierarchy that permits continuing operations with a gradually degrading accuracy. SKYFIX is expected to give an accuracy of 5 meters when within 1000 km of the shore reference station. On completion of the installation there will be six reference stations located along the coast of Australia at Perth, Adelaide, Sydney ,Cairns Darwin and Broome which should place the entire continental shelf within 1000 km of a shore station.

8.1.1 NAVIGATION EQUIPMENT:

1) SKYFIX navigation system
    - Thrimble 4000DL series G.P.S. receiver
    - Racal demodulator
    - Racal Satcom receive only antenna
    - Compaq 386 pesonal computer
2) Magnavox T-Set G.P.S. navigator
3) Magnavox MX 1107RS TRANSIT satellite receiver
4) Magnavox MX 1142 TRANSIT satellite receiver
5) Magnavox MX 610D dual axis doppler sonar
6) Raytheon DSN 450 dual axis doppler soner
7) Sperry Mark 37 gyro compass
8) S.G. Brown SG 1000 gyro compass

8.1.2 ADDITIONAL EQUIPMENT:

9) Raytheon 12 khz. echo sounder
10) Raytheon 3.5 khz. sub-bottom profiler
11) Bodenseewerk KSS31 marine gravity meter
12) Geometrics G801/803 magnetometer/gradiometer



Offset Diagram/Antenna Location

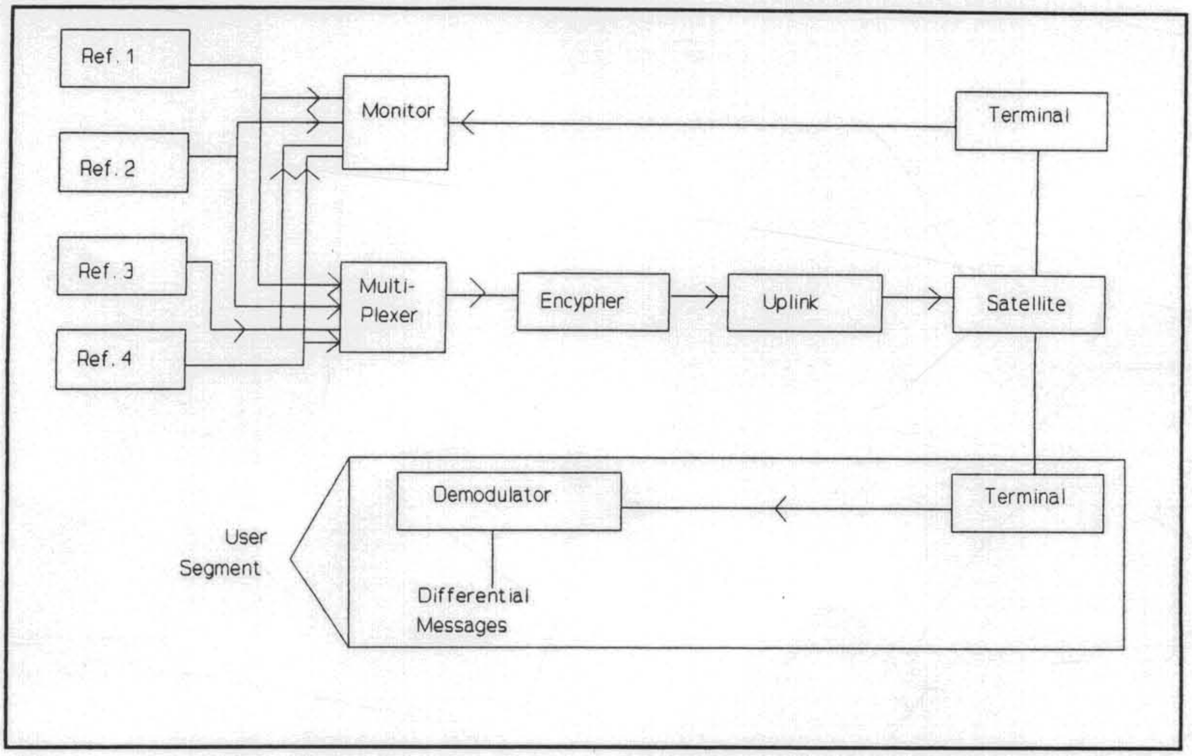
8.2 SKYFIX - GENERAL SYSTEM DESCRIPTION

Skyfix is a data link for broadcasting differential GPS correction messages. It is used in conjunction with GPS receivers, enhancing their position accuracy. This section describes the fundamental system structure and its different operational configurations.

Due to the wide area coverage of the geostationary satellite used in Skyfix,the reference station to user seperation is no longer constrained by the effective range of the link. Allowing corrections to remain valid over longer ranges (1000+ km).
In having multiple reference station corections available on a single signal, significant redundancy is built in. While changing between reference stations requires a minimum of effort.
A high (1200 bits/s) link data rate ensures an update rate of better than 4 seconds. Reducing significantly the degradation of the GPS position.

8.2.1 SYSTEM DESCRIPTION

The SKYFIX network generates differential messages, which are then monitored and broadcast over geostationary satellite. These signals can then be recieved by suitable equipipped user.
Gps reference stations have been installed at selected locations to generate the messages. These messages are then transferred to the monitor facility by land line. On reception at the monitor they are contiuously quality controled by specialised software and a operator, 24hrs. a day. The monitor records all irregularities and informs the operator, who performs the neccesary action.



Block diagram SkyFix System

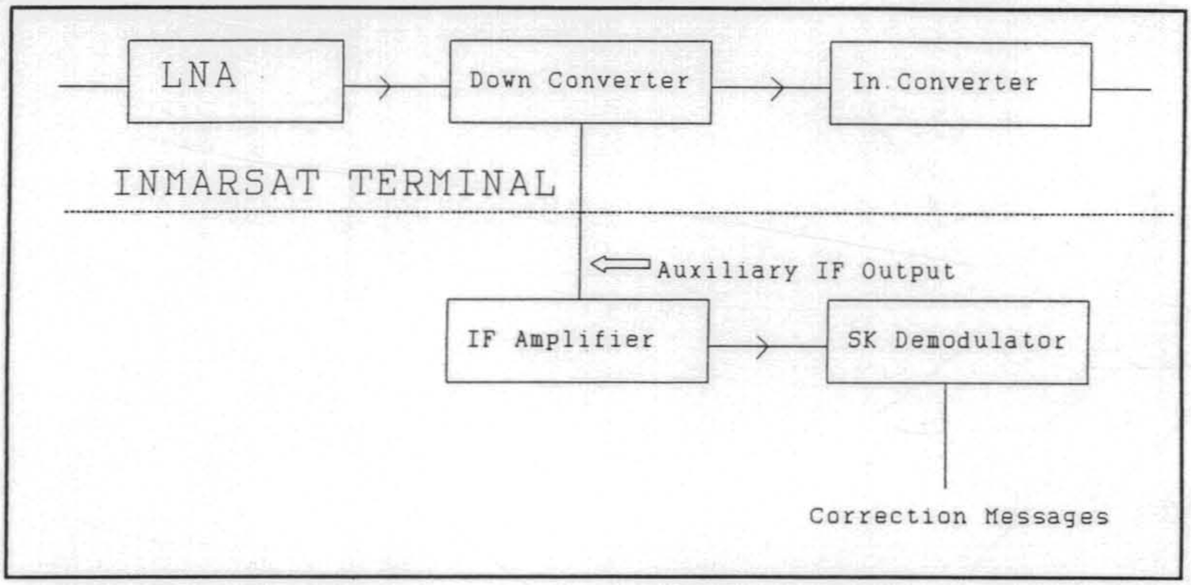
Once QC checked, the messages are also multiplexed into one data string, encyphered to prevent unauthorised users and passed on to the satellite uplink station. There the messages are modulated onto SkyFix's own frequency and beamed upto to the region's Inmarsat satellite. The satellite then relays the signal back to earth.

8.2.2 CORRECTION MESSAGES.

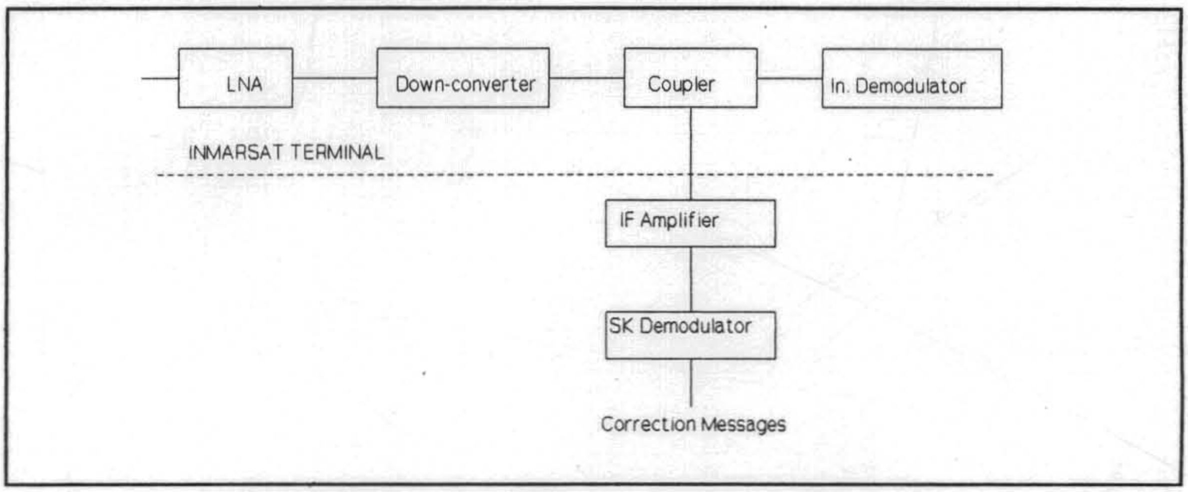
An Inmarsat terminal can be used to receive the weak satellite signals. With such a terminal onboard a SkyFix Satellite Data Demodulator (SDD) can be connected to the terminal to retrieve the differential messages. This does not interfere with the normal telephone or telex traffic on the terminal. SkyFix operates on its own seperate frequency.
A seperate terminal dedicated to SkyFix can be installed as on the RIG SEISMIC. This can be either a full standard "A" terminal or a specially developed recieve only terminal.
The terminal utilises a parabolic antenna coupled to a low noise amplifier (LNA) and down converted to an intermediate frequency (IF).

8.3 INMARSAT TERMINALS.

In normal Inmarsat operation, the IF is fed into a demodulator. This demodulator is not compatible with SkyFix, so the signal has to be directed into a special SkyFix demodulator (SDD).
On terminals that have an auxiliary IF output (e.g. Magnavox MX2400) extraction is relativly simple (fig. 2). Terminals without this feature require a direction coupler in the IF path between the down-converter and demodulator. A direction coupler being a device that splits the IF signal leaving the original IF path more or less undisturbed.



Inmarsat Terminal with Auxiliary IF output



Inmarsat Terminal without IF output

8.3.1 RECEIVE ONLY TERMINAL.

The development of these receivers by RACAL SURVEY, allows the SkyFix system to be used on vessels that lack an Inmarsat terminal. The basic principles remain as above . However with no transmition or processing capabilities the unit is lighter and less bulky than a standard Inmarsat terminal.
The messages output from the receive only terminal are at a frequency and power compatible with the SDD. No directional couplers are required.

8.4 EQUIPMENT CHARACTERISTICS

SKYFIX SYSTEM:

number of reference stations	: 4
number of monitor stations	: 1
network management	: full quality control and data integrity monitoring
frequency band	: 1.5 Ghz.
modulation type	: binary phase shift keyed
baude rate	: 1200 bits/s
symbol rate	: 2400 sym/s
bit error rate	: < 1E-6
error correction	: 1/2 rate convolutional encoding, K=7
differential message protocol	: RTCM 104
message types transmitted	: 1, 2, 3, 5, 6, & 16
message type 1 update rate	: <2 sec(4 sv, 4 stn's) <4 sec(8 sv, 4 stn's)
message type 1 delay	: <1.5sec(4 sv,4 stn's) : <2.5sec(8 sv,4 stn's)

SATELLITE DATA DEMODULATOR:

IF input impedance	: 50 ohms
input connector	: female BNC.
IF signal level	: -15 to -55 dBm
max. composite IF input level	: 0 dBm in 20 Mhz bandwidth
IF input range	: 60.00 to 80.00 MHz 5kHz steps
max. data clock frequency error	: +/- 50 ppm
decoding rate	: 1/2 Viterbi decoder (3 bit soft decision)
output protocol	: RS 232
baud rate	: 2k4, 4k8, 9k6, 19k2
stop bits	: 1, 1.5 or 2
paraty	: odd, even or none
output connector	: female 25 way D type
voltage	: 240/120V (45- 440 Hz)
consumption	: 50 W max.
fuse	: 1 amp anti-surge
case	: 19" rack mount
dimensions	: 132 - 483 - 500 mm.
weight	:< 15 Kg.
operating temp.	:+10 to +40 Deg C

IF AMPLIFIER 90593:

input impedance	: 50 ohms.
input connector	: female BNC
frequency range	: 10 Mhz to 500 Mhz
gain	: -15 dB to 55 dB 10 dB steps
output impedance	: 50 ohms
output connecter	: female BNC
voltage	: 240/120v (47-63 Hz)
consumption	: 25 W max.
fuse	: 0.25 amp
dimensions	: 120-190-260 mm.
weight	: 3 Kg.
operating temp.	: +10 to +40 Deg. C
special features	: two amp. units can be mounted in a 19" rack : 75/50 Ohm impedance matching pad available

DIRECTIONAL COUPLER.

frequency range	: 5 to 860 Mhz.
attenuation (main path)	: 1.0 dB
attenuation (tap)	: 10.5 dB
input connector	: female F type
output connector (main path)	: female F type
output connector (tap)	: female F type
dimensions	: 25-50-50 mm
weight	: 0.075 Kg.
special features	: main path DC coupled : tap NOT DC coupled to main path

9.1 SURVEY PRODUCTION DETAIL

LINE	DIR.	FSP	LSP	TOT-SP	TOT-KM	FCSP	LCSP	TOT-CSP	TOT-CKM	STATUS
**				DATE: 21/09/91						
BD91-218	053	162	962	801	20.025	203	962	760	19.000	COMP
BD91-215	236	140	912	773	19.325	140	912	773	19.325	COMP
BD91-212	056	166	942	777	19.425	166	942	777	19.425	COMP
BD91-214	235	160	932	773	19.325	160	932	773	19.325	COMP
BD91-211	056	127	722	596	14.900	127	722	596	14.900	COMP
** Subtotal **										
								3679	91.975	
**				DATE: 22/09/91						
BD91-213	235	116	203	88	2.200	0	0	0	0.000	TBR
BD91-2131	550	125	207	83	2.075	0	0	0	0.000	TBR
BD91-2132	55	141	932	792	19.800	141	932	792	19.800	COMP
BD91-216	55	122	946	825	20.625	122	946	825	20.625	COMP
** Subtotal **										
								1617	40.425	
**				DATE: 23/09/91						
BD91-219	231	102	869	768	19.200	102	869	768	19.200	COMP
BD91-222	51	118	714	597	14.925	118	714	597	14.925	COMP
BD91-210	145	112	421	310	7.750	0	0	0	0.000	TBR
BD91-207	147	129	843	715	17.875	129	650	522	13.050	TBC
BD91-2071	147	1030	2073	1044	26.100	1112	2073	962	24.050	COMP
** Subtotal **										
								2849	71.225	
**				DATE: 24/09/91						
BD91-209	329	132	1589	1458	36.450	132	1589	1458	36.450	COMP
BD91-206	147	169	1610	1442	36.050	169	1610	1442	36.050	COMP
BD91-208	328	191	1621	1431	35.775	191	1621	1431	35.775	COMP
BD91-2101	148	255	1720	1466	36.650	255	1720	1466	36.650	COMP
** Subtotal **										
								5797	144.925	
**				DATE: 25/09/91						
BD91-221	230	123	709	587	14.675	123	709	587	14.675	COMP
BD91-217	53	103	1040	938	23.450	103	1040	938	23.450	COMP
BD91-220	132	132	870	739	18.475	0	0	0	0.000	TBR
** Subtotal **										
								1525	38.125	
**				DATE: 26/09/91						
BD91-2201	49	154	879	726	18.150	154	879	726	18.150	COMP
** Subtotal **										
								726	18.150	
*** Total ***										
								16193	404.825	

9.2 SURVEY ACTIVITY DETAILS

FROM TO	ACTIVITY	TOTAL	CHARGE
**	DATE 17/09/91		
00:00-24:00	ALONG SIDE PORTLAND	24.000	0.000
** Subtotal **			
		24.000	0.000
**	DATE 18/09/91		
00:00-08:10	ALONGSIDE PORTLAND	8.167	0.000
08:10-24:00	DEPART PORTLAND FOR PROSPECT AREA	15.833	0.000
** Subtotal **			
		24.000	0.000
**	DATE 19/09/91		
00:00-14:45	INTRANSIT TO PROSPECT AREA	14.750	0.000
14:45-24:00	DEPLOYING STREAMER	9.250	0.000
** Subtotal **			
		24.000	0.000
**	DATE 20/09/91		
00:00-01:30	DEPLOYING STREAMER	1.500	0.000
01:30-03:04	STREAMER BALLAST/CHECKS	1.567	0.000
03:04-04:56	DEPLOY SOURCE	1.867	0.000
04:56-05:17	RUN TO LINE	0.350	0.000
05:17-12:43	NAV. STATION FAILURE	7.433	0.000
12:43-24:00	STANDBY FOR WEATHER	11.283	0.000
** Subtotal **			
		24.000	0.000
**	DATE 21/09/91		
00:00-04:00	STANDBY WEATHER	4.000	0.000
04:00-05:30	HEADING FOR LINE-BD91-218	1.500	0.000
05:30-07:33	SHOOTING LINE BD218	2.050	0.000
07:33-09:44	LINE CHANGE	2.183	0.000
09:44-11:55	SHOOTING LINE BD91-215	2.183	0.000
11:55-14:03	LINE CHANGE	2.133	0.000
14:03-16:13	SHOOTING LINE BD91-212	2.167	0.000
16:13-18:33	LINE CHANGE	2.333	0.000
18:33-19:47	SHOOTING LINE BD91-214	1.233	0.000
19:47-22:35	LINE CHANGE	2.800	0.000
22:35-24:00	SHOOTING LINE BD91-211	1.418	0.000
** Subtotal **			
		24.000	0.000

**	DATE 22/09/91		
00:00-00:11	CONT. SHOOTING LINE BD91-211	0.183	0.000
00:11-04:45	LINE CHANGE	4.567	0.000
04:45-05:00	ABORT LINE BD91-210	0.250	0.000
05:00-06:15	TRANSIT TO LINE BD91-213	1.250	0.000
06:15-06:47	SHOOTING LINE BD91-213 FROM N.E.	0.533	0.000
06:47-10:50	TERMINATED BD91-213 SWELL NOISE	4.050	0.000
10:50-11:04	SHOOTING LINE BD91-2131	0.233	0.000
11:04-14:40	LINE TERM. TRANSPORT FAIL	3.600	0.000
14:40-16:54	SHOOTING LINE BD91-2132	2.233	0.000
16:54-22:42	LINE CHANGE	5.800	0.000
22:42-23:55	SHOOTING LINE BD91-216	1.217	0.000
23:55-24:00	LINE CHANGE	0.084	0.000
** Subtotal **			
		24.000	0.000

**	DATE 23/09/91		
00:00-01:51	LINE CHANGE	1.850	0.000
01:51-03:55	SHOOTING LINE BD91-219	2.067	0.000
03:55-06:03	LINE CHANGE	2.133	0.000
06:03-07:40	SHOOTING LINE BD91-222	1.617	0.000
07:40-11:14	LINE CHANGE/EXTENDED FOR SRCE MAINT	3.567	0.000
11:14-12:03	SHOOTING N.W. END OF LINE BD91-210	0.817	0.000
12:03-14:16	LINE CHANGE	2.217	0.000
14:16-15:42	SHOOTING LINE BD91-207	1.433	0.000
15:42-20:01	TERM. CABLE DEPTHS OUT OF SPEC.	4.317	0.000
20:01-22:35	SHOOTING LINE BD91-2071	2.567	0.000
22:35-24:00	LINE CHANGE	1.415	0.000
** Subtotal **			
		24.000	0.000

**	DATE 24/09/91		
00:00-00:44	LINE CHANGE	0.733	0.000
00:44-04:40	SHOOTING LINE BD91-209	3.933	0.000
04:40-06:30	LINE CHANGE	1.833	0.000
06:30-10:21	SHOOTING LINE BD91-206	3.850	0.000
10:21-12:45	LINE CHANGE	2.400	0.000
12:45-16:40	SHOOTING LINE BD91-208	3.917	0.000
16:40-19:34	LINE CHANGE	2.900	0.000
19:34-23:32	SHOOTING LINE BD91-2101	3.967	0.000
23:32-24:00	LINE CHANGE	0.467	0.000
** Subtotal **			
		24.000	0.000

**	DATE 25/09/91		
00:00-02:43	LINE CHANGE	2.717	0.000
02:43-05:53	ABORT LN.BD91-221.FEATHER ANGLES	3.167	0.000
05:53-07:36	SHOOTING LINE BD91-221	1.717	0.000
07:36-09:34	LINE CHANGE	1.967	0.000
09:34-12:20	SHOOTING LINE BD91-217	2.767	0.000
12:20-14:26	LINE CHANGE	2.100	0.000
14:26-18:40	ABORT LN.BD91-220 FEATH ANGLES	4.233	0.000
18:40-20:44	SHOOTING LINE BD91-220	2.067	0.000
20:44-23:01	LINE CHANGE/RESHOOT BD91-2201	2.283	0.000
23:01-24:00	SHOOTING LINE BD91-2201	0.982	0.000
** Subtotal **			
		24.000	0.000
**	DATE 26/09/91		
00:00-00:58	SHOOTING LINE BD91-2201	0.967	0.000
00:58-03:43	BMR GUN TESTS	2.750	0.000
03:43-06:48	STREAMER RETRIEVAL	3.083	0.000
06:48-13:30	TRANSIT TO DEVONPORT	6.700	0.000
13:30-24:00		10.500	0.000
** Subtotal **			
		24.000	0.000
*** Total ***			
		240.00	0.000

9.3 SURVEY Q.A. LINE LOGS

LINE: BD91-218 AZIMUTH: 053 STATUS: COMP DATE: 21/09/91

START: 05:03 HRS FSP: 162 FCSP: 203 TOTAL SP: 801 TOTAL KM: 20.025
END: 07:33 HRS LSP: 962 LCSP: 962 TOTAL CSP: 760 TOTAL CKM: 19.000

FSP LAT: 40 36 59.04 S FSP LON: 147 40 14.04 E FSP WATER DEPTH: 39.0
LSP LAT: 40 30 43.14 S LSP LON: 147 51 07.14 E LSP WATER DEPTH: 33.0

OFFSET (M): 195.0 WIND: 3 to 4 SEA: MOD SWELL (M): 3

STREAMER:- DEPTHS (M):10+/-1 FEATHERING : 3.0 PORT
SOL NOISE: 6.7 uBAR AVERAGE NEAR 6 GROUPS: 19.5 uBAR AVERAGE
EOL NOISE: uBAR AVERAGE NEAR 6 GROUPS: uBAR AVERAGE
STATUS: Trace # 75 dead, missed the first 0.55 km of the line.

ENERGY SOURCE:- CAPACITY (in3): 2400 DEPTH (M): 6 PRESSURE (psi): 1800
PERFORMANCE:

NAVIGATION:- SYSTEM: SKYFIX/DGPS STATIONS IN USE: ADELAIDE
PERFORMANCE: 06:48 hrs - 06:58 hrs lost DGPS navigating on gps.

COMMENTS: EDITS: SP#

LINE: BD91-211 AZIMUTH: 056 STATUS: COMP DATE: 21/09/91

START: 22:35 HRS FSP: 127 FCSP: 127 TOTAL SP: 596 TOTAL KM: 14.900
END: 00:11 HRS LSP: 722 LCSP: 722 TOTAL CSP: 596 TOTAL CKM: 14.900

FSP LAT: 40 30 37.38 S FSP LON: 147 30 57.90 E FSP WATER DEPTH: 47.0
LSP LAT: 40 26 07.02 S LSP LON: 147 39 45.00 E LSP WATER DEPTH: 46.0

OFFSET (M): 195.0 WIND: 4 TO 5 SEA: MOD SWELL (M): 3.0

STREAMER:- DEPTHS (M):10+/-1 FEATHERING : 2.0 PORT
SOL NOISE: 4.155 uBAR AVERAGE NEAR 6 GROUPS: 5.815 uBAR AVERAGE
EOL NOISE: 4.775 uBAR AVERAGE NEAR 6 GROUPS: 18.547 uBAR AVERAGE
STATUS: Trace #75 dead

ENERGY SOURCE:- CAPACITY (in3): 2400 DEPTH (M): 6 PRESSURE (psi): 1800
PERFORMANCE:

NAVIGATION:- SYSTEM: SKYFIX/DGPS STATIONS IN USE: ADELAIDE
PERFORMANCE: 5 SATS BOL PDOPS 6.0

COMMENTS: EDITS: SP#

LINE: BD91-212 AZIMUTH: 056 STATUS: COMP DATE: 21/09/91

START: 14:03 HRS FSP: 166 FCSP: 166 TOTAL SP: 777 TOTAL KM: 19.425
END: 16:13 HRS LSP: 942 LCSP: 942 TOTAL CSP: 777 TOTAL CKM: 19.425

FSP LAT: 40 33 38.16 S FSP LON: 147 29 45.30 E FSP WATER DEPTH: 46.0
LSP LAT: 40 27 45.18 S LSP LON: 147 41 06.42 E LSP WATER DEPTH: 39.0

OFFSET (M): 195.0 WIND: 3 - 4 SEA: MOD SWELL (M): 3

STREAMER:- DEPTHS (M):10+/-1 FEATHERING : 2.5 PORT
SOL NOISE: 6.73 uBAR AVERAGE NEAR 6 GROUPS: 17.02 uBAR AVERAGE
EOL NOISE: 6.285 uBAR AVERAGE NEAR 6 GROUPS: 14.68 uBAR AVERAGE
STATUS: trace # 75 dead, trace # 113 dead

ENERGY SOURCE:- CAPACITY (in3): 2400 DEPTH (M): 6 PRESSURE (psi): 1800
PERFORMANCE:

NAVIGATION:- SYSTEM: SKYFIX/DGPS STATIONS IN USE: ADELAIDE
PERFORMANCE:

COMMENTS: EDITS: SP#

LINE: BD91-215 AZIMUTH: 236 STATUS: COMP DATE: 21/09/91

START: 09:44 HRS FSP: 140 FCSP: 140 TOTAL SP: 773 TOTAL KM: 19.325
END: 11:55 HRS LSP: 912 LCSP: 912 TOTAL CSP: 773 TOTAL CKM: 19.325

FSP LAT: 40 29 44.16 S FSP LON: 147 44 56.40 E FSP WATER DEPTH: 35.0
LSP LAT: 40 35 40.50 S LSP LON: 147 33 23.22 E LSP WATER DEPTH: 43.0

OFFSET (M): 206.0 WIND: 3 TO 4 SEA: MOD SWELL (M): 3

STREAMER:- DEPTHS (M):10+/-1 FEATHERING : 5.0 PORT
SOL NOISE: 6.1 uBAR AVERAGE NEAR 6 GROUPS: 19.3 uBAR AVERAGE
EOL NOISE: 10.6 uBAR AVERAGE NEAR 6 GROUPS: 23.1 uBAR AVERAGE
STATUS: TRACE #75 DEAD

ENERGY SOURCE:- CAPACITY (in3): 2400 DEPTH (M): 6 PRESSURE (psi): 1800
PERFORMANCE:

NAVIGATION:- SYSTEM: SKYFIX/DGPS STATIONS IN USE: ADELAIDE
PERFORMANCE: 10:38 HRS. TO 10:45 HRS LOST DGPS

COMMENTS: EDITS: SP#

LINE: BD91-214 AZIMUTH: 235 STATUS: COMP DATE: 21/09/91

START: 18:33 HRS FSP: 160 FCSP: 160 TOTAL SP: 773 TOTAL KM: 19.325
END: 19:47 HRS LSP: 932 LCSP: 932 TOTAL CSP: 773 TOTAL CKM: 19.325

FSP LAT: 40 30 19.86 S FSP LON: 147 41 49.92 E FSP WATER DEPTH: 36.0
LSP LAT: 40 33 51.18 S LSP LON: 147 35 20.28 E LSP WATER DEPTH: 40.0

OFFSET (M): 201.0 WIND: 3 TO 4 SEA: MOD SWELL (M): 3

STREAMER:- DEPTHS (M):10+/-1 FEATHERING : 2.0 STBD
SOL NOISE: 5.67 uBAR AVERAGE NEAR 6 GROUPS: 18.58 uBAR AVERAGE
EOL NOISE: 6.05 uBAR AVERAGE NEAR 6 GROUPS: 17.65 uBAR AVERAGE
STATUS: TRACE # 75 DEAD

ENERGY SOURCE:- CAPACITY (in3): 2400 DEPTH (M): 6 PRESSURE (psi): 1800
PERFORMANCE:

NAVIGATION:- SYSTEM: SKYFIX/DGPS STATIONS IN USE: ADELAIDE
PERFORMANCE: 5 SATS IN CONSTELATION AT BOL. PDOPS 2.2
4 SATS IN CONSTELATION AT EOL. PDOPS 3.7

COMMENTS: EDITS: SP#

LINE: BD91-213 AZIMUTH: 235 STATUS: TBR DATE: 22/09/91

START: 14:40 HRS FSP: 116 FCSP: 0 TOTAL SP: 88 TOTAL KM: 2.200
END: 16:54 HRS LSP: 203 LCSP: 0 TOTAL CSP: 0 TOTAL CKM: 0.000

FSP LAT: 40 34 36.42 S FSP LON: 147 30 05.82 E FSP WATER DEPTH: 43.0
LSP LAT: 40 28 30.90 S LSP LON: 147 41 35.64 E LSP WATER DEPTH: 36.0

OFFSET (M): 191.0 WIND: 3 TO 4 SEA: MOD SWELL (M): 3

STREAMER:- DEPTHS (M):10+/-1 FEATHERING : 5.0 PORT
SOL NOISE: 5.06 uBAR AVERAGE NEAR 6 GROUPS: 12.41 uBAR AVERAGE
EOL NOISE: 5.5 uBAR AVERAGE NEAR 6 GROUPS: 11.05 uBAR AVERAGE
STATUS: TRACE # 75 DEAD

ENERGY SOURCE:- CAPACITY (in3): 2400 DEPTH (M): 6 PRESSURE (psi): 1800
PERFORMANCE:

NAVIGATION:- SYSTEM: SKYFIX/DGPS STATIONS IN USE: ADELAIDE
PERFORMANCE: 6 SATS AT BOL PDOPS 2.8

COMMENTS: EDITS: SP#

LINE: BD91-216 AZIMUTH: 55 STATUS: COMP DATE: 22/09/91

START: 11:42 HRS FSP: 122 FCSP: 122 TOTAL SP: 825 TOTAL KM: 20.625
END: 13:55 HRS LSP: 946 LCSP: 946 TOTAL CSP: 825 TOTAL CKM: 20.625

FSP LAT: 40 35 48.54 S FSP LON: 147 37 21.30 E FSP WATER DEPTH: 41.0
LSP LAT: 40 29 22.14 S LSP LON: 147 49 06.42 E LSP WATER DEPTH: 31.0

OFFSET (M): 186.0 WIND: 3 TO 4 SEA: MOD SWELL (M): 2-3

STREAMER:- DEPTHS (M):10+/-1 FEATHERING : 3.0 PORT BOL- 3.0 STBD EOL
SOL NOISE: 4.553 uBAR AVERAGE NEAR 6 GROUPS: 18.698 uBAR AVERAGE
EOL NOISE: 5.525 uBAR AVERAGE NEAR 6 GROUPS: 17.570 uBAR AVERAGE
STATUS: TRACE #75 DEAD

ENERGY SOURCE:- CAPACITY (in3): 2400 DEPTH (M): 6 PRESSURE (psi): 1800
PERFORMANCE:

NAVIGATION:- SYSTEM: SKYFIX/DGPS STATIONS IN USE: ADELAIDE
PERFORMANCE: 6 SATS BOL PDOPS 2.2
4 SATS EOL PDOPS 10.9

COMMENTS: EDITS: SP#

LINE: BD91-219 AZIMUTH: 231 STATUS: COMP DATE: 23/09/91

START: 01:51 HRS FSP: 102 FCSP: 102 TOTAL SP: 768 TOTAL KM: 19.200
END: 03:55 HRS LSP: 869 LCSP: 869 TOTAL CSP: 768 TOTAL CKM: 19.200

FSP LAT: 40 32 42.12 S FSP LON: 147 50 34.86 E FSP WATER DEPTH: 29.0
LSP LAT: 40 39 11.88 S LSP LON: 147 39 58.74 E LSP WATER DEPTH: 22.0

OFFSET (M): 175.0 WIND: 2 TO 3 SEA: MOD SWELL (M): 2 - 3

STREAMER:- DEPTHS (M):10+/-1 FEATHERING : 8.0 PORT BOL - 2.0 PORT EOL
SOL NOISE: 4.553 uBAR AVERAGE NEAR 6 GROUPS: 18.698 uBAR AVERAGE
EOL NOISE: 5.525 uBAR AVERAGE NEAR 6 GROUPS: 17.370 uBAR AVERAGE
STATUS: TRACE # 75 DEAD

ENERGY SOURCE:- CAPACITY (in3): 2400 DEPTH (M): 6 PRESSURE (psi): 1800
PERFORMANCE:

NAVIGATION:- SYSTEM: SKYFIX/DGPS STATIONS IN USE: ADELAIDE
PERFORMANCE:

COMMENTS: EDITS: SP#

LINE: BD91-222 AZIMUTH: 51 STATUS: COMP DATE: 23/09/91

START: 06:03 HRS FSP: 118 FCSP: 118 TOTAL SP: 597 TOTAL KM: 14.925
END: 07:40 HRS LSP: 714 LCSP: 714 TOTAL CSP: 597 TOTAL CKM: 14.925

FSP LAT: 40 42 49.14 S FSP LON: 147 44 04.50 E FSP WATER DEPTH: 36.0
LSP LAT: 40 37 44.22 S LSP LON: 147 52 19.92 E LSP WATER DEPTH: 30.0

OFFSET (M): 195.0 WIND: 2 TO 3 SEA: MOD SWELL (M): 2

STREAMER:- DEPTHS (M):10+/-1 FEATHERING : 7.0 PORT BOL 4.0 PORT EOL
SOL NOISE: 7.63 uBAR AVERAGE NEAR 6 GROUPS: 11.94 uBAR AVERAGE
EOL NOISE: uBAR AVERAGE NEAR 6 GROUPS: uBAR AVERAGE
STATUS: TRACE #75 DEAD

ENERGY SOURCE:- CAPACITY (in3): 2400 DEPTH (M): 6 PRESSURE (psi): 1800
PERFORMANCE:

NAVIGATION:- SYSTEM: SKYFIX/DGPS STATIONS IN USE: ADELAIDE
PERFORMANCE:

COMMENTS: EDITS: SP#

LINE: BD91-210 AZIMUTH: 145 STATUS: TBR DATE: 23/09/91

START: HRS FSP: 112 FCSP: 0 TOTAL SP: 310 TOTAL KM: 7.750
END: HRS LSP: 421 LCSP: 0 TOTAL CSP: 0 TOTAL CKM: 0.000

FSP LAT: . S FSP LON: . E FSP WATER DEPTH: 0.0
LSP LAT: . S LSP LON: . E LSP WATER DEPTH: 0.0

OFFSET (M): 195.0 WIND: SEA: SWELL (M):

STREAMER:- DEPTHS (M):10+/-1 FEATHERING : X.X PORT - X.X STBD
SOL NOISE: uBAR AVERAGE NEAR 6 GROUPS: uBAR AVERAGE
EOL NOISE: uBAR AVERAGE NEAR 6 GROUPS: uBAR AVERAGE
STATUS:

ENERGY SOURCE:- CAPACITY (in3): 2400 DEPTH (M): 6 PRESSURE (psi): 1800
PERFORMANCE:

NAVIGATION:- SYSTEM: SKYFIX/DGPS STATIONS IN USE: ADELAIDE
PERFORMANCE:

COMMENTS: EDITS: SP#

LINE: BD91-207 AZIMUTH: 147 STATUS: TBC DATE: 23/09/91

START: 04:16 HRS FSP: 129 FCSP: 129 TOTAL SP: 715 TOTAL KM: 17.875
END: 06:13 HRS LSP: 843 LCSP: 650 TOTAL CSP: 522 TOTAL CKM: 13.050

FSP LAT: 40 25 48.00 S FSP LON: 147 32 40.20 E FSP WATER DEPTH: 44.0
LSP LAT: 40 34 00.78 S LSP LON: 147 39 36.66 E LSP WATER DEPTH: 35.0

OFFSET (M): 195.0 WIND: 2 TO 3 SEA: MOD SWELL (M): 2 - 3

STREAMER:- DEPTHS (M):10+/-1 FEATHERING : 6.0 PORT
SOL NOISE: 5.54 uBAR AVERAGE NEAR 6 GROUPS: 14.6 uBAR AVERAGE
EOL NOISE: 5.97 uBAR AVERAGE NEAR 6 GROUPS: 16.65 uBAR AVERAGE
STATUS: TRACE # 75 DEAD

ENERGY SOURCE:- CAPACITY (in3): 2400 DEPTH (M): 6 PRESSURE (psi): 1800
PERFORMANCE:

NAVIGATION:- SYSTEM: SKYFIX/DGPS STATIONS IN USE: ADELAIDE
PERFORMANCE:

COMMENTS: EDITS: SP#S 651 THROUGH 843

LINE: BD91-2071 AZIMUTH: 147 STATUS: COMP DATE: 23/09/91

START: 20:01 HRS FSP: 1030 FCSP: 1112 TOTAL SP: 1044 TOTAL KM: 26.100
END: 22:35 HRS LSP: 2073 LCSP: 2073 TOTAL CSP: 962 TOTAL CKM: 24.050

FSP LAT: 40 29 48.42 S FSP LON: 147 36 03.84 E FSP WATER DEPTH: 39.0
LSP LAT: 40 42 48.06 S LSP LON: 147 47 04.14 E LSP WATER DEPTH: 32.0

OFFSET (M): 190.0 WIND: 2 - 3 SEA: MOD SWELL (M): 2 - 3

STREAMER:- DEPTHS (M):10+/-1 FEATHERING : 6.0 PORT
SOL NOISE: 6.77 uBAR AVERAGE NEAR 6 GROUPS: 19.7 uBAR AVERAGE
EOL NOISE: 9.81 uBAR AVERAGE NEAR 6 GROUPS: 15.5 uBAR AVERAGE
STATUS: TRACE #75 DEAD

ENERGY SOURCE:- CAPACITY (in3): 2400 DEPTH (M): 6 PRESSURE (psi): 1800
PERFORMANCE:

NAVIGATION:- SYSTEM: SKYFIX/DGPS STATIONS IN USE: ADELAIDE
PERFORMANCE: 6 SATS BOL PDOPS 2.0
10:41 hrs - 10:46 hrs PDOPS ABOVE 20.0

COMMENTS: EDITS: SP#

LINE: BD91-209 AZIMUTH: 329 STATUS: COMP DATE: 24/09/91

START: 00:44 HRS FSP: 132 FCSP: 132 TOTAL SP: 1458 TOTAL KM: 36.450
END: 04:40 HRS LSP: 1589 LCSP: 1589 TOTAL CSP: 1458 TOTAL CKM: 36.450

FSP LAT: 40 41 09.36 S FSP LON: 147 48 06.78 E FSP WATER DEPTH: 32.0
LSP LAT: 40 24 19.92 S LSP LON: 147 34 28.74 E LSP WATER DEPTH: 42.0

OFFSET (M): 190.0 WIND: 3 TO 4 SEA: MOD SWELL (M): 2

STREAMER:- DEPTHS (M):10+/-1 FEATHERING : 2.0 STBD
SOL NOISE: 6.93 uBAR AVERAGE NEAR 6 GROUPS: 15.7 uBAR AVERAGE
EOL NOISE: 7.05 uBAR AVERAGE NEAR 6 GROUPS: 14.5 uBAR AVERAGE
STATUS: TRACE # 75 DEAD

ENERGY SOURCE:- CAPACITY (in3): 2400 DEPTH (M): 6 PRESSURE (psi): 1800
PERFORMANCE:

NAVIGATION:- SYSTEM: SKYFIX/DGPS STATIONS IN USE: ADELAIDE
PERFORMANCE:

COMMENTS: EDITS: SP#

LINE: BD91-206 AZIMUTH: 147 STATUS: COMP DATE: 24/09/91

START: 06:26 HRS FSP: 169 FCSP: 169 TOTAL SP: 1442 TOTAL KM: 36.050
END: 10:21 HRS LSP: 1610 LCSP: 1610 TOTAL CSP: 1442 TOTAL CKM: 36.050

FSP LAT: 40 26 15.84 S FSP LON: 147 31 33.54 E FSP WATER DEPTH: 46.0
LSP LAT: 40 42 49.92 S LSP LON: 147 46 00.00 E LSP WATER DEPTH: 36.0

OFFSET (M): 190.0 WIND: 2 TO 3 SEA: MOD SWELL (M): 2 -3

STREAMER:- DEPTHS (M):10+/-1 FEATHERING : 6.0 PORT BOL- 5.0 STBD EOL
SOL NOISE: 7.91 uBAR AVERAGE NEAR 6 GROUPS: 13.54 uBAR AVERAGE
EOL NOISE: 6.28 uBAR AVERAGE NEAR 6 GROUPS: 16.18 uBAR AVERAGE
STATUS: TRACE # 75 DEAD

ENERGY SOURCE:- CAPACITY (in3): 2400 DEPTH (M): 6 PRESSURE (psi): 1800
PERFORMANCE: PORT ARRAY CHANGED TO 2 - 3 - 2 - 1 FROM BOL.

NAVIGATION:- SYSTEM: SKYFIX/DGPS STATIONS IN USE: ADELAIDE
PERFORMANCE:

COMMENTS: EDITS: SP# 148 TO 168 AMPLIFIERS ON MAX. WHILE RECORDING

LINE: BD91-208 AZIMUTH: 328 STATUS: COMP DATE: 24/09/91

START: 12:45 HRS FSP: 191 FCSP: 191 TOTAL SP: 1431 TOTAL KM: 35.775
END: 16:40 HRS LSP: 1621 LCSP: 1621 TOTAL CSP: 1431 TOTAL CKM: 35.775

FSP LAT: 40 41 26.34 S FSP LON: 147 46 59.52 E FSP WATER DEPTH: 35.0
LSP LAT: 40 24 49.38 S LSP LON: 147 33 10.92 E LSP WATER DEPTH: 43.0

OFFSET (M): 195.0 WIND: 2 TO 3 SEA: MOD SWELL (M): 2 - 3

STREAMER:- DEPTHS (M):10+/-1 FEATHERING : 3.0 STBD
SOL NOISE: 7.29 uBAR AVERAGE NEAR 6 GROUPS: 20.4 uBAR AVERAGE
EOL NOISE: 5.25 uBAR AVERAGE NEAR 6 GROUPS: 16.8 uBAR AVERAGE
STATUS: TRACE #75 DEAD

ENERGY SOURCE:- CAPACITY (in3): 2400 DEPTH (M): 6 PRESSURE (psi): 1800
PERFORMANCE: BETWEEN SHOT POINTS 374 GUN CONFIG. ALTERED TO STAY IN SPEC.
CONSULT SHOT LOG.

NAVIGATION:- SYSTEM: SKYFIX/DGPS STATIONS IN USE: ADELAIDE
PERFORMANCE: SP#S 378 THROUGH 394 LOST PRIMARY NAV. SYSTEM DUE TO POOR GEOMETRY
SECONDARY SYSTEM USED (GPS) TILL PRIMARY LOCKED IN.

COMMENTS: EDITS: SP# LOST SP#S 1029 THROUGH 1040. TRANSPORT HUNG UP.

LINE: BD91-2101 AZIMUTH: 148 STATUS: COMP DATE: 24/09/91

START: 19:34 HRS FSP: 255 FCSP: 255 TOTAL SP: 1466 TOTAL KM: 36.650
END: 23:32 HRS LSP: 1720 LCSP: 1720 TOTAL CSP: 1466 TOTAL CKM: 36.650

FSP LAT: 40 23 45.78 S FSP LON: 147 36 18.78 E FSP WATER DEPTH: 43.0
LSP LAT: 40 40 53.34 S LSP LON: 147 50 02.48 E LSP WATER DEPTH: 30.0

OFFSET (M): 195.0 WIND: 2 - 3 SEA: MOD SWELL (M): 2 - 3

STREAMER:- DEPTHS (M):10+/-1 FEATHERING : 2.0 PORT BOL- 2.0 STBD EOL
SOL NOISE: 6.45 uBAR AVERAGE NEAR 6 GROUPS: 16.5 uBAR AVERAGE
EOL NOISE: 4.99 uBAR AVERAGE NEAR 6 GROUPS: 11.6 uBAR AVERAGE
STATUS: TRACE #75 DEAD

ENERGY SOURCE:- CAPACITY (in3): 2400 DEPTH (M): 6 PRESSURE (psi): 1800
PERFORMANCE:

NAVIGATION:- SYSTEM: SKYFIX/DGPS STATIONS IN USE: ADELAIDE
PERFORMANCE: 20:37 HRS HDOPS > 10, 20:39 HRS HDOPS > 20, 10:40 HRS HDOPS < 2

COMMENTS: EDITS: SP#

LINE: BD91-221 AZIMUTH: 230 STATUS: COMP DATE: 25/09/91

START: 05:53 HRS FSP: 123 FCSP: 123 TOTAL SP: 587 TOTAL KM: 14.675
END: 07:36 HRS LSP: 709 LCSP: 709 TOTAL CSP: 587 TOTAL CKM: 14.675

FSP LAT: 40 36 15.00 S FSP LON: 147 50 18.30 E FSP WATER DEPTH: 46.0
LSP LAT: 40 41 54.54 S LSP LON: 147 41 29.28 E LSP WATER DEPTH: 46.0

OFFSET (M): 195.0 WIND: 2 SEA: MOD SWELL (M): 1 - 2

STREAMER:- DEPTHS (M):10+/-1 FEATHERING : 2.0 STBD
SOL NOISE: 6.21 uBAR AVERAGE NEAR 6 GROUPS: 14.42 uBAR AVERAGE
EOL NOISE: 5.93 uBAR AVERAGE NEAR 6 GROUPS: 16.2 uBAR AVERAGE
STATUS: TRACE # 75 DEAD

ENERGY SOURCE:- CAPACITY (in3): 2400 DEPTH (M): 6 PRESSURE (psi): 1800
PERFORMANCE:

NAVIGATION:- SYSTEM: SKYFIX/DGPS STATIONS IN USE: ADELAIDE
PERFORMANCE: LOSS OF DGPS SP # 560 THROUGH 585

COMMENTS: EDITS: SP#

LINE: BD91-217 AZIMUTH: 53 STATUS: COMP DATE: 25/09/91

START: 09:34 HRS FSP: 103 FCSP: 103 TOTAL SP: 938 TOTAL KM: 23.450
END: 12:20 HRS LSP: 1040 LCSP: 1040 TOTAL CSP: 938 TOTAL CKM: 23.450

FSP LAT: 40 36 51.36 S FSP LON: 147 37 51.42 E FSP WATER DEPTH: 38.0
LSP LAT: 40 29 20.04 S LSP LON: 147 51 09.24 E LSP WATER DEPTH: 32.0

OFFSET (M): 190.0 WIND: 3 TO 4 SEA: MOD SWELL (M): 2 - 3

STREAMER:- DEPTHS (M):10+/-1 FEATHERING : 3.5 PORT BOL- 2.0 STBD EOL
SOL NOISE: 6.86 uBAR AVERAGE NEAR 6 GROUPS: 19.6 uBAR AVERAGE
EOL NOISE: 3.94 uBAR AVERAGE NEAR 6 GROUPS: 14.6 uBAR AVERAGE
STATUS: TRACE # 75 DEAD

ENERGY SOURCE:- CAPACITY (in3): 2400 DEPTH (M): 6 PRESSURE (psi): 1800
PERFORMANCE: GUN LOGGER FAILED TO PRINT, GUN ARRAY VIDIO MON. USED FOR Q.C.

NAVIGATION:- SYSTEM: SKYFIX/DGPS STATIONS IN USE: ADELAIDE
PERFORMANCE:

COMMENTS: EDITS: SP#

LINE: BD91-220 AZIMUTH: 132 STATUS: TBR DATE: 25/09/91

START: 18:40 HRS FSP: 132 FCSP: 0 TOTAL SP: 739 TOTAL KM: 18.475
END: 20:44 HRS LSP: 870 LCSP: 0 TOTAL CSP: 0 TOTAL CKM: 0.000

FSP LAT: 40 33 54.84 S FSP LON: 147 51 06.30 E FSP WATER DEPTH: 29.0
LSP LAT: 40 40 35.70 S LSP LON: 147 40 48.06 E LSP WATER DEPTH: 21.0

OFFSET (M): 190.0 WIND: 4 - 5 SEA: MOD SWELL (M): 2 - 3

STREAMER:- DEPTHS (M):10+/-1 FEATHERING : 4.0 STBD
SOL NOISE: 4.01 uBAR AVERAGE NEAR 6 GROUPS: 12.0 uBAR AVERAGE
EOL NOISE: 4.24 uBAR AVERAGE NEAR 6 GROUPS: 14.7 uBAR AVERAGE
STATUS: FROM SHOT POINT 431 STREAMER DEPTHS WERE OUT OF SPEC 11 - 13 METERS ALONG THE BACK 50% OF STREAMER. LINE TO BE RESHOT.

ENERGY SOURCE:- CAPACITY (in3): 2400 DEPTH (M): 6 PRESSURE (psi): 1800
PERFORMANCE:

NAVIGATION:- SYSTEM: SKYFIX/DGPS STATIONS IN USE: ADELAIDE
PERFORMANCE: HIGH HORIZONTAL DIFFS FROM SP# 780

COMMENTS: EDITS: SP#

LINE: BD91-2201 AZIMUTH: 49 STATUS: COMP DATE: 26/09/91

START: 23:01 HRS FSP: 154 FCSP: 154 TOTAL SP: 726 TOTAL KM: 18.150
END: 00:58 HRS LSP: 879 LCSP: 879 TOTAL CSP: 726 TOTAL CKM: 18.150

FSP LAT: 40 40 11.34 S FSP LON: 147 41 25.74 E FSP WATER DEPTH: 21.0
LSP LAT: 40 33 42.30 S LSP LON: 147 51 26.04 E LSP WATER DEPTH: 29.0

OFFSET (M): 190.0 WIND: 4 - 5 SEA: MOD SWELL (M): 3 - 4

STREAMER:- DEPTHS (M):10+/-1 FEATHERING : 4.5 PORT BOL - 1.0 STBD EOL
SOL NOISE: 6.94 uBAR AVERAGE NEAR 6 GROUPS: 17.46 uBAR AVERAGE
EOL NOISE: 6.26 uBAR AVERAGE NEAR 6 GROUPS: 13.42 uBAR AVERAGE
STATUS: TRACE #75 DEAD

ENERGY SOURCE:- CAPACITY (in3): 2400 DEPTH (M): 6 PRESSURE (psi): 1800
PERFORMANCE:

NAVIGATION:- SYSTEM: SKYFIX/DGPS STATIONS IN USE: ADELAIDE
PERFORMANCE: 6 SATS BOL

COMMENTS: EDITS: SP#S 245 THROUGH 250 LOST. TAPE TRANSPORT FAILED

258083

\OPREPORT

OPERATIONS REPORT FOR BRIDGE OIL LTD

BRIDGE DURROON AREA; SEPTEMBER 1991

Bureau of Mineral Resources : Rig Seismic

Keith Lockwood, Gary Bickford, Heather Miller

258084

CONTENTS

1. CHRONOLOGICAL SUMMARY

The ship with maritime crew arrived in Portland, western Victoria on September 16, 1991. The geoscience crew joined the vessel on the same day. Preparations for departure proceeded to completion and the vessel departed for the Duroon Basin project area on September 18, 1991. Personnel on the vessel during the project are listed in Appendix I. The ship arrived on prospect by September 20, and cable laying was completed on the same day. A variety of instrument calibration and system checks were conducted during the 20th, and seismic operations commenced by 5.30 am on September 21.

Table 1 lists the sequence of seismic lines shot during the project in chronological order.

From the commencement of operations, a total of 22 hours and 40 mins standby time accumulated as specified in Appendix II. Line BD91-207 was resumed after a discontinuation due to high streamer noise. The northern end of BD91-210 was initially shot with acceptable to marginal streamer noise levels but was reshot at BMR discretion to provide an unbroken line and to provide higher signal-to-noise ratios.

Very strong tidal movements made streamer depths uncontrollable on line BD91-220 beyond SP431. At Representative's request the line was re-commenced at the opposite end and in the opposite direction. At BMR discretion the entire line was shot to provide an unbroken line.

On September 26, seismic field tapes (20 boxes) and support data (3 boxes) were landed at Devonport, Tasmania. They were accepted by Bridge Oil representative Drew Murray for freighting to Digital in Brisbane.

A navigation data set of magnetic tape and support data were despatched from Devonport by hand to BMR Canberra on the same day.

The data shipment details are attached to this report as Appendix III.

TABLE 1

Date	Time from	Time to	Line	SP from	SP to	
Sept 21	0530	0733	BD91-218	203	962	
	0944	1154	BD91-215	140	912	
	1411	1610	BD91-212	166	942	
	1834	1947	BD91-2134	201	655	
	2235		BD91-211	227		
Sept 22		0011	BD91-211		722	
	1446	1654	BD91-213	140	932	
	2142	2355	BD91-216	122	946	
Sept 23	0151	0355	BD91-219	102	869	
	6003	0740	BD91-222	118	714	
	1113	1203	BD91-210	112	421	
	1418	1542	BD91-207	129	650	
	1947	2235	BD91-2071	1030	2072	EXTENSION OF 207
Sept 24	0044	1589	BD91-209	132	1589	
	0630	1021	BD91-206	169	1610	
	1249	1640	BD91-208	191	1621	
	1935	2332	BD91-2101	255	1719	RESHOOT OF 210
Sept 25	0553	0736	BD91-221	123	769	
	0934	1040	BD91-217	103	1040	
	1840	2044	BD91-220	132	870	
	2301		BD91-2201	154		
Sept 26		0058	BD91-2201		879	RESHOOT OF 220

2. DATA ACQUISITION

2.1 Seismic Data

2.1.1 Streamer Cable

The streamer is a Fjord Instruments programmable analogue system configured in a 2400 m length with 192 active seismic channels each of 12.5 m length. A cable diagram for the Bridge Oil application is attached (Figure 1.).

Seven Syntron RCL-3 cable levellers and three RCU-831 heading sensors were used. Cable levellers were attached at the centre of groups 1, 33, 65, 97, 129, 161, and at the end of group 192. Compasses were attached at the centre of groups 17, 113, and 177. Compass readings were entered in the seismic desk log book at regular intervals. Cable depth was held to 10+/- 1.5 m for the survey.

The water-break detectors are at the centres of the leading 12.5 m active gtroups in each active section. For this project, water-breaks were recorded from centre of groups 1, 49, 97,145. They were logged in data channels 203, 204, 205, and 206. Water breaks were displayed regularly on the cycling monitor.

The sensitivity of the seismic streamer groups configured as above is 22 uV per uBar.

2.1.2 The seismic energy source

Two identical arrays of 150 cu. in. GSI sleeve guns were operated during the survey. Sixteen guns in each array were available of which 8 were in operation at any one time. Volume was 2400 cu.in. at a pressure of 1800 psi.

SPECIFIED CONFIGURATION

SHIP	30m	111000	11000	110	10

Gun separation = 0.5 m
Cluster separation + 2.5 m
Array separation port-starboard = 12 m
Depth = 6+/- 1.5 m

The primary : bubble ratio of this configuration is predicted to be 8.6 (see Figure 2).

2.1.3 A correction of -60 ms should be made to seismic time due to gun controller delay.

2.1.3 Performance of seismic source and receiver arrays.

A. The timing of each airgun discharge was monitored by the computer and printed on the gun-logger.

A gun timing error of "300" signifies that no discharge was detected within a 30 ms window of the pre-determined time. This message is commonly an indication that the gun is not programmed for the current shot. Persistent errors of 1-2 ms resulted in

FIGURE 1

Cable Diagram for Bridge Oil Survey (BD91) - BMR Survey 104

Section	Bird	Compass	Water Break	Comments
Tow Leader				
Stretch #1				
Stretch #2				
Stretch #3				
Active # 1	Bird#1		Water Break #1	12.5m group
Active # 2				12.5m group
Active # 3		Compass#8		12.5m group
Active # 4				12.5m group
Active # 5	Bird#2			12.5m group
Active # 6				12.5m group
Active # 7			Water Break#2	12.5m group
Active # 8				12.5m group
Active # 9	Bird#3			12.5m group
Active # 10				12.5m group
Active # 11				12.5m group
Active # 12				12.5m group
Active # 13	Bird#4		Water Break#3	12.5m group
Active # 14				12.5m group
Active # 15		Compass#9		12.5m group
Active # 16				12.5m group
Active # 17	Bird#5			12.5m group
Active # 18				12.5m group
Active # 19			Water Break #4	12.5m group
Active # 20				12.5m group
Active # 21	Bird#6			12.5m group
Active # 22				12.5m group
Active # 23		Compass#10		12.5m group
Active # 24				12.5m group
Stretch# 4	Bird#7			

With 12.5 m groups each section has 8 channels

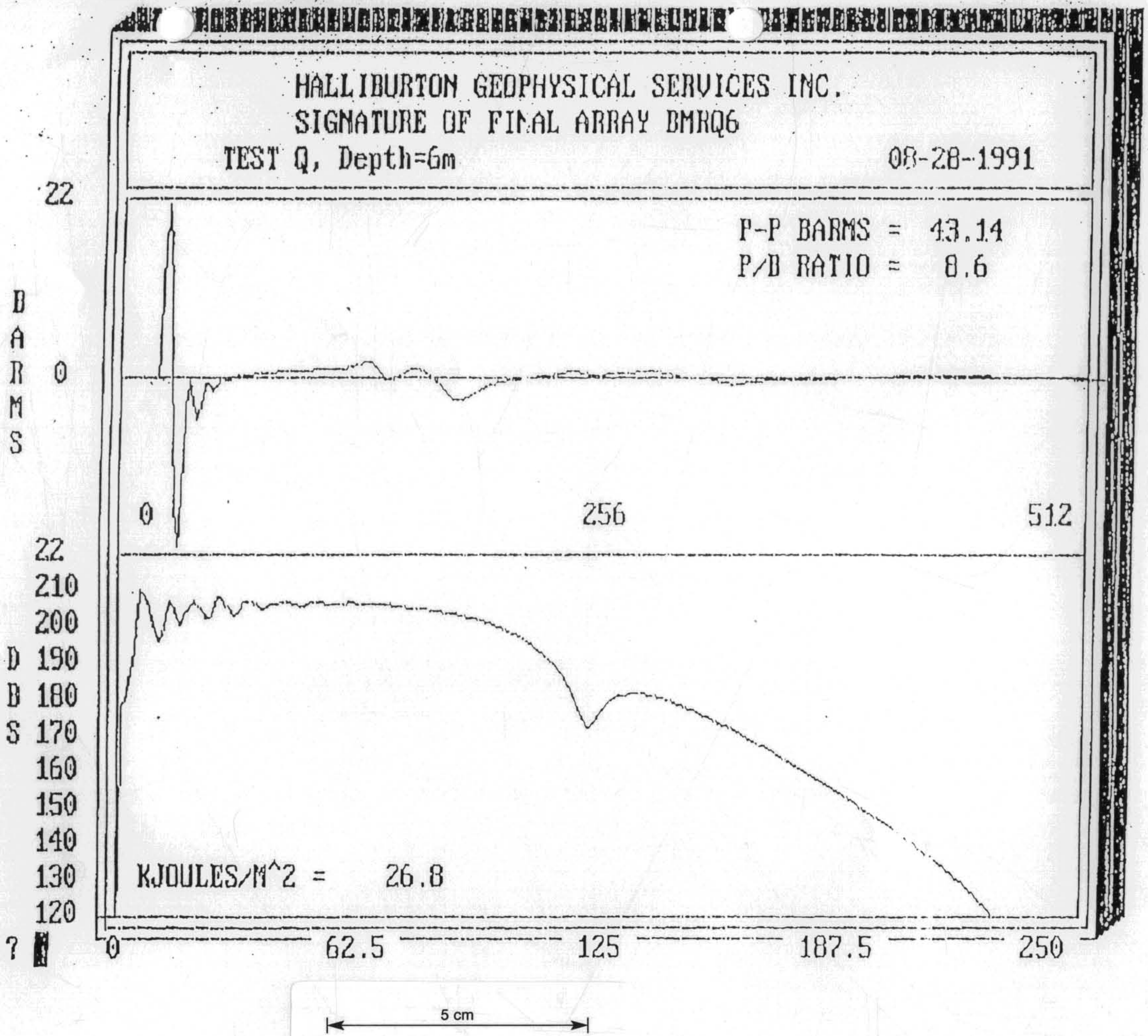


FIGURE 2

258089

the gun being deactivated by the operator and a substitute gun activated provided that no gaps in the cluster of more than 1 m are created, or that no two clusters of the specified size are reduced. The gun-logger records all such errors and substitutions in hard copy. A timing error of more than 2 ms on any gun was treated as a missed shot. On line BD91-217 the gun-logger printing software failed for most of the line but real time monitoring ensured satisfactory performance.

Gun depth sensors were calibrated at the start of project, and at every occasion the arrays were on board between lines for repair. The float-and-rope system for gun-depth control performed satisfactorily for the duration of the project.

On line BD91-218, a single array only (starboard) was firing for the start of the line (SP 162 to 202).

B. The streamer depth indicator outputs were logged as hard copy for each shot on each line, along with bird wing angles and RMS signal levels for each data channel. Streamer depths were satisfactory throughout except for line BD91-220 where strong tidal currents prevented sufficient streamer depth control. The line was reshot as BD91-2201.

Streamer noise levels were monitored at the start and end of each liner. Paper displays incorporating RMS noise levels over 2 seconds for each channel, an average over all data channels, and a histogram in uBar for each channel, were generated and submitted with QC data for each line to Digital. At the beginning of the project, noise levels at a streamer depth of 8+/-1.5 m were marginal to unacceptable, and following discussions with Bridge Oil Representative, the operations commenced with the streamer towing at 10+/-1.5 m.

Streamer data channel 75 was dead in the cable throughout the project.

2.1.4 The seismic acquisition and recording system.

The seismic data recording system is built around a Microvax II computer, a BMR-modified Phoenix a/d converter, and Telex 9273 high density tape drives. Output data is written to tape in a modified 16 bit floating point SEG-Y format. All non-optional words in the headers are standard.

Diagnostic checks and calibrations were performed on significant system components. Prescribed system test results were recorded on tape prior to commencement of operations. These included, but were not restricted to, amplifier noise, converter noise, cross-talk levels, and impulse response tests. The phase homogeneity across all channels was checked and adjusted. Amplifier noise tests and oscillator tests were performed on a daily basis and recorded on tape.

On line BD91-206 the amplifiers remained locked in maximum gain at the start of the line due to a software failure. The failure was corrected after 22 shots from the programmed SOL.

2.1.5 Seismic data quality

Two single channel seismic section displays were produced continuously, at different scales of compression, to provide indications of reflected signal strength. Channel two was invariably used for this purpose. Geological structuring was clearly delineated at times of three seconds or more on most lines.

In addition one channel was taken from each shot and displayed on a separate display, with the channel incremented by one for each successive shot. This provided a hard copy record of the instantaneous quality of channels across all offsets. Shot record displays were dumped at intervals along each line, from memory to printer, to provide further quality checks.

At the conclusion of each line, one or more tapes were mounted on a separate tape drive and played back to demonstrate the integrity of recorded tapes.

2.2 Navigation System

2.2.1 Primary navigation system

The navigation computer logged positions computed from several sources.

A differential GPS system leased from RACAL Survey Ltd provided the primary navigation data. Real time corrections to GPS psuedo-ranges were received via geostationary communication satellite from a reference station at Adelaide during the operation.

The DGPS system consisted of two Trimble 4000 series GPS receivers, one RACAL satellite data demodulator, and RACAL-supplied software running on two COMPAQ 386 PCs. The configuration is schematically shown in Figure 3.

Real-time position control was supplied by the RACAL1 data set.

The separation of the ship and reference station was approximately 1000 km. Figure 4 shows the effects on precision of the range from the reference station, and the GPS error budget for all sources of error.

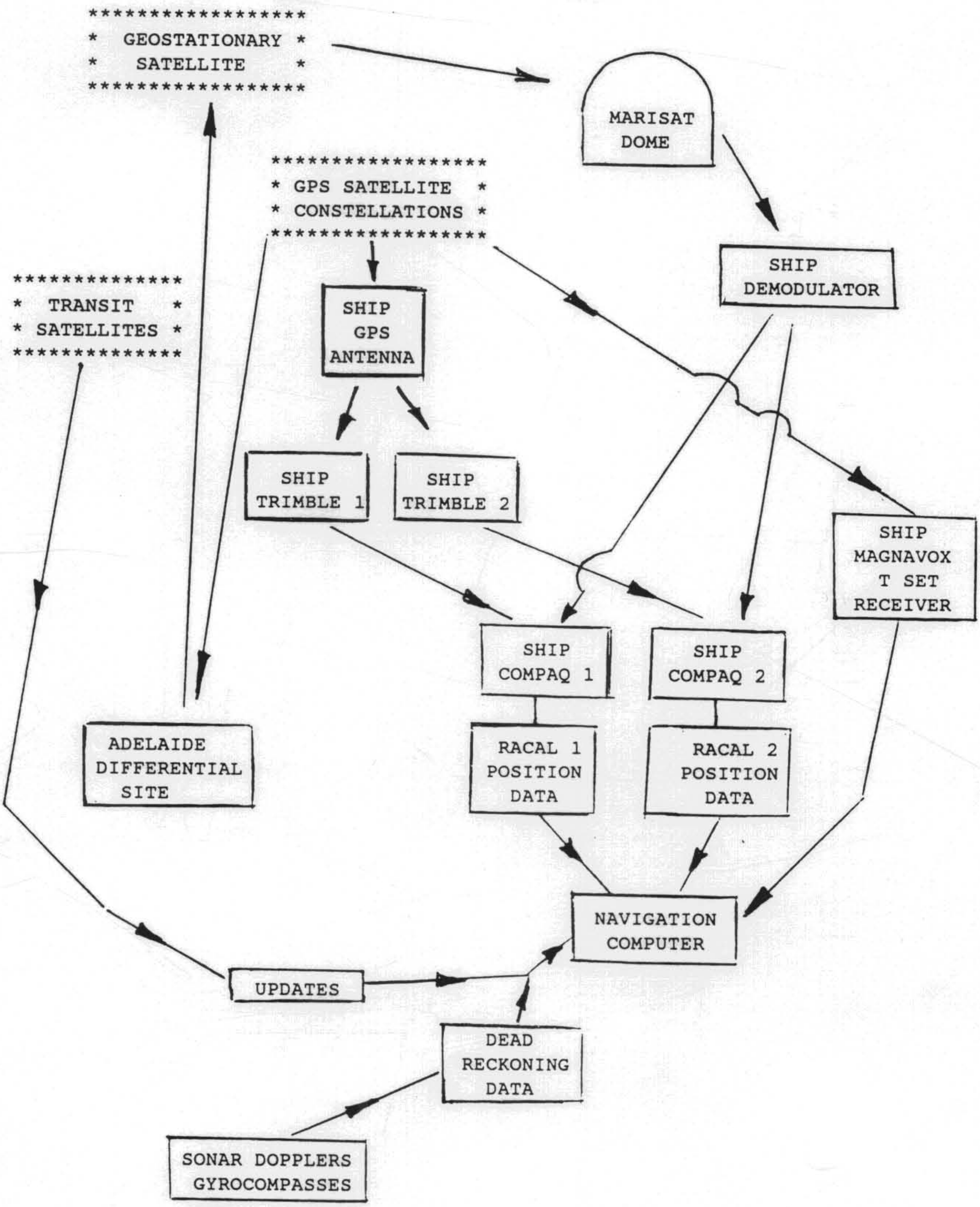
Differential corrections were available for a minimum of 3 psuedo-ranges for all seismic recording operations. In some periods a reduction of precision was experienced. Only 15 of the proposed 18 satellites were in orbit and functioning at the time of the survey.

This resulted in short periods of poor constellation geometry and hence low precision. It was always possible to avoid such periods at start of lines, because of the availability of predictions for the GPS constellations.

Appendix IV lists the predicted precision for a 24-hour period of the survey. Only insignificant variations in this geometric influence occurred over the time of the survey.

2.2.2 Secondary Navigation Systems

FIGURE 3 : NAVIGATION SCHEMATIC



GPS

DGPS ERROR BUDGET WITH DISTANCE

(Brown, Journal of ION, Autumn 1990)

Source/Range	0 KM	200 KM	900 KM	1800 KM	3600 KM	Extended DGPS 3600KM
Clock	0	0	0	0	0	0
Ephemeris	0	0.1	0.5	1	2	1
S.A	0	0	0	0	0	0.3
Ionosphere	0	2	5	6	8	2
Troposphere	0	2	2	2	2	0.3
Receiver Noise	1	1	1	1	1	1
UERE	1	3	5	7	8.5	2.5
NAV Accuracy 1 Sigma HDOP=1.5	1.5	4.5	7.5	10.5	12.75	4

FIGURE 4

The normal reception of a minimum of 3 satellite range corrections (for 3 satlalites in view from the ship) ensured that differential control was in effect for the great majority of the seismic shooting. For a few periods of approximately 10 minutes when 3 useable corrections were not being received (due to shadowing of the dome antenna by the ship's mast for example), control continued in non-differential mode, and ship speed, course, and shot interval were held constant. During other brief periods when less than 3 satellites were visible from the ship (due to shadowing of the GPS antenna or intermittent failure on the space vehicle, for example), then the navigation computer passed control to a non-differential Magnavox T-set receiver with a different antenna and different selection criteria for low altitude satellites. Again, ship conditions were held constant.

When DGPS control became available following such events, the ship was never further off line than 15 metres, and no adjustments to shot interval were necessary.

A further set of ship positions were logged by the main navigation computer. These were determined by dead reckoning based on data from sonar dopplers and a gyro-compass, with satellite fixes at regular intervals. These data are not considered suitable for seismic positioning at the petroleum prospect standard unless suitably post-processed.

2.2.3 Navigation Post Processing

All raw and corrected field positioning data from all sources were returned to BMR Canberra for processing. 128 channels of data at 1 minute intervals were written to tape from the navigation computer.

Appendix V lists the non-seismic data channels.

The field NAVLOG printouts listed much of this information, so as to provide quality assurance during acquisition.

On close inspection the RACAL2 data set proved to be slightly less noisy than RACAL1 and was adopted as the core data set. The final corrected locations were based on a blend of processed data from the several field systems.

The corrected locations were written to tape as an ASCII file of position in standard UKOA format, and provided to Bridge Oil.

2.2.4 Shot spacing

The seismic recording system receives speed information from the navigation computer and varies the shot interval as appropriate, within an operator-specified window. Adjustments were rarely made to this window because of the transient nature of the environmental factors influencing apparent ship speed.

Ship's antenna position for each shot was generated by resampling the time series navigation data. The shot number was logged by the navigation data logging system every 10 seconds. Setback distance to the shot is :

(Antenna to stern) + (Stern to array centre) = 46 m+36 m = 82 m

2.2.5 Offset information

Distance from stern to the centre group 1 is given by the lengths of 3 x 50 m stretch sections plus the armoured-leader length as reported in the seismic log book. Distance from stern to the centre of gun array is 36 m.

Water break arrivals were recorded to provide additional offset information.

There are thus two sources of shot-to-group 1 offset information.

2.3 OTHER DATA

2.3.1 Gravity Data

A Bodenseewerk Geosystem KSS-31 marine gravity meter was operated continuously throughout the survey. The output was logged by the navigation data logging computer, along with ship velocity and direction. The status of these data is subject to clarification. It is not intended that the data be reduced or presented within any specific time frame.

2.3.2 Magnetic Data

A geometrics G801/803 magnetometer was operated along most seismic lines. The output was logged by the navigation data logging computer. The status of these data is subject to clarification. It is not intended that the data be reduced or presented in any specific time frame.

2.3.3 Water column trace hydrocarbon data

DHD (direct hydrocarbon detection) equipment, consisting of light hydrocarbon extractor and gas chromatographs, were operated in test mode during a proportion of the survey. This was for test and calibration purposes only and provided no data of significance to the survey.

2.3.4 Water Depth Data

Bathymetric data were obtained from a Raytheon echo-sounder frequency 12 KHz and a maximum output of 2kW. The transducer was mounted on the lower end of an extendable boom and operated at a depth of 9 meters. Water depth data were continuously plotted on an EPC recorder. The water depth given by the separation of the outgoing and return pulses (heavy lines) on the EPC displays should be corrected by +9 m for a sea-level datum. The scale used was 1000 m full deflection.

Digital water depths were recorded and listed as "DEPTH2" on the NAVLOG1 printouts at one minute intervals.

3. TAPE LISTINGS, LINE LENGTH LISTINGS

3.1 TAPE LISTINGS

Appendix III(2) shows the first and last tape number for each line shot during the project. Where a line segment was reshot and hence a sequence of tapes is not to be processed, this is indicated in the list.

3.2 LINE LENGTH LISTINGS

A first and last good shot were logged in the seismic log book, together with a time (UTC). These are also the defined line ends used in the line summaries which accompanied the field tapes to Digital. The location of the line ends is available from the NAVLOG printout but this can only be read from nearest whole minute of time so that locations noted in the field are for a ship position to within 30 seconds. The defined line ends in latitude and longitude were used to compute the lengths of lines in column 6 of Table 2. The figures in column 7 are derived on the assumption that shot spacing was constant at 25 metres. The methods give total km shot as 398.20 and 399.95 respectively. The former figure is regarded as the most accurate (Column 6).

Respectfully submitted.

K. Lockwood
Through Chief, Marine Program

T. Powell

TABLE 2

LINE	START	POSITION	STOP	POSITION	LENGTH	LENGTH
206	SP 169	40 deg 26.488 min	SP 1610	40 deg 43.832 min	36.31	36.025
		147 deg 31.771 min		147 deg 46.000 min		
207	SP 129	40 deg 25.941 min	SP 650	40 deg 31.833 min	12.99	13.025
		147 deg 32.787 min		147 deg 37.782 min		
2071	SP 1030	40 deg 30.871 min	SP2072	40 deg 42.801 min	22.14	26.05
		147 deg 36.943 min		147 deg 37.782		
208	SP 191	40 deg 41.439 min	SP 1621	40 deg 24.823 min	36.42	35.75
		147 deg 46.992 min		147 deg 33.182 min		
209	SP 132	40 deg 41.156 min	SP 1589	40 deg 24.332 min	36.61	36.425
		147 deg 48.113 min		147 deg 34.479 min		
2101	SP 255	40 deg 23.763 min	SP 1719	40 deg 40.889 min	37.18	36.6
		147 deg 36.313 min		147 deg 50.068 min		
211	SP 127	40 deg 30.623 min	SP 722	40 deg 26.117 min	14.94	14.875
		147 deg 30.965 min		147 deg 39.750 min		
212	SP 166	40 deg 33.636 min	SP 942	40 deg 27.753 min	19.36	19.4
		147 deg 29.755 min		147 deg 41.107 min		
213	SP 140	40 deg 34.607 min	SP 932	40 deg 28.515 min	19.57	19.8
		147 deg 30.097 min		147 deg 41.594 min		
214	SP 201	40 deg 30.331 min	SP 655	40 deg 33.853 min	11.24	11.35
		147 deg 41.832 min		147 deg 35.338 min		
215	SP 140	40 deg 29.736 min	SP 912	40 deg 35.675 min	19.64	19.3
		147 deg 44.940 min		147 deg 33.387 min		
216	SP 122	40 deg 35.809 min	SP 946	40 deg 29.369 min	20.4	20.6
		147 deg 37.355 min		147 deg 49.107 min		
217	SP 103	40 deg 36.856 min	SP 1040	40 deg 29.334 min	23.34	23.425
		147 deg 37.857 min		147 deg 51.154 min		
218	SP 203	40 deg 36.984 min	SP 962	40 deg 30.719 min	19.22	18.975
		147 deg 40 234 min		147 deg 51.119 min		
219	SP 102	40 deg 32.702 min	SP 869	40 deg 39.198 min	19.17	19.175
		147 deg 50.581 min		147 deg 39.979min		
2201	SP 154	40 deg 40.189 min	SP 879	40 deg 33.705 min	18.5	18.125
		147 deg 41.429 min		147 deg 51.434 min		
221	SP 123	40 deg 36.250 min	SP 769	40 deg 41.904 min	16.23	16.15
		147 deg 50.305 min		147 deg 41.488 min		
222	SP 118	40 deg 42.819 min	SP 714	40 deg 37.737 min	14.94	14.9
		147 deg 44.075 min		147 deg 52.332 min		

258098

APPENDIX I

Personnel on board Rig Seismic during Bridge Duroon Project

	BMR Staff		Maritime Staff
Party Leaders	Gary Bickford	Master	Bob Hardinge
	Keith Lockwood	Chief Eng.	John Scott
Systems/QC	Heather Miller	Eng. Staff	Tom Ireland
	Noori Alavi		Don Brown
Seismic Observers	Jim Bedford	Electrician	Wayne Hanson
	Lavchlan Hatch		
		First Officer	Lindsay Gillies
Navigation	Chris Lawson		
	Tiernan McNamara	2nd Officer	Mike Gusterson
	Cameron Buchanan		
	Jim Reid	AB1	Lucky Luscombe
Electronics	Lindsay Miller	AB2	Mike Pitcher
	Claude Saroch		
	Martin Callaway	AB3	John Fraser
Mechanical	John Roberts	Ch. Steward	Henk Dekker
	Simon Milnes		
	stephen Wiggins	Cook	Wasa Leary
	David Sewter		
	Ross Bodger	Steward	Steve Staveley
		Stwd/seaman	Steve O'Rourke

Other BMR Staff

Geochemistry	Jeremy Bishop
	Greg Sparksman
	Fenji Stradwick

APPENDIX II

Data transfer and Standby Time

As defined under the terms of Appendix G of the agreement, standby time accumulated as follows :

September 22

Start 0500 hrs : abandoned start of line BD91-210 due to weather - gun string being thrown across cable leadin by heavy swells.

Continued to start of line BD91-213, which in turn was abandoned due to heavy swells and inoperable weather conditions.

Concluded with successful start of line BD91-213 at 1446 hrs

STANDBY 8 HR 30 M

September 25

Start 0243 hrs : abandoned start of line BD91-221 due to excessive feathering and noise.

Concluded with successful start to same line at 0553

STANDBY 3 HR 10 M

September 25

Start 1933 hrs : abandoned line BD91-220 at SP431 due uncontreollable cable in strong tidal conditions.

Concluded 2301 hrs, start of line BD91-2201

STANDBY 3 HR 30 M

September 26

Start 0700 hrs : cable recovered, en route to Devonport for data drop and disembark Representative

Concluded 1530 hrs, depart Devonport for other program

STANDBY 8 HR 30 M

CUMULATIVE STANDBY 22 HR 40 M

APPENDIX III (1)

BMR TO DIGITAL EXPLORATION LTD

20 BOXES SEISMIC TAPES

BOX NO.	FROM	TO
1	1	10
2	11	20
3	21	30
4	31	40
5	41	50
6	51	60
7	61	70
8	71	80
9	81	90
10	91	100
11	101	110
12	111	120
13	121	130
14	131	140
15	141	150
16	151	160
17	161	170
18	171	180
19	181	190
20	191	193

TOTAL 20 BOXES 193 TAPES

Received by: on behalf of Bridge Oil

APPENDIX III (2) 258101

		BMR		BRIDGE	OIL		
	TAPE	LIST	PROJECT	BD91			
	LINE			TAPES			
	BD91-218		1	TO	9		
	BD91-215		10	TO	17		
	BD91-212		18	TO	26		
	BD91-214		27	TO	32		
	BD91-211		33	TO	39		
	BD91-213		40	TO	48		
	BD91-216		49	TO	57		
	BD91-219		58	TO	65		
	BD91-222		66	TO	72		
	BD91-210		73	TO	76	DO NOT PROCESS	
	BD91-207		77	TO	84		
	BD91-2071		85	TO	96		
	BD91-209		97	TO	112		
	BD91-206		113	TO	128		
	BD91-208		129	TO	145		
	BD91-2101		146	TO	162		
	BD91-221		163	TO	168		
	BD91-217		169	TO	177		
	BD91-220		178	TO	185	DO NOT PROCESS	
	BD91-2201		186	TO	194		

N. Lockwood.
26/9/91.

Copy to Dave Murray
BMR

APPENDIX III (3)

104 BD91 - Bridge Oil - Items Dispatched

Navlog 1
BD91-001
Start: 104.259.0800
Stop: 104.263.1822

Navlog 2
BD91-001
Start: 104.260.2241
Stop: 104.263.1806

Navlog 2
BD91-002
Start: 104.263.1806
Stop: 104.267.2340

Navlog 2
BD91-003
Start: 104.267.2350
Stop: 104.268.1504

DAS TTY
BD91-001
Start: 104.260.0907
Stop: 104.263.1800

Seismic Log Book

Received by: on behalf of Bridge Oil

APPENDIX III (4)

Survey 104- BD91- Bridge Oil

EPC Rolls
12Khz
104/001
Start:
Stop: 104.264.1000

104/002
Start: 104.264.1010
Stop: 104.268.0015

3.5Khz
104/001
Start: 104.263.0500
Stop: 104.265.1245

104/002
Start: 104.265.1250
Stop: 104.268.2044

Received by: on behalf of Bridge Oil

APPENDIX III (5)

BMR TO DIGITAL EXPLORATION LTD

3 BOXES ADDITIONAL DATA

BOX NO.		
1		4 envelopes of QC Data, EPC Rolls, noise tests, instrument tests, line cover notes
2		Lines 206-214 Printouts(Shot logger, Gun logger, Seismic TTY, Cycling Monitor, Slow Monitor, Fast Monitior)
3		Lines 206-214 Printouts(Shot logger, Gun logger, Seismic TTY, Cycling Monitor, Slow Monitor, Fast Monitior)
	TOTAL	3 BOXES

Received by: on behalf of Bridge Oil

		Survey number 104, BD91 Bridge Oil				
	Items despatched to BMR with Cameron Buchannan					
	Navlog1					
	BD91-002					
	Start: 104.263.1806					
	Stop: 104.267.1340					
	Navlog1					
	BD91-003					
	Start: 104.267.1340					
	Stop: 104.268.1519					
	DAS TTY					
	BD91-002					
	Start: 104.263.1800					
	Stop: 104.267.1335					
	DAS TTY					
	bd91-003					
	Start: 104.267.1338					
	Stop: 104.268.1518					
	DAS Tapes					
	Number	Start	Stop			
	104/001		104.263.0105			
	104/D002	104.263.0105	104.264.2352			
	104/D003	104.264.2352	104.266.2002			
	104/D004	104.266.2002	104.267.1519		System Crash	
	104/D005	104.267.1542	104.268.1618			

APPENDIX IV (1)

SATVIZ: GPS Satellite Visibility And
Dilution of Precision and Satellite Combination Table

Scenario:	C:\SATVIZ\ADEL.SCN
Almanac:	C:\SATVIZ\SVIZ0830.ALM
Scenario Date:	Sunday September 22, 1991
Scenario Time:	From 00:00 To 00:00 (UTC)
Position (WGS-84):	S35:00.00000, E138:00.00000
Visibility Mask:	10.00 degrees
SVs Enabled:	2 3 6 11 12 13 14 15 16 17 18 19 20 21 23 24
SVs Disabled:	None
SVs Not Visible:	All Enabled Satellites Visible
Optimized For:	HDOP

Time	Satellites	PDOP	HDOP	VDOP	Unused Satellites
00:00	14 15 18 19	7.4	4.4	6.0	
00:05	14 15 18 19	6.1	3.7	4.9	
00:10	14 15 18 19	5.3	3.3	4.2	
00:14	14 15 18 19	4.7	3.0	3.7	
00:58	* 14 18 19 24	3.7	2.4	2.9	
01:02	14 18 19 24	3.6	2.3	2.8	
01:07	14 18 19 24	3.6	2.3	2.7	
01:12	14 18 19 24	3.5	2.3	2.6	
01:17	14 18 19 24	3.4	2.3	2.5	
01:22	14 18 19 24	3.4	2.3	2.5	
01:26	14 18 19 24	3.3	2.3	2.4	
01:31	14 18 19 24	3.3	2.3	2.4	
01:36	14 18 19 24	3.3	2.3	2.3	
01:41	14 18 19 24	3.3	2.4	2.4	
01:46	14 18 19 24	3.4	2.4	2.4	
01:50	14 18 19 24	3.5	2.5	2.4	
01:55	14 18 19 24	3.6	2.6	2.5	
02:00	14 18 19 24	3.8	2.7	2.6	
02:19	* 06 14 18 19	10.3	6.1	8.4	
02:24	* 02 06 18 19	10.6	6.1	8.7	14
02:29	* 02 06 14 19	10.7	6.2	8.7	18
02:34	* 02 06 14 18	9.0	4.9	7.5	19
02:38	* 06 14 16 18	2.8	1.6	2.3	02 19
02:43	06 14 16 18	2.7	1.6	2.2	02 19
02:48	* 06 16 18 19	4.0	2.3	3.2	02
02:53	06 16 18 19	4.1	2.3	3.4	02
02:58	06 16 18 19	4.3	2.3	3.6	02
03:02	* 02 11 16 19	2.3	1.2	1.9	06 18
03:07	02 11 16 19	2.3	1.3	1.9	06 18
03:12	02 11 16 19	2.4	1.3	2.0	06 18
03:17	02 11 16 19	2.5	1.3	2.1	06 18
03:22	02 11 16 19	2.5	1.3	2.2	06 18
03:26	02 11 16 19	2.6	1.3	2.3	06 18
03:31	02 11 16 19	2.7	1.4	2.3	06 18
03:36	02 11 16 19	2.8	1.4	2.4	06 18
03:41	02 11 16 19	2.9	1.5	2.5	06 18
03:46	02 11 16 19	3.1	1.6	2.6	06 18
03:50	* 02 16 18 19	4.6	1.6	4.3	06 11
03:55	02 16 18 19	4.3	1.5	4.0	06 11
04:00	02 16 18 19	4.1	1.5	3.8	06 11
04:05	* 11 16 18 19	3.6	1.5	3.3	02 06
04:10	11 16 18 19	3.7	1.4	3.4	02 06
04:14	11 16 18 19	3.8	1.4	3.6	02 06
04:19	11 16 18 19	3.9	1.4	3.7	02 06
04:24	11 16 18 19	4.0	1.3	3.7	02 06
04:29	11 16 18 19	4.0	1.3	3.8	02 06
04:34	11 16 18 19	4.0	1.3	3.8	02 06
04:38	11 16 18 19	4.0	1.3	3.7	02 06
04:43	11 16 18 19	3.9	1.3	3.7	02 06

IZ: GPS Satellite Visibility And Geometry Analysis
Dilution of Precision and Satellite Combination Table

Scenario:	C:\SATVIZ\BASS.SCN
Almanac:	C:\SATVIZ\SVIZ0830.ALM
Scenario Date:	Sunday September 22, 1991
Scenario Time:	From 00:00 To 24:00 (UTC)
Position (WGS-84):	S41:00.00000, E147:00.00000
Visibility Mask:	10.00 degrees
SVs Enabled:	2 3 6 11 12 13 14 15 16 17 18 19 20 21 23 24
SVs Disabled:	None
SVs Not Visible:	All Enabled Satellites Visible

Time	Satellites	PDOP	HDOP	VDOP	Unused Satellites
00:00	14 18 19	.	2.4	.	
00:05	14 18 19	.	2.4	.	
00:10	14 18 19	.	2.4	.	
00:14	14 18 19	.	2.4	.	
00:19	14 18 19	.	2.4	.	
00:24	14 18 19	.	2.4	.	
00:29	14 18 19	.	2.4	.	
00:34	14 18 19	.	2.4	.	
00:38	14 18 19	.	2.4	.	
00:43	14 18 19	.	2.4	.	
00:48	14 18 19	.	2.4	.	
00:53	14 18 19	.	2.4	.	
00:58	14 18 19	.	2.4	.	
01:02	14 18 19	.	2.4	.	
01:07	14 18 19	.	2.4	.	
01:12	14 18 19	.	2.4	.	
01:17	14 18 19	.	2.4	.	
01:22	14 18 19	.	2.4	.	
01:26	14 18 19	.	2.4	.	
01:31	14 18 19	.	2.4	.	
01:36	14 18 19	.	2.5	.	
01:41	14 18 19	.	2.5	.	
01:46	14 18 19	.	2.5	.	
01:50	14 18 19	.	2.5	.	
01:55	14 18 19	.	2.6	.	
02:00	14 18 19	.	2.6	.	
02:05	14 18 19	.	2.6	.	
02:10	14 18 19	.	2.7	.	
02:14	14 18 19	.	2.7	.	
02:19	14 18 19	.	2.8	.	
02:24	14 18 19	.	2.8	.	
02:29	14 18 19	.	2.9	.	
02:38	* 16 18 19	.	6.5	.	
02:43	* 02 11 16	.	1.2	.	18 19
02:48	02 11 16	.	1.2	.	18 19
02:53	02 11 16	.	1.2	.	06 18 19
02:58	02 11 16	.	1.3	.	06 18 19
03:02	02 11 16	.	1.3	.	06 18 19
03:07	02 11 16	.	1.3	.	06 18 19
03:12	02 11 16	.	1.3	.	06 18 19
03:17	02 11 16	.	1.3	.	06 18 19
03:22	02 11 16	.	1.4	.	06 18 19
03:26	02 11 16	.	1.4	.	06 18 19
03:31	02 11 16	.	1.4	.	06 18 19
03:36	02 11 16	.	1.5	.	06 18 19
03:41	02 11 16	.	1.5	.	06 18 19
03:46	02 11 16	.	1.6	.	06 18 19
03:50	02 11 16	.	1.7	.	06 18 19
03:55	* 11 16 18	.	1.7	.	02 06 19
04:00	11 16 18	.	1.6	.	02 06 19

APPENDIX IV (1)

04:48		11	16	18	19	3.8	1.3	3.6	02 06
04:53		11	16	18	19	3.7	1.2	3.5	02 06
04:58		11	16	18	19	3.6	1.2	3.4	02 06
05:02		11	16	18	19	3.5	1.2	3.3	02 06
05:07	*	06	11	16	19	3.3	1.7	2.9	02
05:12		06	11	16	19	3.1	1.6	2.7	02
05:17		06	11	16	19	3.0	1.5	2.6	02
05:22		06	11	16	19	2.8	1.5	2.4	02
05:26	*	02	06	16	19	4.2	2.5	3.4	
05:31		02	06	16	19	4.5	2.7	3.6	
05:36		02	06	16	19	4.8	2.8	3.9	
05:41	*	02	13	16	19	5.0	2.7	4.2	06
05:46		02	13	16	19	4.8	2.5	4.0	06
05:50		02	13	16	19	4.5	2.3	3.9	06
05:55		02	13	16	19	4.3	2.2	3.7	06
06:00	*	06	13	16	19	4.7	2.0	4.3	02
06:05		06	13	16	19	4.1	1.8	3.7	02
06:10		06	13	16	19	3.7	1.7	3.3	02
06:14	*	02	06	13	19	22.3	10.9	19.4	
06:19		02	06	13	19	36.2	18.5	31.0	
06:24		02	06	13	19	88.1	47.7	74.1	
07:22	*	02	06	12	13	27.8	13.2	24.4	
07:26		02	06	12	13	47.0	23.1	40.9	
07:36	*	02	06	12	13	62.5	33.8	52.6	
07:41		02	06	12	13	26.4	15.0	21.7	
07:46		02	06	12	13	16.3	9.8	13.1	
07:50	*	02	12	13	24	2.2	1.3	1.7	06
07:55		02	12	13	24	2.2	1.3	1.7	06
08:00		02	12	13	24	2.2	1.3	1.8	06
08:05		02	12	13	24	2.3	1.4	1.9	06
08:10	*	02	06	12	24	4.5	1.4	4.3	13
08:14		02	06	12	24	4.8	1.4	4.6	13
08:19		02	06	12	24	5.1	1.4	4.9	13
08:24	*	02	12	13	24	2.7	1.5	2.2	06
08:29		02	12	13	24	2.8	1.6	2.3	06
08:34		02	12	13	24	3.0	1.6	2.5	06
08:38		02	12	13	24	3.2	1.7	2.6	06
08:43		02	12	13	24	3.4	1.9	2.8	06
08:48		02	12	13	24	3.6	2.0	3.0	06
08:53		02	12	13	24	3.9	2.2	3.2	06
08:58	*	06	12	13	24	5.6	3.0	4.8	
09:02		06	12	13	24	5.6	3.0	4.7	
09:07		06	12	13	24	5.5	3.1	4.5	
09:12		06	12	13	24	5.3	3.1	4.2	
09:17	*	06	13	20	24	3.3	2.1	2.6	12
09:22		06	13	20	24	3.2	2.0	2.5	12
09:26		06	13	20	24	3.0	1.9	2.3	12
09:31	*	12	13	20	24	3.5	2.0	2.9	
09:36		12	13	20	24	3.5	2.0	2.9	
09:41		12	13	20	24	3.5	2.0	2.9	
09:46		12	13	20	24	3.6	2.0	3.0	
09:50		12	13	20	24	3.9	2.2	3.2	
09:55		12	13	20	24	4.3	2.4	3.6	
10:00		12	13	20	24	5.0	2.8	4.1	
10:05		12	13	20	24	6.1	3.4	5.1	
10:10		12	13	20	24	8.3	4.6	6.9	
10:14		12	13	20	24	13.5	7.5	11.2	
10:19	*	03	13	20	24	2.8	1.6	2.4	12
10:24		03	13	20	24	2.8	1.6	2.3	12
10:29		03	13	20	24	2.7	1.6	2.2	12
10:34		03	13	20	24	2.7	1.7	2.1	12
10:38	*	03	12	13	20	2.6	1.7	2.0	24
10:43		03	12	13	20	2.6	1.7	2.0	24
10:48	*	03	12	13	16	2.3	1.3	1.8	20 24
10:53	*	03	13	16	24	2.3	1.3	1.9	12 20
10:58		03	13	16	24	2.3	1.3	2.0	12 20

:05		11	16	18	.	1.6	.	02 06 19	
:10		11	16	18	.	1.5	.	02 06 19	
04:14		11	16	18	.	1.5	.	02 06 19	
04:19		11	16	18	.	1.4	.	02 06 19	
04:24		11	16	18	.	1.4	.	02 06 19	
04:29		11	16	18	.	1.4	.	02 06 19	
04:34		11	16	18	.	1.3	.	02 06 19	
04:38		11	16	18	.	1.3	.	02 06 19	
04:43		11	16	18	.	1.3	.	02 06 19	
04:48		11	16	18	.	1.3	.	02 06 19	
04:53		11	16	18	.	1.3	.	02 06 19	
04:58		11	16	18	.	1.2	.	02 06 19	
05:02	*	11	16	19	.	2.1	.	02 06	
05:07		11	16	19	.	2.0	.	02 06	
05:12		11	16	19	.	1.9	.	02 06	
05:17		11	16	19	.	1.7	.	02 06	
05:22		11	16	19	.	1.7	.	02 06	
05:26		11	16	19	.	1.6	.	02 06	
05:31		11	16	19	.	1.5	.	02 06	
05:36	*	02	11	19	.	2.0	.	06	
05:41		02	11	19	.	2.1	.	06 15	
05:46		02	11	19	.	2.1	.	06 15	
05:50		02	11	19	.	2.2	.	06 15	
05:55	*	06	13	15	.	1.6	.	02 19	
06:00		06	13	15	.	1.7	.	02 19	
06:05	*	06	13	19	.	1.8	.	02 15	
06:10		06	13	19	.	1.8	.	02 15	
06:14		06	13	19	.	1.8	.	02 15	
06:19		06	13	19	.	1.9	.	02 15	
06:24		06	13	19	.	1.9	.	02 15	
06:29		06	13	19	.	1.9	.	02 15	
06:34	*	02	13	19	.	2.0	.	06 15	
06:38		02	13	19	.	2.0	.	06 15	
06:43	*	02	13	15	.	4.6	.	06	
06:48		02	13	15	.	5.8	.	06	
06:53		02	13	15	.	7.9	.	06	
06:58		02	13	15	.	12.4	.	06	
07:02	*	02	06	15	.	27.8	.	13	
07:07	*	06	13	15	.	18.5	.	02	
07:12		06	13	15	.	9.5	.	02	
07:17		06	13	15	.	6.5	.	02	
07:22		06	13	15	.	5.0	.	02	
07:26	*	12	13	15	.	1.5	.	02 06	
07:31		12	13	15	.	1.5	.	02 06	
07:36		12	13	15	.	1.5	.	02 06	
07:41	*	02	12	13	.	1.7	.	06	
07:46		02	12	13	.	1.8	.	06	
07:50		02	12	13	.	1.9	.	06	
07:55		02	12	13	.	2.0	.	06	
08:00		02	12	13	.	2.1	.	06	
08:05	*	02	12	24	.	1.4	.	06 13	
08:10		02	12	24	.	1.4	.	06 13	
08:14		02	12	24	.	1.4	.	06 13	
08:19		02	12	24	.	1.4	.	06 13	
08:24		02	12	24	.	1.4	.	06 13	
08:29		02	12	24	.	1.4	.	06 13	
08:34		02	12	24	.	1.5	.	06 13	
08:38		02	12	24	.	1.5	.	06 13	
08:43		02	12	24	.	1.5	.	06 13	
08:48		02	12	24	.	1.6	.	06 13	
08:53		02	12	24	.	1.6	.	06 13	
08:58		02	12	24	.	1.7	.	06 13	
09:02		02	12	24	.	1.7	.	06 13	
09:07		02	12	24	.	1.8	.	06 13	
09:12		02	12	24	.	1.9	.	06 13	
09:17		02	12	24	.	2.0	.	06 13	

APPENDIX IV (2)

11:02 *	03 12 16 20	3.0	1.8	2.3	24
11:07 *	03 12 16 24	3.0	1.7	2.4	20
11:12	03 12 16 24	3.1	1.6	2.6	20
11:17	03 12 16 24	3.3	1.5	2.9	20
11:22	03 12 16 24	3.6	1.5	3.3	20
11:26	03 12 16 24	4.1	1.4	3.8	20
11:31	03 12 16 24	4.8	1.4	4.6	20
11:36	03 12 16 24	6.0	1.4	5.8	20
11:41	03 12 16 24	8.2	1.5	8.1	17 20
11:46 *	03 12 20 24	4.2	1.6	3.9	16 17
11:50	03 12 20 24	3.9	1.6	3.6	16 17
11:55	03 12 20 24	3.7	1.6	3.3	16 17
12:00	03 12 20 24	3.5	1.6	3.1	16 17
12:05 *	03 12 16 24	8.9	1.5	8.8	17 20
12:10	03 12 16 24	6.5	1.4	6.3	17 20
12:14 *	03 16 17 24	5.8	1.3	5.6	12 20
12:19	03 16 17 24	5.3	1.3	5.2	12 20
12:24 *	03 12 16 24	3.8	1.3	3.5	17 20
12:29	03 12 16 24	3.4	1.3	3.1	17 20
12:34	03 12 16 24	3.1	1.3	2.8	17 20
12:38 *	03 16 17 24	4.1	1.5	3.9	20
12:43	03 16 17 24	3.9	1.5	3.6	20
12:48	03 16 17 24	3.8	1.6	3.4	20
12:53	03 16 17 24	3.6	1.7	3.2	20
12:58 *	03 16 17 20	4.5	1.7	4.2	24
13:02	03 16 17 20	5.0	1.7	4.7	
13:07	03 16 17 20	5.6	1.8	5.3	
13:12	03 16 17 20	6.4	1.8	6.2	
13:17	03 16 17 20	7.5	1.9	7.3	
13:22	03 16 17 20	9.0	2.0	8.7	
13:26	03 16 17 20	10.8	2.2	10.6	
13:31	03 16 17 20	13.0	2.5	12.8	
13:36 *	03 16 20 23	3.1	2.0	2.4	17
13:41	03 16 20 23	3.3	2.1	2.6	17
13:46 *	16 17 20 23	3.5	2.1	2.7	03
13:50	16 17 20 23	3.6	2.1	2.9	03
13:55	16 17 20 23	3.9	2.2	3.2	03
14:00	16 17 20 23	4.2	2.3	3.6	03
14:05	16 17 20 23	4.7	2.5	4.0	03
14:10	16 17 20 23	5.4	2.8	4.6	03
14:14	16 17 20 23	6.3	3.3	5.4	03
14:19 *	03 16 17 20	7.5	4.0	6.3	23
14:24	03 16 17 20	6.4	3.7	5.3	23
14:29	03 16 17 20	5.6	3.4	4.4	23
14:34	03 16 17 20	5.0	3.2	3.8	23
14:38	03 16 17 20	4.5	3.0	3.3	23
14:43	03 16 17 20	4.1	2.9	2.9	23
14:48	03 16 17 20	3.8	2.8	2.6	23
14:53	03 16 17 20	3.5	2.7	2.3	23
14:58	03 16 17 20	3.4	2.6	2.1	23
15:02 *	03 17 20 23	5.7	3.3	4.6	
15:07	03 17 20 23	5.2	3.2	4.1	
15:12 *	03 17 21 23	3.7	2.6	2.7	20
15:17	03 17 21 23	3.8	2.6	2.7	
15:22	03 17 21 23	3.8	2.5	2.8	
15:26	03 17 21 23	3.8	2.5	2.9	
15:31	03 17 21 23	3.9	2.5	3.0	
15:36	03 17 21 23	3.9	2.5	3.0	
15:41	03 17 21 23	4.0	2.4	3.1	
15:46	03 17 21 23	4.0	2.4	3.2	
15:50	03 17 21 23	4.1	2.4	3.3	
15:55	03 17 21 23	4.2	2.4	3.4	
16:00	03 17 21 23	4.3	2.4	3.6	
16:05	03 17 21 23	4.4	2.4	3.7	
16:10	03 17 21 23	4.6	2.4	3.9	
16:14	03 17 21 23	4.8	[illegible]	4.1	

?22 *	06 12 13	.	2.7	.	24
?26	06 12 13	.	2.5	.	24
09:31 *	13 20 24	.	1.7	.	12
09:36	13 20 24	.	1.7	.	12
09:41	13 20 24	.	1.7	.	12
09:46	13 20 24	.	1.7	.	12
09:50	13 20 24	.	1.7	.	12
09:55	13 20 24	.	1.8	.	12
10:00	13 20 24	.	1.8	.	12
10:05	13 20 24	.	1.8	.	12
10:10	13 20 24	.	1.8	.	12
10:14	13 20 24	.	1.9	.	12
10:19	13 20 24	.	1.9	.	12
10:24 *	12 13 20	.	1.9	.	24
10:29	12 13 20	.	1.9	.	24
10:34	12 13 20	.	1.8	.	24
10:38	12 13 20	.	1.8	.	24
10:43	12 13 20	.	1.7	.	24
10:48	12 13 20	.	1.7	.	03 24
10:53 *	03 13 16	.	1.3	.	12 20 24
10:58	03 13 16	.	1.3	.	12 20 24
11:02	03 13 16	.	1.3	.	12 20 24
11:07	03 13 16	.	1.3	.	12 20 24
11:12	03 13 16	.	1.3	.	12 20 24
11:17	03 13 16	.	1.4	.	12 20 24
11:22	03 13 16	.	1.4	.	12 20 24
11:26	03 13 16	.	1.4	.	12 20 24
11:31	03 13 16	.	1.5	.	12 20 24
11:36 *	03 12 24	.	1.7	.	16 20
11:41	03 12 24	.	1.6	.	16 20
11:46	03 12 24	.	1.6	.	16 20
11:50	03 12 24	.	1.5	.	16 20
11:55	03 12 24	.	1.5	.	16 20
12:00	03 12 24	.	1.5	.	16 20
12:05	03 12 24	.	1.5	.	16 17 20
12:10	03 12 24	.	1.5	.	16 17 20
12:14	03 12 24	.	1.4	.	16 17 20
12:19 *	03 16 17	.	1.8	.	20 24
12:24	03 16 17	.	1.8	.	20 24
12:29	03 16 17	.	1.7	.	20 24
12:34	03 16 17	.	1.7	.	20 24
12:38	03 16 17	.	1.7	.	20 24
12:43	03 16 17	.	1.8	.	20 24
12:48	03 16 17	.	1.8	.	20 24
12:53	03 16 17	.	1.8	.	20 24
12:58	03 16 17	.	1.8	.	20 24
13:02 *	03 20 24	.	1.9	.	16 17
13:07	03 20 24	.	1.8	.	16 17
13:12	03 20 24	.	1.8	.	16 17
13:17	03 20 24	.	1.8	.	16 17
13:22	03 20 24	.	1.8	.	16 17
13:26	03 20 24	.	1.8	.	16 17
13:31 *	03 16 20	.	2.0	.	17
13:36	03 16 20	.	2.0	.	17
13:41	03 16 20	.	2.1	.	17
13:46 *	16 17 20	.	2.1	.	03
13:50	16 17 20	.	2.0	.	03
13:55	16 17 20	.	1.9	.	03
14:00	16 17 20	.	1.9	.	03 23
14:05	16 17 20	.	1.8	.	03 23
14:10	16 17 20	.	1.8	.	03 23
14:14	16 17 20	.	1.8	.	03 23
14:19	16 17 20	.	1.8	.	03 23
14:24	16 17 20	.	1.8	.	03 23
14:29	16 17 20	.	1.8	.	03 23
14:34	16 17 20	.	1.8	.	03 23

APPENDIX IV (3)

APPENDIX IV (4)

16:19		03 17 21 23	5.0	2.5	4.3	
16:24		03 17 21 23	5.3	2.6	4.6	
16:29		03 17 21 23	5.7	2.7	5.0	
16:34		03 17 21 23	6.1	2.9	5.4	
16:38		03 17 21 23	6.7	3.1	5.9	
16:43		03 17 21 23	7.4	3.4	6.6	
16:48	*	03 11 17 21	2.9	1.4	2.5	23
16:53		03 11 17 21	2.9	1.4	2.5	23
16:58		03 11 17 21	2.9	1.4	2.5	23
17:02		03 11 17 21	2.9	1.5	2.5	23
17:07		03 11 17 21	2.8	1.5	2.4	23
17:12		03 11 17 21	2.8	1.5	2.4	23
17:17		03 11 17 21	2.8	1.5	2.4	23
17:22		03 11 17 21	2.8	1.6	2.4	23
17:26		03 11 17 21	2.9	1.6	2.4	23
17:31	*	11 17 21 23	4.1	2.4	3.3	
17:36		11 17 21 23	4.2	2.4	3.4	
17:41		11 17 21 23	4.2	2.5	3.5	
17:46		11 17 21 23	4.3	2.5	3.5	
17:50		11 17 21 23	4.5	2.5	3.7	
17:55		11 17 21 23	4.6	2.6	3.8	
18:00		11 17 21 23	4.8	2.7	4.0	
18:05		11 17 21 23	5.0	2.7	4.2	
18:10		11 17 21 23	5.3	2.8	4.5	
18:14		11 17 21 23	5.7	2.9	4.8	
18:19		11 17 21 23	6.1	3.1	5.2	
18:24		11 17 21 23	6.5	3.3	5.6	
18:29		11 17 21 23	7.0	3.5	6.1	
18:34		11 17 21 23	7.6	3.8	6.6	
18:38	*	11 15 17 23	2.8	2.0	1.9	21
18:43		11 15 17 23	2.7	1.9	1.9	21
18:48	*	11 12 15 21	7.9	7.5	2.5	23
18:53		11 12 15 21	6.5	6.0	2.5	23
18:58		11 12 15 21	5.7	5.1	2.5	23
19:02	*	11 15 21 23	5.2	4.4	2.7	12
19:07		11 15 21 23	4.6	3.8	2.6	12
19:12		11 15 21 23	4.2	3.3	2.6	12
19:17		11 15 21 23	3.9	3.0	2.5	12
19:22		11 15 21 23	3.7	2.7	2.5	12
19:26		11 15 21 23	3.5	2.5	2.5	12
19:31		11 15 21 23	3.4	2.3	2.5	12
19:36		11 15 21 23	3.3	2.1	2.5	12
19:41		11 15 21 23	3.2	2.0	2.5	12
19:46	*	11 12 15 21	4.1	2.5	3.3	
19:50		11 12 15 21	4.0	2.3	3.2	
20:19	*	11 14 15 21	3.2	1.7	2.7	
20:24		11 14 15 21	3.2	1.6	2.7	
20:29		11 14 15 21	3.1	1.6	2.7	
20:34		11 14 15 21	3.1	1.5	2.7	
20:38		11 14 15 21	3.1	1.5	2.7	
20:43		11 14 15 21	3.0	1.4	2.7	
20:48		11 14 15 21	3.0	1.4	2.6	
20:53		11 14 15 21	2.9	1.4	2.6	
20:58		11 14 15 21	2.9	1.4	2.5	
21:02		11 14 15 21	2.8	1.4	2.5	
21:07		11 14 15 21	2.8	1.4	2.4	
21:12		11 14 15 21	2.7	1.4	2.4	
21:17		11 14 15 21	2.7	1.4	2.3	
21:22		11 14 15 21	2.7	1.4	2.3	
21:26		11 14 15 21	2.6	1.4	2.2	
21:31		11 14 15 21	2.6	1.4	2.2	
21:36		11 14 15 21	2.6	1.5	2.1	
22:00	*	14 15 18 21	2.4	1.7	1.7	
22:05		14 15 18 21	2.4	1.7	1.8	
22:10		14 15 18 21	2.4	1.7	1.8	
22:14		14 15 18 21	2.5	1.7	1.8	

:38		16 17 20	.	1.9	.	03 23
:43		16 17 20	.	1.9	.	03 23
14:48		16 17 20	.	1.9	.	03 23
14:53		16 17 20	.	2.0	.	03 23
14:58		16 17 20	.	2.0	.	03 23
15:02	*	03 17 23	.	2.6	.	16
15:07		03 17 23	.	2.6	.	16
15:12		03 17 23	.	2.6	.	16
15:17		03 17 23	.	2.5	.	16
15:22		03 17 23	.	2.5	.	16
15:26		03 17 23	.	2.5	.	16
15:31		03 17 23	.	2.5	.	
15:36	*	03 17 21	.	2.3	.	23
15:41		03 17 21	.	2.2	.	23
15:46		03 17 21	.	2.2	.	23
15:50		03 17 21	.	2.2	.	23
15:55		03 17 21	.	2.1	.	23
16:00		03 17 21	.	2.1	.	23
16:05		03 17 21	.	2.1	.	23
16:10		03 17 21	.	2.1	.	23
16:14		03 17 21	.	2.0	.	23
16:19		03 17 21	.	2.0	.	23
16:24		03 17 21	.	2.0	.	23
16:29		03 17 21	.	2.0	.	23
16:34		03 17 21	.	2.0	.	23
16:38		03 17 21	.	2.0	.	23
16:43		03 17 21	.	2.0	.	23
16:48	*	11 17 21	.	1.6	.	03 23
16:53		11 17 21	.	1.6	.	03 23
16:58		11 17 21	.	1.6	.	03 23
17:02		11 17 21	.	1.7	.	03 23
17:07		11 17 21	.	1.7	.	03 23
17:12		11 17 21	.	1.8	.	03 23
17:17		11 17 21	.	1.8	.	03 23
17:22		11 17 21	.	1.9	.	03 23
17:26	*	03 21 23	.	1.9	.	11 17
17:31	*	11 17 21	.	2.1	.	23
17:36		11 17 21	.	2.2	.	23
17:41		11 17 21	.	2.4	.	23
17:46		11 17 21	.	2.6	.	23
17:50	*	17 21 23	.	2.7	.	11
17:55		17 21 23	.	2.7	.	11
18:00		17 21 23	.	2.6	.	11
18:05		17 21 23	.	2.6	.	11
18:10		17 21 23	.	2.5	.	11 12
18:14		17 21 23	.	2.5	.	11 12
18:19		17 21 23	.	2.4	.	11 12
18:24	*	11 17 23	.	2.4	.	12 21
18:29		11 17 23	.	2.3	.	12 21
18:34		11 17 23	.	2.2	.	12 21
18:38	*	11 12 17	.	2.1	.	21 23
18:43		11 12 17	.	2.0	.	21 23
18:48	*	12 15 17	.	1.9	.	11 21 23
18:53	*	11 12 17	.	1.8	.	15 21 23
18:58	*	11 12 15	.	2.8	.	21 23
19:02		11 12 15	.	2.6	.	21 23
19:07		11 12 15	.	2.4	.	21 23
19:12		11 12 15	.	2.3	.	21 23
19:17		11 12 15	.	2.1	.	21 23
19:22		11 12 15	.	2.1	.	21 23
19:26	*	11 15 23	.	2.0	.	12 21
19:31		11 15 23	.	1.9	.	12 21
19:36		11 15 23	.	1.9	.	12 21
19:41		11 15 23	.	1.8	.	12 21
19:46		11 15 23	.	1.8	.	12 21
19:50		11 15 23	.	1.7	.	12 21

APPENDIX IV (4)

258109

22:34	*	13 14 15 18	4.9	3.4	3.5
22:38		13 14 15 18	4.8	3.3	3.5
22:43		13 14 15 18	4.7	3.2	3.4
22:48		13 14 15 18	4.6	3.1	3.4
22:53		13 14 15 18	4.5	3.0	3.3
22:58		13 14 15 18	4.4	3.0	3.2
23:02		13 14 15 18	4.3	3.0	3.2
23:07		13 14 15 18	4.3	3.0	3.1
23:26	*	14 15 18 19	16.5	9.9	13.2
23:31		14 15 18 19	35.2	20.7	28.5
23:41	*	14 15 18 19	26.9	15.5	22.0
23:46		14 15 18 19	14.4	8.3	11.8
23:50		14 15 18 19	9.9	5.8	8.1
23:55		14 15 18 19	7.6	4.5	6.2
00:00		14 15 18 19	6.3	3.8	5.0

55		11 15 23	.	1.7	.	12 21
00		11 15 23	.	1.7	.	12 21
20:05		11 15 23	.	1.7	.	12 21
20:10		11 15 23	.	1.6	.	12 21
20:14	*	11 15 21	.	1.8	.	12
20:19		11 15 21	.	1.8	.	12
20:24		11 15 21	.	1.8	.	12
20:29		11 15 21	.	1.8	.	12
20:34		11 15 21	.	1.8	.	
20:38	*	11 14 21	.	1.6	.	15
20:43		11 14 21	.	1.5	.	15
20:48		11 14 21	.	1.5	.	15
20:53		11 14 21	.	1.5	.	15
20:58		11 14 21	.	1.5	.	15
21:02		11 14 21	.	1.4	.	15
21:07		11 14 21	.	1.4	.	15
21:12		11 14 21	.	1.4	.	15
21:17	*	14 15 21	.	4.3	.	
21:22		14 15 21	.	3.8	.	
21:26		14 15 21	.	3.4	.	
21:31		14 15 21	.	3.1	.	
21:36		14 15 21	.	2.9	.	
21:41		14 15 21	.	2.7	.	
21:46		14 15 21	.	2.5	.	
21:50		14 15 21	.	2.4	.	
21:55		14 15 21	.	2.3	.	
22:00		14 15 21	.	2.2	.	
22:05		14 15 21	.	2.1	.	
22:10		14 15 21	.	2.0	.	
22:14		14 15 21	.	2.0	.	
22:19	*	13 15 21	.	1.6	.	14
22:24		13 15 21	.	1.6	.	14
22:29	*	13 15 18	.	2.6	.	14
22:34	*	14 15 18	.	2.6	.	13
22:38		14 15 18	.	2.6	.	13
22:43		14 15 18	.	2.5	.	13
22:48		14 15 18	.	2.5	.	13
22:53		14 15 18	.	2.5	.	
22:58		14 15 18	.	2.5	.	
23:02		14 15 18	.	2.5	.	
23:07		14 15 18	.	2.5	.	
23:12		14 15 18	.	2.5	.	
23:17		14 15 18	.	2.5	.	
23:22		14 15 18	.	2.5	.	
23:26		14 15 18	.	2.5	.	
23:31		14 15 18	.	2.6	.	
23:36		14 15 18	.	2.6	.	
23:41		14 15 18	.	2.7	.	
23:46		14 15 18	.	2.7	.	
23:50		14 15 18	.	2.8	.	
23:55	*	14 18 19	.	2.4	.	
00:00		14 18 19	.	2.4	.	

APPENDIX IV (5)

The following is a list of channel allocations for the non- seismic data for Survey 104.

The main data set is saved on magnetic tape every minute in blocks of 128 x 6 floating point words. This represents 128 data channels of 6 records per block.

1	Survey and day number (SS.DDD) from RTE clock
2	Acquisition GMT (.HHMMSS) from RTE clock
3	Acquisition GMT (.HHMMSS) from master clock
4	Latitude, best estimate (radians)
5	Longitude, best estimate (radians)
6	Speed, best estimate (knots)
7	Course, best estimate (degrees)
8	Magnetometer # 1 (gammas)
9	Magnetometer # 2 (gammas)
10	Depth from 3.5 kHz (metres)
11	Depth from 12.5 kHz (metres)
12	F/A Magnavox sonar doppler (4000 counts/nm)
13	P/S Magnavox sonar doppler (4000 counts/nm)
14	F/A Raytheon sonar doppler (193.5 counts/nm)
15	P/S Raytheon sonar doppler (193.5 counts/nm)
16	Paddle Log (7000 counts/nm)
18	S-G Brown gyro heading (degrees)
19	Robertson gyro heading (degrees)
20	Sperry gyro heading (degrees)
25	Racal dGPS #2 Time (hhmmss)
26	Racal dGPS #2 Latitude (radians)
27	Racal dGPS #2 Longitude (radians)
28	Racal dGPS #2 Height (m)
29	Racal dGPS #2 Speed (knots x 10)
30	Racal dGPS #2 Course (degrees x 10)
39	T-Set latitude (thousands of minutes)
40	T-Set longitude (thousands of minutes)
41	T-Set satellite numbers
42	T-Set time (GMT seconds)
43	T-Set DOP
44	T-Set latitude (radians)
45	T-Set longitude (radians)
46	T-Set height above geoid (m)
47	T-Set speed (knots x 10)
48	T-Set course (degrees x 10)
49	T-Set frequency bias
51	Latitude from Magnavox Sonar Doppler (radians)
52	Longitude " " " " (radians)
53	Speed " " " " (knots)
54	Course " " " " (degrees)
55	Latitude from Raytheon Sonar Doppler (radians)
56	Longitude " " " " (radians)
57	Speed " " " " (knots)

58 Course from Raytheon Sonar Doppler (degrees)
59 Latitude from Spare Log (radians)
60 Longitude " " " (radians)
61 Speed " " " (knots)
62 Course " " " (degrees)
67 GMT from Magnavox MX1107 (seconds)
68 Dead reckoned time from MX1107 (seconds)
69 MX1107 latitude (radians)
70 MX1107 longitude (radians)
71 MX1107 speed (knots)
72 MX1107 heading (degrees)
73 GMT from Magnavox MX1142 (seconds)
74 Dead reckoned time from MV1142 (seconds)
75 MX1142 latitude (radians)
76 MX1142 longitude (radians)
77 MX1142 speed (knots)
78 MX1142 heading (degrees)
79 Gravity (mGal x 100)
80 ACX (m/sec2 x 10000)
81 ACY (m/sec2 x 10000)
82 Sea state
83 AGRF magnetic anomaly #1
86 Shot time (HHMMSS)
87 Shot point number
88 Northerly set/drift (radians/10 seconds)
89 Easterly set/drift (radians/10 seconds)
110 Racal #1 dGPS time (GMT hhmmss)
111 Racal #1 dGPS latitude (radians)

112 Racal #1 dGPS longitude (radians)
113 Racal #1 dGPS height (m)
114 Racal #1 dGPS course (degrees x 10)
115 Racal #1 dGPS speed (knots x 10)
116 Racal #1 dGPS number of satellites
117 Racal #1 dGPS PDOP (x 10)
118 Racal #1 dGPS HDOP (x10)
119 Racal #1 dGPS 3-D position error (m)
120 Racal #1 dGPS 2-D position error (m)
121 Racal #1 dGPS differential quality
122 Racal #1 dGPS flag
123 Racal #2 dGPS HDOP
124 Racal #2 dGPS PDOP
125 Racal #2 dGPS number of satellites
126 Racal # 2 mode

258113

SEISMIC DATA PROCESSING REPORT

FOR

BRIDGE OIL LIMITED

T/15P DURROON BASIN SEISMIC SURVEY 1991

BY

DIGITAL EXPLORATION LTD
(A DIGICON COMPANY)

18-December-1991

T.C.GOH : Marine Processing Supervisor

TABLE OF CONTENTS

1.0 INTRODUCTION

This report presents an account of the processing sequence and techniques used for processing seismic data in the T/15P Durroon Basin for Bridge Oil Limited.

A total of 403.775 kms of marine seismic data was processed by Digital Exploration Ltd, Brisbane during the period from October 1991 to December 1991.

Client supervision was provided by Mr. Bob Pickering.

Details of the field data acquisition parameters and processing sequence are given in Sections 2 and 3 respectively.

Listing of line numbers with shotpoint range and kilometre indexes is given in appendix 5.1, archive tape listing in appendix 5.2 and location map in appendix 5.3.

2.0 FIELD DATA ACQUISITION

The data was recorded by BMR between 20 September 1991 and 26 September 1991. A brief summary of the acquisition parameters is as follows :

Vessel	: R/V "Rig Seismic"
Source	: airgun
Source depth	: 6m. average
Shot spacing	: 25 m.
Shot interval	: 10 - 11 sec at 5 knots
Streamer type	: Fjord instruments transformerless
Streamer length	: 2400 m.
Streamer depth	: 10 m. average
Group interval	: 12.5 m.
Number of channels	: 192
Recording fold	: 48
Near offset	: varies from 175 m. to 206 m.
Recording length	: 5 sec.
Sample rate	: 2 ms.
Tape format	: SEG-Y, 6250 bpi
Polarity	: SEG normal

Distance from antenna to source centre : 82 m.

3.0 PROCESSING SEQUENCE

A brief description of the processes used in the processing sequence is as follows :

3.1 TRANSCRIPTION

The field data recorded in BMR 16 bit floating point SEG-Y were transcribed and converted to DISCO format.
The output was to 5 seconds at 4 msec. sample rate.
A minimum phase anti-alias filter was applied prior to resample.

3.2 TRUE AMPLITUDE RECOVERY

The process of true amplitude recovery consists of the following basic steps.

Firstly, the non-linear gain functions, applied during the field recording to modulate the amplitudes of the data to within the dynamic range of the recording instruments and recorded on tape, were removed.

Secondly, correction for amplitude losses due to the spherical spreading of the wavefront as it passes downward through the earth and is reflected back to the surface was made. This is also a non-linear function with time or depth. Thus, as the amplitude of the recorded trace varies inversely with the radius of the advancing wavefront, each trace was multiplied by a function 'VT/2', where V is the seismic wave velocity and T is the two-way time.

The Velocity/Time function used for the spherical divergence correction was:-

Time (ms)	Velocity (m/s)
0	1500
100	1500
450	1800
800	1950
1100	2100
1600	2500
2800	3300
5000	4500

Lastly, compensation for amplitude losses as a result of inelastic attenuation was also made. Each trace was multiplied by an exponential gain function expressed in Db/second.

For this project, an exponential gain function of 3 Db/second was applied from 0.4 to 4.0 seconds and thereafter remained constant.

3.3 SHOT DOMAIN VELOCITY FILTER

When a two-dimensional fourier transform is applied to a seismic record, it is transformed from the time-offset (T-X) domain to the frequency-wavenumber (F-K) domain.

Seismic events in the T-X domain map to events radiating from the origin in the F-K domain and reach the wavenumber "alias frequency" at a frequency given by the relationship alias frequency = 500/dip (where "dip" is the dip, in milliseconds per trace, of the event in the T-X domain).

Some coherent noise trains which appear at various times on the shot records can be isolated to some extent in the F-K domain.

In this data the main difference between the seismic signal and noise was one of apparent dip. Once the location of the noise in the F-K domain was established it was muted out prior to reverse transformation into the T-X domain for subsequent processing. For this data, an F-K filter was designed to preserve data in the dip range of -2.273 ms/trace (-5.500 km/sec) to +3.125 ms/trace (+4.000 km/sec) in the T-X domain.

3.4 2:1 ADJACENT TRACE SUM

2:1 Adjacent trace sum was achieved with a partial moveout compensation using an average velocity.

3.5 STATIC CORRECTIONS

Static corrections of -70.00 ms for gun and recording delays, +10.67 ms for source/streamer corrections were applied, thus referencing the data to mean sea level.

3.6 SIGNATURE DECONVOLUTION

Digicon's preferred shot averaged deconvolution routine is DEFLAT. It designs and applies either a single operator for each input record, or a user specified number of offset dependent operators per input record. The routine is part deterministic and part statistical :

A source wavelet is estimated using manufacturer's instrument phase and amplitude response characteristics for given recording filter settings. In the case of marine data it is also possible to include the shot and receiver ghost.

The data is analysed and a bandwidth selected which relates to the good signal to noise portion of the input data's spectrum. A bandwidth of 8 to 90 Hz was selected for this dataset. Within this bandwidth the data is deconvolved using standard spiking deconvolution operators based on averaged autocorrelation functions.

Outside the selected bandwidth an all-pass dephasing filter is designed that will correct for the modelled wavelet's phase distortion.

The deterministic dephasing filter and spiking deconvolution operator are combined and applied to each input record.

The benefits of this approach are:

1. Spatial Stability

The stability of the output wavelet is improved as the input autocorrelation functions are averaged. If standard trace-by-trace deconvolution is applied noise can, especially in the case of spiking deconvolution, influence the design of the deconvolution operators.

2. Deterministic stability in wavelet design

The low frequency end of the spectrum often governs the shape of the deconvolved wavelet. By replacing this part of the spectrum with known amplitude and phase characteristics the deconvolution will be more stable in the presence of spatially variable low frequency noise, such as ground-roll, mud-roll etc.

For this survey the selected parameters where :

Number of operators per record	:	4
Percentage White Noise	:	0.1
Operator Length	:	400 ms
Number of Design Gates	:	1

Design Gates in msec.

Near trace 400 - 4400 ms

Far Trace 2000 - 4800 ms

Application Gates whole trace

3.7 PREDICTIVE DECONVOLUTION

Digicon's DECONA module uses the Wiener-Levinson algorithm to design filters which effectively extract the predictable signal from the total data spectrum. This alogrithm assumes the input wavelets are minimum phase, the input reflectivity spectrum is white and the wavelet is stationary across the inverse filter design window.

The objectives of predictive deconvolution are two fold and described as follows :

1a SPIKING MODE

In spiking mode (gap of one sample) the data's amplitude spectrum is whitened from 0Hz through to the Nyquist frequency. A percentage white noise is added to the spectrum prior to inverse operator design to maintain stability. A value of 1% white noise is considered normal, however the effective whitening is inversely proportional to the percentage of noise added.

1b GAP MODE

A gap deconvolution operator will reduce the whitening effect of the deconvolution operator. The gap length can be taken as the second zero crossing from the peak value on the data's autocorrelation function thus avoiding changing the input wavelet's phase.

2 MULTIPLE ATTENUATION

The operator length is selected after studying the autocorrelation function. The combined length of the gap plus operator will attenuate multiple energy upto that period.

For this project the selected parameters where :

White Noise Percentage : 0.1%

Gap Lengths : 36 ms

Operator Length : 300 ms

Number of Design Gates : 2

		near offset	far offset
Design Gates			
	[1]	400 - 3000 ms	2000 - 3400 ms
	[2]	2400 - 4400 ms	2800 - 4800 ms
Application Gates			
	[1]	0 - 2000 ms	0 - 2400 ms
	[2]	3400 - 5000 ms	3800 - 5000 ms

3.8 COMMON DEPTH POINT [CDP] GATHER

In this process the seismic traces along a line are sorted into a primary key sequence on the basis of common-depth-point and a secondary key of increasing offset distance within each 'CDP' group. For this project the data were gathered into common-mid-points with a fold (number of traces per CDP) of 48 and a CDP interval of 12.5 meters.

3.9 VELOCITY ANALYSIS [FIRST PASS]

VELFAN Discrete Velocity Analysis is a comprehensive velocity determination package. At each velocity analysis location the CDP gather records are normal move-out corrected with a range of velocities specified by the user. These gathers are then summed to observe the stack response. The module provides a display of the selected velocity control depth points showing :-

1. central CDP gather before correction for normal move-out.
2. normal move-out corrected central CDP gathers associated with their respective velocity fan functions.
3. display of the stack associated with the suite of selected velocity fan functions.

A semblance function is computed across the stacked panels and

displayed in graphical form for user reference. Based on the semblance values the program provides optional time-velocity picks which are displayed as a numerical listing and also imposed on the velocity time graph, which is positioned to the right of the actual data. Offset information displayed above each gather trace can be used to determine the required prestack mute pattern. The mute pattern used for the analysis is displayed on each normal move-out corrected gather record The above analyses were conducted at 2 km interval over 21 alternate CDPs with 11 velocity functions.

3.10 MULTIPLE ATTENUATION [ZMULT]

ZMULT is a multiple attenuation process which is based on the separation of primary events from multiples utilising the F-K domain transform on common midpoint gathered data. Application of a normal moveout curve, which overcorrects the primaries and undercorrects the multiples, will move these events into different quadrants of the F-K domain. By zeroing the "multiple" quadrant, inverse transforming the data and removing the overcorrection velocity, the multiples are attenuated. Velocity analyses can be considerably improved by the application of this process.

3.11 DIP MOVEOUT CORRECTION [DMO]

The data was processed through Digicon's DIPCOGLX F-k domain Dip moveout routine which utilizes a logarithmic transformation of the time axis such that the DMO operator remains temporally stationary as well as spatially stationary. The impulse response of the DIPCOGLX operator has been shown to be comparable to Hale's published algorithm. For further details refer to " Dip moveout in the frequency-wavenumber domain " GEOPHYSICS VOL 52, No 12 (Dec 1987) pp 1718-1721.

The main benefits of including DMO in the processing sequence are :-

1. Dip-independent stacking velocities

Stacking velocities after DMO are dip-independent, allowing both horizontal and dipping reflectors to be stacked with the same RMS velocity ie. the RMS velocity associated with the horizontal event. Thus flat dip primary reflectors and steep dip events (such as fault plane reflections and diffraction limbs) may be optimally stacked at the same time.

2. Removal of reflection point smear

Data recorded at a finite offset is transformed to zero offset thus eliminating reflection point smear. Time varying multi-channel filters applied in the common-offset domain laterally shift the reflection points to their zero-offset position.

Prior to DMO the common depth point data were compressed from OFOLD fold to NFOLD fold using a residual moveout correction and subsequent common offset summation. This effectively increased the signal to noise level and ensured a series of common offsets for the partial migration process. It was noted that the fault plane reflections and diffraction events were enhanced on the DMO stack.

3.12 VELOCITY ANALYSIS [POST DMO]

A second pass of velocity analyses were done on DMO gathers at 1 km interval over 21 alternate CDPs with 11 velocity functions using Digicon's "VELFAN" routine.

3.13 NORMAL MOVEOUT CORRECTION

The stacking velocity functions derived from the final Velocity Analysis are used to compute the normal moveout [NMO] corrections to be applied to the traces in the final CDP gathers.

The NMO is performed assuming that the energy travels in a straight raypath and utilizes the following equation :

TT = (T0**2 + (X**2/V**2)) **0.5

where

TT = Total recorded travel time in seconds

X = Offset

T0 = Time of reflector at zero offset in seconds

V = RMS velocity

**N = raise to the power N

Velocity-time knee points are honoured on adjacent control points prior to interpolation of the temporal velocity field. Then the space variant velocity function is derived by linear interpolation between control points.

3.14 PRE-STACK MUTE

A front-end mute (or ramp) is applied to the shallow and far offset data to remove any undesirable, excess stretching after NMO application. As the start time of the mute is from zero time it will also remove non-compressional background noise recorded above the first breaks. The mute pattern is either determined from comparative prestack mute tests or from NMO corrected gathers.

The mute pattern applied to this project is described below:

Offset(m.)	Time(msec.)
320	0
440	400
2570	2400

3.15 COMMON DEPTH POINT STACK

Stack is the summation of traces within each CDP producing a single stacked trace for each input gather record. The stack is normalised and mute zone compensated to account for the smaller number of live traces in the mute zone and for uneven fold of coverage. The data was recorded with a nominal fold of 48.

3.16 MIGRATION

Seismic stack sections are representations of complex wave fields. Migration is the process which is used to simplify this representation. In general the fundamental effects of migration are :

a) Lateral displacement of dipping events to their correct locations.

b) Collapsing of diffraction patterns to their associated point source origins.

c) Reconstruction of buried foci.

d) Improvement of major and minor fault delineations.

e) Signal-to-noise improvements for coherent events in areas where most of the noise consists of diffraction arrivals.

Kirchhoff method was used with a half aperture of 3.75 km and the velocity field used for migration is 90% of the X-T smoothed final stack velocity field.

3.17 TIME VARIANT FILTER

Application of a time variant filter will remove unwanted noise that lies outside the frequency range of the desired reflection and diffraction data. The stacked data were filtered with a series of zero phase bandpass filters. These following filters were selected from a series of filter test panels:

time(secs)	passband(hz,db/oct)
0.0 - 0.6	12/18 - 55/60
1.5	10/18 - 50/48
3.0	8/18 - 35/48
4.0 - 5.0	8/18 - 30/48

3.18 TIME VARIANT SCALING

For display purpose, a multi-gate balance with the following gate lengths was used :

0 - 200 ms
200 - 400 ms
400 - 800 ms
700 - 1700 ms
1200 - 2200 ms
1700 - 2700 ms
2200 - 3200 ms
2700 - 3700 ms
3200 - 4200 ms
3700 - 4700 ms

3.19 FINAL DISPLAYS

The final stack and migrated data were plotted on film on GEOSPACE with the following parameters :

Horizontal scale	20 traces per cm (1:25,000)
Vertical scale	9.525 cm per second
Display gain	0.85
Datum	mean sea level
Polarity	SEG normal

Field polarity maintained throughout processing

Line intersections, water depths and final stacking velocity functions were annotated above the data section. A sidelabel display gives details of the processing sequence.

4.0 DATA PROCESSING SYSTEM

Digicon's installation in Brisbane is based on two Digital Equipment Corporation's VAX 8650's computers A brief description of the computers and peripheral devices is as follows :-

Main processing system		VAX 1	VAX 2
1) Computer system	:	8650	8650
	:	32 bit central processing unit with total of 32 remote input/output terminals allowing multi-user, multi-functional interactive capability.	
capacity (virtual memory)	:	32 MB	32 MB
operating system	:	DISCO	DISCO
2) Array processors (FPS 100)	:	4 units	4 units
Array processors (NMX 432) (High performance floating point array processor)	:	2 units	1 unit
3) Disk storage system	:	3 units	3 units
capacity (each unit)	:	1.23 GB	1.23 GB
4) Magnetic tape drives	:	15 units	14 units
density	:	800 bpi, 1600 bpi and 6250 bpi	
5) Line printer	:	1 unit	1 unit

6) Display system : BENSON/VERSATEC Electrostatic plotters. (Resolution: 200 dots/inch)

2 units 36" plotter
1 unit 22" plotter

: 1 unit GEOSPACE FILM PLOTTER (Resolution : 508 dots/inch)

7) Digitiser : 2 units summagraphic digitising tables

- 1 unit TEKTRONIX graphics terminal and one hard copy unit
- 1 unit off-line ammonia printer
- 1 unit SUN SPARC workstation

The DISCO system (Digicon's interactive seismic computer) is an extension of the Digicon's modular seismic data processing developed over many years. Being modular, the system is completely flexible allowing complete user control of the number and sequence of operations performed in any job. The DISCO seismic monitor assembles the selected modules in the specified order and controls the processing run.

Respectfully submitted,
Digital Exploration Limited

Teck C. Goh
Marine Processing Supervisor

Dr. Nigel J. Fisher
Processing Manager

258129

5.0 APPENDICES

5.1 Listing of line numbers with shotpoint ranges and kilometres

	Line	Shotpoint	Km
1)	BD91-206	142 - 1614	36.825
2)	BD91-207	203 - 843	16.025
3)	BD91-207A	1021 - 2071	26.275
4)	BD91-208	120 - 1540	35.525
5)	BD91-209	126 - 1594	36.725
6)	BD91-210	248 - 1722	36.875
7)	BD91-211	126 - 724	14.975
8)	BD91-212	156 - 964	20.225
9)	BD91-213	142 - 946	20.125
10)	BD91-214	184 - 658	11.875
11)	BD91-215	134 - 914	19.525
12)	BD91-216	120 - 948	20.725
13)	BD91-217	168 - 1042	21.875
14)	BD91-218	164 - 964	20.025
15)	BD91-219	112 - 872	19.025
16)	BD91-220	148 - 850	17.575
17)	BD91-221	122 - 755	15.850
18)	BD91-222	170 - 718	13.725
		Total	403.775

5.2 Archive tape listing of raw final stack and raw migrated stack

FORMAT : SEGY
DENSITY : 6250 BPI
DATA LENGTH : 5 SEC
SAMPLE RATE : 4 MS

SHOTPOINTS ANNOTATED TO ANTENNA POSITION
CDP-SP RELATIONSHIP : CDP = (SP+1000)*2+6
FOR ALL LINES EXCEPT LINES BD91-207A

1) CPT2805 : RAW FINAL STACK
2) CPT2775 : RAW MIGRATED STACK

FILE NO	LINE	REELTRC	CDP	SP
1	BD91-206	1-3040	2181/2290-5220	142-1614
2	BD91-207/	3041-5944	2303/2412-3214	203-604
	207A		/3215-5206	1069-2071
3	BD91-208	5945-8780	2237/2346-5072	170-1540
4	BD91-209	8781-11812	2149/2258-5180	126-1594
5	BD91-210	11813-14856	2393/2502-5436	248-1722
6	BD91-211	14857-16148	2149/2258-3440	126-724

3) CPT2890 : RAW FINAL STACK
4) CPT2941 : RAW MIGRATED STACK

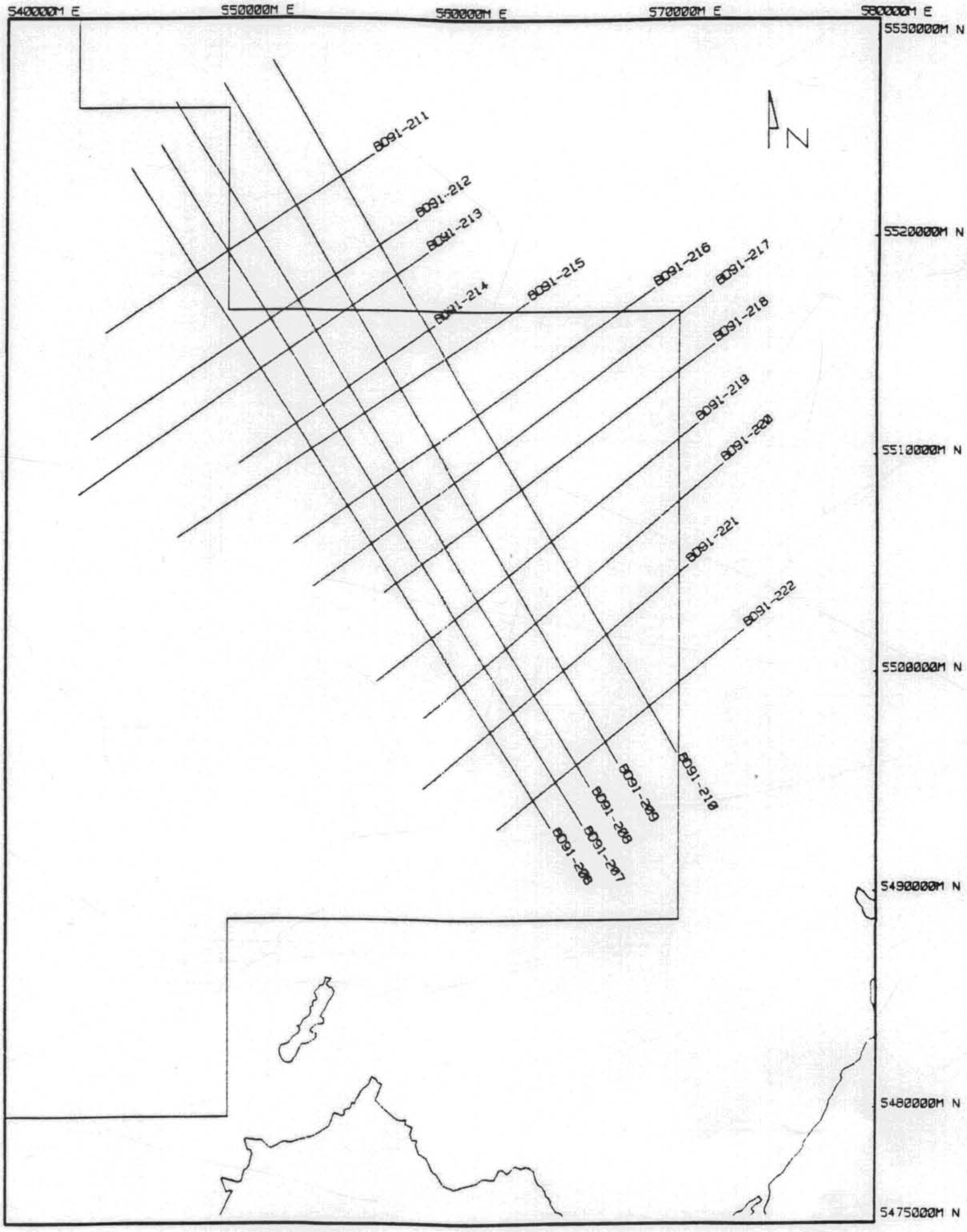
FILE NO	LINE	REELTRC	CDP	SP
1	BD91-212	1-1712	2209/2318-3920	156-964
2	BD91-213	1713-3416	2181/2290-3884	142-946
3	BD91-214	3417-4460	2265/2374-3308	184-658
4	BD91-215	4461-6110	2165/2274-3828	134-914
5	BD91-216	6111-7862	2137/2246-3888	120-948
6	BD91-217	7863-9706	2233/2342-4084	168-1042

5) CPT2942 : RAW FINAL STACK
6) CPT2889 : RAW MIGRATED STACK

FILE NO	LINE	REELTRC	CDP	SP
1	BD91-218	1-1696	2225/2334-3920	164-964
2	BD91-219	1697-3312	2121/2230-3736	112-872
3	BD91-220	3313-4812	2193/2302-3692	148-850
4	BD91-221	4813-6174	2141/2250-3502	122-755
5	BD91-222	6175-7366	2237/2346-3428	170-718

258131

5.3 LOCATION MAP



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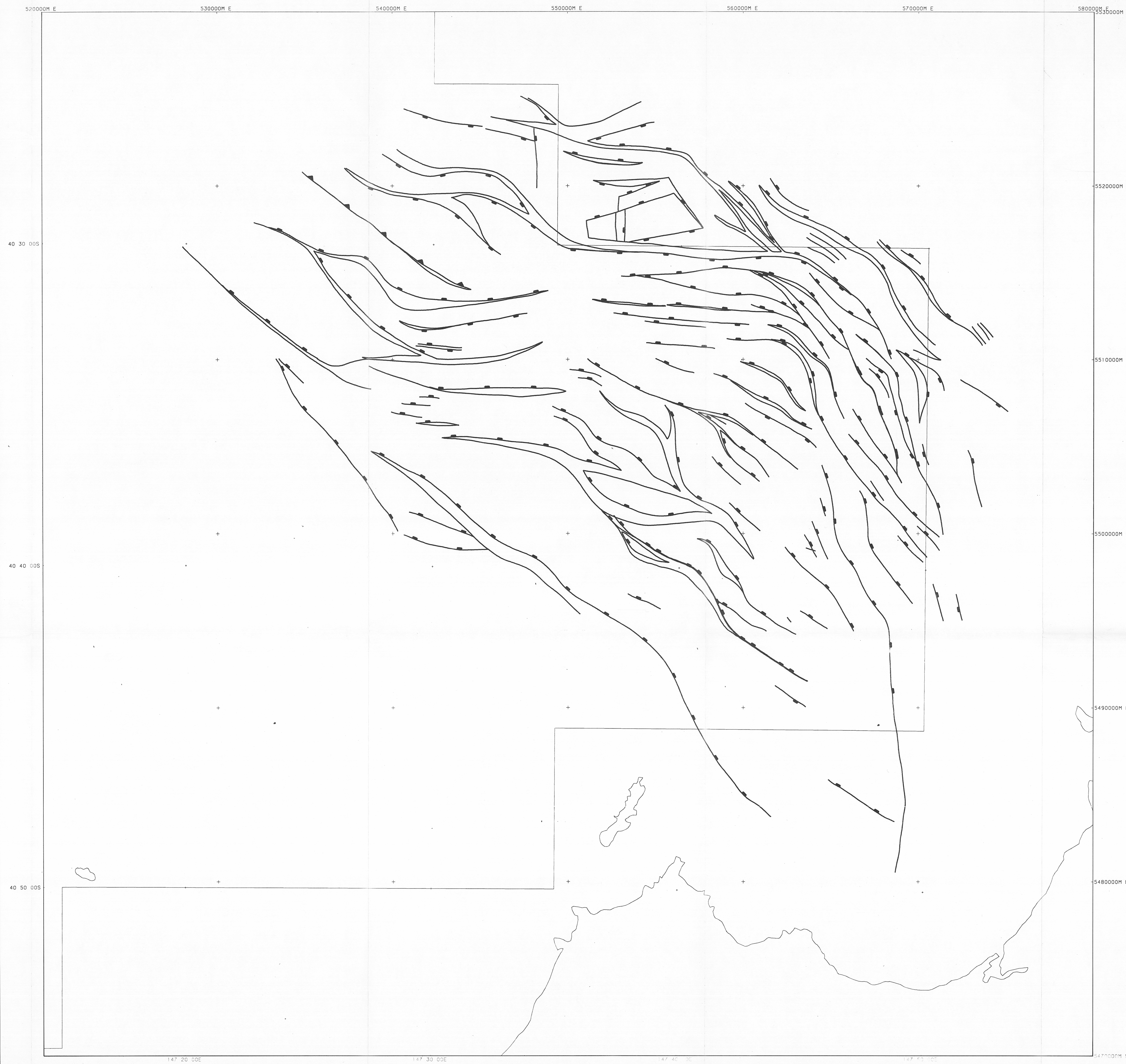
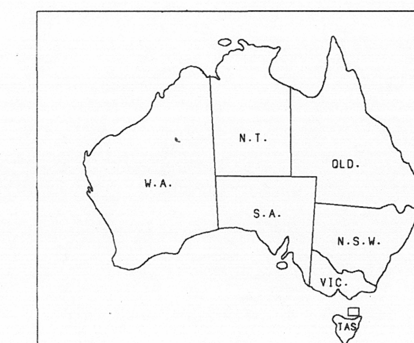




LOCATION MAP

5 cm

1:100000

0 2 4 6 8 10
KILOMETRES

0 1 2 3 4 5
MILES

UNIVERSAL TRANSVERSE MERCATOR PROJECTION
AUSTRALIAN NATIONAL SPHEROID
CENTRAL MERIDIAN 147 00 00E

Bridge Oil Limited

T/15P
DURROON BASIN
TASMANIA

BRIDGE DURROON 1991
SEISMIC SURVEY

TECTONIC ELEMENTS

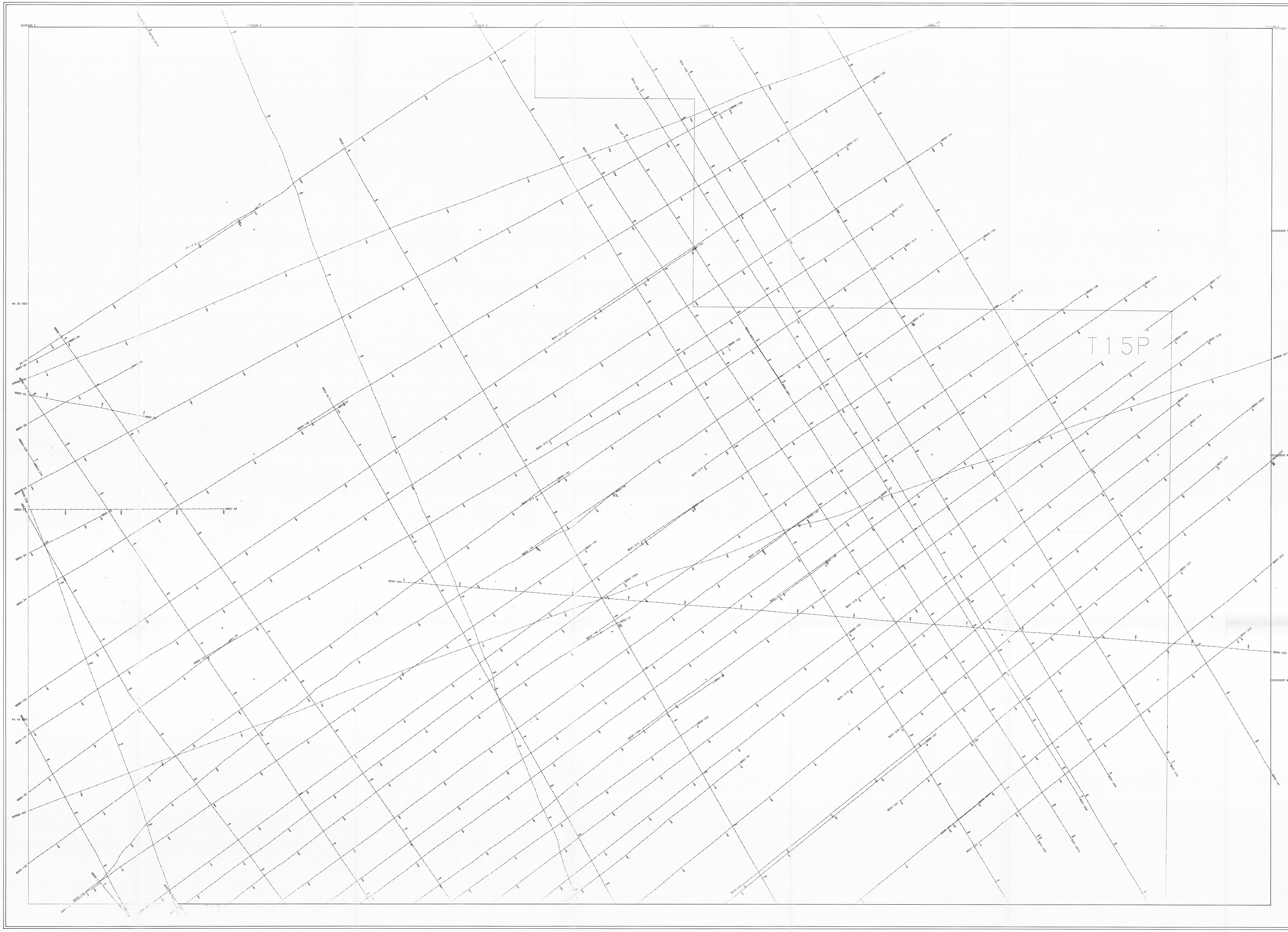
Author : R.P.	Date : MARCH 20 1992
9802	Enclosure : 1

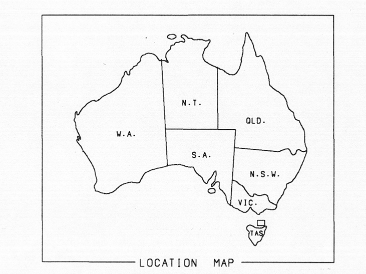
258132

OR-0262

/VCGL (Serveware)

DR V 3





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5 cm

1:50000

0 1 2 3 4 5

KILOMETRES

0 1 2

MILES

UNIVERSAL TRANSVERSE MERCATOR PROJECTION
AUSTRALIAN NATIONAL SPHEROID
CENTRAL MERIDIAN 147 00 00E

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T/15P
DURROON BASIN
TASMANIA

BRIDGE DURROON 1991 SEISMIC SURVEY SHOT POINT BASEMAP

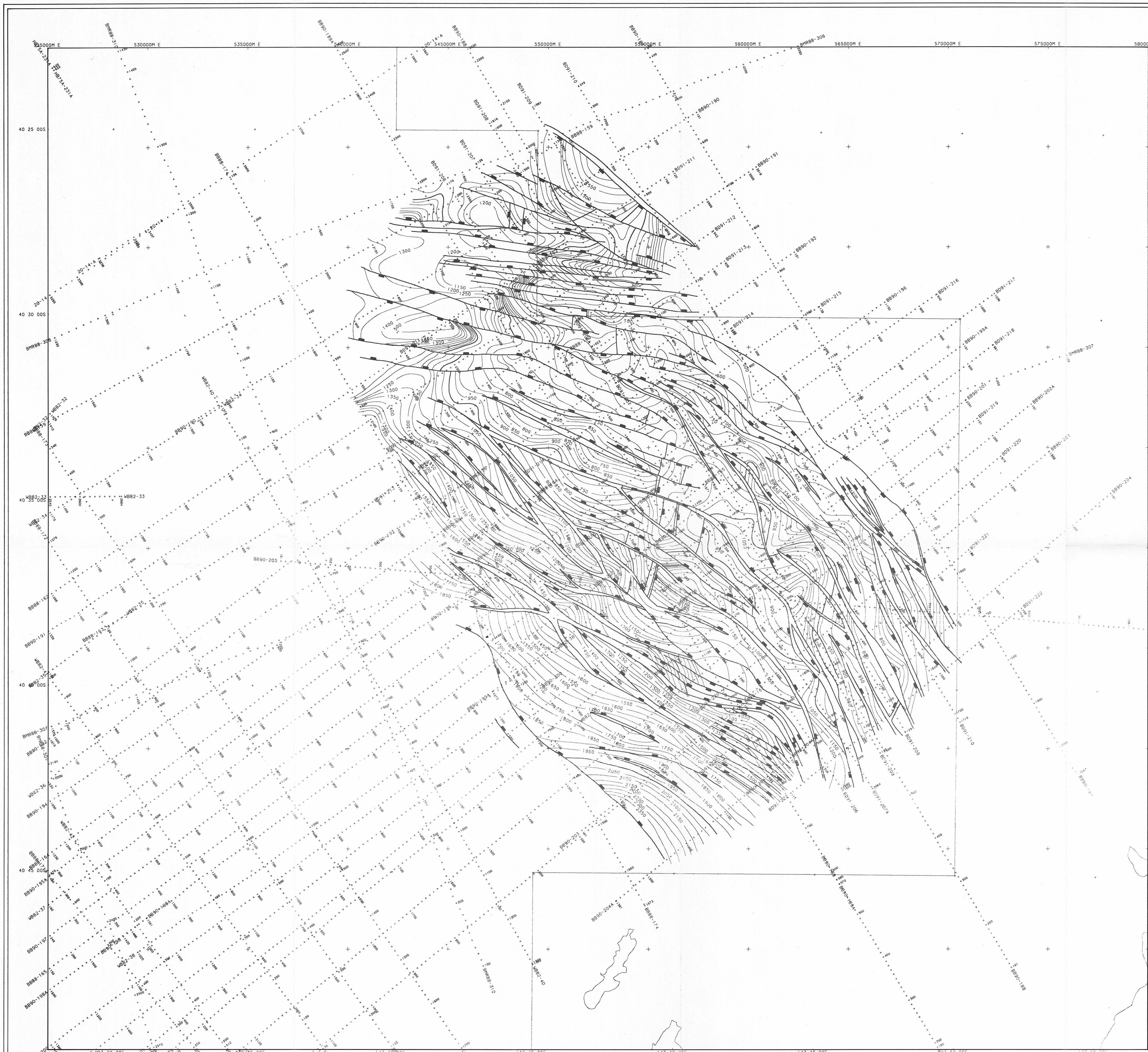
Author: R P	Date: March 20, 1992
Drafted by: js	Revised:
9803	Enclosure : 2

VCGL (Serveware)

258133

OR-0262

DR V 3



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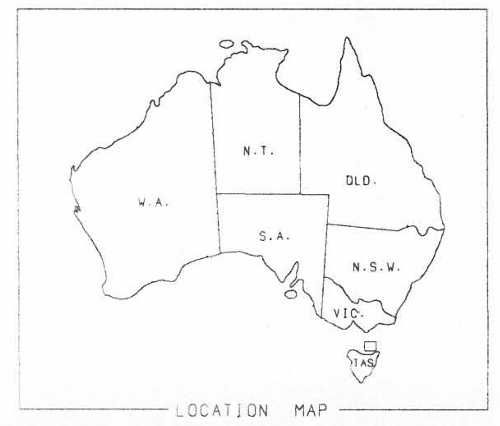

5 cm

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0 2 4 6 8 10

KILOMETRES

0 1 2 3 4 5

MILES

UNIVERSAL TRANSVERSE MERCATOR PROJECTION
AUSTRALIAN NATIONAL SPHEROID
CENTRAL MERIDIAN 147 00 00E

Bridge Oil Limited

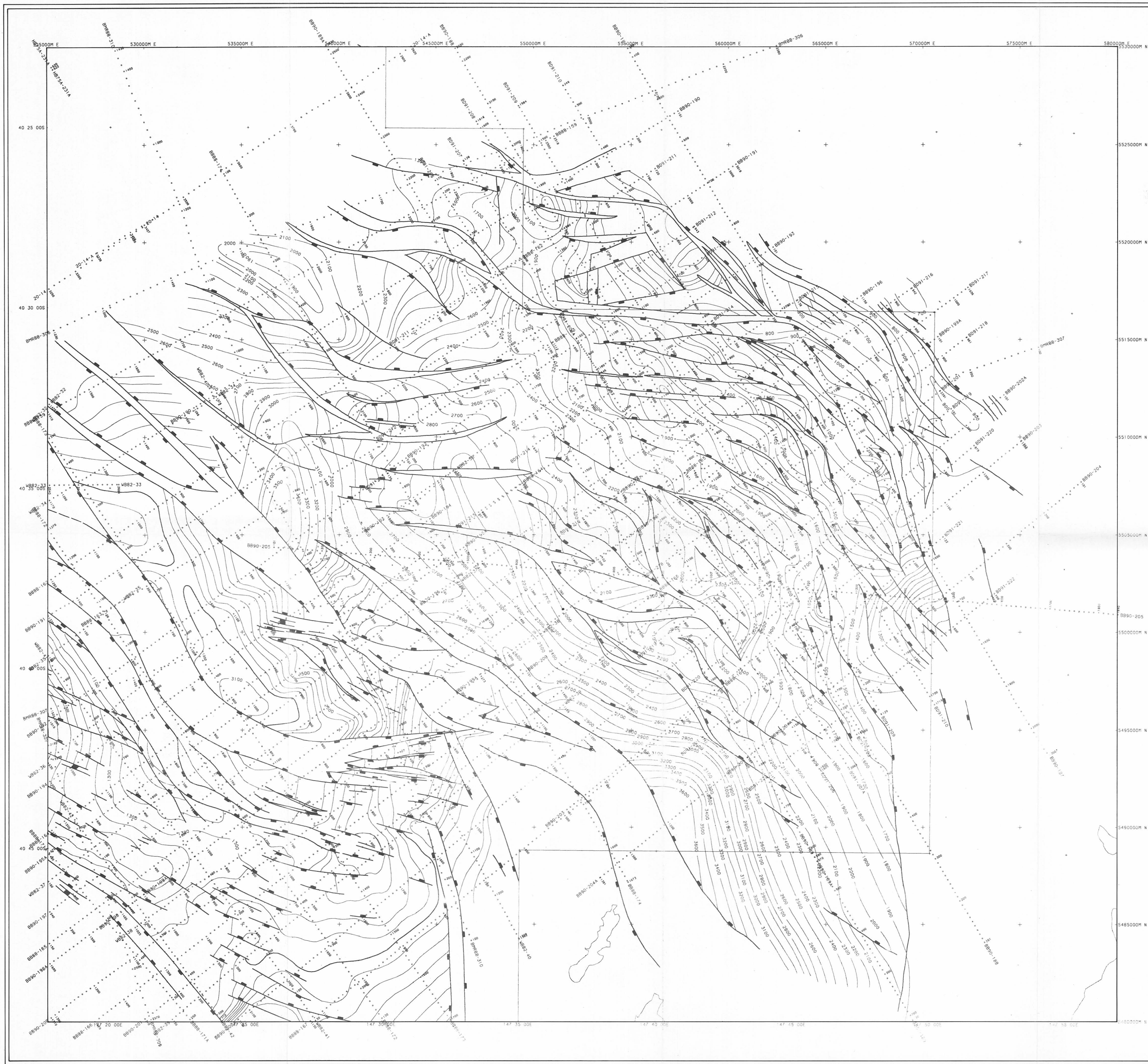
T/15P
DURROON BASIN
TASMANIA

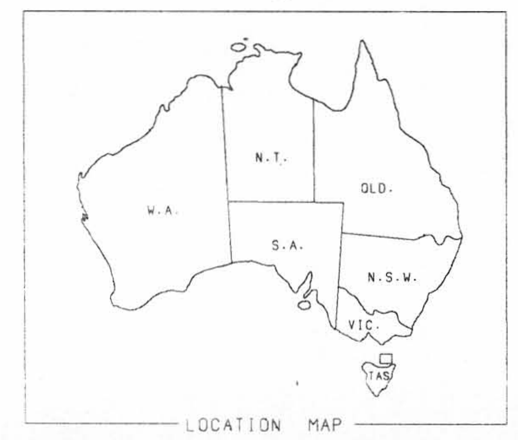
TWT STRUCTURE CONTOURS
on the
INTRA DURROON MEGASEQUENCE

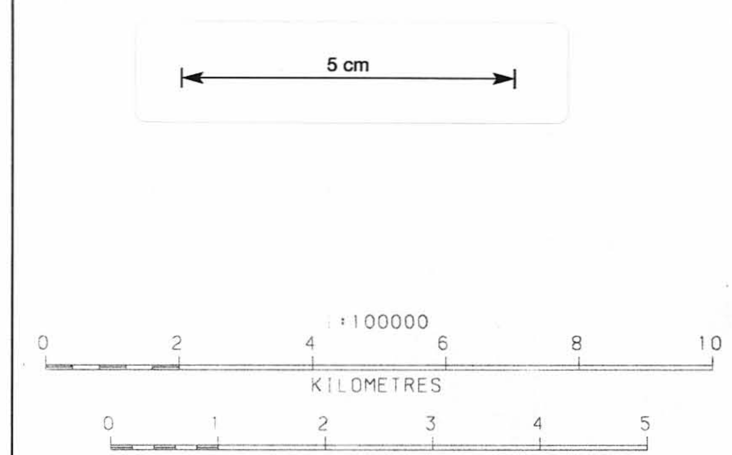
Author: R P	Date: May 18, 1992
Drafted by: js	Revised: -
9804	Enclosure : 3

258134 OR-0262

DR V 3







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AUSTRALIAN NATIONAL SPHEROID
CENTRAL MERIDIAN 147 00 00E

Bridge Oil Limited

T/15P
DURROON BASIN
TASMANIA

TWT STRUCTURE CONTOURS on the TOP OTWAY MEGASEQUENCE

Author: R P	Date: May 18, 1992
Drafted by: js	Revised:
9805	Enclosure : 4

258135 OR-0262

COLOR PLOT TRUNCATED

DR V 3

1:100000

KILOMETRES

MILES

UNIVERSAL TRANSVERSE MERCATOR PROJECTION
AUSTRALIAN NATIONAL SPHEROID
CENTRAL MERIDIAN 147 00 00E

5 cm

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T/15P
DURROON BASIN
TASMANIA

BRIDGE DURROON 1991
SEISMIC SURVEY

BATHYMETRY MAP

258136

Author : R.P.	Date : 20 MARCH 1992
9806	Enclosure : 5

VRI VCGL (Serveware)

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