Western Geophysical

Final Operations Report

3D Marine Seismic Survey
On Behalf of
Woodside Energy Limited

Investigator 3D Survey
Otway Basin, Bass Strait, S. Australia

5th December 1999 - 5th April 2000

Western Pride - P140

WOODSIDE
AUSTRALIAN ENERGY

BAKER HUGHES
Western Geophysical

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1 GENERAL INFORMATION

Survey Name Investigator
Area Otway Basin, Southern Australia
Company Woodside Energy Ltd.
Contractor Western Geophysical

1.1 Introduction

A 3D marine seismic reflection survey was undertaken by WESTERN GEOPHYSICAL, a division of BAKER HUGHES INTERNATIONAL INC, on behalf of WOODSIDE ENERGY LIMITED. The Investigator South prospect began on the 5th December 1999 and ended on the 5th April 2000.
The survey vessel used was the M/V Western Pride, a purpose built seismic survey vessel. Initially eight 4600 metre cables and two 2250 cubic inch energy sources were utilised, however the number of cables deployed was reduced to six very early in the survey due to operational considerations. Further information can be found in the Operations section of this report.
The Investigator survey comprised a single prospect area originally covering approximately 1036 square kilometres, which was later extended to 1043 km^2 when the waypoints were adjusted from 8 to 6 streamers. It was the firm intention of Western Geophysical to acquire the maximum possible CMP coverage of 3D seismic data within the boundaries of the full-fold area (Figure 1.5-1). Initially this was achieved using anti-parallel acquisition, however time constraints favoured the more conventional racetrack technique and this method was used for the majority of the survey. Again, more information can be found in the Operations section of this report.
In addition to the 3D acquisition, four 2D tie-lines were shot in order to tie the seismic data from the 3D survey with selected well-heads. An additional three 2-D lines were not acquired due to time constraints.

1.2 Prospect Parameters

Original 8 Cable 3D Parameters

Prospect Size	Approx.: 1036 km^2
Total number of sail-lines	66
Total number of sail line kilometres	2607.6 km (plus 151.8 km run-out)
Total number of CMP kilometres	41721.6 km (plus 2428.8 km run-out)
Shooting Direction	009°/189°

6 Cable 3D Parameters

Prospect Size	Approx.: 1043 km^2
Total number of sail-lines	88
Total number of sail line kilometres	3508.4 km (plus 202.4 km run-out)
Total number of CMP kilometres	42100.8 km (plus 2428.8 km run-out)
Shooting Direction	009°/189°

2D Parameters

Total number of sail-lines	7
Total number of sail line kilometres	279.65 km (plus 16.1 km run-out)

1.3 Survey Location

The Investigator survey was located in the Otway Basin area off the South West Coast of Victoria, Australia. The closest part of the prospect was approximately 14.5 nautical miles south of Port Campbell. (Figure 1.3-1).

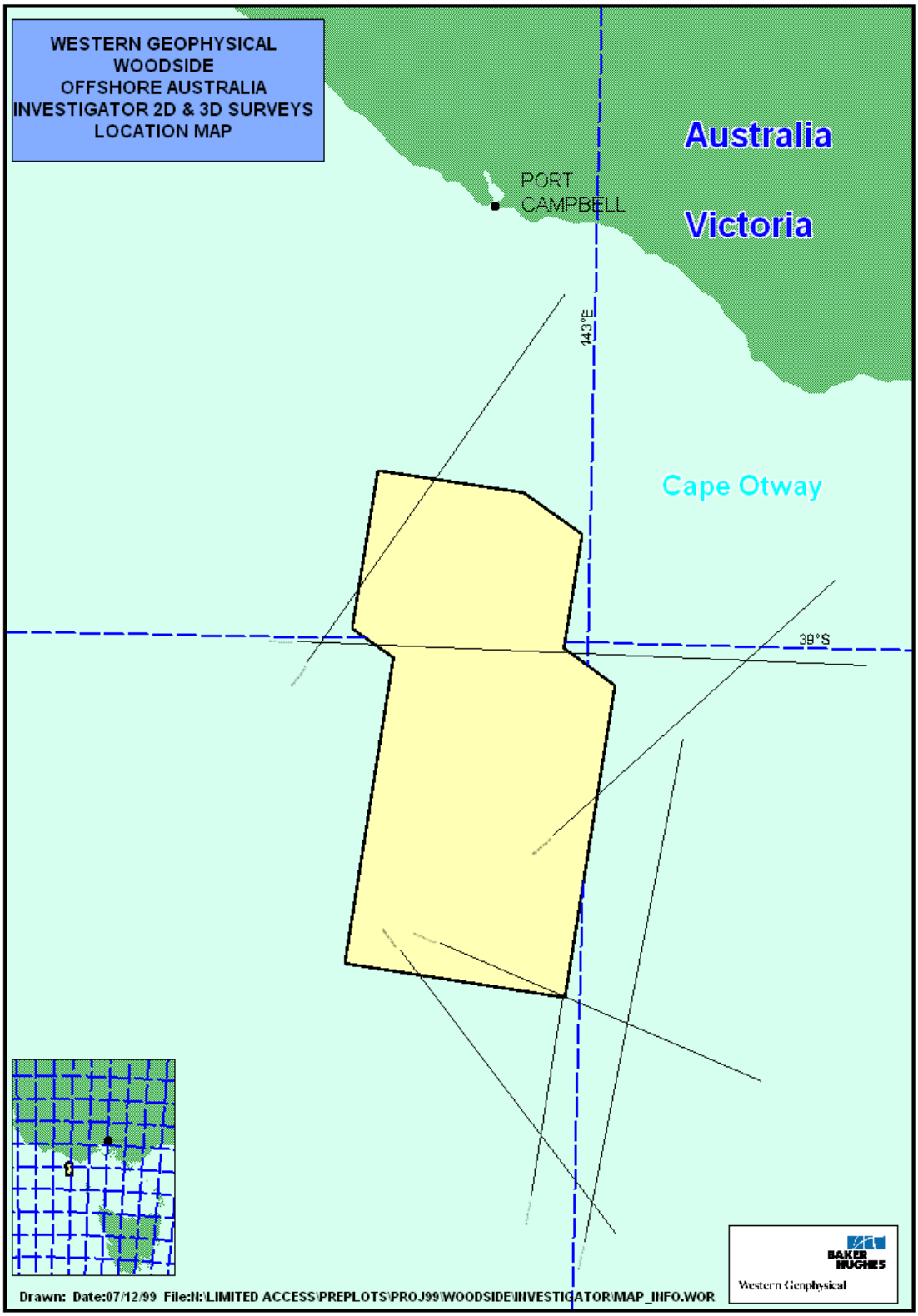

Figure 1.3-1 Survey Location

1.4 Survey Acquisition Parameter Summary

At the beginning of the survey several parameters were adjusted to optimise the data acquisition. The summary below lists the parameters that were in use for the majority of the survey. Significant changes are also summarised below. Further information can be found in the Parameter Reports, which accompany all data shipments.

Recording System:	System Type	Input / Output MSX
	L.C. Filter	2 Hz @ 12 dB/Octave
	High Cut. Filter	206 Hz @ 264 dB/Octave
	Record Length	4.5 s (4608 ms)*
	Sample Rate	2 ms
Seismic Cable:	Cable Type	Thomson Marconi Solid Streamer
	Number of cables	6†
	Number of channels	368 per streamer + Auxiliaries
	Cable length	4600 m
	Group Interval	12.5 m
	Depth	6 m (±1 m).
	Separation	100 m between each cable 500 m total spread†
Sources:	Source Type	Tuned Airgun Array
	Number of sources	2 Arrays
	Array Volume	2250 cu.in
	Pressure	2000 psi (±150 psi)
	Depth	5 m (±0.5 m)
	Separation	50.00 m
	Shot Point Interval	12.5 m flip flop 25 m per source
Coverage:	Nominal Fold	92
	Acquisition Bin Size	12.5 m (in-line) x 25 m (cross-line)
	Swath Acquisition	12 CMP lines per pass†
Vessel Positioning:	Primary System (1st preference)	Racal Multifix differential GPS using Racal Skyfix RTCM corrections
	Backup Primary System (2nd preference)	Fugro MRdGPS differential GPS using Fugro Starfix RTCM corrections
	QC System	QPS Multiref differential GPS using both Skyfix and Starfix corrections
	Other Systems	POSNET differential GPS using a single Skyfix/Starfix reference station

† The survey originally began with eight cables, but this was reduced to six after sequence 008. At the end of the survey four 2D lines were shot with a single source and a single cable (Sequences 149-152).
* The first three sequences were acquired with a record length of 5 sec (5120 ms). This was reduced to 4.5 sec (4608 ms) to allow the vessel speed to be increased. Sequences 148-152 (the 2D tie-lines) were acquired with a record length of 6 sec (6144 ms).

1.5 Full Fold Coverage

Figure 1.5-1 Full Fold Coverage Pre-Plot Definition

To obtain full fold coverage over the entire prospect area, 184 run-out shotpoints were required at the termination end of each sail line. No run-in shotpoints were required, as the start of each line was referenced to the first hit on the full-fold grid by adding a shotpoint layback in the Spectra Navigation system. This shot-point layback was the in-line distance from the vessel reference point to the first in-line CMP position, at the midpoint between the centre of source and the first receiver.

Navigation data was recorded for an additional 100 overlap shots at start, and 10 shotpoints at the end of each acquired line. This data was used to remove filter edge effects during navigation processing.

1.6 Source/Streamer Configuration

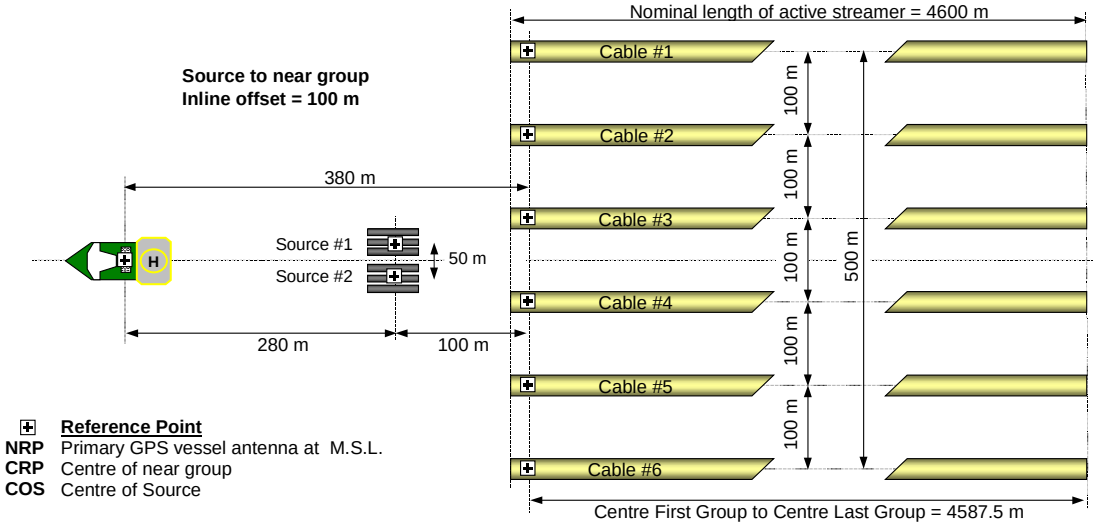

Figure 1.6-1 Nominal Source/Streamer Configuration (Seq 009)

1.6.1 Energy Sources

Two low-pressure sleeve gun arrays were used to provide the seismic energy source for this survey. Each array combined three 750 cubic inch sub-arrays to give 2250 cubic inches per source. Each sub-array was 15.1 m in length and comprised 8 separate sleeve guns operating at a depth of 5 m (+/- 0.5 m).

1.6.2 Streamers

Six cables were used for the acquisition of the majority of the survey. The active length of each cable was 4600 m with a 12.5 m group spacing, giving 368 receiver groups per cable. The separation between each adjacent streamer was 100.0 m, resulting in a total cable spread of 500 m.

1.6.3 Inline Offsets

Configuration changes to the towed equipment were reflected in the nominal offsets of the sources and streamers. The major changes are summarised below.

8 Cable Configuration Nominal Offsets (Seq 001-008)	
Vessel to Centre of Sources	490 m
Vessel to Streamer 1st Group	640 m
Centre of Source to Streamer 1st Group	150 m

6 Cable Configuration Nominal Offsets with Short Vane Warp (Seq 009-029)

Vessel to Centre of Sources	280 m
Vessel to Streamer 1st Group	380 m
Centre of Source to Streamer 1st Group	100 m

6 Cable Configuration Nominal Offsets with Lengthened Vane Warp (Seq 030-148)

Vessel to Centre of Sources	315 m
Vessel to Streamer 1st Group	440 m
Centre of Source to Streamer 1st Group	125 m

1 Cable 2D Configuration Offsets (Seq 149-152)

Vessel to Centre of Source	085 m
Vessel to Streamer 1st Group	195 m
Centre of Source to Streamer 1st Group	110 m

1.7 CMP Coverage

Using the source/streamer configuration outlined, it was possible to acquire twelve CMP sub-surface lines with each pass of the vessel. The cable length was originally specified as 4500 m, to provide a nominal fold of 90. For technical reasons, the cable length used for acquisition was 4600 m, providing a nominal fold of coverage for the survey area of 92.

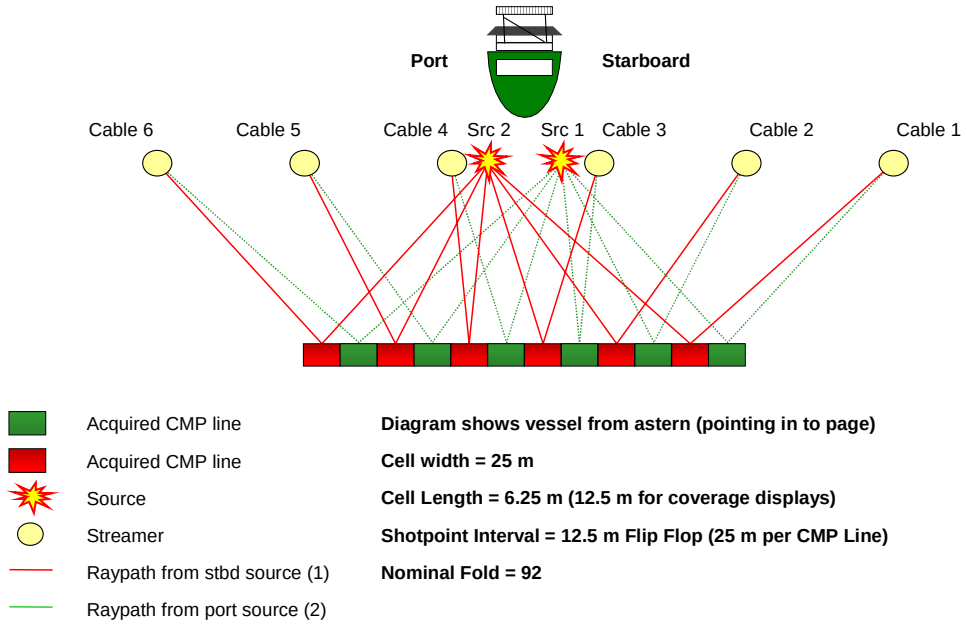

Figure 1.7-1 Nominal CMP Acquisition (6 Cables)

1.7.1 Anti-Parallel Coverage Acquisition

The eastern block of shorter lines on the Investigator prospect was acquired using an anti-parallel shooting technique. Using this method of acquisition, each sail-line pass was shot in the reciprocal direction to its two adjacent lines.

The anti-parallel method results in improved post-DMO distribution of reflection points, as reflection points cluster towards the centre of the spread when shooting up-dip, and cluster towards the edge of the spread when shooting down-dip. The improved reflection-point distribution reduces amplitude and phase variations in the final dataset, which are caused by imbalance in the DMO operator.

1.7.2 Race Track Coverage Acquisition

Due to the time constraints of the survey, and the additional line change time required for anti-parallel acquisition, this method was halted in favour of the more conventional race track acquisition, where adjacent sail-lines are combined into directional swathes.

1.8 Coverage Analysis and Flexing Specifications

The coverage obtained was analysed by splitting the source-receiver separation into four distinct offset groups:

Nears	150 m to 1300 m
Near Mids	1300m to 2450m
Far Mids	2450 m to 3600 m
Fars	3600 m to 4750 m

The vessel was steered for the best coverage of the near-mids followed by the near offsets. A progressive infill technique was used on this survey after discussion with the onboard client representative, as it was felt that this would provide the most optimal final coverage.

Coverage was assessed utilising the static bin concept, and the following target coverage criteria:

Nears	90 % (of 15 fold)
Near Mids	80 % (of 15 fold)
Far Mids	70 % hits (of 15 fold)
Fars	60 % hits (of 15 fold)

Infill was assessed following flexing of the coverage data using a cross-line binning grid expansion. The client-specified flexing parameters used a stepped cross-line bin expansion. The near and near mid offsets remained unflexed (25 m cross-line bin size). A 200% (50 m) was applied to the far-mid offsets and a 300% (75 m) was applied to the far offsets.

1.9 Line Name Convention

The lines acquired for this survey were identified using the following naming convention:

W00INV*lineYX*

Where: ***W00INV*** is the survey prefix
line is the 4 digit line number as defined by the acquisition grid.
YX is a suffix added to the line name to distinguish different passes along the same sail-line. ***Y*** is the line type; i.e. P for prime, I for infill, R for reshoot. ***X*** is an incremental number, starting at one for each line type.

CMP lines were numbered from the western boundary of the survey area and incremented to the east. Shotpoint numbers were referenced to the southern boundary of the survey area and incremented to the north.

2 OPERATIONS

2.1 Onboard Personnel

2.1.1 Marine Crew

Master:	Richard Dixon
	Jonathon Jones
1st Mate:	Victor Pinto
	Glen Laurence
2nd Mate:	Darren Webster
	Tony Egito
Chief Engineer:	Robert Moore
	John Maclean
1st Engineer	C. Gonsalves
	Robert Egan
2nd Engineer	Russell Vik
	Eamon Heggarty

2.1.2 Seismic Crew

Party Chief	Rob Secker
	Dave Coughlan
	Paddy MacCurtain
HSE Advisor	Ian Robertson
	Lyall Cowin
Co-ordinator	Wayne Buffham
	Eric Gundersen
	Russ Blohm
Assistant Co-ordinator:	Iain Smith
	Alan Lewis
	Rob Coe
	Brent Spooner
Senior Observer:	Les Hayden
	Rolando Jaberina
	Andy Gibson
	Gary Birkett
Observer	Adam Powell
	Brad Feist
	Justin Hall
	Rob Coe
	Clive Dugdale
	Adam Norris
Technician:	Nick Skingle
	Kevin Jones
	Steve Parker
	Julian Ramsey
	Andy Craven
	Larry Dusolt
	Nolan Vaness

Cable Repair	Gairn McClelland Nat Roach
Chief Gun Mechanic:	Andy Statham Ted Currey
Gun Mechanic:	Ronnie Morales Steve French Greg Back Marcus Egington Jason Phillips
Senior Navigator:	Mike Ray Andy Young
Navigator:	Richard Stirrup Fred Aiken Jason Liddell Gary Nicholson Kevin Cane Chris Gibbons Colin Sheppard Karl Prinz John Cole Pete Huxford
Field QA:	Rhod Morrison Mark Trickett Martin Skirving David Millard
Navigation QC & Processing:	Gary Nicholson Luke Cannon Peter Hayward Mike Vink Nick Martin
Seismic QC & Processing:	Geoff Garratt Virgilio Carreon Ocal Necmioglu Mike Grimes Giorgio Liberati Abd El Aleem El Essawy

2.2 Production Figures

Start of Job 5th December 1999
End job 5th April 2000

2.2.1 Time Breakdown All

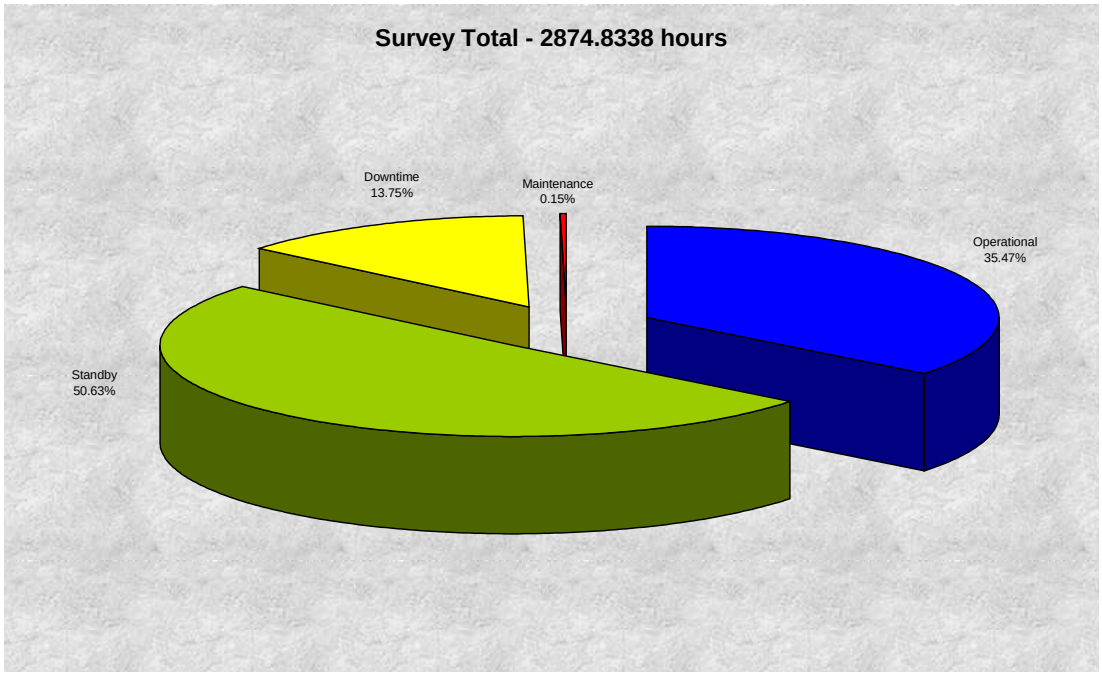

Figure 2-1 Time Breakdown

Survey Total	2874.83	100.000%
Operational	1019.83	35.500%
Standby	1455.55	50.600%
Downtime	395.20	13.700%
Maintenance	4.25	0.001%

2.2.2 Operational Time

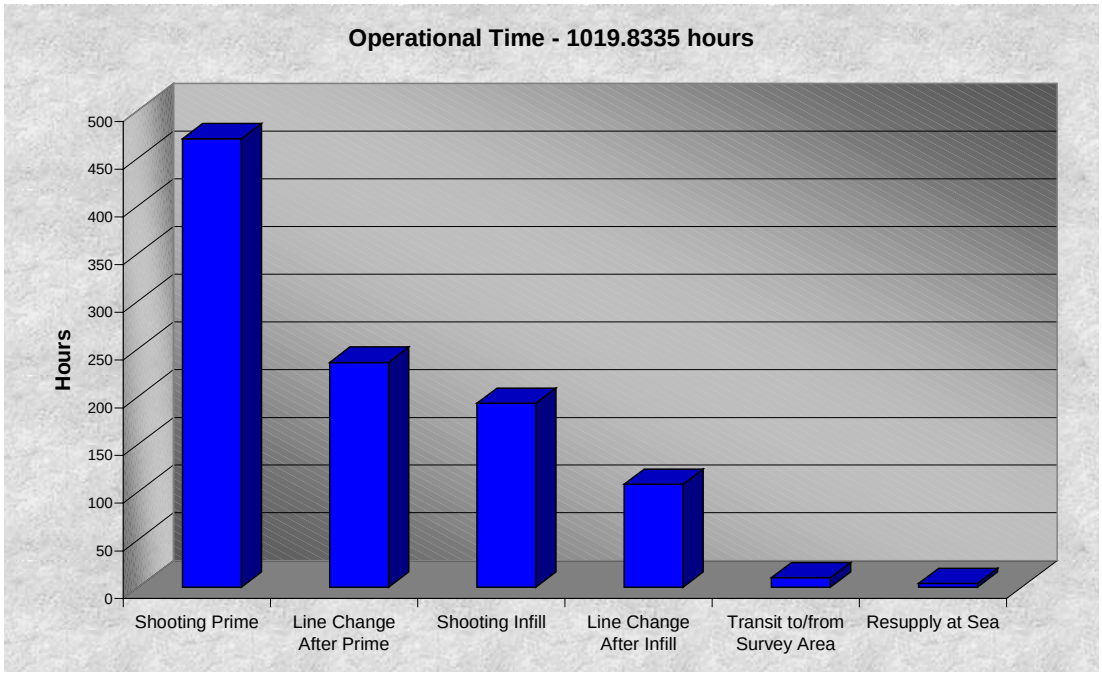

Figure 2-2 Operational Time Breakdown

Operational Time	1019.83	100.0%
Shooting Prime	470.05	46.1%
Line Change After Prime	235.68	23.1%
Line Change After Infill	107.83	10.6%
Shooting Infill	192.63	18.9%
Resupply at Sea	3.80	0.4%
Transit to/from Survey Area	9.83	1.0%

2.2.3 Standby Time

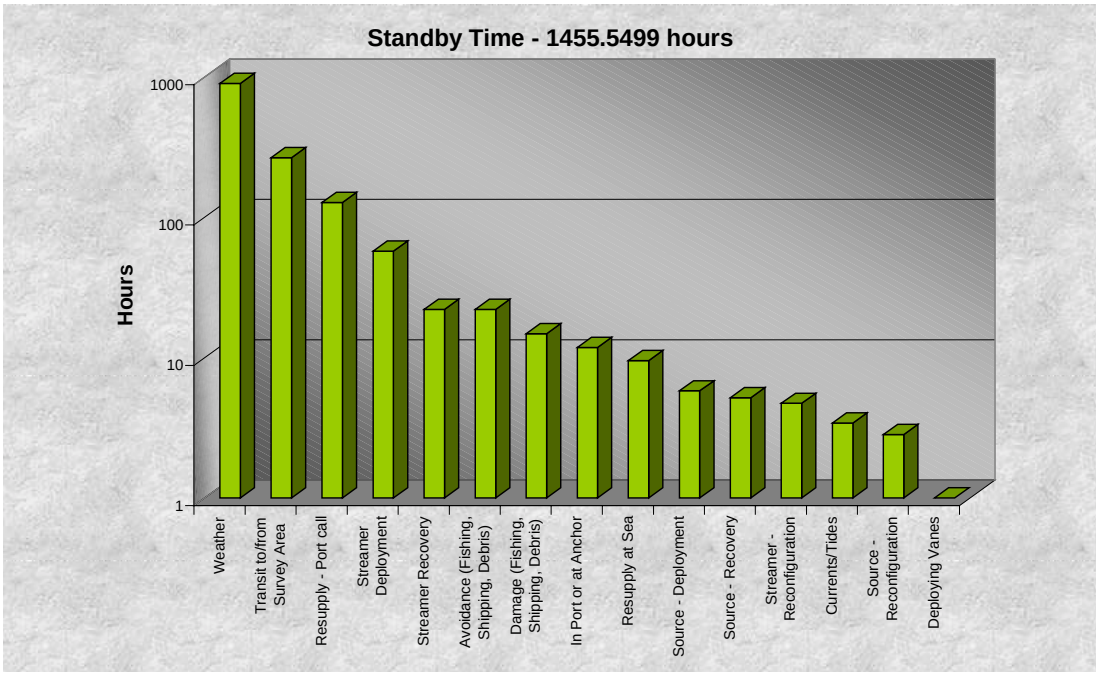

Figure 2-3 Standby Time Breakdown

Standby Time	**1455.55**	**100.0%**
Weather	901.08	61.9%
Transit to/from Survey Area	266.37	18.3%
Resupply - Port Call	127.52	8.8%
Streamer - Deployment	57.35	3.9%
Streamer - Recovery	22.08	1.5%
Avoidance (Fishing Shipping Debris)	22.07	1.5%
Damage (Fishing Shipping Debris)	14.80	1.0%
In Port or at Anchor	11.83	0.8%
Resupply at Sea	9.50	0.7%
Source - Deployment	5.80	0.4%
Source - Recovery	5.18	0.4%
Streamer - Reconfiguration	4.72	0.3%
Currents / Tides	3.42	0.2%
Source - Reconfiguration	2.83	0.2%
Deploying Vanes	1.00	0.1%

2.2.4 Downtime

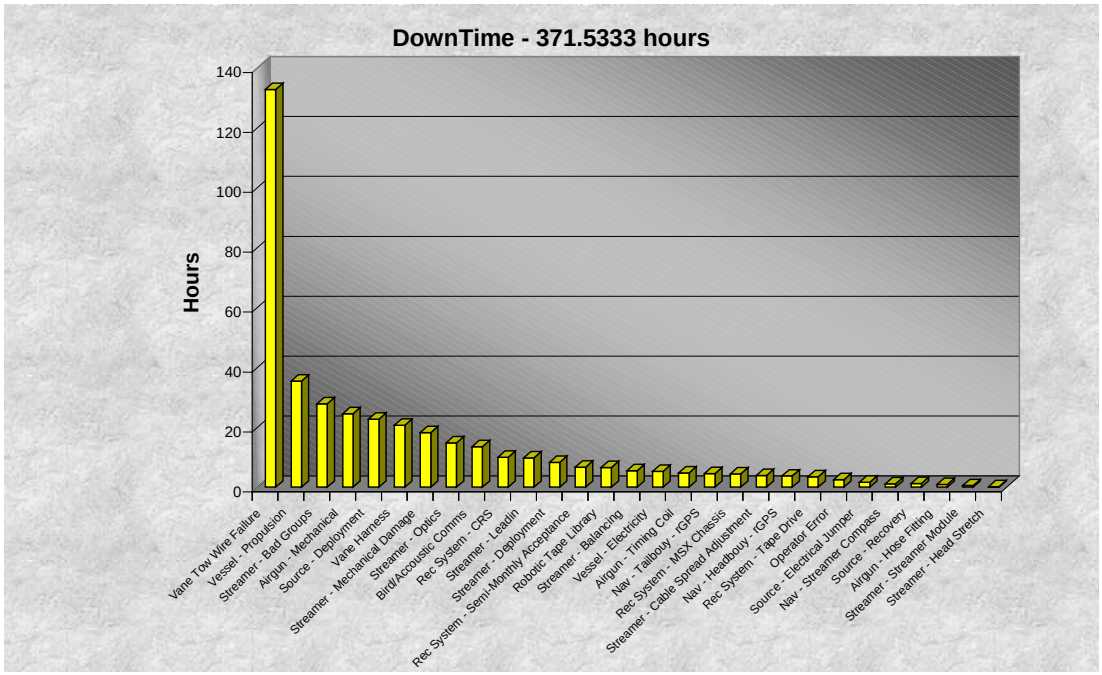

Figure 2-4 DownTime Breakdown

DownTime	371.53	100.0%
Vane Tow Wire Failure	132.73	35.7%
Vessel - Propulsion	35.42	9.5%
Streamer - Bad Groups	27.83	7.5%
Airgun - Mechanical	24.48	6.6%
Source - Deployment	22.63	6.1%
Vane Harness	20.68	5.6%
Streamer - Mechanical Damage	18.20	4.9%
Streamer - Optics	14.75	4.0%
Bird/Acoustic Comms	13.50	3.6%
Recording System - CRS	10.00	2.7%
Streamer - Lead-in	9.75	2.6%
Streamer - Deployment	8.25	2.2%
Rec. System - Semi-Monthly Acceptance	6.67	1.8%
Robotic Tape Library	6.58	1.8%
Streamer - Balancing	5.48	1.5%
Vessel - Electricity	5.32	1.4%
Airgun - Timing Coil	4.75	1.3%
Nav - Tailbuoy - rGPS	4.50	1.2%
Rec. System - MSX Chassis	4.45	1.2%
Streamer - Cable Spread Adjustment	3.88	1.0%
Nav - Headbouy - rGPS	3.73	1.0%
Rec. System - Tape drive	3.47	0.9%
Operator Error	2.53	0.7%
Source - Electrical Jumper	1.63	0.4%
Nav - Streamer Compass	1.15	0.3%

Source - Recovery	1.22	0.3%
Airgun - Hose Fitting	0.88	0.2%
Streamer - Streamer Module	0.50	0.1%
Streamer - Head Stretch	0.17	0.0%

2.2.5 Maintenance

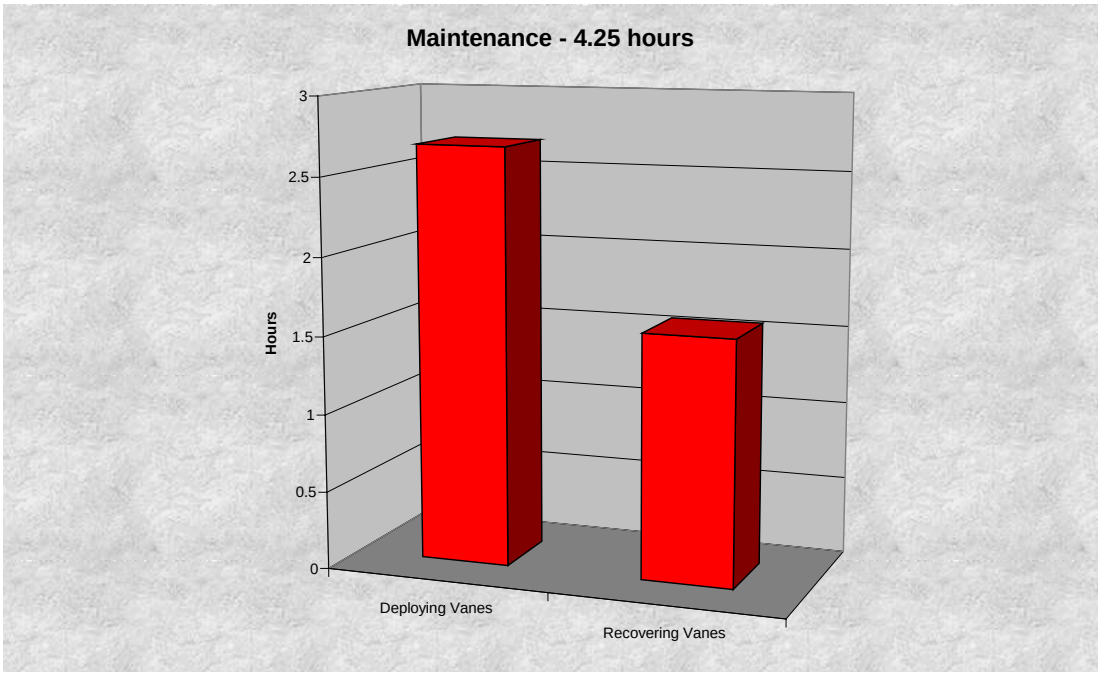

Figure 2-5 Maintenance Time Breakdown

Maintenance	**4.25**	**100.0%**
Deploying Vanes	2.68	63.1%
Recovering Vanes	1.57	36.9%

2.3 Operational Comments and Problems

2.3.1 Weather

Throughout the survey, the weather conditions were marginal. There were extensive periods of weather down time, and many lines were rejected after analysis of the seismic data identified unacceptable levels of swell noise.

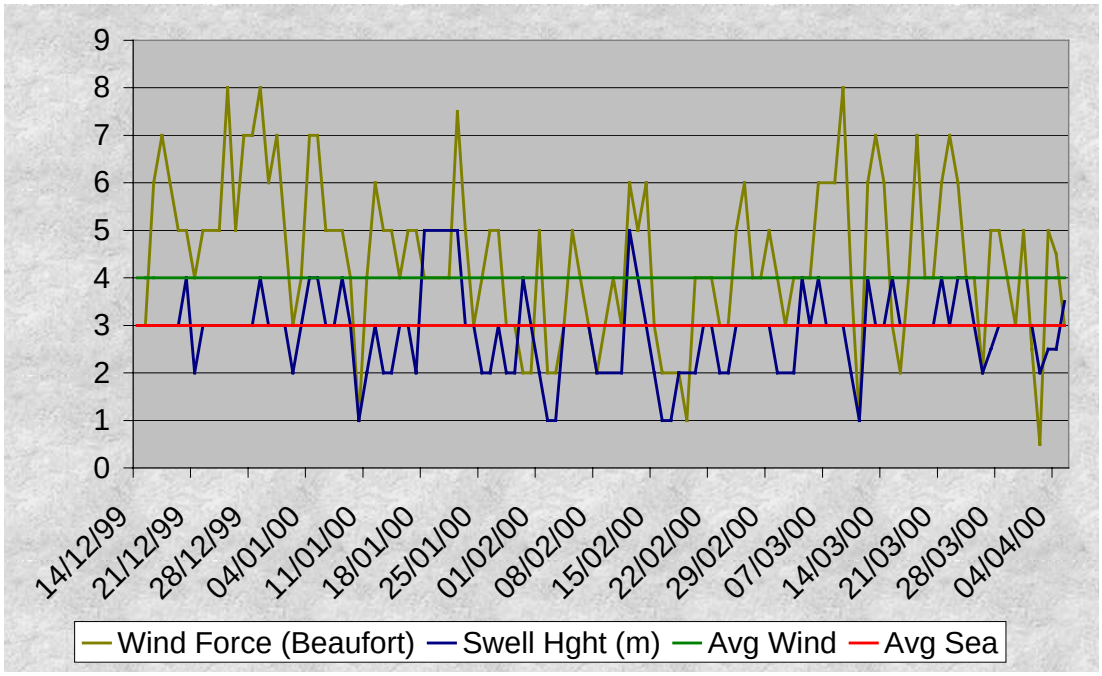

Figure 2-6 Weather Summary

2.3.2 Streamer Configuration Changes

The adverse weather conditions found on the prospect also forced a reduction in the number of cable deployed from eight to six. This reduction made it possible to retrieve individual cables for cable maintenance while leaving the remainder of the cables deployed. This was important, as there were very few weather windows for the small boat operations normally used to effect repairs. The number of deployed cables was reduced from eight to six following sequence 008.

2.3.3 Recording System Parameter Changes

At the start of the survey, data was being acquired using a 5 second record length. This was very close to the maximum record length achievable within a 12.5 metre shotpoint interval. It was hoped that using the CRS multi-shot option would allow a shortened cycle time, but this proved technically difficult to implement. After sequence 003 the record length was reduced to 4.5 seconds in order to allow an increase in vessel speed, which improved cable depth control in the rough conditions.

2.3.4 Equipment Failures

Generally, with the exception of the comments below, the equipment performed to a high standard throughout the survey.

- The rough seas experienced throughout the survey put the towed equipment under severe strain. This caused the wire to the port vane to part during particularly rough weather on two separate occasions. In order to prevent further occurrence of this fault both vane wires were replaced with heavier duty wire.
- The main tow from the vanes to the streamers became unspliced, again due to heavy inclement weather, again on two separate occasions.
- The tailbuoys also had a higher than average failure rate during this survey due to damage caused by the high sea states.
- During the mobilisation and early stages of acquisition, the Continuous Recording System would not perform multishot acquisition satisfactorily. Single shot acquisition was enabled instead.
- Data telemetry errors were seen on a number of occasions. Cable 1 gave errors during the early 8 cable sequences. This was probably due to an in-water collision with debris, as the depth of the cable head fluctuated wildly just before the cable failed. Cables 4 and 6 also failed during the survey. The cause in both these cases was a bad module.

2.3.5 Seismic Noise

- There was no external seismic interference seen during the prospect.
- Due to the prevalent weather conditions, swell noise was extensive. The majority of the lines acquired exhibited some degree of swell noise. A bench mark line was established early on in the survey and all subsequent lines were compared to this bench mark using brute stack sections and RMS noise analysis. The bench mark line was sequence 12, which was rejected by a small margin after extensive processing tests.
- Screw noise from passing shipping was seen on occasions but was never of sufficient magnitude to warrant reacquiring the data.
- An increase in strum noise was seen on heads of outer cables following the extension of the vane warps before acquiring sequence 30. This was cured by installing new, faired vane warps before acquiring sequence 142.

2.3.6 Fishing

The prospect was split into swathes and the local fishermen were informed of the location of each swathe the vessel was operating in, together with estimated completion times. While this did not completely eliminate incidents, as a few lines were aborted due to fishing gear ahead, it reduced them and co-operation was generally good.

2.3.6.1 Perfect Lady Fishing Equipment Pick up Summary.

Boat Name	Reg.	Owner Name	No.	Type	Status	Date	Lat.-Long. (in Deg-Min)	Comments
Arctic Gull	X6K	Ian McEackeran	4	Pots	Pulled	15/12/99	142-24.84 S 38-56.08 E	
Aquamarine	XSY	Paul Armstrong	8	Pots	Pulled	15/12/99	142-25.52 S 38-58.81 E	
Dolphin Ii	XNL		6	Pots	Pulled	01/03/00	143-02.98 S 38-54.44 E	Wife picked up Pt.Fairy 4th
Amayos	XCF	David Sharp	2	Pots	Pulled	01/11/00	142-41.15 S 39-03.27 E	
Arctic Gull	X6K	Ian McEackeran	8	Pots	Pulled	21/01/00	142-59.82 S 39-17.84 E 142-59.?? S 39-17.09 E	
Arctic Gull	X6K	Ian McEackeran	7	Pots	Pulled	28/01/00	142-59.63 S 39-16.78 E 142-59.97 S 39-16.01 E	1 x Pot Broke off

Boat Name	Reg.	Owner Name	No.	Type	Status	Date	Lat.-Long. (in Deg-Min)	Comments
Arctic Gull	X6K	Ian McEackeran	7	Pots	Pulled	29/01/00	142-54.76 S 39-18.10 E 142-54.51 S 39-17.69 E	
Melina E	UPA	Gary Edwards	1	Pot	Pulled	31/01/00	142-53.94 S 39-21.26 E	Picked up 9th Feb
Arctic Gull	X6K	Ian McEackeran	4	Pots	Pulled	02/01/00	142-52.12 S 39-17.86 E 142-52.36 S 39-17.14 E 142-52.88 S 39-16.39 E	
Georges Bay	TET	Shannon Churchill	5	Pots	Pulled	02/04/00	142-54.11 S 39-23.67 E 142-54.89 S 39-23.76 E 142-54.39 S 39-23.89 E 142-54.?? S 39-24.04 E 142-54.52 S 39-24.16 E	
Gwen Kane	XSZ	Wayne Towers	6	Pots	Pulled	03/10/00	142-57-49 S 39-11-16 E 142-57-63 S 39-11-88 E	Pots were inside our area
Putty's Pride	UHQ	Ross Ferrier	1	Pot	Pulled	16/3/00		
Georges Bay	TET	Shannon Churchill	7	Pots	Pulled	04/01/00	142-50-45 S 39-17-57	Pots moved back after pasting

3 HEALTH, SAFETY AND THE ENVIRONMENT

3.1 Introduction

Western Geophysical has an active progressive approach to HSE. The vessel and crew's safety in their work environment is of paramount importance. Training is also important and in addition to regular on board training exercises, crew members are placed on external training courses covering offshore survival, fire fighting, fast rescue craft, advanced 1st aid etc. Western Geophysical also have their own training courses covering the Safety Management System, and field 1st aid, on which crew members are also placed. Near Miss, Unsafe Condition and Unsafe Act reporting is carried out on the crew.

3.2 Training Courses

During this survey crew members were required to maintain Offshore Survival and Helicopter Underwater Escape Training courses at two yearly intervals. Several of the crew attended refresher courses during the course of the survey.

3.3 Safety Management System (SMS) Documentation

The Western Geophysical's SMS is electronically based on Lotus Notes. The SMS is split into three levels:

Level 1 - Corporate and contains the company's policies, training modules and fleet instructions.
Level 2 - Regional and contains Crisis response plans, Hazard Register and MSDS information.
Level 3 - Is the vessel specific part of the SMS

The final part of the SMS, which can be found in hard copy on the vessel, is the Project Plan, which addresses job specific issues such as Medevac, local hazards and acts as an interface with the Clients SMS.

3.4 HSE induction for new personnel

All new personnel to the vessel are given a copy of the Ship's bill and given an orientation and general safety tour. This is carried out within 24 hours of joining. Job specific HSE inductions are given by the various department heads and included in the Western Pride SMS.
28 personnel were given vessel HSE orientations during the prospect. This includes contractors and field service personnel.

3.5 Areas of Improvement

At the beginning of this survey Western conducted an internal HSE audit. There were 54 action items resulting from this audit, of these 2 are outstanding and 4 are continuing.

3.6 Audits

3.6.1 Inter-departmental audits

The vessel has a schedule of inter departmental audits which take place monthly and will cover the whole vessel over the course of a year. The HSE Advisor is responsible for close out documentation and follow up of outstanding points.

3.6.2 Internal Audits and Client Audits

Western Geophysical also has an internal audit program carried out by the HSE department based in the London Office. All vessels are audited once a year with a follow up audit 6 months later.
Woodside conducted an Environmental audit during the survey.

Audit	Date
Western Internal Audit	Dec 1999
Woodside Environmental audit	Dec 1999
Inter-department audit - Accomodation	Dec 1999
Inter-department audit - Gun Deck	Jan 2000
Inter-department audit - Hospital	Feb 2000

3.6.3 Safety Committee Meetings

The Safety Committee is made up of the Master, Chief Officer, Chief Engineer, Party Chief, Coordinator/s, HSE Advisor and department heads. The Safety Committee meets at least once a month, or when necessary, discussing issues such as the near misses, unsafe acts, the ISM code and associated audits. Minutes of these meetings are emailed to all departments and posted on the HSE notice board. A copy is also forwarded to London HSE.

3.6.4 Crew Safety Meetings

Crew safety meetings are held at least once a month to discuss HSE issues and provide an open forum for crew discussion, suggestions and ideas. Issues similar to those discussed in the Safety Committee meetings are covered, as well as matters arising from the day to day running of the ship. The meetings are attended by all crew members who are able to leave their duties. The minutes of meetings are e-mailed to all departments and posted on the notice board for those not in attendance. Minutes are also forwarded to London HSE.

See also the Health, Safety and Environmental statistics below.

3.7 Drills

Drills are held at least once a week to practice emergency procedures. The drills are attended by all crewmembers able to leave their duties. The drills are frequently augmented by safety videos.

3.8 Incidents and Accidents

3.8.1 Near misses / Unsafe Acts / Unsafe Conditions

Refer to the Health, Safety and Environmental statistics below.

3.8.2 Accidents

Refer to the Health, Safety and Environmental statistics below.

3.8.3 Reporting

All near misses, accidents or medical treatment cases are reported.
Any damage with a repair or replacement cost of more than US $5000 is reported and filed through a company-wide database.

Special reporting procedures exist when:

a) Any accident involving an employee or subcontractor, which results in lost work days.
b) Any accident which results in death of any person, including third parties.
c) Any accident involving damage to property with a repair or replacement cost of in excess of US $25000

These must be reported by the responsible manager within 24 hours to both the Company President and the world wide HSE manager.

3.9 Cetacean Sightings

As part of Western Geophysical's environmental policy any cetacean sightings are recorded and information forwarded to Environment Australia and Woodside.

3.10 Health, Safety And Environmental Statistics

Exposure Hours (calculated on 24 hr exposure)	
WGC / Total Marine (inc. shore support)	142,128
Client	5,856
Sub Contractor	2,400
Supply boat	39,648
Total for survey	**190,032**
Number of accidents / injury	14
Number of first aid cases	13
Number of restricted work cases	0
Number of medical treatment cases	0
Number of LTI	0
Number of Near Misses	12
Number of Unsafe Acts	18
Number of Unsafe Conditions	48
Number of Environmental incidents	1
Number of Crew Safety Meetings	5
Number of Safety Committee Meetings	4
Number of fire drills	4
Number of lifeboat drills	7
Other emergency drills	6
Number of CMV launches	14
CMV Hours	10.45
Number of FRC launches	17
FRC Hours	18.83
Burnable waste (burnt)	64.25 m^3
Non burnable waste (discharged ashore)	38.3 m^3
Burnable sludge (burnt)	25,570.25 litres

4 SURVEY VESSELS

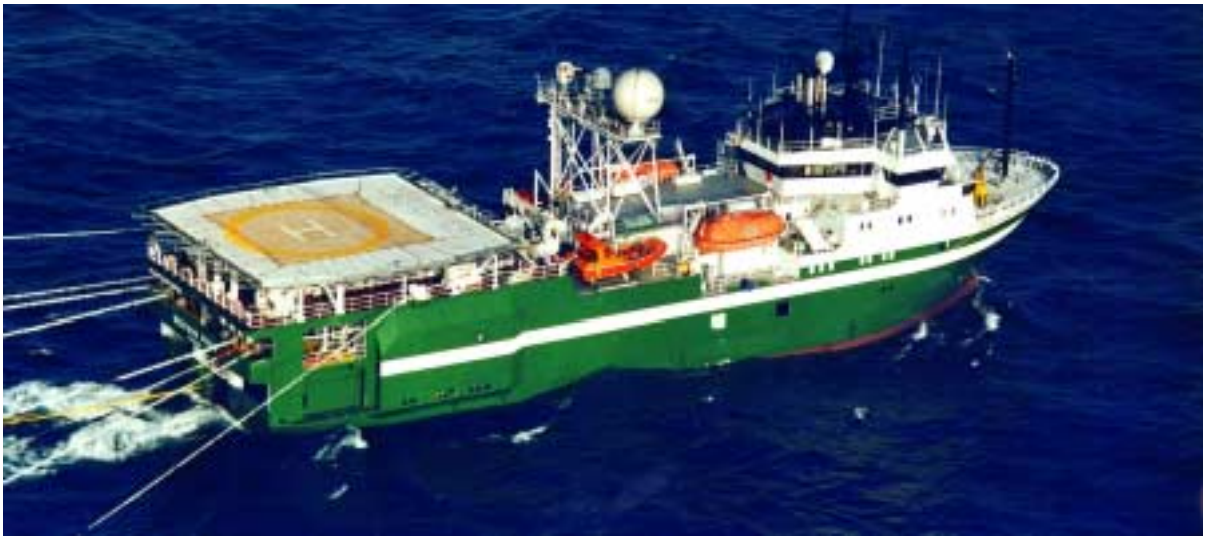

Figure 3.10-1 R/V Western Pride

4.1 R/V Western Pride

4.1.1 Introduction

The R/V WESTERN PRIDE is a purpose built seismic vessel, constructed at the Ulstein Hatlo Yard at Ulsteinvik in Norway. She was christened in 1991 and re–fitted in April 1998 in Aarhus, Denmark. She is equipped for 8 x 6000 metre streamers, and has 8 strings of low-pressure air guns. Propulsion and compressors are all mechanically driven, with all rotating machinery resiliently mounted to ensure hydroacoustic noise is kept to a minimum. The hull and propulsion system is designed specifically for extremely low noise level.

4.1.2 Vessel Description

Vessel Name	Western Pride
Port of Registry	Panama
Flag	Republic of Panama.
Year Built	1991
Where Built	Ulsteinvik, Norway
Builders Name	Ulstein Verft AS
Built As	Seismic Survey Vessel
Vessel Upgrade	March - June 1998 Aarhus Denmark
Classification Society	Det Norske Veritas
Classification	DnV 1A1,ICE-C, EO, HELDK.
Registration number	19993-9.
Call sign	3EYQ8.
Owners	Western Sea Services
Operators	Western Geophysical a division of Baker Hughes
Dimensions	
Length	71.5 metres.
Beam	17.0 metres.

Draft	5.9 metres.
Gross Tonnage	2,945
Net Tonnage	883
Accommodation capacity	56 + 1 Hospital.
Maximum Cruising speed	14 knots.
Cruising range	36 days + 4 days emergency fuel 11,000 nautical miles
Fuel capacity	1,000 cubic metres (900 service + 100 emergency)
Fuel Consumption cruising	Approx. 25 cubic metres / day
Fuel Consumption shooting	Approx. 28-30 cubic metres per day (30-32 days)
Main Engine Lube oil capacity	12 cubic metres (12,000 litres).
Cable oil capacity	16 cubic metres (16,000 litres).
Freshwater capacity	110 cubic metres
Freshwater making capacity	1 x Serck COMO, RXT 12/8, 12 tons/day. 1 x Aqua Sep 9 tons/day reverse osmosis.
Freshwater endurance	Unlimited - water makers.
Incinerator	Teamtec/Golar Marine Incinerator - garbage & waste oil
Helideck	Rated up to & including AS 332 Super Puma, S76, Bell 212 helicopters,
Helideck Approval	CAA/DNV approved.
Lifeboats	2 x 48 person, enclosed, diesel driven.
Liferafts	8 x 16 person as per SOLAS requirements.
Fast Rescue Craft	1 x Seabear 23 inboard diesel, davit deployed.
Work boat	1 x CMV (Cable Maintenance Vessel)
Main Engines	2 x Bergen Diesel BD32M6, each of 3,600 bhp.
Propulsion	2 x 4 bladed Ulstien - Liaaen variable pitch.
Main generators	2 x Leroy Somer 1,665 kVA, 450V/60 Hz, 3 phase, shaft driven.
Aux. Generator	1 x Caterpillar 3512 900 KVA, 450V
Clean Power	2 x 75KVA, 208/120, 60 Hz
Bow thruster	Ulstien-Liaaen 150 TV 800 hp, variable pitch propeller
Seismic Hydraulic Equipment	Odim
Fixed Fire Fighting systems	
Halon	Engine / Compressor spaces Recording room / Tape store Hydraulic room Galley Incinerator room.
Foam (AFFF)	Cable Reels Helideck.
CO2	Paint locker.
Navigation	SAL Log 502-6 electromagnetic speed log. Furuno FAR-2822, X band ARPA. Decca Marine Bridgemaster 343/12E, S band ARPA. Furuno FSN-50 transit satellite receiver. Furuno GP-500 GPS receiver. Furuno LC-90 Mk II Loran-C receiver. Furuno FD-525 VHF direction finder. Furuno FE-680 echo sounder, 0-2,100 metres.

	Furuno DFax 208-A weather facsimile receiver. Sait Navtex 2 - XH5123 receiver. Robertson AP9 Mk II autopilot. C Plath SR-180 Mk1 gyrocompass. Taiyo TD-C318 emergency automatic direction finder.
Emergency Positioning	2 x Jotron Search and Rescue Transponders (SARTS) Jotron X-94492 Sarsat Cospas 406 MHz EPIRB
Communications (GMDSS STANDARDS)	Vingtor shipboard communications system Thrane & Thrane TT 3000 standard-C Inmarsat telex system. Thrane & Thrane TT 3210A integrated radio telex system. 2 x Skanti DSC 3000 VHF DSC Controller Receiver 2 x Skanti TRP-3000 VHF radios (to 5 slave handsets) Sailor RT 2047 VHF radio/telephone. Skanti DSC 9000 MF/HF DSC Contoller / Receiver. Skanti Control Unit 8000 HF-SSB Transceiver. Skanti WR 6000 Watch Receiver 2182 kHz. 2 x Navico GMDSS hand held VHF radios. Sailor RT 2047 VHF radio / telephone, simplex & duplex. Jotron TR-6102 AM/VHF aeronautical radio Dittel FSG 7MPS UHF Transceiver aeronautical radio
Inmarsat	JRC Inmarsat A - JUE 45A Mk II - Voice, telex, fax, data
V-Sat	Data Marine Systems C band - Voice, fax, data

4.1.3 Vessel V-SAT contact

Tel: 00 61 (0) 8 92682 663 (Party Chief)
Tel: 00 61 (0) 8 92682 636 (Co-ordinator/Fax)
Tel: 00 61 (0) 8 92682 649 (Client)
Tel: 00 61 (0) 8 92682 664 (Crew)

4.1.4 Vessel INMARSAT contact

Tel: 00 873 1335433
Fax: 00 873 1335434

5 GEODETIC & CARTOGRAPHIC PARAMETERS

5.1 Local Datum

Local Datum Name	AGD84
Spheroid	Australian National Spheroid (ANS)
Semi-major axis	6378160.000
1/flattening	298.2500000

5.2 Satellite Datum

Satellite Datum Name	WGS 84
Spheroid	WGS 84
Semi-major axis	6378137.000
1/flattening	298.257224

5.3 Shift Parameters

From WGS 84 to Local Datum
Dx = +116.0 m
Dy = +50.47 m
Dz = -141.69 m
Rx = -0.23 arc sec*
Ry = -0.39 arc sec*
Rz = -0.344 arc sec*
Scale factor = -0.0983 ppm

*As entered in the Spectra INS, which uses the Bursa Wolf Rotation Convention, a 'left handed' rotation rule. For Co-ordinate Frame Rotation, which is a 'right handed' rotation rule, the signs of the rotations must be reversed.

5.4 Mapping Projection

Mapping Projection Name	AMG ZONE 54 (UTM)
Origin of Latitude	000° 00' 00.00" N
Origin of Longitude	141° 00' 00.00" E
False Northing	10,000,000.0 m
False Easting	500,000.0 m
Central Meridian	141° 00' 00.00" E
Scale factor at CM	0.9996
Grid Units	Metres

5.5 Geoidal/Spheroidal Mean Undulation

-2.624 m Calculated using the OSU91A model at the nine boundary points of the survey grid

	Easting (local projection)	Northing (local projection)	Geoid/Spheroid Separation
P1	649973.0	5682748.5	-2.768
P2	652442.7	5698341.7	-2.294
P3	666764.2	5696073.4	-1.947
P4	672475.0	5692017.6	-1.897

	Easting (local projection)	Northing (local projection)	Geoid/Spheroid Separation
P5	670691.7	5680757.9	-2.237
P6	675759.3	5676955.8	-2.197
P7	670890.3	5646214.0	-3.331
P8	649185.8	5649651.7	-4.219
P9	653982.5	5679936.7	-2.730
		Average:	**-2.624**

5.6 Magnetic declination

+11.103° Calculated using the IGRF95 model for 25-Dec-1999 at the nine boundary points of the survey grid

	Easting (local projection)	Northing (local projection)	Magnetic Declination
P1	649973.0	5682748.5	11.021
P2	652442.7	5698341.7	10.991
P3	666764.2	5696073.4	11.076
P4	672475.0	5692017.6	11.119
P5	670691.7	5680757.9	11.141
P6	675759.3	5676955.8	11.180
P7	670890.3	5646214.0	11.242
P8	649185.8	5649651.7	11.110
P9	653982.5	5679936.7	11.051
		Average:	**11.103**

5.7 Binning Grid

The in-line cell size used for both real-time fold-of-coverage acquisition displays and for offline fold-of-coverage displays was 12.5 m.
The cross-line cell size, based on the CMP spacing, was 25.0 m.
The binning grid used was defined using Grid distances.
A shotpoint layback was used such that the first shotpoint of the line coincided with the first CMP hit in the full-fold area.

5.7.1 Binning Grid Parameters

Binning Grid

Map Grid Origin Easting	643880.97	(bin centre)
Map Grid Origin Northing	5647960.68	(bin centre)
Map Grid Bearing (°)	9.000	(In-line axis)
	In-line	X-line
Bin Grid Extent (m)	53587.50	27475.00
Bin Number at Origin	801	978
Bin Number Increment	1	1
Bin Dimensions (m)	12.5	25.0
Apply scale factor	No (using mapping grid distances)	

Nominal Offset Distribution

Minimum Offset (m)	150
Maximum Offset (m)	4750
Offset Increment (m)	50

Coverage Groups	Near Offset (m)	Far Offset (m)
Nears	150	1300
Near Mids	1300	2450
Far Mids	2450	3600
Fars	3600	4750

6 SEISMIC EQUIPMENT - RECORDING ROOM INTEGRATION

6.1 Overview

The central onboard computer system is a dual frame IBM SP-2 containing 20 UNIX based computer nodes, and administered by a UNIX based PowerPC workstation. The nodes are connected to hard disk packs totalling 1 Tbyte capacity, and to 16 3590 cartridge transports, in addition to the four drives dedicated to the CRS recording system. Separate nodes run the Spectra Navigation System, the Reflex Binning System, the Prospect Data Logger, the Unavchk Navigation Processing System software and the Omega Seismic Processing System software. The remaining acquisition and processing systems run on external computer systems connected to the central SP2 via the vessel's ethernet network where necessary.

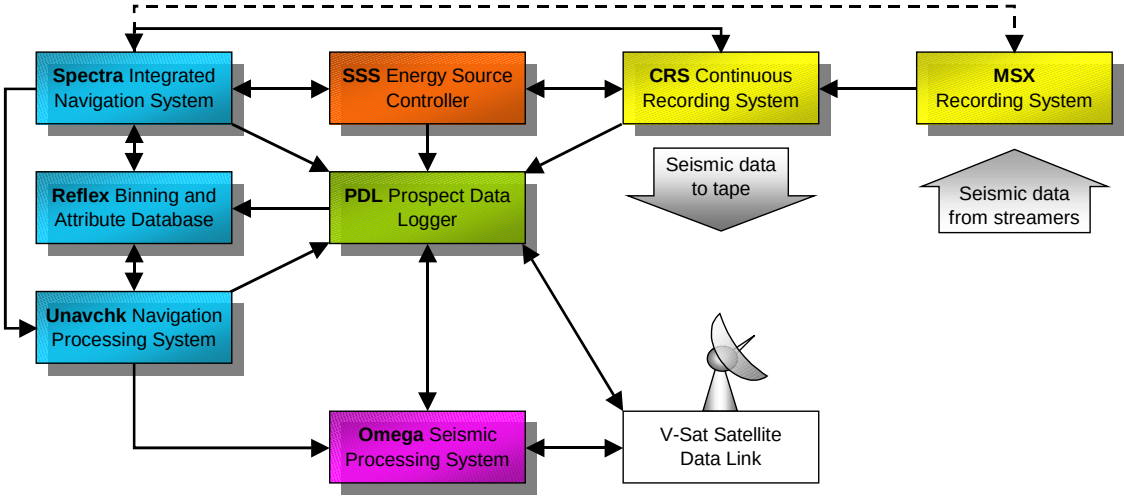

Figure 6.1-1 Schematic Diagram of Recording Room Communications

Western's Marine Integrated Data Acquisition System (MIDAS) is designed to integrate all the systems within the recording room. The heart of the system is the Prospect Database Logger (PDL). The PDL software communicates in real-time with three seismic acquisition systems, namely the Spectra Integrated Navigation System, the SSS Energy Source Synchroniser and the Continuous Recording System, in order to collate and database the shot-by-shot line information from these systems into an ORACLE™ database.

From this single centralised database, PDL permits easy access to any information via the PDL software itself, through an ANSI standard database query language (SQL plus), or via the ORACLE Browser™ graphical interface. This allows the data to be passed to other Recording Room systems, such as the Omega Seismic Processing System, or Reflex's binning and attribute database. It also allows the information to be accessed remotely via a replicated database onshore, which is regularly updated over the satellite system. This facility is used by remote processing groups to provide near-instant access to line information and to survey parameters.

PDL supplies standardised QC and administrative report generation, utilising information supplied from all the acquisition and processing systems. Line logs and reports are

generated each line from PDL, providing a single centralised report containing all information pertaining to the particular line.
PDL also supplies the interface between the recording system, and the automatic tape-handling system.

Quality assurance functions provided by MIDAS/PDL include:

- Fully automated, robotic tape handling.
- 100% read after write verification.
- Tape copy, QC and processing control.
- Satellite Network connection.
- Onshore QC and processing control.
- Improved communications and data transfer procedures with onshore representatives.
- Comprehensive Attribute Analysis.
- PDL - OMEGA SPS integration.
- Automatic initiation of seismic QC.
- Automatic write-protecting of 3590 tapes.
- Large screen video displays.

The PDL system is composed of two major software components, which operate within the UNIX operating system (AIX 4.2), in the X/Motif environment.

- A program module to gather and log data in the database, in near real-time.
- A program module to provide users access to the database via a graphical user interface.

6.2 Fully Automated Tape Handling

PDL, together with an E-MASS™ robotic tape library storage unit, Volserv™ tape library-cataloguing database, and MMS, (Media Management System) provide fully automated and catalogued tape handling. All raw and processed tapes are handled by MMS, which assigns each one a unique, identifying catalogue file name. PDL also has an electronic write-protect facility, automatically acting on each raw field tape to prevent any data being overwritten.
MMS supports IBM standard label, ANSI standard labels and non-labelled tapes. IBM standard label processing helps to ensure that the correct volumes are mounted in the correct order, and helps to prevent the accidental overwrite of tape volumes.
MMS is Western developed software and is part of the Omega Seismic Processing system. It handles all tape-related processes: directing all tape processing activities for a particular node; providing an OSF/Motif user interface, which receives, displays and controls tape mount requests; interacting with Volserv, the robotic tape library software, to mount specific volumes or any volume with scratch status on specific tape drives.

6.3 QC And Processing System Integration

6.3.1 Onboard Data Processing Control

MIDAS and PDL control and co-ordinate the low end onboard data processing QC by communicating with the Omega Seismic Processing system via the opserv daemon. The opserv daemon transfers data from PDL to the Global Parameter Database (GPD) within Omega. The GPD stores this line information, which is automatically inserted into the data processing flow for the relevant line, automating much of the processing procedure and reducing the chances of erroneous operator entry.

The Opsrv daemon also provides the ability to automate processing of the data on a reel-by-reel or line-by-line basis. The processing flow is built and run automatically when PDL signals that the end of a reel, or the end of a line has been reached. The GPD line parameters are used to tailor the automated processing flow.

7 SEISMIC EQUIPMENT - ENERGY SOURCE

7.1 Western Pride Energy Source Parameters

Type	WGC Sleeve Gun
Number of Arrays	2 3D lines (Seq 001-147) 1 2D lines (Seq 148-152)
Number of Sub-Arrays	3
Number Of Guns per Array	24 (8 per sub-array)
Pressure	2000 psi (± 150 psi)
Volume	2250 cu.in.
Source Output	74.1 bar-m (peak to trough 3-128 Hz) 40.7 bar-m (0 to peak) 17.3:1 peak to bubble ratio
Gun Depth Monitoring	SSS OCM (Version 1.7 with Y2K patches)
Source depth	5 m (± 0.5 m)
Array Separation	50.0 m
Array width	12.0 m
Sub Array Separation	6 m
Sub Array Length	15.1 m
Pop Interval	12.5 m flip flop 25.0 m per source array - 3D Lines 25 m single source - 2D lines
Gun Synchronisation	± 1.0 ms logged edited if error greater than ±1.5 ms
Gun Synchronisation System	SSS OCM (Version 1.7 with Y2K patches)
Near field hydrophone	1 hydrophone for each sub array element (6 per sub array)

7.2 General Overview

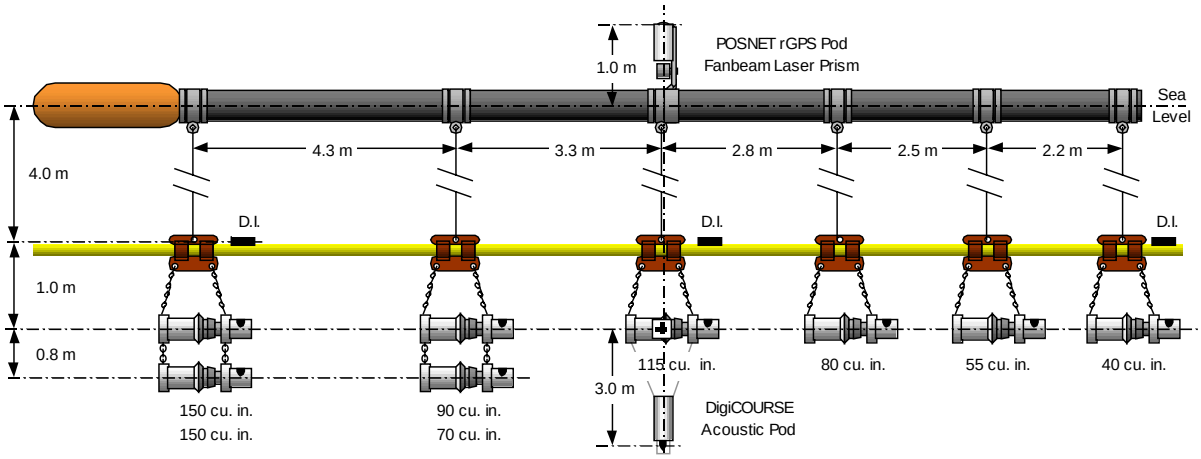

Figure 7.2-1 750 Cubic Inch Sub-array

The basic component of the sleeve gun array used on board the Western Pride is the 750 cubic inch sub-array. This sub-array is comprised of 8 individual guns configured into 6 signature tuning elements. The vessel is equipped with eight low-pressure airgun sub-arrays. Each sub-array handling system consists of an 800 metre string (hose bundle) terminated in a mini-bundle (active sub-array) supporting eight Sleeve Gun units.

Each sub-array is 15.1 meters in length. With the current sub-array configuration, the vessel supports 64 active Sleeve Gun units, with the capability of adding 64 more.

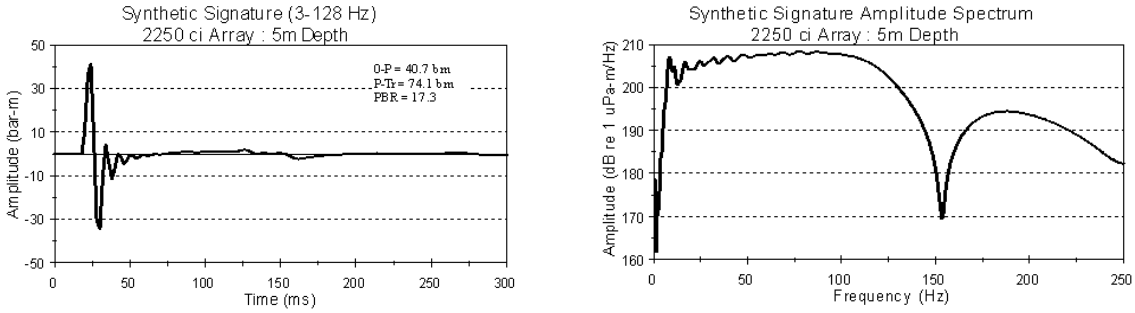

Figure 7.2-3 Source Signature and Amplitude Spectrum for 2250 in^3 Array at 5 m depth

7.2.1 Source layout

The following diagram illustrates the nominal source configuration during the survey.

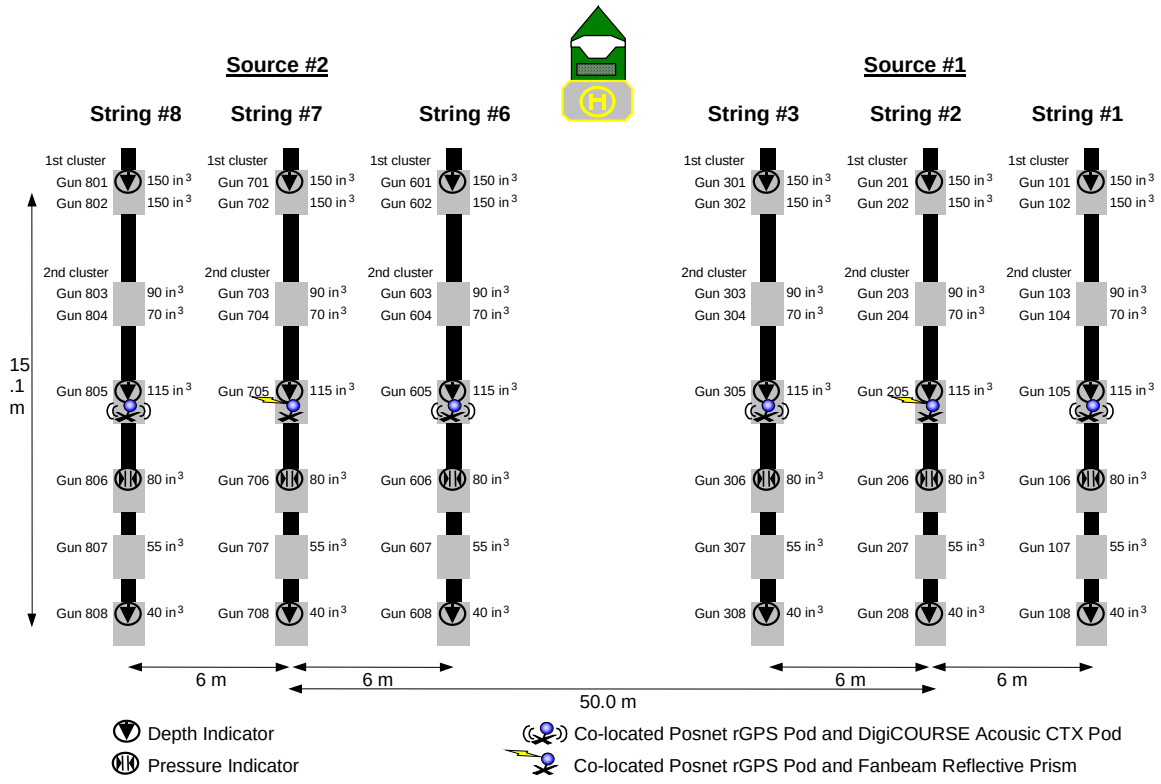

Figure 7.2-4 Source Configuration

7.2.2 Compressors

The R/V Western Pride is equipped with 2 x 2725 SCFM Eureka/Ariel Compressors driven by Caterpillar 3516 diesel engines. Operating at 2000 PSI with approximately 7.5 seconds per pop cycle time, the vessel can support airgun arrays up to 6000 cubic inches.

7.2.3 The SSS Gun Controller/Synchronisation System

7.2.3.1 General Information

The Source Synchroniser System (SSS) is capable of controlling and monitoring up to 128 individual guns and synchronising of the firing of these guns to within 100 μs. It allows monitoring of gun performance criteria such as gun synchronisation, misfires, detection of autofires and double pops, and provides end-of-line reports containing information on system parameters and parameter changes, depth and pressure data, gun errors and gun performance summaries.

7.2.3.2 SSS Workstation

A Sun Sparc UNIX workstation runs all the SSS applications. Control and data information is exchanged with the GSM via a dedicated ethernet link. The workstation, together with addition X-terminals, provides X-windows based graphical user interfaces to control and monitor the system, and to perform extensive diagnostic utilities.

7.2.3.3 Gun Synchroniser Monitor (GSM)

The GSM is built around a VME chassis. It exchanges control and data information with the RACUs and passes this data to the workstation and to the navigation and seismic acquisition systems.

7.2.3.4 Remote Acquisition and Control Units (RACUs)

The RACUs contain the electronics that synchronise the guns and drive the gun solenoids. They are situated in the water, just aft of the bellhousing of the hose bundle and communicate with the shipboard electronics via a high-speed serial link. By positioning the RACUs in close proximity to the guns, fewer hose bundle wires are required and electrical leakage is minimised resulting in greater drive currents for the guns. Each RACU controls up to eight guns and each provide the following data on a shot-by-shot basis:

- Near field data samples (512 ms at 1 ms sampling)
- High resolution near field data samples (50 ms at 0.1 ms sampling)
- High resolution fire detect data samples (50 ms at 0.1 ms sampling)
- High resolution solenoid current data samples (50 ms at 0.1 ms sampling)
- Voltages and temperature within the RACU
- Up to eight depth or pressure values

7.2.3.5 Gun Pressure Monitoring

One LRS pressure indicator is installed on each mini-bundle (active sub-array). Accurate pressure readings are provided, via the sub-array RACU, to the SSS where the pressures are monitored and, if out of tolerance, flagged as bad. The gun pressures are also recorded on the Seismic User Header.

7.2.3.6 Gun Depth Monitoring

The depths of the sources are monitored using three LRS Depth Indicators (DIs) per sub-array. The DIs are situated on the sub array's mini bundle, which is 1.0 m above the operating depth of the sleeve guns in the water, at offsets of +7.6, 0.0 and -7.5 m with respect to the centre of the sub-array. The depths are monitored by the SSS, which flags any depths out of tolerance, and are recorded on the Seismic User Header.

8 SEISMIC EQUIPMENT - RECORDING SYSTEM AND STREAMERS

8.1 Recording System Parameters

Recording System	MSX System
System Version	Version 2.0 by Input / Output
Record length	5.0 sec (5120 ms) Seq 001-002 4.5 sec (4608 ms) Seq 003-148 6.0 sec (6144 ms) Seq 149-152 - 2D lines
Tape Interface System	Continuous Recording System (CRS)
System Version	Version 3.0.1 by Western Geophysical
Record length	5.0 sec (5120 ms) Seq 001-002 4.5 sec (4608 ms) Seq 003-147 6.0 sec (6144 ms) Seq 148-152 - 2D lines
Multishot acquisition	Not used
Recorded data format	8058 SEG D – DMX
Trace polarity	positive pressure = negative number on tape = negative pulse on plot
Tape type	3M 3590
Tape drive type	IBM 8590
Sample rate	2 ms
Number of auxiliary channels	168
Low Cut Filter	2 Hz @ 12 dB/Octave
High Cut Filter	206 Hz @ 264 dB/Octave

8.2 Recording System Overview

Seismic data acquisition is controlled by the MSX recording system, which was developed to be a stand-alone system. Data is transmitted digitally from the streamers to the onboard MSX system where it is demultiplexed, filtered and output in SEG-D format. External header information is passed to the MSX from the Spectra Integrated Navigation System via a serial link.
Instead of outputting the SEG-D data to tape, the MSX instead passes the data to the CRS (Continuous Recording System) which emulates the MSX tape drives. The CRS combines high-speed data handling with a 72 GB RAID hard disk system allowing the SEG-D data received from the MSX system to be written to disk. Once saved to disk the SEG-D data is output to one of the four tape drives attached to the CRS system. When using the CRS, the tape writing process is no longer real-time and tape drive or media related problems can be fixed without interrupting acquisition.

8.3 The CRS Tape Interface System

8.3.1 CRS Overview and Features

As stated above, the primary purpose of the CRS is to de-couple the real-time acquisition from the tape writing process, in order to prevent tape drive or media related problems from halting acquisition. The CRS also provides the following further features, designed to extend the capabilities of the seismic recording system:

- The CRS can record SSS gun data and signatures
- The CRS supports the retrieval of seismic data from remote boats using radio telemetry, and merge this data with the associated local shot before output to tape.
- The CRS is able to split incoming SEG-D datasets into multiple SEG-D files in order to reduce system overhead time and increase shooting speeds, or decrease shotpoint intervals. For example, the MSX can be configured to record a long record with Spectra and SSS firing multiple shots within this time. The resulting SEG-D file can then be split into shorter segments associated with each individual firing of the guns. This is known as multishot acquisition.
- The CRS allows improved seismic QC system by passing the seismic data to SeisView, a real-time Omega Seismic Processing environment.
- The CRS interfaces directly with PDL for data logging and QC.

8.3.2 CRS Data Flow

The CRS is linked via SCSI to the MSX system, in order to emulate the MSX tape drives, and receive the SEG-D data. The CRS is also linked to the Spectra Navigation System and the SSS Energy Source Synchroniser via a private ethernet network. Spectra provides external header information, while the SSS provides the near field signatures and gun information. During acquisition, the SEG-D data from the MSX Recording system is merged with the external header data from Spectra and the gun data from the SSS. The data is identified using the Field Shot Identifier (FSID). The data is then written to the RAID hard disk system, and from disk to tape. A new SEG-D header is written to the data before it is output to tape with the reel and file number fields updated using the values from within the CRS. New headers and gun data are also generated from the Spectra and SSS input when the CRS outputs extra SEG-D files in multishot mode.

8.4 The MSX Recording System

8.4.1 MSX Overview

The MSX is a marine 24-bit digital seismic data acquisition system that blends the use of 24-bit resolution data acquisition, fibre-optic telemetry, large channel capacity, and extended cables of up to 12,000m active length to provide exceptional data quality and recording features.

The data is decimated in each streamer module using digital anti-alias filters and transmitted serially to the shipboard recording system using high-speed fibre-optic digital telemetry. The MSX System has a superb bandwidth, anti-aliasing, and signal-to-noise performance, and can record up to 8000 channels in a SEG-D de-multiplexed seismic data format at a 2 or 4 millisecond sample rate or up to 4000 channels at a 1 millisecond sample rate. The MSX supports seismic data recording on IBM 3590 Cartridge tape drives.

The MSX Operator Interface Console (OIC), which consists of a SUN SPARC workstation, connected to the MSX VME chassis by means of an Ethernet network, performs extensive data logging functions. The OIC enables post-line analysis programs to access the seismic header information from each shotpoint as well as any error automatically logged by the system. Comments entered by the operator at selected shotpoints can also be stored in a real-time database in order to retain all the exceptions, detected either by the system or the operator. Other OIC functions include automated testing and production of observer logs, although this function is usually performed by PDL software.

8.5 Seismic Quality Control

8.5.1 Data Telemetry Quality Control and Diagnostic Procedures

The MSX has numerous built-in test features to ensure the operational integrity of the in-water and onboard electronic modules and telemetry link. The system transmits a digital test signal down the cable where each module captures the signal and performs a variety of diagnostic procedures.

The diagnostic procedures that can be performed by the MSX include:

- Test the digital link without the module or marine remote units in the circuit and then with each device included.
- Test the analogue path by sending a digital test pattern to the module where it is converted to a precision analogue signal by a digital to analogue converter, (DAC), with characteristics similar to that of the 24 bit ADC. The resulting signal is fed to the marine remote units with the hydrophones in or out of the circuit.
- Generate various signals, such as sine waves, impulses, dual frequency signals at dual levels or input an external signal.

8.5.2 Online Displays

Through the Enhanced Visualisation Processor (EVP), the MSX is able to produce online displays of the seismic data being acquired. The shot records may be plotted out through the OYOgs624 thermal plotter, or displayed on a monitor display with user defined scales, and filters.

The MSX OIC also has a colour-coded display showing the amplitude detected by each channel, together with an online display illustrating the status of each shotpoint.

The addition of the CRS allows the SeisView system to produce real time displays of both raw and processed data. The full suite of Omega seismic processing tools can be used to tailor the displays for specific QC requirements, limited only by the data volume and computing speed.

8.5.3 Offline Quality Assurance

Through MIDAS (Marine Integrated Data Acquisition System), the MSX/CRS recording system is linked to the Omega Seismic Processing System, where several QC products are routinely produced.

All relevant shotpoint information generated by the CRS is passed onto the PDL database where this information is logged, and may be accessed directly via SQL plus, or the Oracle Browser ™. The data is also accessed via PDL reports, which generates observer logs, line and survey reports, based on information gained from all the recording room systems.

8.6 Recording System Discussion

The CRS is a new system recently deployed for field operations. Unfortunately, teething problems have been experienced during this survey, which resulted in the use of the slower vessel speed single shot acquisition rather than the multi shot acquisition technique.

8.7 Streamer Parameters

Streamer Type	Thomson Marconi Sentry Solid Streamer - (24bit)

Number of Cables	8 cables Seq 001-008 6 cables Seq 009-148 1 cable Seq 149-152 - 2D lines
Deployment System	Cross-Tag Configuration
Group Length	17.55 m
Group Interval	12.5 m - centre to centre
Streamer Length	4600 m
Streamer Depth	6.0 m ± 1.0 m
Number of Channels	368 per cable 2944 total seismic, 112 auxiliary Seq 001-008 2208 total seismic, 104 auxiliary Seq 009-147 368 total seismic, 84 auxiliary Seq 148-152
Number of hydrophones per group	14 (group interval 12.5 m)
Number of groups per Module	16 (group interval 12.5 m)
Number of groups per section	8 (group interval 12.5 m)
Hydrophone type	Ceramic piezo-electric dish hydrophone
Data telemetry	Fibre optic
Trace numbering	From head of each cable
Number of Compasses	18 per cable
Number of Levellers	18 per cable
Leveller Type	DigiCOURSE Pro2K combined Compass / Bird
Streamer Positioning	DigiCOURSE, Digirange Acoustic nodes DigiCOURSE Pro2K combined Compass / Bird POSNET remote GPS targets on each tailbuoy
In-line cable offsets (Vessel to 1st group)	640 m (8 Cable Acquisition) 440 m (6 Cable Acquisition) 195 m (1 Cable Acquisition - 2D)
In-line source offsets (Vessel to centre of arrays)	490 m (8 Cable Acquisition) 315 m (6 Cable Acquisition 85 m (1 Cable Acquisition - 2D)
Near offset (1st group to centre of arrays)	150 m (8 cable Acquisition) 125 m (6 Cable Acquisition) 110 m (1 Cable Acquisition - 2D)
Streamer separation	100.0 m 500.0 m total for 6 Cable Acquisiton 700.0 m total for 8 Cable Acquisition
Source array separation	50.0 m

8.8 Channel Sets

The MSX system was configured with the following channel sets:

8.8.1 Eight Cable Acquisition - Seq 001 to 008

Channel set #1-8 (368 channels each)	Seismic Data
Channel set #9-16 (4 channels each)	Waterbreak channels
Channel set #17 (1 channel)	Recording system start
Channel set #18 (1 channel)	Combined Timebreak
Channel set #19-22 (1 channel each)	Array Timebreak
Channel set #23-31 (1 channel each)	Spare
Channel set #32 (1 channel)	Sample Count
Channel set #33 (64 channels at 512ms)	Near Field Gun Channels

8.8.2 Six Cable Acquisition - Seq 009 to 147

Channel set #1-6 (368 channels each)	Seismic Data
Channel set #7-12 (4 channels each)	Waterbreak channels
Channel set #13 (1 channel)	Recording system start
Channel set #14 (1 channel)	Combined Timebreak
Channel set #15-18 (1 channel each)	Array Timebreak
Channel set #19-27 (1 channel each)	Spare
Channel set #28 (1 channel)	Sample Count
Channel set #29 (64 channels at 512ms)	Near Field Gun Channels

8.8.3 2D Acquisition - Seq 148 to 152

Number of Channels	368 seismic + 16 auxilliaries
Channel set 1 (368 channels)	Seismic data
Channel set 2 (4 channels)	Waterbreaks
Channel set 4 (1 channel)	Recording System Start
Channel set 5 (1 channel)	Combined Timebreak
Channel set 6-9 (1 channel each)	Array Timebreak
Channel set 10-17 (1 channel each)	Spare
Channel set 18 (1 channel)	Sample Count
Channel set 19 (64 channels at 512 ms)	Gun signature

8.9 Active Sections - TMS Solid Streamer

The active sections form the major part of the streamer assembly. These sections are manufactured to work under extremely harsh conditions. One example of this is related to the nominal length of the active section. The manufacturers allow for a tension that is much greater than is normally seen. Therefore, the active sections are slightly shorter than the nominal 100 m. The actual module-centre to module-centre length of an active section is closer to 99.6 m, giving a group interval of 12.45 m, and these are the values used in the navigation acquisition and processing. However, for clarity and brevity the nominal length of 100 m and group interval of 12.5 m have been used in the parameter summaries in this report.

An MSX module joins two identical active sections. The resulting 200 metre assembly connects to other identical assemblies via a CSX module at each end of the assembly, up to a maximum streamer length of 12,000 metres. The 100 metre active sections are designated as alpha (A) and bravo (B) sections in order to show their position with respect to the modules. The alpha sections occupy the position behind the CSX modules, and the bravo sections behind the MSX modules.

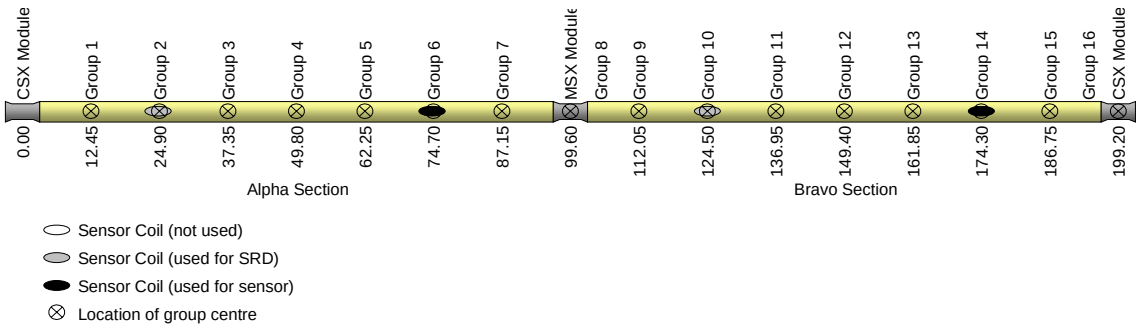

Figure 8.9-1 Active Assembly

Each 100 m active section contains a waterbreak phone, a depth transducer, two communication coils, and 112 hydrophones.
The depth transducer performs a sea water depth to voltage conversion, and outputs the resulting signals to the streamer module for A/D conversion.
The communications coil receives control commands from the recording room and couples them to the streamer depth controllers / compass units, and the acoustic positioning units. The communication coils also allow the transmittal of data back to the recording room from these units. Each section has two such coils. The first, at 24.25 m from the module-centre at the head of the section is a traditional inductive coil. These coils were not used for sensors throughout the survey, however Streamer Retreival Devices (SRDs) were located at these coils on some sections. The second coil, which is 74.10 m from the head, is designed for the new generation Pro2000 Digicourse acoustic and compass/bird sensors. These coils allow the sensors to be powered from the cable via inductive coupling, and eliminate battery changes.
The hydrophones are divided into 8 groups of 14 phones; these are connected to a centre weighted, tapered array for noise reduction.

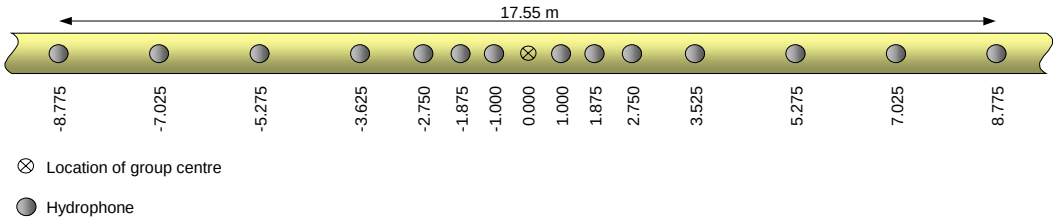

Figure 8.9-2 Group Hydrophone Location

The MSX modules, which are approximately 0.4 m long, contain all the electronics for digitising the analogue signals from the hydrophone groups, as well as transmitting the data to the onboard recording system. The CSX modules, again 0.4 m long, merely act as connectors.

8.9.1.1 Front Stretch Section.

This portion of the cable comprises three separate sections of two cable types.
These sections are used to isolate the active portion of the streamer from the motion of the vessel and pullavane. The use of TMS Stubbie and Syntron RVIM sections is to achieve a greater reliability of the Front stretch section when compared with the oil filled stretch sections.

8.9.1.1.1 Stubbie Section.

The stubbie sections are located fore and aft of the Syntron RVIM section as part of the head elastic for each streamer. The stubbie comprises an 8.6 m section of solid streamer cable. There are 2 coils present at 2.34 m and 5.83 m from the head of the section. These coils were not utilised, as they are incompatible with the Digicourse Pro 2000 equipment.

8.9.1.1.2 Syntron RVIM Section.

These sections act as damping springs and have a nominal unstretched length is 24 m. The actual length whilst in use is dependent on factors such as the speed of the vessel and streamer length. The RVIM comprises a section of rubberised elastic skin with an internal umbilical of cables and optical fibres contained within a pressurised environment

8.9.1.2 Tail End Stretch.

The tail end of the streamer is isolated from the tail buoy by a Cable and a stretch section. The section has the same construction as the front-end stretch, except it contains 8 hydrophones, which are designed to complete the hydrophone compliment for the last group. However this last group on all cables is not used, due to incompatibility between the solid streamer and the oil filled stretch section. The nominal unstretched length of the tail stretches is 85.0 m, with Pro2000 coils at 10.0 m and 80.5 m from the head of the section. Actual lengths are monitored using in-line acoustic ranges.

8.9.1.3 Cable Head Section.

The cable head sections are 8.9 m long and contain a water-break hydrophone, a cable tension meter and a Pro2000 communication coil at 6.0 m from the head.

8.9.1.4 Comments.

The Thompson Marconi ™ Sentry Solid streamers have proved to be a large improvement over the previously utilised oil-filled streamers.

8.9.1.4.1 Cable Noise

The ambient cable noise has been drastically reduced following the utilisation of the TMS solid streamers. This enables production to continue into poorer weather conditions than was previously possible, while retaining a high degree of data quality. The cable balance is also greatly improved by the use of the solid streamers: this reduces the amount of work the birds have to do and a consistently balanced streamer means much lower noise levels.

8.9.1.4.2 Deployment / Retrieval Damage

The amount of damage incurred by the sections during deployment and retrieval has been reduced by the use of the TMS solid streamers:
The section skins are more resilient, and any damage that does occur to the skins is much less drastic than with oil filled streamers. If the outer skin is punctured, water is not free to pass down the section, and the hole may simply be welded back together again.

The solid billets protect the internal wiring of the cables, and the removal of bulkheads removes the possibility of damage at these localised 'hard spots'.

9 SEISMIC EQUIPMENT - NAVIGATION SYSTEMS

9.1 Navigation Parameter Summary

Survey Control System	SPECTRA
Software Revision	7.6.5
Dedicated Computer	IBM RISC6000 SP2 node.
User Interface	20" Network Display Monitors
Tape Transport	IBM 3590 Tape Drive.
Tape Format	UKOOA P2/94
Steered point (NRP)	Vessel main dGPS antenna at waterline
Shotpoint Layback	565 m Seq 001-008
	377.5 m Seq 009-089
	390 m Seq 090-148
	140 m Seq 149-152 - 2D lines
Primary Navigation System	Racal Multifix
Type of System	Differential GPS
GPS Receiver Type	Trimble 4000DS Receiver
Survey Company	Racal
Differential Company	Racal
Secondary Navigation System	Fugro MRdGPS
Type of System	Differential GPS
GPS Receiver Type	Trimble 4000DS Receiver
Survey Company	Fugro
Differential Company	Fugro
QC Navigation System	QPS Multiref
Type of System	Differential GPS
GPS Receiver Type	Trimble 4000 DSi
Survey Company	QPS
Differential Company	Racal & Fugro [Multiple reference]
Other Navigation Systems	Posnet (2 systems)
Type of System	dGPS
GPS Receiver Type	Trimble 4000 SSi
Survey Company	Western Geophysical
Differential Company	Racal & Fugro

9.2 SPECTRA Integrated Navigation System (Concept Systems)

Software version	7.6.5 (Under AIX 4.2 & Motif 1.2)
Hardware:	IBM RISC6000 SP2 node.
	4 x 20" Network Display Monitors
	1 IBM 3590 Tape Drive.
	2 x VME Chassis RTNUs (one on-line, one spare)

9.2.1 General

Spectra, is a comprehensive integrated seismic navigation system with a modular design. The Spectra system has been developed by Concept Systems to accommodate any advances in positioning technology as they happen. All Spectra software conforms to Open Systems standards, which allow users to continuously benefit from advances in computer technology.

Spectra is based on an expandable network of UNIX workstations with a dedicated Real Time Navigation Unit sensor acquisition system (RTNU) providing access to a database of over 100 navigation sensors and closure timing to a 50 micro-second resolution. The RTNU is supplied as a VME racked system, performing data acquisition and providing header information output, and communicates with the rest of Spectra via an Ethernet network using the TCP/IP set of network protocols.

Spectra, comprises several modules or “Nodes”, which can run on workstations connected by a Local Area Network. Each node consists of a process, or group of processes, performing a specific task, with some nodes having the ability to be run independently of other Nodes. Nodes communicate through the Data Server, which stores information supplied by the system’s producer process and passes it on demand to consumer processes.

9.2.2 Network Algorithm

Spectra, uses all sensors over the entire marine configuration to compute the source and cable positions in a single adjustment. The advantage of this is that the sensors are treated as an integrated network, which provides the optimal positioning solution. The network computation algorithm is performed by the Network Calculation Node (NCN) in a 3-stage process: Firstly pre-processing is carried out; offsets and scales are applied to the observations, and if gating is enabled, the observations that fail the gate are so marked. This gate is defined as the maximum value that an observation can change between shots, and is the simplest way to detect observational outliers.

The next stage is the Prediction process which estimates positions and observations at a prediction time, usually the next shot, using the information from previous shots and positions. The NCN does this by computing the state transition matrix and the driving noise covariance matrix and then computes a predicted state at the next shot.

The final stage is the Adjustment process. At this stage the design and dynamic parts of the network computation are merged into a Kalman Filter, which has the ability to perform “data-snooping” and rejection using the innovations of the observations. Simplified, this means that if an observation exceeds its predicted value by a certain amount then it will be seen as bad and will be rejected from the network solution. The Kalman Filter will then recalculate a solution with one less bad measurement. This process is repeated until all statistical tests and criteria have been met.

9.2.3 Features

1. Navigation acquisition and validation with real-time source and streamer positioning for marine seismic surveys ranging from simple 2D and high resolution requirements to extensive 3D multi-streamer, multi-vessel configurations.
2. The Real-time data acquisition unit with its integrated GPS receiver used as a GPS clock provide triggering to 50 microseconds, allowing remote synchronisation of seismic and navigation systems.
3. Real-time binning, CMP and offset distribution displays are fully compatible with REFLEX off-line binning and analysis package including bin expansion capabilities.

The system will also display features and overlays, giving the user accurate graphical information on the positions of obstacles and hazards on the survey area.
4. Real-time navigation data logging to UKOOA P1/90, P2/91 and P2/94 standards. For data security, data is logged both to an IBM 3590 tape and hard disk.
5. Quality control features providing alarm and audit facilities. Extensive on-line graphical analysis features and end of line reporting provides an excellent tool to identify problems as they occur and to deselect observations when ever they affect the integrity of the network.
6. Positioning using Kalman filtering with advanced data snooping statistical testing to identify blunders and outliers.
7. Spectra has the ability to load and store separate node configuration files, providing the user with maximum flexibility and minimum effort in setting up for a new survey.

9.3 REFLEX Binning System (Concept Systems)

Software version	1.7.2 (Under AIX 4.2 & Motif 1.2)
Hardware:	IBM SP2 node.
	1 x 20" Display Monitor

9.3.1 General

Reflex has been designed and developed by Concept Systems to provide 3D binning/coverage control combined with other spatial analysis facilities. Reflex was used for fold of coverage displays using the source and receiver positions in the processed P1/90 datasets.
Features:
1. A database capable of holding position and attribute information for all points of interest in any 3D seismic survey. With the flexibility to edit out lines, sources, cables or even receivers for given shotpoint ranges.
2. Text reports on various parameters. Spatial plots of all types of data. The generation of histograms, offset distribution and statistics for areas of interest on the Prospect.
3. Binning of data using a variety of binning configurations including flexi-binning. Binning configuration files can be saved and restored with the minimum of effort.
4. Comprehensive report generation, which includes all parameters entered, lines binned and edits applied.

9.3.2 Reflex Attributes

The Reflex database can include attributes other than fold. These attributes are generated by several of the QC and processing packages onboard, and are then imported into the Reflex database where they are merged with the navigation data already present. Areal displays of data can then be produced to highlight the occurrence of any spatially localised errors.

The following attributes were imported into Reflex for each shotpoint of this survey:
- Seismic Signal generated by Omega within a client-defined window - one value per shot calculated, from all traces in Omega.
- Seismic Noise generated by Omega within a client-defined window - one value per shot, calculated from all traces in Omega.
- Seismic Signal/Noise ratio generated by Omega - one value per shot calculated from all traces in Omega.
- Water Depth generated from P190 data in Reflex.
- Primary vs. Secondary Navigation position difference generated by Unavchk.
- Streamer Feather for each streamer generated by Unavchk.
- Streamer Separation for head, mid and tail of each cable generated by Unavchk.

- Minimum Streamer Depth for each streamer generated by Unavchk.
- Mean Streamer Depth for each streamer generated by Unavchk.
- Maximum Streamer Depth for each streamer generated by Unavchk.
- Source volume generated by SSS/PDL.
- Minimum Source pressure generated by SSS/PDL.
- Mean Source pressure generated by SSS/PDL.
- Maximum Source pressure generated by SSS/PDL.
- Minimum Source depth generated by SSS/PDL.
- Mean Source depth generated by SSS/PDL.
- Maximum Source depth generated by SSS/PDL.
- Minimum gun sync generated by SSS/PDL.
- Maximum gun sync generated by SSS/PDL.

9.4 Vessel Positioning

The positioning of the vessel is derived from a network solution of the entire available vessel positioning systems. Each positioning system can be weighted according to its theoretical accuracy in order to provide an optimum, final vessel position.

For this prospect, five separate vessel-positioning systems were logged aboard the Western Pride. All five systems were differentially corrected global positioning systems (dGPS).

The primary vessel navigation system used in the real-time vessel position network was Racal Multifix dGPS. The secondary vessel navigation system used in the real-time vessel position network was Fugro MRdGPS, and the third system used was QPS Multiref.

Two other dGPS systems were logged, but were not used in the real-time network solution. These were two POSNET systems, the first using a single Racal differential reference station, and the second using a single Fugro differential reference station.

9.4.1 RACAL Multifix differential GPS System

Software Version	2.10 (under DOS)
Hardware:	Trimble DSi 9 channel GPS receiver
	Pentium PC

The Racal Multifix dGPS system calculates up to six independent positioning solutions, using filtered differential corrections from a maximum of fifteen reference stations. Several quality control features are incorporated into the system, including data snooping and statistical measurements in accordance with UKOOA guidelines.

Differential Corrections

For this survey corrections were supplied from Racal using the Skyfix system via both the JRC Inmarsat A (Pacific Ocean Satellite) and the Saturn Inmarsat (also Pacific Ocean Satellite)

The Racal differential stations used to compute the real-time vessel position within the Racal Multifix system were as follows:

Station	ID	Latitude	Longitude	Height
Melbourne	[208]	038° 27' 52.887"S	144° 54' 46.667"E	146.22 m
Adelaide	[205]	035° 17' 30.129"S	138° 34' 50.577"E	400.19 m

Broome	[206]	033° 59' 12.483"S	151° 14' 24.217"E	74.95 m

9.4.2 FUGRO Multi Reference differential GPS (MRdGPS) System

Software Version 2.03.10 (under Windows NT)
Hardware: Trimble DSi 9 channel GPS receiver
Pentium PC

The Fugro MRdGPS system uses multiple reference stations and differential atmospheric/ionospheric modelling to provide a differential GPS positioning solution where spatial de-correlation effects, usually experienced in dGPS systems, are significantly reduced.

Differential Corrections
For this survey corrections were supplied from Fugro via the Spot system (Optus Satellite).

The Fugro differential stations used to compute the real-time vessel position within the Fugro MRdGPS system were as follows:

Station	**ID**	**Latitude**	**Longitude**	**Height**
Melbourne	[385]	038° 27' 53.375"S	144° 54' 46.909"E	144.9 m
Pt Augusta	[326]	032° 29' 55.166"S	137° 46' 31.459"E	19.0 m
Bathurst	[326]	033° 25' 46.902"S	149° 34' 01.960"E	756.8 m

9.4.3 QPS (Quality Positioning Systems) Multireference differential GPS System

Software Version 2.42
Hardware: Trimble DSi 9 channel GPS receiver
200MHz Pentium PC

The QPS Multiref dGPS system calculates a dGPS position using differential corrections from a number of equally weighted reference station in order to compute a multi-reference station solution. The advantage of using multiple reference stations is that this allows the QPS system to differentiate between good and bad data using statistical tests.

Differential Corrections
For this survey, both the Racal and the Fugro reference stations were interfaced to the QPS and used in its positioning solution.

Racal Differential Corrections via Inmarsat

Station	**ID**	**Latitude**	**Longitude**	**Height**
Melbourne	[208]	038° 27' 52.887"S	144° 54' 46.667"E	146.22 m
Adelaide	[205]	035° 17' 30.129"S	138° 34' 50.577"E	400.19 m
Broome	[206]	033° 59' 12.483"S	151° 14' 24.217"E	74.95 m

Fugro Differential Corrections via Spot

Station	**ID**	**Latitude**	**Longitude**	**Height**
Melbourne	[385]	038° 27' 53.375"S	144° 54' 46.909"E	144.9 m
Pt Augusta	[326]	032° 29' 55.166"S	137° 46' 31.459"E	19.0 m
Bathurst	[326]	033° 25' 46.902"S	149° 34' 01.960"E	756.8 m

9.4.4 POSNET Dual Band dGPS System (Western Geophysical)

Software version 1.57
Hardware: Trimble SSi 18 channel GPS receiver
Dual 133 MHz Pentium PC For PosNet Software

POSNET is a differential GPS system that, when supplied with Sargas format differential corrections, provides high precision real time navigation with an accuracy of one part-per-million of the radial distance from the mobile position to the reference station (i.e. 1 m at 1000 km). The system uses proprietary techniques to make full use of the dual frequency band observables (L1 and L2), allowing the system to eliminate ionospheric errors.

The vessel equipment consists of a rack mounted PC, which has multiple RS232 interfaces (up to 34 ports). These serial ports are a mixture of hardware set and user definable ports. Each required piece of equipment is interfaced via these ports, including:

- GPS receiver
- Multiple Differential Corrections
- Pitch, Roll & Gyro

Differential corrections can be received via a number of methods. Standard RTCM can be interfaced (Racal and Fugro standards) as well as Western Geophysical's corrections received over the VSAT system.

An antenna position derived to the waterline of the vessel is then computed, using the pitch and roll data. Multiple outputs of raw data are provided for recording and QC purposes. Two POSNET systems are run side by side and are interfaced to Spectra over an ethernet link.

Differential Corrections

For this survey one POSNET system used differential corrections from Racal, the other POSNET system used differential corrections from Fugro.

POSNET 1
Racal

Station	ID	Latitude	Longitude	Height
Melbourne	[208]	038° 27' 52.887"S	144° 54' 46.667"E	146.22 m

POSNET 2 (Interfaced to Spectra as PN02)
Fugro

Station	ID	Latitude	Longitude	Height
Melbourne	[385]	038° 27' 53.375"S	144° 54' 46.909"E	144.9 m

9.5 dGPS Positioning Quality Control

9.5.1 MobileQC (Western Geophysical)

Software Version 1.30

MobileQC is an application that runs under Windows NT. Its purpose is to provide graphical displays of the quality indicator outputs produced by the POSNET system. This includes all signal strength, elevations and satellites in view of the vessel. MobileQC also has the ability to monitor remote rGPS targets, such as headbuoys and tailbuoys.

9.5.2 QPS (Quality Positioning Systems) Multireference dGPS

Software Version 2.42

Although included as part of the vessel positioning solution, QPS was used mainly as a QC tool to monitor the raw observations and differential corrections input into both the Racal Multifix and Fugro MRdGPS systems, and also to monitor the output positions. As a QC tool, the system fully complies with the UKOOA guidelines for quality control on

differential GPS, providing outlier rejection and statistical analysis of data (e.g. F-Test, W-Test).

9.6 Source and Streamer Positioning

The positions of the sources and streamers were calculated by combining the measurements from several positioning systems into a single positioning network. The integrity of this network is ensured by co-locating multiple sensors into single network nodes (headbuoys, and tailbuoys), and by providing sufficient network redundancy that in, the event of a fault in one system, network integrity is still maintained through the other redundant ranges.
The Vessel, Sources and Cable heads are tied together by acoustic ranges into a head-net, which is anchored by the rGPS and laser-mounted headbuoys and by vessel itself.
Acoustic ranges tie the tails of the streamers into a tail-net, which is anchored by the rGPS mounted tail buoys.
The cable shapes are determined by cable mounted compass units. An acoustic mid-net tightens the mid-cable positioning, which is the weakest point of the compass traverse.

9.6.1 Input/Output Marine Pro2000 Acoustic System

Hardware	VME chassis based Motorola 68030 for DMU Pentium 200 MHz Computer
Software	Input/ Output Marine Pro2000

An active acoustic system, manufactured by Input/ Output Marine Systems, is used to provide the links in the positioning network. Intelligent transceivers range between one another by sending and receiving short pulses of high frequency. Ranging is currently split in three separate networks at the head, mid and tail of the cables. This system has two types of ranging transceivers, each capable of ranging to 12 other acoustic devices:

1. Cable Units (CMX) are mounted on the streamer and communicates with the vessel using induction techniques with pick-up coils located in the streamer. With the new generation Pro2000 units used on this survey, power is also provided to the unit via the streamer coil, using inductive coupling. A back-up battery provides power when the streamer is powered down.
2. Gun and tailbuoy units (CTX) are mounted on the sub-arrays and tailbuoys. The units mounted on the guns use two pairs of shielded wires that provide command/power (24 volts) and data communication with the vessel. The tailbuoy units are slightly different in that they use power from the streamer. The acoustic data is passed back to the vessel via the STIC cable and streamer data lines.

The Digicourse computer outputs all the range data to the navigation computer on a shot by shot basis via an ethernet link.

Velocity of Sound in Water
The velocity of sound was determined using a Valeport temperature/salinity (T/S) probe. A total of nine TS Dips were taken at regular interval throughout the survey. All deep TS Dip results showed a strong thermocline at about 90 m. During calm spells another thermocline would develop in the top 15m. Only the top 15m of the water column was used to determine the final velocity, as this was more indicative of the acoustic sensor environment.

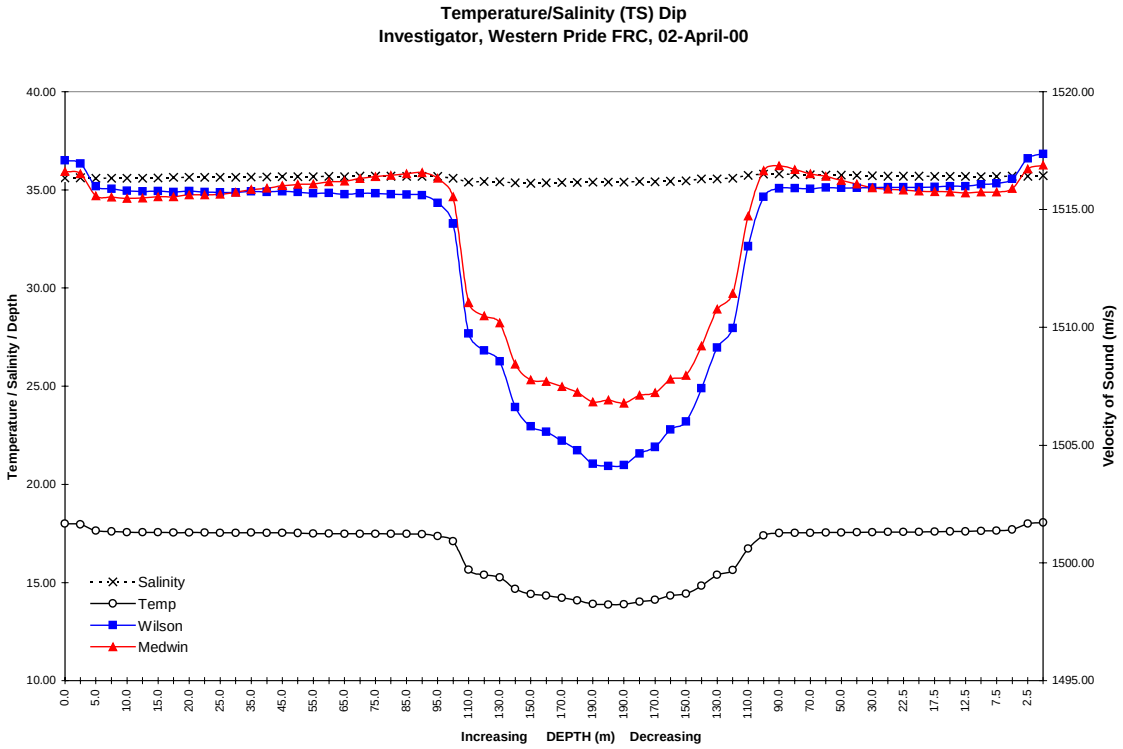

Figure 9.6-1 TS Dip Example (2nd April)

The summarised results are as shown below:

Date	Local Time	Location		Average Velocity (Top 15 m of column)
21st Dec 1999	16:00	39° 10' S	142° 55' E	**1512 m/s**
2nd Jan 2000	17:00	39° 24' S	143° 03' E	**1513 m/s**
9th Jan 2000	16:00	39° 15' S	143° 56' E	**1514 m/s**
31st Jan 2000	16:00	38° 54' S	143° 00' E	**1515 m/s**
17th Feb 2000	10:00	39° 10' S	142° 50' E	**1517 m/s**
28th Feb 2000	08:00	39° 14' S	142 51' E	**1518 m/s**
10th March 2000	18:00	39° 07' S	142° 58' E	**1520 m/s**
16th March 2000	15:30	38° 53' S	142° 54' E	**1516 m/s**
2nd April 2000	16:30	39° 20' S	142° 47' E	**1516 m/s**

9.6.2 POSNET rGPS Range/Bearing Systems (Western Geophysical)

Western Geophysical's POSNET system is a combined system, calculating the absolute position of the vessel and the relative position of a number of rGPS targets. Each POSNET relative GPS unit contains a 12 channel Trimble GPS receiver. The GPS pseudo-ranges are transferred to the vessel, where the target's relative position is calculated. Thus giving a true range and bearing between the GPS antenna on the vessel and the GPS antenna on the remote buoy.

The vessel uses two types of POSNET rGPS units, one type for positioning the gunstrings, the other for tailbuoy positioning. The units mounted on the gunstrings are referred to as headbuoys. The headbuoy units are wired through the gunstrings, allowing power transmission from and data communication with, the shipboard controller. The

tailbuoy units are similarly wired through the STIC cable and on through the seismic streamer to the vessel.

Target data is passed to the navigation computer every second and includes range, bearing, and satellite information.

9.6.3 MDL Fanbeam Laser target tracking system (Marine Data Ltd)

Hardware	Laser scanning unit Power supply unit Universal Control Unit
Software Version	1.59

Fanbeam is a laser ranging system designed to measure the range and angular position of reflective targets. The diode laser produces a 20° vertical fan beam, which is scanned across a user-defined sector. The use of a wide vertical fan shaped beam allows the detection of small targets not in vertical alignment with the laser, and further allows considerable motion of the scanning head whilst keeping the targets in view. The Fanbeam has a narrow horizontal beam width of 2 cm and has a divergence of 1.5m radians, giving good horizontal resolution.

Measurement of the horizontal angle is by a shaft encoder that is directly coupled to the laser table and has a resolution of 0.01°. Scanning speed is user programmable and variable from 3° to 50° sec^{-1}.

As it is an optical system, Fanbeam is extremely sensitive to airborne particles. Rain, fog or spray significantly degrade the range and bearing data, quickly making them unusable. Fanbeam is also a line of sight system. Heavy seas can adversely affect the data by obscuring the targets.

Retro-reflective optical prism targets are co-located with the rGPS antennas on the outer gun strings of each energy source array. The gun prism targets are attached to the head buoy on the guns. The range and bearing of each target is tracked from the Fanbeam mounted on the stern of the vessel.

Raw data is passed to the SPECTRA navigation system and recorded in the P2 dataset. As the scanning head is fixed to the vessel, the output bearings are relative to vessel heading and need to be gyro corrected to obtain true north readings.

9.6.4 Pro2000 Streamer Compasses (Input/Output Marine)

Hardware	VME chassis based Motorola 68030 for DMU Pentium 200 MHz computer for GUI
Software	Input/ Output Marine Pro2000

The Pro2000 Compass Bird family, are microprocessor-based control and monitoring devices that mount externally on the streamer. The units used aboard the Western Pride are combined bird/compasses. They provide streamer depth monitoring, streamer depth control and streamer compass bearings used to determine cable shape.

Once programmed with the assigned operating depth the bird operates independently to control streamer depth by adjusting its wings to provide lift or dive. The assembly is housed in a non-corroding, non-magnetic moulded polyurethane body that is streamlined

to minimise flow-induced noise. The compasses are rotary card type and are accurate to 0.5° with a resolution of 0.3°.

The units communicate with the system controller onboard the vessel over a single twisted pair transmission line in the streamer using inductive coupling. Additionally the Pro2000 units receive power from the cable via the inductive coil in the same manner as the acoustic units.

The Pro2000 is a new system, which has provided a significant improvement in depth control, as there is no need to have a trade off between extended battery life and bird responsiveness.

9.6.5 Gyrocompasses (Sperry)

Primary - Gyro 2	Sperry Mk. 227 (Ser. No. 480)
Secondary - Gyro 1	Sperry Mk. 227 (Ser. No. 495)

The Mk227 gyrocompass provides a true north azimuth reference. It is designed for larger vessels and includes a data transmission system, which provides heading information to remote systems and indicators. Mechanical and electronic systems can compensate the gyrocompass for errors associated with latitude and velocity. These corrections are not applied to the recorded raw gyro readings, but are calculated by the navigation software.

Both gyros are recorded by the Spectra navigation system. One gyro is the primary survey gyro. The second gyro is used as a backup system and for data comparisons.

9.6.6 Fathometer (Simrad)

Hardware	Simrad EA500 Type PDD
Software	Firmware 2.6.1
Water Depth Reference Point	Sea Level

The SIMRAD EA500 Fathometer has two transducer frequencies (18 kHz and 200 kHz); designed for operation in differing water depths. For this survey, the 18 kHz transducer was chosen for its better performance in the water depths on this survey (200-2000 m).

The water depth recorded by the Fathometer was output raw to the Spectra system. A correction of 5.94 metres, derived by dimensional survey, was applied during navigation processing in order to correct the data to the mean sea level datum.

A fixed value of 1500 m/s for the speed of sound in water was entered into the Fathometer throughout the survey. The data was scaled during navigation processing with an average value of the velocity for the water column

10 ONBOARD PROCESSING - NAVIGATION

10.1 UNAVCHK Marine Navigation Processing System (Western Geophysical)

Software Version 1.9.6
Dedicated Computer IBM Scaleable Power Parallel System (20 node SP2)

UNAVCHK, Western's navigation processing software, uses a sequential, extended Kalman filter to give an integrated network solution of the positions of all nodes within the marine network for every shotpoint. Special processing of some observations, e.g. slant ranges being reduced to the horizontal and cable compasses being reduced to chord azimuths, allows the mixing of compass and acoustic observations in a single integrated adjustment. Network nodes are positioned as a function of all the navigation observations, each observation being weighted by its standard deviation. Along the cables, a cubic spline interpolates the co-ordinates of the receivers as functions of along-cable distances of nodes and receivers. From each node on the gun strings, an estimate of centre of source position is obtained by simple layback and from these positions, a centre of source position is derived.

All computation is performed on the mapping plane. Compass bearings are corrected for magnetic declination and meridian convergence and geodetic azimuths are corrected for meridian convergence. Scale factor is applied to all ranges. The post-processing system provides comprehensive quality control tools including statistical reports, graphical displays and a variety of plots, such as time series plots, bullet plots and network node plots, all of which are used to confirm the accuracy and reliability of the Post Plot data. Comparisons of real-time to processed positions may also be performed.

10.2 Navigation Processing Flow Overview

1. Reformat from P2/94 to UNAVCHK internal format.
2. Select processing shotpoint range and create line database.
3. Process sensor data.
4. Network refinement.
5. Source and Receiver co-ordinate computation.
6. Output to P1/90 UKOOA.

At each stage in the processing flow, UNAVCHK provides extensive plots and statistical reports. These are used to perform comprehensive quality control analysis of all the navigation sensor measurements, and of the processing algorithms.

10.3 Navigation Sensor Processing

There are three essential processes that UNAVCHK can apply to the raw navigation data, in order to enhance the signal and attenuate noise before the network algorithm. The three filtering techniques are summarised below:

10.3.1 Manual Editing

Manual editing allows the processor to replace outliers or spikes in the raw data with interpolated values. UNAVCHK's Senedt provides a suite of tools that assist the processor in this task. The graphical editor (Figure 10.3-1) is particularly useful as it allows bad measurement ranges to be easily identified and selected for interpolation. UNAVCHK is able to use either linear or polynomial interpolation. The polynomial fit was used for this survey, due to its more accurate fit to the data.

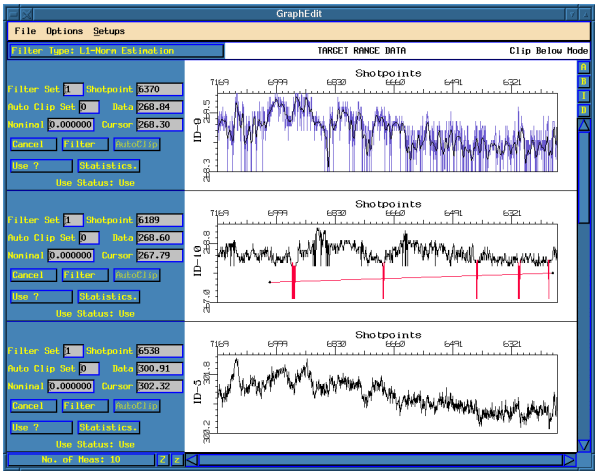

Figure 10.3-1 Senedt Graphical Editor

10.3.2 Despiking

Despiking is an automatic filter designed to replace spikes or outliers with interpolated data. UNAVCHK uses a windowed median filter. A rolling window is centred on the shotpoint being filtered. If the data value for the shotpoint in question differs, by more than a threshold value, from the median of the values within the window, then the data value is replaced by an interpolated value.

Both the window length and the threshold are defined for each measurement by the processor. These filter parameters are usually determined at the start of the survey, from tests of the initial data, but may be changed on a line by line basis should the quality or character of the data change.

10.3.3 Smoothing

Smoothing attenuates random noise by applying a low pass filter. UNAVCHK uses a windowed, cosine-weighted average filter. A rolling window is centred on the shotpoint being filtered. The data value of the shotpoint being filtered is replaced by the weighted average of the data values within the window. The data values within the window are weighted by multiplying them with a truncated cosine function, which causes those data values closest to the shotpoint to be given more precedence.

10.4 Positioning Refinement Using Network Adjustment

The network refinement algorithm in Western's UNAVCHK post-processing system uses the sequential extended Kalman filter estimation technique. The extended Kalman filter generates optimal position co-ordinates by combining all the measurements available at a shotpoint, with the position co-ordinates at that shot, as predicted from earlier measurements. Measurements are weighted in the network according to their standard deviation. This standard deviation can be fixed for a particular measurement or measurement type, or can be dynamically computed by UNAVCHK for each shotpoint. During this survey dynamic SD computation was utilised for all sensors except for rGPS ranges and bearings, and compass ranges and bearings which straddle the last active section and the tail stretch on each streamer.

The main features of the network refinement algorithm are:

- Versatility in accommodating various measurements with the quality and reliability of each measurement handled appropriately by weighting.

- A fully integrated network solution for the full network achieved by using all available measurements, such as cable compass bearings, azimuths, acoustic ranges, absolute positions and relative geodetic observations.
- Data snooping technique based upon the innovation (measured minus predicted) values and W-statistics for detecting blunders or gross errors.
- Additional pseudo-measurements, such as physical and/or static distances, which are not directly measured by the real-time sensors, may be included to strengthen the network solution.
- The filter is recursive. The derived position co-ordinates are based on all the measurements up to the current shotpoint by carrying forward data from the previous shots in a fading memory filter.
- Computational efficiency through sequential processing of the measurements.
- Calculation of known biases such as cable stretch and cable rotation as part of the network solution.

10.5 Source and Receiver Co-ordinate Computations

After the completion of the network solution, the source and receiver co-ordinates are computed. This computation is based on the nodes that are on the sources and the cables. The source co-ordinate computation derives the geometric centre of a gun array, which comprises of several gun strings. Starting from a node with known co-ordinates derived from the network solution on a gun string, the offsets from the geometric centre of the gun-array and the calculated tow-angle are used to derive a solution for the geometric centre of the gun array. This computation is repeated for each node on a gun string. The source co-ordinates are then computed from the mean of the geometric centres derived from each gun string.

The receiver co-ordinates are derived by first fitting a cubic spline through the nodes on the cable. The co-ordinates of the cable nodes are derived from the network adjustment. The receiver co-ordinates are computed from the cable fit using the distance down the cable of each group. Cable stretch is computed as part of the network algorithm and the distance between each receiver group decreases from the head of the cable to the tail, reflecting the decrease in tension.

10.6 Quality Control Procedures

UNAVCHK provides an extensive set of plots and statistics, which are used to monitor the quality of the navigation data, and the accuracy of the processing algorithms. A few of the more important QC checks performed on a line-by-line basis are outlined below.

10.6.1 Data Quality Checks

- **Shot time differences** - following the creation of the UNAVCHK database, the time interval between shots is checked. Any spikes indicate either missing data, or anomalies with the vessel positioning.
- **Raw, Processed and Raw Vs Processed Data** - a number of plots and statistical reports are generated which provide detailed information about the quality of each measurement. A comparison between the raw and processed data highlights the quality of the processing and the suitability of the filter parameters.
- **Sensor Vs Sensor comparisons** - co-located sensors are compared against each other. Any differences will be due to errors within the data. Comparisons include vessel positions from primary and secondary navigation; headbuoy locations using laser ranging Vs rGPS; primary Vs secondary gyrocompasses and two-way acoustic ranges.

10.6.2 Network Refinement Quality Checks

- **Network statistics** - the computation of error and reliability statistics is an integral part of the network refinement algorithm. Statistics such as w-statistics, degrees of freedom, error ellipses, internal and external reliability, marginal detectable errors and χ^2 tests all contribute to the understanding of the quality of the network. All these statistics are produced as both time-series plots and statistical reports.
- **Network residuals** - time series plots of the residuals are produced for each measurement. The residual is the difference between the measured range and the range between the two nodes after network adjustment. Spikes or non-zero values indicate bad or biased measurements, or a problem with the network solution.
- **Node movement** - node movement anomalies indicate jumps in the network solution, which are usually caused by areas of weak geometry.
- **Network solved biases** - cable stretch and cable rotation, are both known biases which, are solved by the network algorithm. Stretch, caused by the towing tension on the cable, should be relatively constant, varying only with vessel speed, or during sharp manoeuvres. The stretch should decrease linearly from the head to the tail. Cable rotation is normally required to adjust the position of the tail end of the cable, as located using the cable compasses, to the position of the tailbuoy. The bias is mainly due to local fluctuations in the magnetic declination. It should remain relatively constant throughout the line and give a similar value for each cable.

10.6.3 Final Product Quality Checks

- **Sail-line plot** - the vessel, source, receiver and tailbuoy positions are taken from the P1/90 and plotted using a greatly exaggerated cross-line scale. This allows the comparative positions to be checked.
- **Offset checks -** the comparative positions of the vessel, sources, receivers and tailbuoys are also checked on the basis, of individual separations, both prior to output to P1/90 and again using the P1/90 positions. The comparisons from the P1/90 positions will be identical to those from the pre-P1 positions apart from changes caused by the loss of accuracy due to the P1/90 format, and the need to interpolate the non-firing source. However re-computing the offsets provides unambiguous confirmation of the P1/90 data quality. Each offset is also compared with the same offset from the other lines, allowing trends and anomalies to be identified.
- **UNAVCHK Vs SPECTRA P1/90 Comparisons** - the network algorithms used by UNAVCHK and SPECTRA follow two different routes to produce two final P1/90 datasets that are virtually independent of one another. Favourable comparisons between the two datasets give a high degree of confidence in the final data quality.
- **P2/94 Header Differences** - once the first set of P2/94 headers has been checked it can be used to compare against the set from the second line. The second line can then be used to compare with the third and so on. This quickly highlights any parameter changes within the P2/94, which can then be checked for validity.
- **Statistical summaries -** UNIX scripts are used to condense the statistical information from the line and flag deviations from a predetermined norm.

10.7 Navigation Data Deliverables

Navigation data was produced on the Western Pride in the formats listed below. All the navigation data produced was sent to Woodside Energy Ltd, with archive sets sent to both Western Geophysical, Perth and Western Geophysical, London.

Data shipment details can be found in Section 12 of this report.

10.7.1 Raw data format P2/94 UKOOA

Raw data was produced by Spectra in UKOOA P2/94 format. These datasets were checked for quality and amended if necessary before being shipped. Aside from some minor edits to improve the descriptive comments in the header cards, the final P2/94s were as recorded by the Spectra Navigation System.

10.7.2 Processed data format P1/90 UKOOA

Final post-processed navigation data was produced by UNAVCHK in UKOOA P1/90 format.
Several P1/90s were produced, each containing a different sub-set of the positioning data.

10.7.2.1 Source and Receiver P1/90 format.

The line name convention used was the same as the sail line name as used during acquisition.

Shot Records:	W	Western's Extension Record
	V	Position of vessel NRP (main GPS antenna)
	A	Position of main GPS antenna
	S	Position of firing source
	Z	Positions of all sources, firing and non-firing
	T	Tailbuoy positions
	E	Echosounder position
Receiver Records:	R	Receiver positions

Water depths in these datasets were tidal adjusted to mean sea level using data supplied by Woodside Energy Ltd.

10.7.2.2 Vessel/Echosounder position P1/90 format

The line name convention used was the same as the sail line name as used during acquisition.

Shot Records:	A	Position of main GPS antenna
	E	Echosounder position

These datasets were created for bathymetric processing in WGC, London.

10.7.2.3 Bin Centre position P1/90 format

The line name convention used was similar to the sail line naming convention used during acquisition. The line was prefixed with W00INV, followed by a 4 digit number which corresponded to the cross-line cell number (CMP line) of the acquisition grid. The point number in columns 20-25 corresponded to the inline cell number (shotpoint number) of the acquisition grid

Shot Records:	Q	Position of the bin centre

The Q record was slightly modified to replace the water depth in columns 67-71 with the fold of coverage. Two P1/90s were produced, one using raw coverage, the other using flexed coverage.

10.8 Navigation Processing Comments

10.8.1 Data Quality

The navigation data was generally of good quality throughout the survey, with few problems seen. The adverse weather conditions seen on the prospect had the biggest impact on the quality of the navigation data. However, in all but the most extreme weather conditions the network had sufficient redundancy to produce valid node positions with estimated errors well within the contractual tolerances.

- Swell noise degraded the acoustics, especially the ranges from the gun-strings to the streamer heads.
- Increased noise was also apparent on the streamer compass data.
- Equipment damage due to heavy seas caused a number of sensor failures, mainly on the gun-strings and tailbuoys.
- High winds and seas caused steerng difficulties, which in turn lead to high node dynamics, most notably on sequences 112 (line 1846I5), 121 (line 1282P1) and 122 (line 1462P1).

10.8.2 Additional Processing Comments

- Sequences 001-004 were acquired with the seismic data from cables 5 and 6 assigned to incorrect channel sets, which gave the appearance of cables 5 and 6 being swapped. The P2/94 UKOOA files for these lines were manually edited to swap the streamer ID in the header, so that when the P1/90 UKOOA was produced the seismic data from these swapped cables were assigned the correct geometry.
- Depth processing was performed on the data from the compass/birds on each cable. The receiver depths were calculated from this data and these depths were written to the P1/90 UKOOA datasets.
- Raw echo sounder data was corrected for vessel draught of 5.94 m and for a velocity of sound calculated from the TS Dip data for the whole water column. Tidal corrections were also applied to adjust the water depths to Mean Sea Level, using tidal data supplied by Woodside.

11 ONBOARD PROCESSING - SEISMIC

11.1 Omega Onboard Seismic Processing System (Western Geophysical)

System	Omega Seismic Processing System
Version	1.8.0.2
Hardware	2 Frame 20 node IBM SP2 - 15 nodes used for Omega SPS 4 x Tektronix X-terminals 12 x IBM 3590 Cartridge Tape Drives EMASS Robotic Tape Library OYO Geospace GS-624 Thermal Plotter

The *Omega Seismic Processing System* is a full batch and interactive seismic processing system from Western Geophysical. It is a queue processing system, in which data flows through a user-defined sequence of seismic functions, each of which provides a discrete geophysical operation or controls or modifies the data flow. Data flow operations include the input or output of data in a variety of industry formats, as well as trace selection, sorting, and the branching and merging of separate processing paths.

The Omega system provides an ever-expanding set of tools for interactive quality control and parameter selection. These include Velocity Analysis, Seismic Event Picker, and Attribute Display Applications.

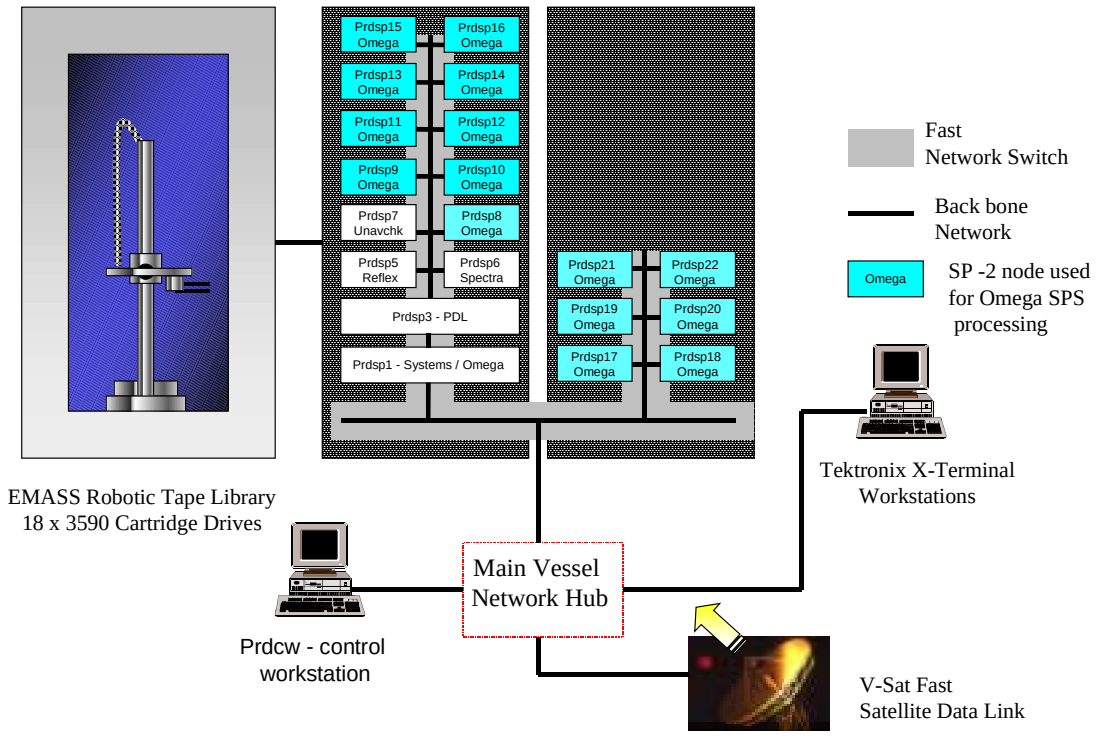

Figure 11.1-1 Processing Hardware

11.2 Seismic Processing General Information

Processing of the seismic data from the Investigator survey was limited to the production of SEG-D copy tapes and quality checks of the recorded data. Therefore, the flows used were designed primarily for checking the quality of the seismic data and for aiding decisions on the final disposition of marginal portions of this data.

The processing of the data was performed in discrete stages, with each stage producing QC products. QC was performed using the processing summary text printout produced as standard by Omega, and by using several different plot and display options

All of the seismic processing was performed by personnel onboard the Western Pride. The remote processing facility was not used during this survey.

11.2.1 Processing Flow Overview

The processing stages were as follows

Stage 1 - Copy the original SEG-D field tape
Each time a field tape containing accepted shots was created during acquisition, a byte for byte tape copy was produced.

Stage 2 - Signal/Noise Analysis from SEG-D field tape copies
The SEG-D copies were input into this processing stage in order to check the integrity of the copying process. Average signal and noise RMS values were calculated from the data using two user-defined windows. These values were used to produce several displays :

- A display of average signal values with trace number along one axis and shotpoint number along the second aided in the identification of consistently weak traces.
- A display of average noise values, with trace number along one axis and shotpoint number along the second, was particularly useful in identifying consistently noisy or spiking traces, and external noise sources.
- A single average signal value for each trace was examined on a line by line basis to identify consistently weak traces.
- A single average noise value for each trace was examined on a line by line basis to identify consistently noisy traces.
- Average signal and noise values were output from Omega and loaded into the Reflex attribute and binning database. Areal plots generated by Reflex of the signal, noise and signal to noise ratios from this data, allowed spatial anomalies to be investigated.

Step 3 - Generate/QC the near trace profile
The near trace from a single cable was sorted so that shots fired by the starboard array were displayed consecutively, followed by shots from the port array. These plots were used primarily to identify problems with the energy source and any timing errors.

Step 4 - Spectral Analysis from selected raw shots
Spectral analysis displays and F-K analysis displays were generated for every line. These displays helped to confirm the data integrity and were useful in pin pointing any noise on the data.

Step 5 - Linear Moveout (LMO) QC
The navigation data provided accurate positions (X and Y co-ordinates) for the source and receivers. These co-ordinates were used to calculate a direct line offset between the first trace of each cable and the source. The near traces were then corrected for

Linear Moveout, using the velocity of sound in water, bringing the direct arrivals from the first trace to time zero. The traces were time shifted 50 ms to make the display clearer.

The purpose of the LMO plots was to compare the processed navigation derived position for the first trace of each cable with the observed seismic direct arrival data. The alignment of the direct arrivals should be consistent from record to record for each cable. A misalignment indicates a problem with the navigation data or timing errors. Source array select errors, where the processed navigation data has flagged the wrong source as the firing source, are also easily detected.

Step 6 - Generate the brute stack input from the SEG-D field tape copies
This stage was run as a pre-processing step.

Step 7 - Generate/QC the brute stack
Most of the decisions to retain or reject data contaminated by seismic noise were based on the quality of the brute stack section, as they provided the best indication of whether the final dataset would be compromised.

Step 8 - Generate/QC selected migrated stacks
Migrated stacks were to be run on a request only basis, in order to assess marginal data. No such requests were made and no stacks were produced during production processing onboard the Vessel.

Step 9 - Build the near trace cube
Individual stack files were generated for each sail-line, and merged at the end of the survey to a single cube dataset. Time-Slices, In-Line and Cross-Line sections were generated from this merged cube. The individual datasets were also loaded into OmegaVu, an interpretation package, which allowed slices to be generated from any part of the cube and displayed in 2 or 3 dimensions.

Like the LMO QC, the near trace cube (NT Cube) is a quality check of the navigation data and is particularly useful for positioning QC along the boundary between swathes of lines shot in opposite directions. The only anomalies seen during this survey were corrected by applying tidal statics.

11.2.2 Plot and Display Types

SEISPLOT produces a hardcopy of the data on the 24" OYO Geospace thermal plotter.
QCVIEWER produces an internal format file. This file has several advantages over the hardcopy plots, as it can be re-scaled, zoomed are enhanced using a variety of display options.
TERMINAL DISPLAYS were used for instant screen displays of the data.

11.3 Seismic Processing Parameter Tests

11.3.1 Low cut bandpass filter design

Tests were conducted to determine a suitable low-cut filter value to reduce the effect of low frequency noise on the quality of data in near trace cube stack, brute stack and migrated stack processing. Zero phase low-cut bandpass filters with values of 3, 4, 5, 6, 8 and 10 Hz were applied to raw shot data and output to a terminal display for comparison with unfiltered raw data. Taking into account an expected high incidence of rough weather throughout the survey it was decided that a 8 Hz filter with a slope of 36 dB/octave would be appropriate for removing low frequency swell generated cable noise.

11.3.2 Trace decimation of data for stacking

In order to reduce the processing time needed to generate brute stack sections the number of input traces was reduced by a factor of two. Tests were conducted to determine an appropriate method of decimating the data before stacking. Spectral analyses of shot ordered data after k-filter/trace reduction were compared against spectra of decimated shot ordered data following the application of differential offset normal moveout and summing of adjacent traces. These two methods are outlined below.
Based on the spectra displays it was decided to apply differential offset NMO and trace summing to decimate the data in the brute stack processing sequence.

K-Filter / Trace Reduction

A seismic section such as a shot gather, CMP gather or stack section is a two-dimensional array of samples representing the amplitude of the seismic signal as a function of reflection time (t) and trace position (x). A Fourier transform can be used to convert trace position to the spatial frequency or wavenumber (k) domain. A range of wavenumbers was specified to be passed by the filter and a taper was applied to the filter boundaries to smooth the transition between the pass and the reject regions.

After k-filtering, the number of traces in each shot record was reduced by dropping alternate traces. Consequently, the k-filter was chosen to act as an anti-aliasing filter in the wavenumber domain, attenuating energy that would otherwise have become aliased when the trace separation was doubled by the dropping of alternate traces.

For convenience, the k-filter was implemented in the f-k domain. A 2-D Fourier transform was used to convert trace position to the wavenumber domain and reflection time to the frequency (f) domain. After implementation of the k-filter the data were inverse Fourier transformed back to the t-x domain.

Parameter values:

Input Shot Records: 368 traces
Output Shot Records: 184 traces

High Wavenumber Cutoff: 0.5 of k-Nyquist (relative to input trace separation)
Taper (centred on the high wavenumber cutoff): 0.06 of k-Nyquist

Differential NMO / Adjacent Trace Sum

Applying differential offset NMO to seismic data modifies each input trace, making it appear to be recorded at a particular offset, which is referred to as the differential offset. Each input shot gather was divided into groups of 2 sequential adjacent traces each i.e. traces 1 and 2 would form the first group, traces 3 and 4 would form the next group and so on. The differential offset to which each trace in each group was NMO corrected was the offset of the first trace in each group. Applying differential offset moveout in this way aligns seismic reflections in the traces within a group so that these events are reinforced when traces within the group are summed to produce a single output trace.

11.3.3 Determination of exponential gain

Ungained and gained shot gathers were output to terminal displays for comparison to determine an appropriate value for the gain exponent to be used in the brute stack processing sequence. From displays generated using values of 0.5, 0.75, 1.0 and 1.5 dBs^{-1} as the gain exponent it was decided that a value of 0.5 dBs^{-1} was the most appropriate value.

11.3.4 Deconvolution before stack

The parameter values used to design deconvolution operators for comparison are summarised in the following table:

Parameter values: (ms)

Autocorrelation Half Length	Prediction Distance	Analysis Window(s) Start Time Delay	Analysis Window(s) Length	Application Window(s) Start Time Delay	Application Window(s) Length
250	4	300 500	1700 3200	0 500	2000 3200
250	12	300 500	1700 3200	0 500	2000 3200
250	24	300 500	1700 3200	0 500	2000 3200
250	36	300 500	1700 3200	0 500	2000 3200
250	36	100 500	2500 4500	-100 500	2500 4500
200	32	100 500	2000 4500	-100 500	2500 4500
220	32	200 0	2150 2150	200 0	2150 2150

From comparison of brute stack displays, using the above test values the deconvolution parameters considered the most appropriate were those listed below.

Parameter values: (ms)

Autocorrelation Half Length	Prediction Distance	Analysis Start Time Delay	Windows Length	Application Start Time Delay	Windows Length
200	32	100 500	2000 4500	-100 500	2500 4500

11.3.5 Data trace muting

An outside (early time) mute was designed, using the Omega interactive data editor, from NMO corrected cmp gathers to reduce the effects of direct arrival and refracted energy. The picked mute times and corresponding offset distances are listed in the following table.

Parameter values:

Time (ms)	Offset (m)
4	350
2332	2600
4300	4700

11.3.6 Residual Amplitude (RAAC) Stack Display Gain

The RAAC process is designed to further recover amplitudes not already compensated for without unduly affecting the amplitude characteristics of the data i.e. preserving relative amplitudes. Amplitude analysis was performed on a stacked dataset with one spatial window bounded by the first and last cmp locations of the complete section and temporal sliding windows with a length of 200 ms advancing at 100 ms intervals. Temporal smoothing over 3 window lengths was applied before output. The residual amplitude compensation (RAC) set derived from the analysis and subsequently applied to the data is shown in the following table:

time (ms)	RAC multiplier	time (ms)	RAC Multiplier	time (ms)	RAC multiplier	time (ms)	RAC multiplier
104	201.3	204	278.4	304	377.6	404	492
504	610.1	604	738.8	704	896.8	804	1081
904	1309	1004	1581	1104	1882	1204	2163
1304	2402	1404	2590	1504	2723	1604	2775
1704	2769	1804	2740	1904	2692	2004	2617
2104	2553	2204	2512	2304	2488	2404	2435
2504	2358	2604	2257	2704	2179	2804	2096
2904	2069	3004	2116	3104	2175	3204	2172
3304	2107	3404	2096	3504	2044	3604	1765
3704	1477	3804	1525	3904	1720	4004	1859
4104	1761	4204	1713	4304	1685	4404	1636
4504	1584	4604	1531	4704	1401	4804	1139
4904	848.8	5004	597.6				

(RAC values are at the centre times of each 200 ms window advancing at 100 ms intervals)

11.3.7 Tidal Statics

The initial time slices and cross-line plots from the near trace cube showed that the data from adjacent lines was not in complete alignment. The tidal corrections applied in the navigation processing were also applied as statics before the 3D stack and the alignment showed a very significant improvement.

11.4 Seismic Processing Flow Detail

11.4.1 SEG_D Copy (run for each non DNP SEG-D Field Tape)

- Input SEG-D
- Output Copy SEG-D Tapes
- Output Raw Shots (every 100th shot)
- Output Near Traces (Traces 1, 3, 5, 7, 9, 11, 13, 15, from each cable)

11.4.2 EOL (End of Line)

- Input SEG-D Copy
- Renumber traces to 1-2208 of cables 1-6 (1-2944 of cables 1-8)
- Resample to 4 ms zero phase anti-alias filter 75% Nyquist frequency
- 1. Select single sub-surface line (1 cable, 1 source) rotating through line by sequence
  - Output for brute stack input
- 2. Apply Zero-Phase Low-Cut Filter;
  Low-Cut Frequency : 6 Hz
  Low-Cutoff Slope : 18 dB/octave

- Signal Analysis (using hyperbolic window starting at 2000 ms with length 500 ms, moveout velocity 1730 ms^{-1})
- Output to disk
- Terminal Display

- 3. Apply Zero-Phase Low-Cut Filter;
  Low-Cut Frequency : 6 Hz
  Low-Cutoff Slope : 18 dB/octave
- Noise Analysis (using linear window 4000-4500 ms)
- Output to disk
- Terminal Display

11.4.3 Near Trace Profile

- Input Near Traces
- Select the first trace from a single cable rotating by sequence
- Resample to 4 ms zero phase anti-alias filter 75% Nyquist frequency
- Apply Zero phase-Band-Pass Filter;
  Low-Cut Frequency : 6 Hz
  Low-Cutoff Slope : 18 dB/octave
- Sort in source order
- Output SEG-Y
- Output QCViewer and CGM graphics files

11.4.4 Spectral Analysis

- Input Raw Shots
- 1. Shot gathers selected every 100 files
  - Apply Exponential Gain of 0.5 dBs^{-1}
  - F-K Analysis
  - Terminal Display for F-K Analysis
- 2. Spectral Analysis (using hyperbolic window starting at 0 ms with length 1000 ms, moveout velocity 1512 ms^{-1})
- Stack the spectra to give an average for line
- GRAPH Output for Spectral Analysis
- 2. Terminal display of 1 shot record for QC

11.4.5 Signal / Noise Analysis Displays

- Input Signal and Noise Analysis
- 1. Stack the signal analysis to give an average for the line
  - Terminal Display for Signal Analysis
- 2. Output RMS Signal Plots;
  - CGM signal file output from SEISPLOT
  - QCViewer signal file from OUTPUT_QCVIEWER
- 3. Stack the noise analysis to give an average for the line
  - Terminal Display for Noise Analysis
- 4. Output RMS Noise Plots;
  - CGM noise file output from SEISPLOT
  - QCViewer noise file from OUTPUT_QCVIEWER
- 5. Calculate ratio of Signal versus Noise using divide operator
  - Output the S/N ratio
  - Terminal Display for Signal/Noise ratio
- 6. Merge Signal and Noise Analysis Data
  - Get Average rms for noise and signal

- Get ABS_PEAK_AMP
- Output_Seisstat for Reflex

11.4.6 Linear Moveout (LMO)

- Input Near Traces, trace length 1000 ms
- Select the first trace from each cable
- Apply Zero-Band-Pass Filter;
  Low-Cut Frequency : 4 Hz
  Low-Cutoff Slope : 24 dB/octave
- Input Final P1/90 UKOOA and Generate Omega format geometry database
- Geometry Update - add positional information in the seismic trace header
- Supersample traces to 1 ms to improve moveout resolution
- Apply trace balancing to normalise RMS amplitudes to 2000
- Apply low cut filter 4 Hz, 24 dB/octave slope
- Shift data to 50 ms to make allowance for the direct arrival
- Perform Linear Moveout Analysis using velocity of sound in water from TS dip
- Sort by FLD_CABLE_NUM and IDENT_NUM
- Output QCViewer and CGM display files

11.4.7 Brute Stack

- Input single sub-surface line
- Assign geometry from database created in LMO step
- Grid define to apply 3D cell ordering based on the survey area grid
- Wide cell grid assign a 2D pseudo CMP locations based on a single crossline whose width is the full width of the prospect area
- Apply differential offset hyperbolic moveout before summing
- Edit bad traces
- Weight and sum every two adjacent traces within the gathers in non-surface consistent
  mode
- Apply Geometric spreading (V^2T) Compensation
- Apply Exponential Gain 0.5 dBs^{-1}
- Sort in CMP order
- Apply Predictive Deconvolution;
  Autocorrelation Half-Length: 200 ms
  White-Noise Percent: 0.01
  Prediction Distance: 32 ms
  Autocorrelation Windows:
  Window 1 Delay/Overlap Constant: 100 ms
  Constant Window Length: 2000 ms
  Window 2 Delay/Overlap Constant: 500 ms
  Constant Window Length: 4500 ms
  Application Windows:
  Window 1 Delay/Overlap Constant: 100 ms
  Constant Window Length: 250 ms
  Window 2 Delay/Overlap Constant: 500 ms
  Constant Window Length: 4500 ms
- Apply Normal Moveout using Interpolated 3D velocity field
- Apply Outside Mute
  Offset/Time 350/0 2600/2332 4700/4300
- Stack

- Apply static correction for source/cable depths; 7 ms
- Output SEG-Y
- Apply Zero-Band-Pass Filter;
  Low-Cut Frequency : 8 Hz
  Low-Cutoff Slope : 36 dB/octave
  High-Cut Frequency: 80 Hz
  High-Cutoff Slope : 72 dB/octave
- Apply compensation for residual amplitude decay
- Output QCViewer and CGM display files

11.4.8 Near Trace Cube Bitmap

- Input near traces, trace length 4608 ms
- Edit bad traces
- Assign geometry from database created in LMO step
- Output progressive bitmap file

11.4.9 Near Trace Cube 3D Stack

- Input near traces, trace length 4608 ms
- Edit bad traces
- Assign geometry from database created in LMO step
- Apply Zero-Phase Low-Cut Filter;
  Low-Cut Frequency : 8 Hz
  Low-Cutoff Slope : 36 dB/octave
- Apply Normal Moveout using the single function average velocities
- Outside trace mute
- Stack progressive bitmap file
- Output SEG-Y

11.4.10 Near Trace Cube Stack Merge

- Input progressive stack files
- Merge output data
- Output seismic data
- Select inline, cross-line and time slice sections
- Output SEG-Y
- Output QCViewer and CGM display files

11.4.11 Brute Stack Migration

- Input Brute Stack
- Programmed gain to taper edge amplitudes
- Velocity Conversions to Minimum Velocity
- Extended Stolt 2D Migration using minimum velocity function taken from the relevant sub-surface line of the supplied velocity field
- 1. Output SEG-Y
- 2. Apply Zero-Band-Pass Filter;
  Low-Cut Frequency : 8 Hz
  Low-Cutoff Slope : 36 dB/octave
  High-Cut Frequency: 80 Hz
  High-Cutoff Slope : 72 dB/octave
  - Apply compensation for residual amplitude decay
  - Output QCViewer and CGM display files

11.4.12 Master Grid

Corner Number	X Coordinate	Y Coordinate
MG1	643880.970000	5647960.680000
MG2	652265.864775	5700900.773876
MG3	671042.398761	5643658.728390
MG4	679427.293536	5696598.822266

First Primary Ordinal:	810.0
Last Primary Ordinal:	5089.0
Primary Ordinal Increment:	1.0
First Secondary Ordinal:	978.0
Last Secondary Ordinal:	2078.0
Secondary Ordinal Increment:	1.0
Primary Cell Size (m):	12.5
Secondary Cell Size (m):	25.0
Maximum Primary Index:	4289.0
Maximum Secondary Index:	1101.0
Total Number of Cells:	4722189.0
Azimuth MG1 -> MG2 (°):	9.0

11.4.13 Velocity Function

A single function averaged from regional velocities comprising client-supplied data. This function was used in geometric spreading compensation for amplitude recovery, in differential offset nmo prior to trace decimation and in the near trace cube prestack NMO

RMS Velocities (ms^{-1})	Two-way Traveltimes (ms)	RMS Velocities (ms^{-1})	Two-way Traveltimes (ms)
1514	0	3887	2700
1640	100	4039	2800
1724	200	4153	2900
1804	300	4263	3000
1881	400	4362	3100
1931	500	4459	3200
1980	600	4527	3300
2028	700	4593	3400
2074	800	4659	3500
2095	900	4724	3600
2116	1000	4786	3700
2137	1100	4847	3800
2158	1200	4915	3900
2197	1300	4982	4000
2236	1400	5045	4100
2314	1500	5108	4200
2390	1600	5179	4300
2487	1700	5249	4400
2581	1800	5287	4500
2702	1900	5325	4600
2817	2000	5408	4700
2952	2100	5490	4800
3081	2200	5539	4900
3247	2300	5587	5000

RMS Velocities (ms^{-1})	Two-way Traveltimes (ms)	RMS Velocities (ms^{-1})	Two-way Traveltimes (ms)
3405	2400	5587	5100
3570	2500	5587	5200
3728	2600		

11.5 Final Seismic Processing Deliverables

11.5.1 Electronic Data Transmissions

- QC Viewer plots of LMO, Signal/Noise Analysis, Near Trace Profiles and Brute Stacks were sent via the V-Sat communications system to Western Geophysical's London and Perth Offices for further verification. The QC Viewer plots of Signal/Noise Analysis, Near Trace Profiles and Brute Stackswere also forwarded on to Woodside's Perth office.

11.5.2 Deliverable To Veritas DGC

Copy Field Seismic Data
Raw SEG-D Seismic Tape Copies

11.5.3 Deliverable To Woodside Energy Ltd.

Field Seismic QC Products
Brute Stack Sections for each sail line - hardcopy and SEG-Y format
Migrated Stack Sections when produced – hardcopy and SEG-Y format
Near Trace Sections for each sail line - hardcopy and SEG-Y format
Near Trace Cube - SEGY format
RMS Signal/Noise Analysis for each sail line - QC Viewer & GIF files
Near Trace Cube Slices - QC Viewer & GIF files

11.5.4 Deliverable To Western Geophysical, London

Seismic Processing Data
Near trace cube, Ω format
Near Trace Sections, LMO QC, RMS Analysis and Brute Stack - QCViewer files
OMEGA Flows, Velocity text files, Trace Deletes, GPD and Tape Lists

11.6 Additional Seismic Processing Information and Comments

11.6.1 Data Character and Quality

11.6.1.1 Seismic Noise

- The weather and sea conditions were a significant factor affecting the acquisition and subsequent processing throughout the survey. High wind speeds and rough seas led to many lines being affected by swell noise and fluctuating cable depths. Two affected lines, sequences 012 (line 1918P1) and 013 (line 1906P1), were processed through to generate a migrated stack which was assessed to determine the effect of the swell noise. These sequences were adjudged to be borderline unacceptable and were used as benchmarks in determining the acceptability of other noise affected data.

11.6.1.2 Acquisition Parameter Changes

- Sequences 001 (line 1840P1), 002 (line 2048P1), 003 (line 1936P1), 004 (line 1952P1), 005 (line 2032P1), 006 (line 2016P1), 007 (line 1968P1) and 008 (line 1888P1) were acquired as per the original survey specifications with 8 x 4600 m cables totalling 2944 data channels. All subsequent sequences were acquired using 6 x 4600 m cables totalling 2208 data channels.
- Sequences 001 (line 1840P1), 002 (line 2048P1) and 003 (line 1936P1) were acquired with the MSX CRS (Continuous Recording System) configured to record 5120 ms of data per shot. In order to be able to increase the vessel speed the record length was reduced to 4.5 s (4608 ms) prior to sequence 004 (line 1952P1). All subsequent 3D data from sequence 004 onwards was acquired with a record length of 4608 ms.

11.6.1.3 Problems Seen During Acquisition and Processing

- Due to an incorrect configuration file being loaded in the MSX recording system for sequences 001 (line 1840P1), 002 (line 2048P1), 003 (line 1936P1) and 004 (line 1952P1), data from streamers 5 and 6 were recorded to incorrect channel sets, as these sequences were acquired with the streamer numbers incorrectly assigned to the input ports in the MSX system. The result of this error was that all the seismic data from streamer 5 was recorded to channel set 6 and all the data from streamer 6 was recorded to channel set 5. Also the waterbreaks from streamer 5 were recorded to channel set 14, while the waterbreaks from streamer 6 were recorded to channel set 13. The error was detected by the linear moveout (LMO) QC process which is intended to highlight problems of this nature. The raw navigation P2/94 UKOOA was modified to ensure that all the seismic traces are assigned the correct geometry so that downstream processing was unaffected.
- Due to a recording system problem during sequence 003 (line 1936P1) the data recorded to tape is non- sequential in places. The shotpoint / file number ranges of each field tape of this sequence are as given in the line logs. No attempt was made to re-order the data to shotpoint sequential order during the copying process and the SEGD copy tapes are exact replicas of the original field tapes.
- Sequences 104 (line 1738I1), 105 (line 1822I1), 106 (line 1522I2) and 107 (line 1534I6) were affected by multiple telemetry errors on cable 4 (channels 1105-1472). Individual shot record displays were used in conjunction with the recording system error report in order to compile a log of data to be edited in downstream processing.
- Due to a error manually inputing a navigation parameter prior to commencement of sequence 105 (line 1822I1) the recorded shotpoints, despite being acquired at the correct locations, were incorrectly numbered. The start and end shotpoint range, which should have been numbered from 4649 to 817, were actually recorded as 4600 to 768.
- Perturbations were observed in the linear moveout (LMO) displays used to QC the merged seismic and positional data for sequences 112 (line 1846I5), 121 (line 1282P1) and 122 (line 1462P1). Extensive investigation and re-processing confirmed the validity of the navigation raw data and it was concluded that the anomalies were caused as a result of rapid dynamic movement of the vessel and towed in-water equipment close to the vessel. The high rates of change of position, particularly in the cross-line direction were attributed to the wind and sea conditions prevailing at the time.

12 DATA SHIPMENTS

12.1 Data Shipments to Woodside Energy Ltd. (Client)

Attn: Michelle Hitch
Woodside Energy Ltd.
1 Adelaide Terrace
Perth
Western Australia 6000

12.1.1 Field Seismic QC Products

Shipment #	Date Shipped	Sequences Shipped
140-00-081	6th April 2000	001-147 (all 3D sequences)
140-00-088	6th April 2000	148-152 (all 2D sequences)

- ❑ PDL Line Reports - HTML format on CD-ROM
  These reports include:
  - Shotpoint Event Logs
  - Tape Logs
  - Special Event Comments/Line Acceptance Logs
- ❑ Feather & Fathometer Plots - HTML format GIF files on CD-ROM
- ❑ Receiver Depth Edits - ASCII format on CD-ROM

- ❑ Parameter Report - Microsoft Excel 7 format on CD-ROM
  This report includes:
  - Seismic System Parameters
  - Gun Array Diagram
  - Equipment and Software Listing

- ❑ Fathometer printouts - hardcopy
- ❑ Start and End of Line Noise Analysis - hardcopy
- ❑ Brute Stack Sections for each sail line - hardcopy
- ❑ Migrated Stack Sections when produced - hardcopy
- ❑ Near Trace Sections for each sail line - hardcopy

12.1.2 Processed Seismic Data

Shipped with the Field Seismic QC Products. See shipping details above.

- ❑ Brute Stack Sections for each sail line - SEG-Y files tarred to 2.5GB 8 mm
- ❑ Migrated Stack Sections when produced - SEG-Y files tarred to 2.5GB 8 mm
- ❑ Near Trace Sections for each sail line - SEG-Y files tarred to 2.5GB 8 mm
- ❑ Near Trace Cube - SEGY format on 3590 Cartridge

- ❑ RMS Signal/Noise Analysis for each sail line - GIF files tarred to 2.5GB 8 mm
- ❑ Near Trace Cube Slices - QC Viewer & GIF files tarred to 2.5GB 8 mm

- ❑ Processed Data Tape Inventory Log - hardcopy and diskette

12.1.3 Processed Navigation Data

Shipment #	Date Shipped	Sequences Shipped
140-00-046	22nd February 2000	001-080
140-00-061	29th March 2000	081-140
140-00-076	6th April 2000	141-147
140-00-079	6th April 2000	148-152 (all 2D sequences)

- ❑ 1 Set of Raw P2/94 UKOOA files - tarred to 2.5GB 8 mm
- ❑ 1 Set of Final P1/90 UKOOA files (All Records) - tarred to 2.5GB 8 mm
- ❑ Processed Navigation Tape Inventory - hardcopy and diskette
- ❑ Shotpoint location map - hardcopy

12.1.4 Bin Positioning Data

Shipment #	Date Shipped	Sequences Shipped
		001-147 (all 3D sequences)

NOTE: This item to be supplied by Western Geophysical's London office due to system constraints onboard.

- ❑ 3D Bin Positioning UKOOAs (raw and flexed coverage) - tarred to 2.5GB 8 mm

12.2 Data Shipments to Compustor, Belmont

Attn: Peter Manford / Emma Day
CompuStor
18 Fisher Street
Belmont
Western Australia 6104

12.2.1 Original Field Seismic Data - Seg-D format

Shipment #	Date Shipped	Sequences Shipped
140-99-252	6th April 2000	001-147 (all 3D sequences)
140-00-084	6th April 2000	148-152 (all 2D sequences)

- ❑ Raw SEG-D Seismic Tape Originals (sealed) on 3590 Cartridge
- ❑ SEG-D Seismic Tape Box Logs - hardcopy
- ❑ SEG-D Seismic Tape Inventory Log - hardcopy and diskette

- ❑ PDL Line Reports - HTML format on CD-ROM
  - These reports include:
    - Shotpoint Event Logs
    - Tape Logs
    - Special Event Comments/Line Acceptance Logs
- ❑ Feather & Fathometer Plots - HTML format GIF files on CD-ROM
- ❑ Receiver Depth Edits - ASCII format on CD-ROM

- ❑ Parameter Report - Microsoft Excel 7 format on CD-ROM
  - This report includes:
    - Seismic System Parameters
    - Gun Array Diagram
    - Equipment and Software Listing

12.3 Data Shipments to Veritas DGC Ltd, Perth

Attn: Paula Cronin, Amy Cheang
Veritas DGC
38 Ord Street
West Perth
Western Australia 6005

12.3.1 Copy Field Seismic Data - Seg-D Format

Shipment #	Date Shipped	Sequences Shipped
140-00-016	22nd February 2000	001-080
140-00-052	29th March 2000	081-140
140-00-080	6th April 2000	141-147
140-00-086	6th April 2000	148-152 (all 2D sequences)

- ❑ Raw SEG-D Seismic Tape Copies (sealed) on 3590 Cartridge
- ❑ SEG-D Seismic Tape Box Logs - hardcopy
- ❑ SEG-D Seismic Tape Inventory Log - hardcopy and diskette

- ❑ PDL Line Reports - HTML format on CD-ROM
  These reports include :
  - Shotpoint Event Logs
  - Tape Logs
  - Special Event Comments/Line Acceptance Logs
- ❑ Feather & Fathometer Plots - HTML format GIF files on CD-ROM
- ❑ Receiver Depth Edits - ASCII format on CD-ROM

- ❑ Parameter Report - Microsoft Excel 7 format on CD-ROM
  This report includes:
  - Seismic System Parameters
  - Gun Array Diagram
  - Equipment and Software Listing

Camera Plots for each sail line - hardcopy

12.4 Data Shipments to Western Geophysical, Perth

Attn: Wayne Anderson, Mike Giles
Western Geophysical
2nd Level, Sheraton Court
207 Adelaide Terrace
East Perth
Western Australia 6004

12.4.1 Raw Navigation Data

Shipment #	Date Shipped	Sequences Shipped
140-00-048	22nd February 2000	001-080
140-00-062	29th March 2000	081-140
140-00-077	6th April 2000	141-152

NOTE: Shipment 140-00-077 contains 3D (Seq 141-147) and 2D (Seq 148-152) data.

- ❑ SPECTRA real-time P1 (not edited) files tarred on 3590
- ❑ SPECTRA P2 Raw (and not edited) UKOOA files tarred on 3590

12.4.2 Processed Navigation Data

Shipped with the raw navigation data. See shipping details above.

- ❑ UNAVCHK P2 Raw (but edited) UKOOA files tarred on 3590
- ❑ UNAVCHK P1 Final UKOOA files (All Records) tarred on 3590
- ❑ UNAVCHK P1 Final UKOOA files (A and E records) tarred on 3590
- ❑ UNAVCHK setups and reports tarred on 3590
  - Set-up files
  - QC Summaries (offsets/comparisons/qcstats)
  - Processing HTML reports

- ❑ Accepted Line List, diskette and paper copy
- ❑ Parameter Report, diskette
- ❑ Tape Directories, diskette

12.5 Data Shipments to Western Geophysical, London

Attn: Gary Poole, Steven Calthrop and Louise Cox
Western Geophysical
455, London Road
Isleworth
Middlesex, TW7 5AB
U.K.

12.5.1 Raw Navigation Data

Shipment #	Date Shipped	Sequences Shipped
140-00-047	22nd February 2000	001-080
140-00-063	29th March 2000	081-140
140-00-078	6th April 2000	141-152

NOTE: Shipment 140-00-078 contains 3D (Seq 141-147) and 2D (Seq 148-152) data.

- ❑ SPECTRA Final Configuration files on diskette
- ❑ SPECTRA Backup Configuration files on diskette
- ❑ SPECTRA real-time P1 (not edited) files tarred on 3590
- ❑ SPECTRA P2 Raw (and not edited) UKOOA files tarred on 3590
- ❑ Tape Directories, diskette

12.5.2 Processed Navigation Data

Shipped with the raw navigation data. See shipping details above.

- ❑ UNAVCHK P2 Raw (but edited) UKOOA files tarred on 3590
- ❑ UNAVCHK P1 Final UKOOA files (All Records) tarred on 3590
- ❑ UNAVCHK P1 Final UKOOA files (A and E records) tarred on 3590
- ❑ UNAVCHK setups and reports tarred on 3590
  - Set-up files
  - QC Summaries (offsets/comparisons/qcstats)
  - Processing HTML reports
- ❑ Accepted Line List, diskette and paper copy
- ❑ Tape Directories, diskette

12.5.3 Seismic Processing Data

Shipment #	Date Shipped	Sequences Shipped
140-00-092	14th April 2000	001-152 (all sequences)

NOTE: Shipment 140-00-092 contains 3D (Seq 001-147) and 2D (Seq 148-152) data.

- ❑ OMEGA Near trace cube on 3590, Ω format
- ❑ OMEGA QCViewer files tarred on 3590
- ❑ OMEGA Flows, Velocity text files, Trace Deletes, GPD and Tape Lists on CD-ROM
- ❑ Tape Directories, diskette

12.5.4 Other Archive Data - PDL

Shipped with Seismic Processing Data. See shipping detials for 140-00-092 above

- ❑ PDL Database on 3590 with the following sent as part of the database:

Observer Line Reports
SSS Line Reports
Navigator Line Reports
Line Acceptance Forms

- ❑ PDL Line Reports - HTML format on CD-ROM
- ❑ Receiver Depth Edits - ASCII format on CD-ROM
- ❑ Parameter Report, CD-ROM

12.5.5 Other Archive Data - Reflex

Shipment #	**Date Shipped**	**Sequences Shipped**
140-00-100	7th May 2000	001-147 (all 3D sequences)

- ❑ REFLEX Database on 3590

13 SUB-CONTRACTORS

- Fugro Starfix AS: Provided differential GPS corrections system used onboard the vessel during this survey

  Address: Fugro Geodetic Pte Ltd
  Loyang Offshore Supply Base
  Box No 5040
  Singapore 508988
  Tel: (65) 543 0200
  Fax: (65) 543 0500

- Racal Survey (UK) Ltd: Provided differential GPS corrections system used onboard the vessel during this survey

  Address: Racal Survey Pte Ltd
  3rd Floor
  45 Joo Koon Circle
  Singapore 629106
  Tel: (65) 8610878
  Fax: (65) 8616337

- Total Marine Services Pty Ltd.: Provided the ships crew for the Western Pride throughout the survey. This includes all officers, engineers and deck crew.

  Address: 4 Rous Head Road
  North Freemantle
  Wetsern Australia 6159
  Tel: (61) 8 9430 5595
  Fax: (61) 8 9430 5595

14 APPENDIX 1 - CALIBRATION RESULTS

14.1 Pre-Survey Calibrations and Verifications in Jurong, Singapore

14.1.1 Overview

The pre survey Calibrations / Verifications took place from the 2nd October to 6th October, whilst docked at ST Marine, Jurong in Singapore.

The following calibrations and verifications took place:

- dGPS verification : Racal Multifix, Fugro Multifix, QPS Multifix & Posnet.
- rGPS verification : 11 x Tailbuoy pods, 9 x Headbuoy pods
- 041° Gyro calibration : 2 x Sperry Mk 227 and the mast-mounted Posnet pod
- 226° Gyro calibration : 2 x Sperry Mk 227 and the mast-mounted Posnet pod
- MDL Fanbeam: 3 targets

All the Calibrations and Verifications followed the procedures as set by Western Geophysical.

14.1.2 Personnel

The appointed Surveyor was Louise Cox [Western Geophysical] Western Pride personnel included Rhod Morrison [FDQAGL] and Mike Ray, Rob Jordan, Chris Gibbons & Richard Stirrup [Navigators].

14.1.3 Diary of Events (Times in UTC)

All times are in U.T.C.

Saturday 2nd October 1999

01:00 Western Pride alongside at Singapore Technologies Marine, Singapore.
03:00 Surveyor arrives at Western Pride
05:00 Establish a temporary point TMP1 using range and bearing observations from control point B002, RO B003
06:12 Commence starboard side of gyro calibration
07:40 Complete starboard side of gyro calibration

Sunday 3rd October 1999

00:30 Arrive at Western Pride
02:00 Position sites for Posnet pods and fanbeam targets
DELAY : Unable to get power to gun pods
06:12 Began RGPS verification for tailbuoy pods 1461, 1347, 1287 and 1371 and gun pod 1060. At the same time, began Fanbeam verification.
06:43 Completed RGPS and Fanbeam verification.
07:43 Began RGPS verification for tailbuoy pods 1329, 1052, 1443 and 1055 and gun pod 1061
07:59 Completed RGPS verification.
09:30 Began RGPS verification for tailbuoy pods 1051 and 1342 and gun pods 1480 and 1063
09:46 Completed RGPS verification.

Monday 4th October
00:30 Arrive at Western Pride
01:10 Began RGPS verification for tailbuoy pod 1277 and gun pods 1064 and 1065
01:26 Completed RGPS verification.
01:51 Began RGPS verification for tailbuoy pod 1277 (repeat) and gun pods 1482 and 1308
02:06 Completed RGPS verification
02:25 Began RGPS verification for tailbuoy pod 1277 (repeat) and gun pods 1482 (repeat) and 1522
02:41 Completed RGPS verification
05:30 Vessel turned

Tuesday 5th October
01:52 Began Port side of gyro calibration
03:22 Completed Port side of gyro calibration

Wednesday 6th October
01:30 Traversed round control points to tighten up control
08:55 Began DGPS verification
09:25 Completed DGPS verification

14.1.4 Gyro Calibration

Two Sperry Mk227 Gyros were calibrated. In addition, ranges and bearing were taken to the Posnet pod mounted on the forward mast and the prime Posnet antenna. The bearing output from the Posnet pod was logged as a third gyro and was also calibrated.
The reading from each gyro was recorded by the utility node of Spectra, whilst the surveyors measured a range and bearing to targets located on the bow and stern on the centre line of the vessel. Ranges were taken every two minutes for one hour. The fixed corrections for the Gyros were all disabled prior to commencing the calibration.
The latitude controls on the gyros were set and a speed correction of zero knots was used. The vessel was securely tied against the quay.

For each side of the gyro, the surveyor could observe prisms mounted at the bow and stern from TMP1.

The onboard gyrocompasses were checked to ensure that the correct latitude and speed values were entered. The SPECTRA integrated navigation system was checked to ensure that data from the gyrocompasses was being received and that all previous C-O values were removed.

A logging node was started in SPECTRA with raw data being recorded to file every 10 seconds. The surveyor's watch was then synchronised to SPECTRA time.

True range and horizontal bearings were then recorded by the surveyor from point TMP1 to both targets. Observations were taken every two minutes to the targets on bow and stern for an hour and a half.

On completion, all observations were entered into a spreadsheet. By using a local grid, the vessel's computed heading was calculated. This heading was then compared to the gyrocompasses observed headings and C-O values obtained.

The starboard side of the gyro verification was done first. The vessel turned a few days later when it was convenient with all other processes. The vessel was left to settle overnight and the port side was completed. Due to the shape of the vessel towards the stern when the vessel turned it was unable to turn a full 180 degrees due to the fenders. This meant that the headings were 41 degrees and 226 degrees.

For each side of the gyro the Posnet gyro was also logged in order that a C-O value to the centre line of the vessel could be obtained.

Gyro 1 [S/N 495] is the primary gyro. Gyro 2 [S/N 480] is secondary.

14.1.4.1 Gyrocompass Calibration Results

Gyro 1 [S/N : 495] DIR 041°	C-O	: 0.59°	S.Dev : 0.05
Gyro 1]S/N : 495] DIR 226°	C-O	: 0.32°	S.Dev : 0.08
Mean		: 0.45°	
Previous C-O : -0.51 April 99			
Gyro 2 [S/N : 480] DIR 041°	C-O	: 0.02°	S.Dev : 0.08
Gyro 2 [S/N : 480] DIR 226°	C-O	: -0.09°	S.Dev : 0.08
Mean		: -0.04°	
Previous C-O : -1.19° April 99			
Gyro 3 [Posnet] DIR 041°	C-O	: -0.02°	S.Dev: 0.26
Gyro 3 [Posnet] DIR 226°	C-O	: -0.06°	S.Dev: 0.32
Mean		: -0.04°	
Previous C-O : 0.99° April 99			

14.1.5 Absolute Positioning Verification

The Western Pride had four DGPS systems to be verified.

The Primary positioning system was Racal Multifix system using differential corrections supplied by reference stations at Singapore, Terengganu, Miri and Jakarta.

The secondary system was Fugro MRDGPS system using differential corrections supplied by reference stations at Singapore, Kuantan, Satun, Uung Tau and Miri.

The tertiary system was QPS Multifix which used Racal differential stations of Singapore, Terengganu and Miri and Fugro stations of Singapore, Satun and Miri.

The Posnet system was also verified.

The verification was conducted in the WGS84 datum with a UTM projection from the control point TMP2.
Surveying control was established at point TMP2 from where the vessel navigation mast could be clearly seen. A prism was located below the main antenna which is common for all dGPS systems

The SPECTRA integrated navigation system was configured to log data to disc every 10 seconds. Once confirmation had been received that all systems were operating normally the surveyors began observations from TMP1 to the prism. This process was repeated every minute until 30 good observations had been obtained. The results were then converted to Northings and Eastings using Unavchk with the projection parameters used below.

Projection	: UTM ZONE 48
Origin of Lat.	: 000° 00' 00.00"
Origin of Long(CM).	: 103° 00' 00.00"
False Northing	: 0.00 m
False Easting	: 500,000 m
Scale Factor at C.M.	: 0.9996

The satellite constellation was monitored during the verifications and seen to be good, with six or more satellites in view above 10° and a PDOP better than 4.0 throughout.

The elevation mask in each system was set to 10°.

14.1.5.1 dGPS Verification Results

QPS Multifix	Eastings	: 0.83	S.Dev	: 0.51
	Northings	: 0.01	S.Dev	: 0.26
Fugro Multifix	Eastings	: 0.25	S.Dev	: 0.23
	Northings	: -0.56	S.Dev	: 0.19
Racal Multifix	Eastings	: 0.18	S.Dev	: 0.20
	Northings	: -0.34	S.Dev	: 0.21
Posnet	Eastings	: 0.31	S.Dev	: 0.22
	Northings	: -0.32	S.Dev	: 0.19

14.1.6 MDL Fanbeam Laser Ranging System

The Fanbeam LRU was calibrated using three prisms placed at Sites 1, 2 and 3 around the dockside. This verification was carried out simultaneously with the first set of Posnet pods. This was possible because the main antenna and Fanbeam unit are co-located. The surveyor measured horizontal range and bearing observations from TMP1. The raw ranges and bearings of each Fanbeam target were recorded using the utility node of the Spectra system. Thirty samples were collected.

The Scanning head was zeroed against a reference target placed on the centre line of the vessel prior to the start of the calibration. In addition, an instrument alignment angle of –1.34° derived from previous calibrations remained enabled in the Fanbeam computer.

14.1.6.1 Fanbeam Calibration Results

Target 1 Range [66 m]	C-O mean: -0.02 m	C-O SD: 0.10 m
Target 1 Bearing [33°]	C-O mean: 0.78°	C-O SD: 0.31°
Target 2 Range [76 m]	C-O mean: -0.10 m	C-O SD: 0.06 m
Target 2 Bearing [54°]	C-O mean: 0.30°	C-O SD: 0.05°
Target 3 Range [105 m]	C-O mean: 0.00 m	C-O SD: 0.09 m
Target 3 Bearing [67°]	C-O mean: 0.21°	C-O SD: 0.05°

Range C-O: -0.04 m
Bearing C-O: -0.43°
Gyro C-O corrected bearing C-O: 0.45°
Fanbeam bearing C-O to be used: -0.89° (-1.34° + 0.45°)

Data from gyro 1 was used to correct the Fanbeam bearing to true north. No gyro correction was applied in the calculation of the C-Os given above. The correction to be applied to Gyro 1 is 0.45°

14.1.7 POSNET rGPS Tailbuoy/Headbuoy System Verification

Twenty Posnet buoys in total needed verifying, eleven tailbuoys and nine headbuoys. Four sites were used to locate the Posnet pods. Three of these sites were close enough to the boat so that the cables for the headbuoy pods would reach. Due to a connection problem with the gun strings at first we were only able to verify one headbuoy pod at a time. Fortunately an extra gun string was fixed so we could do two gun pods at a time, this meant that in total there were six sets of observations required in order to verify all twenty pods.

Spectra was configured to log the position of the pods every ten seconds. The surveyor on the dockside observed a prism on the main antenna of the Western Pride every minute for a period of thirty minutes from TMP1 for the first set of pods. For all subsequent RGPS verifications the prism was observed every 30 seconds for a period of fifteen minutes. This was because during the first set of observations the Fanbeam was being verified also. The surveyor's watch was synchronised with UTC.

The satellite constellation was monitored during the verifications and seen to be good, with six or more satellites in view above 10° and a PDOP better than 4.0 throughout.

14.1.7.1 rGPS Verification Results

		RANGE		BEARING	
SERIAL No.	SITE	MEAN C-O	S.Dev	MEAN C-O	S.Dev
TB 1461	1	0.43	0.17	-0.13	0.25
TB 1347	2	0.38	0.03	-0.18	0.05
TB 1287	3	-0.37	1.08	-0.49	0.49
TB 1371	4	0.36	0.41	-0.18	0.04
HB 1060	1	0.57	0.05	0.24	0.06
TB 1329	4	0.18	0.11	-0.07	0.03
TB 1052	3	0.03	0.26	-0.29	0.01
TB 1443	2	0.10	0.09	-0.41	0.02
TB 1055	1	0.40	0.07	-0.04	0.05
HB 1061	1	0.08	0.11	-0.13	0.09
TB 1051	1	0.46	0.04	0.11	0.13
TB 1342	3	0.57	0.54	0.42	0.21
HB 1480	1	0.59	0.05	-0.17	0.14
HB 1063	3	0.22	0.13	-0.19	0.07
HB 1064	1	0.77	0.21	0.03	0.17
HB 1065	3	0.60	0.29	-0.22	0.03
TB 1277	1	-0.03	0.46	-1.60	0.52
HB 1308	1	0.54	0.23	-0.13	0.40
HB 1482	3	0.41	0.08	-0.20	0.04
TB 1277(Rpt)	1	0.42	0.57	-2.23	0.65
HB 1522	1	0.17	0.11	-0.61	0.09
HB 1482(Rpt)	3	0.22	0.01	-0.31	0.01

14.2 Post-Survey Calibrations and Verifications in Cape Town, South Africa and Walvis Bay, Namibia

14.2.1 Overview

The post-survey Calibrations / Verifications took place from the 7th May to 10th May 2000 whilst docked at Berth 500 in Cape Town dock in South Africa. Additional verifications took place whilst the Western Pride was docked at New Quay, Walvis Bay on the 13th May, where the spare dGPS receivers were verified and some of the Posnet rGPS pods verifications were repeated.

The following calibrations and verifications took place:

- dGPS verifications : Posnet (two systems), Fugro MrDGPS, QPS Multiref (Fugro), QPS Multiref (Racal)
- rGPS verifications : 11 x Tailbuoy pods, 8 x Headbuoy pods
- 308° Gyro calibration : 2 x Sperry Mk 227 and the mast-mounted Posnet pod
- 133° Gyro calibration : 2 x Sperry Mk 227 and the mast-mounted Posnet pod
- MDL Fanbeam laser range calibration: 3 targets

All the Calibrations and Verifications followed the procedures as set by Western Geophysical.

14.2.2 Personnel

The appointed Surveyor was Louise Cox [Western Geophysical]. Western Pride personnel included Rhod Morrison [FDQAGL] and Mike Ray, Jason Liddell, Gary Nicholson [Navigators].

14.2.3 Diary of Events (Times in UTC)

All times are in U.T.C.

Sunday 7th May 2000

10:00 Surveyor arrives at Western Pride
10:30 Meets with Navigators to discuss plan for the calibrations
11:00 Locate existing control points (WGC1 and WGC2)in Berth 501 which was next to Berth 500 in the dock
12:00 Traverse through to Berth 500 and establish a baseline down that berth (WGC3 and WGC4)
14:00 Decide to set up on WGC1 to do the starboard side of the gyro verification but leave the verification until tomorrow.

Monday 8th May 2000

05:45 Arrive at Western Pride
07:25 Commence starboard side of gyro verification
08:52 Completed starboard side of gyro verification
13:36 Began rGPS verification for tailbuoy pods 1461, 1565 and 1203 and gun pods 1308, 1522 and 1061
14:07 Completed rGPS verification
14:47 Began rGPS verification for tailbuoy pods 1433, 1277, 1534 and 1347 and gun pods 1480, 1060 and 1062
15:18 Completed rGPS verification.

Tuesday 9th May 2000

06:45 Arrive at Western Pride
07:30 Began rGPS verification for tailbuoy pods 1454, 1342, 1055 and 1051 and gun pods 1064 and 1499
07:59 Completed rGPS verification.

Navigator's noticed an incorrect parameter in the rGPS controllor (pitch and roll applied to the main antenna). It was decided to repeat the rGPS verifications.

11:04 Began rGPS verification for tailbuoy pods 1461, 1565 and 1203 and gun pods 1308, 1522 and 1061
11:33 Completed rGPS verification
12:06 Began rGPS verification for tailbuoy pods 1433, 1277, 1534 and 1347 and gun pods 1480, 1060 and 1062
12:35 Completed rGPS verification
13:22 Began rGPS verification for tailbuoy pods 1454, 1342, 1055 and 1051 and gun pods 1064 and 1499
13:51 Completed rGPS verification
19:30 Vessel turned

Wednesday 10th May 2000

05:45 Arrived at vessel
08:27 Began Port side of gyro verification
09:54 Completed Port side of gyro verification
12:25 Began Fanbeam verification
12:54 Completed Fanbeam verification
15:40 Began first dGPS verification
16:09 Completed first dGPS verification
17:00 Began second dGPS verification
17:29 Completed second dGPS verification
18:00 Western Pride set sail to Walvis Bay

Saturday 13th May 2000

05:00 Alongside Walvis Bay. Preparing for rGPS calibration
10:46 Began first rGPS verification.
11:15 Completed first rGPS verification
12:28 Began combined dGPS and second rGPS verification
12:39 Aborted combined dGPS and second rGPS verification due to poor satellite coverage
13:19 Restarted combined dGPS and second rGPS verification
13:48 Completed combined dGPS and second rGPS verification

14.2.4 Gyro Calibration

Two Sperry Mk227 Gyros were calibrated. In addition, the bearing from the prime Posnet antenna to the Posnet rGPS pod mounted on the forward mast was logged as a third gyro and calibrated.

The latitude controls on the gyros were set and a speed correction of zero knots was used. The SPECTRA integrated navigation system was checked to ensure that data from the gyrocompasses was being received and that all previous C-O values were removed. The vessel was securely tied against the quay.

A logging node was started in SPECTRA with raw data being recorded to file every 10 seconds. The surveyor's watch was then synchronized to SPECTRA time. True range and horizontal bearings were then recorded by the surveyors from where they had set up to both targets. Observations were taken every three minutes to the targets on bow and stern for an hour and a half.

For the starboard side of the gyro, the surveyor could observe prisms mounted at the bow and stern from WGC1. When the vessel turned however, obstructions around the dock prevented the same points from being observed from a site close enough to the vessel. Therefore, the prism that was on the bow was moved to the top of the forward mast. This meant that both prisms could be seen from a new point that had been established (WGC5). The prism was still on the centre line of the vessel, but the baseline was reduced by about 3 metres.

On completion, all observations were entered into a spreadsheet and the computed heading was calculated. This heading was then compared to the gyrocompasses observed headings and C-O values obtained.

The starboard side of the gyro calibration (308°) was done first. The vessel turned a few days later when it was logistically convenient. The vessel was left to settle overnight and the port side of calibration (133°) was completed.

Following errors seen during the acquisition of previous surveys Gyro 1 [S/N 495] was the secondary gyro, and Gyro 2 [S/N 480] was the primary gyro throughout this survey.

14.2.4.1 Gyrocompass Calibration Results

Gyro 1 [S/N : 495] DIR 308°	C-O	: -0.06°	S.Dev : 0.08
Gyro 1]S/N : 495] DIR 133°	C-O	: 0.41°	S.Dev : 0.14
Mean		**: 0.17°**	
Previous C-O : 0.45° October 99			

Gyro 2 [S/N : 480] DIR 308°	C-O	: -0.32°	S.Dev : 0.12
Gyro 2 [S/N : 480] DIR 133°	C-O	: -0.28°	S.Dev : 0.15
Mean		**: -0.30°**	
Previous C-O : -0.04° October 99			

Gyro 3 [Posnet] DIR 308°	C-O	: 0.41°	S.Dev: 0.12
Gyro 3 [Posnet] DIR 133°	C-O	: 0.53°	S.Dev: 0.28
Mean		**: 0.47°**	
Previous C-O : -0.04° October 99			

14.2.5 Absolute Positioning Verification

The Western Pride had four dGPS systems to be verified. Each system was verified twice in Cape Town and a further verification was performed in Walvis Bay, as this was nearer than Cape Town to the next prospect, and to the available reference stations.

Two Posnet systems, Posnet #1 and Posnet #2 used SARGAS differential corrections supplied by a reference station at Luanda for all the verifications.

Fugro MRdGPS used StarFix dual-frequency differential corrections supplied by reference stations at Luanda, Sao Tome and Douala for all the verifications.

QPS Multi-Reference using SARGAS corrections from Luanda and Fugro StarFixPlus corrections from Luanda, Sao Tome and Douala for the first and third verifications. For the second session of the dGPS verifications, QPS used Racal SkyFix corrections from Walvis Bay, Cape Town and Port Nolloth. The spare GPS receiver was used for the QPS Multi-Reference verification in Walvis Bay.

Surveying control was established at a dockside control point from where the vessel navigation mast could be clearly seen. A prism was located below the main antenna, which is common for all dGPS systems.

The SPECTRA integrated navigation system was configured to log raw data to disc every 10 seconds. Once confirmation had been received that all systems were operating normally the surveyors began observations from the control point to the prism. This process was repeated every minute until 30 good observations had been obtained.

The Cape Town verification was conducted in the WGS84 datum with a UTM Zone 34S projection.

Projection	: UTM ZONE 34 S
Origin of Lat.	: 000° 00' 00.00"
Origin of Long. (C.M.)	: 021° 00' 00.00"
False Northing	: 10,000,000.00 m
False Easting	: 500,000 m
Scale Factor at C.M.	: 0.9996

The Walvis Bay verification was conducted in the WGS84 datum with a UTM Zone 33S projection.

Projection	: UTM ZONE 33 S
Origin of Lat.	: 000° 00' 00.00"
Origin of Long. (C.M.)	: 015° 00' 00.00"
False Northing	: 10,000,000.00 m
False Easting	: 500,000 m
Scale Factor at C.M.	: 0.9996

The raw data string logged contained the latitude and longditude in WGS84 datum. These were then converted to Northings and Eastings using Unavchk with the projection parameters used above.

The satellite constellation was monitored during the verifications and seen to be good, with six or more satellites in view above 10° and a PDOP better than 4.0 throughout. One verification in Walvis Bay was aborted when these conditions were not being met.

The elevation mask in each system was set to 10°.

14.2.5.1 dGPS Verification Results

Cape Town Results - Session #1

Posnet #1	[Luanda (Sargas-V)]	Eastings	: 0.10	S.Dev	: 0.41
		Northings	: 0.34	S.Dev	: 0.27
Posnet #2	[Luanda (Sargas-V)]	Eastings	: -0.57	S.Dev	: 0.39
		Northings	: -0.22	S.Dev	: 0.21
Fugro Multifix	[Luanda, Sao Tome, Douala (Starfix)]	Eastings	: 2.68	S.Dev	: 0.58
		Northings	: -0.91	S.Dev	: 0.29
QPS Multifix	[Luanda (Sargas-V); Luanda, Sao Tome, Douala (Starfix)]	Eastings	: 0.51	S.Dev	: 0.68
		Northings	: 4.19	S.Dev	: 0.49

Cape Town Results - Session #2

Posnet #1	[Luanda (Sargas-V)]	Eastings	: -0.32	S.Dev	: 0.21
		Northings	: 0.73	S.Dev	: 0.26
Posnet #2	[Luanda (Sargas-V)]	Eastings	: -0.96	S.Dev	: 0.13
		Northings	: -0.30	S.Dev	: 0.16
Fugro Multifix	[Luanda, Sao Tome, Douala (Starfix)]	Eastings	: 1.29	S.Dev	: 0.20
		Northings	: 0.88	S.Dev	: 0.31
QPS Multifix	[Walvis Bay, Cape Town, Port Nolloth (SkyFix)]	Eastings	: 0.08	S.Dev	: 0.31
		Northings	: 1.42	S.Dev	: 0.26

Walvis Bay Results

Posnet #1	[Luanda (Sargas-V)]	Eastings	: 0.71	S.Dev	: 0.29
		Northings	: -0.04	S.Dev	: 0.13
Fugro Multifix	[Luanda, Sao Tome, Douala (Starfix)]	Eastings	: 1.22	S.Dev	: 0.30
		Northings	: -2.95	S.Dev	: 0.32
QPS Multifix	[Luanda (Sargas-V); Luanda, Sao Tome, Douala (Starfix)]	Eastings	: 1.29	S.Dev	: 0.20
		Northings	: 0.88	S.Dev	: 0.31

14.2.6 MDL Fanbeam Laser Ranging System

The Fanbeam LRU was calibrated using three prisms placed at Sites 1, 2 and 3 around the dockside.

The Scanning head was zeroed against a reference target placed on the centre line of the vessel prior to the start of the calibration. An instrument alignment angle of –1.38° was required to zero the output bearing, and this alignment angle was enabled in the Fanbeam computer throughout the calibration.

The surveyor measured horizontal range and bearing observations from WGC5 every minute for 30 minutes. The raw ranges and bearings of each Fanbeam target were recorded every 10 seconds using the utility node of the Spectra system, as were the raw gyro readings.

14.2.6.1 Fanbeam Calibration Results

All bearing C-Os given after rotating to true north with the raw readings from Gyro 2, and applying a hull alignment correction to Gyro 2 of -0.30°

Target 1 Range [115 m]	C-O mean: 0.06 m	C-O SD: 0.14 m
Target 1 Bearing [177°]	C-O mean: -0.02°	C-O SD: 0.27°
Target 2 Range [180 m]	C-O mean: 0.01 m	C-O SD: 0.07 m

Target 2 Bearing [184°]	C-O mean: 0.03°	C-O SD: 0.20°
Target 3 Range [70 m]	C-O mean: 0.13 m	C-O SD: 0.08 m
Target 3 Bearing [198°]	C-O mean: -0.29°	C-O SD: 0.12°

Range C-O: 0.07 m
Bearing C-O: -0.09°

14.2.7 POSNET rGPS Tailbuoy/Headbuoy System Verification

Nineteen Posnet pods in total needed verifying, eleven tail pods and eight gun pods. Four sites were used in Cape Town to locate the Posnet pods. Three of these sites were close enough to the boat so that the cables for the gun pods would reach. In total there were three sets of observations required in order to verify all nineteen pods in Cape Town. A number of the pods verified in Cape Town gave poor results, mainly during the 2nd verification. These six tailbuoy pods and three headbuoy pods were re-verified in Walvis Bay using identical surveying techniques.

Prior to each of the verifications the positions of the pods on the dockside were established by measuring range and bearings to each one from a known control point.

Spectra was configured to log the position of the pods every ten seconds. The surveyor on the dockside control point observed a prism on the main antenna of the Western Pride every minute for a period of thirty minutes for every set of pods.

The satellite constellation was monitored during the verifications and seen to be good, with six or more satellites in view above 10° and a PDOP better than 4.0 throughout. One verification in Walvis Bay was aborted when these conditions were not being met.

14.2.7.1 rGPS Verification Results

Cape Town Results

Pod S/N	Tail Pod/ Gun Pod	Range		Bearing		Easting		Northing	
		C-O	SD	C-O	SD	C-O	SD	C-O	SD
1308	Gun	0.06	0.11	0.07	0.09	0.05	0.12	0.09	0.10
1522	Gun	-0.32	0.08	0.32	0.08	0.54	0.10	0.00	0.09
1061	Gun	-0.60	0.17	0.23	0.07	0.72	0.14	-0.15	0.17
1461	Tail	-1.00	0.37	1.32	0.27	1.99	0.48	-0.06	0.18
1565	Tail	-0.51	0.20	0.64	0.15	1.01	0.27	0.11	0.10
1203	Tail	-0.73	0.13	0.43	0.07	1.09	0.15	0.02	0.10
1480	Gun	-1.35	0.08	-0.76	0.41	-0.25	0.47	-1.66	0.28
1060	Gun	-1.45	0.06	-0.68	0.31	-0.09	0.34	1.73	0.26
1062	Gun	-0.22	0.13	-1.00	0.29	1.25	0.44	1.42	0.35
1443	Tail	-0.61	0.22	-0.44	0.14	-0.22	0.24	-0.80	0.26
1277	Tail	-1.70	0.07	-1.44	0.75	-0.63	0.89	-2.53	0.57
1534	Tail	-1.23	0.44	-1.42	0.44	-1.16	0.91	2.70	0.26
1347	Tail	-1.25	0.10	-0.54	0.14	-0.03	0.26	-1.77	0.21
1064	Gun	-0.26	0.04	0.25	0.04	0.43	0.05	-0.01	0.05
1499	Gun	-0.39	0.08	0.34	0.03	0.74	0.09	0.16	0.05
1454	Tail	-0.29	0.04	0.52	0.03	0.73	0.04	0.06	0.05
1342	Tail	-0.29	0.05	0.54	0.03	0.76	0.04	0.21	0.06
1055	Tail	0.53	0.42	-0.43	0.47	-0.95	0.82	-0.14	0.51

1051	Tail	-1.60	0.13	0.27	0.09	1.58	0.13	-0.69	0.22

Highlighted pods were repeated in Walvis Bay. Results are given below.

Walvis Bay Results

Pod S/N	Tail Pod/ Gun Pod	Range		Bearing		Easting		Northing	
		C-O	SD	C-O	SD	C-O	SD	C-O	SD
1480	Gun	-0.36	0.07	-0.16	0.03	0.43	0.07	-0.20	0.05
1060	Gun	0.06	0.09	0.05	0.11	-0.05	0.10	0.05	0.08
1062	Gun	0.10	0.30	-0.01	0.12	-0.09	0.34	-0.04	0.10
1055	Tail	0.49	0.30	0.24	0.26	-0.58	0.39	0.21	0.31
1051	Tail	0.24	0.37	0.21	0.28	-0.33	0.48	0.31	0.44
1461	Tail	-0.51	0.30	0.04	0.12	0.47	0.34	0.21	0.10
1565	Tail	1.86	0.06	0.06	0.93	-1.78	0.58	0.54	0.90
1277	Tail	-0.16	0.09	0.23	0.11	0.20	0.10	0.14	0.08
1534	Tail	-0.39	0.07	0.02	0.03	0.37	0.07	0.13	0.05

15 APPENDIX 2 - PRODUCTION LOG

15.1 INVESTIGATOR 3D LINES SEQ 001-147

Seq	Linename	Date	Dir	Acquisition	Status	Acquired Good Shots	Required Shotpoints	Missed / Bad Shot Ranges	Comments	Reshot As Seq
1	**W00INV1840P1**	**22-Dec-99**	**188**	**Prime**	**Rejected**	**0 - 0**	**3719 - 817**		**Line rejected d/t separations**	**28***
2	W00INV2048P1	22-Dec-99	8	Prime	Incomplete	1001 - 3395	1001 - 3683			
2	**W00INV2048P1**	**22-Dec-99**	**8**		**Reshot**		**Shot Edit**	**3396 - 3683**	**Early EOL d/t Gun Errors**	**22**
3	W00INV1936P1	22-Dec-99	188	Prime	Incomplete	3617 - 817	3617 - 817			
3	**W00INV1936P1**	**22-Dec-99**	**188**		**Reshot**		**Shot Edit**	**1913 - 1887**	**MSX Lock-up**	**36**
3	**W00INV1936P1**	**22-Dec-99**	**188**		**Coverage OK**		**Shot Edit**	**2892 - 2876**	**Gun Errors (Even Shots Only)**	
3	**W00INV1936P1**	**22-Dec-99**	**188**		**Coverage OK**		**Trace Edit**	**3617 - 817**	**Cable 1 : CH 1-368 No Data Telemetry**	
4	W00INV1952P1	23-Dec-99	8	Prime	Incomplete	1001 - 3784	1001 - 3784			
4	**W00INV1952P1**	**23-Dec-99**	**8**		**Coverage OK**		**Trace Edit**	**1001 - 3784**	**Cable 1 : CH 1-368 No Data Telemetry**	
5	W00INV2032P1	23-Dec-99	188	Prime	Incomplete	3515 - 817	3515 - 817			
5	**W00INV2032P1**	**23-Dec-99**	**188**		**Coverage OK**		**Trace Edit**	**3515 - 817**	**Cable 1 : CH 1-368 No Data Telemetry**	
6	**W00INV2016P1**	**24-Dec-99**	**8**	**Prime**	**Rejected**	**0 - 0**	**1001 - 3716**		**Line rejected d/t acoustics/weather**	**9***
7	**W00INV1968P1**	**24-Dec-99**	**188**	**Prime**	**Rejected**	**0 - 0**	**3583 - 817**		**Line rejected d/t acoustics/weather**	**10***
8	**W00INV1888P1**	**24-Dec-99**	**8**	**Prime**	**Rejected**	**0 - 0**	**1001 - 3852**		**Line rejected d/t acoustics/weather**	**14***
9	**W00INV2026P1**	**02-Jan-00**	**8**	**Prime**	**Rejected**	**0 - 0**	**1001 - 3706**		**Line rejected d/t low source volume**	**11**
10	W00INV1954P1	03-Jan-00	188	Prime	Complete	3599 - 817	3599 - 817			
11	W00INV2026P2	03-Jan-00	8	Continuation	Complete	1001 - 3706	1001 - 3706			
12	**W00INV1918P1**	**05-Jan-00**	**8**	**Prime**	**Rejected**	**0 - 0**	**1001 - 3821**		**Line rejected d/t weather noise**	**31**
13	**W00INV1906P1**	**05-Jan-00**	**188**	**Prime**	**Rejected**	**0 - 0**	**3650 - 817**		**Line rejected d/t weather noise**	**29**
14	W00INV1894P1	06-Jan-00	8	Prime	Complete	1001 - 3848	1001 - 3847			
15	W00INV2014P1	06-Jan-00	188	Prime	Complete	3536 - 817	3535 - 817			
16	W00INV1966P1	06-Jan-00	8	Prime	Complete	1001 - 3770	1001 - 3770			
17	W00INV1894I1	07-Jan-00	188	Infill	Complete	3663 - 817	3663 - 817			
18	W00INV2002P1	07-Jan-00	8	Prime	Complete	1001 - 3732	1001 - 3732			
19	W00INV1882P1	07-Jan-00	188	Prime	Complete	3675 - 818	3675 - 817			
20	W00INV1870P1	08-Jan-00	8	Prime	Complete	1001 - 3872	1001 - 3872			
21	W00INV1990P1	08-Jan-00	188	Prime	Incomplete	3561 - 2040	3561 - 817			
21	**W00INV1990P1**	**08-Jan-00**	**188**		**Reshot**		**Shot Edit**	**2039 - 817**	**Early EOL d/t Fishing vessel in path**	**27**
22	W00INV2048R1	08-Jan-00	8	Reshoot	Complete	3386 - 3683	3386 - 3683			

Seq	Linename	Date	Dir	Acquisition	Status	Acquired Good Shots	Required Shotpoints	Missed / Bad Shot Ranges	Comments	Reshot As Seq
23	W00INV1870I1	09-Jan-00	188	Infill	Complete	3688 - 817	3688 - 817			
24	W00INV1942I1	09-Jan-00	8	Infill	Complete	1125 - 3796	1125 - 3796			
24	**W00INV1942I1**	**09-Jan-00**	**8**		**Coverage OK**		**Shot Edit**	**2541 - 3119**	**Coverage not required**	
25	W00INV1858P1	09-Jan-00	188	Prime	Complete	3701 - 817	3701 - 817			
26	W00INV1978P1	10-Jan-00	8	Prime	Complete	1001 - 3757	1001 - 3757			
27	W00INV1978I1	10-Jan-00	188	Infill/Cont.	Complete	3573 - 817	3573 - 817			
28	W00INV1846P1	10-Jan-00	8	Prime	Complete	1001 - 3898	1001 - 3898			
29	**W00INV1906R1**	**10-Jan-00**	**188**	**Reshoot**	**Rejected**	**0 - 0**	**3650 - 817**		**Line rejected d/t vane wire failure**	**38**
30	W00INV2002I1	16-Jan-00	8	Infill	Complete	1001 - 2179	1001 - 2179			
31	**W00INV1918R1**	**25-Jan-00**	**8**	**Reshoot**	**Rejected**	**0 - 0**	**1001 - 3821**		**Line rejected d/t Fishing vessel**	**32**
32	**W00INV1918R2**	**26-Jan-00**	**8**	**Reshoot**	**Rejected**	**0 - 0**	**1001 - 3821**		**Line rejected d/t weather**	**34**
33	W00INV2026I2	28-Jan-00	188	Infill	Complete	1350 - 817	1350 - 817			
34	W00INV1918R3	28-Jan-00	8	Reshoot	Complete	1001 - 3821	1001 - 3821			
35	W00INV2038I1	28-Jan-00	188	Infill	Incomplete	3420 - 3045	3420 - 3045			
35	**W00INV2038I1**	**28-Jan-00**	**188**		**Coverage OK**		**Trace Edit**	**3420 - 3045**	**Cable 5 : CH 1-368 Cable Depth Control**	
36	W00INV1930R1	29-Jan-00	188	Reshoot	Complete	1923 - 1877	1923 - 1877			
37	**W00INV1846I1**	**29-Jan-00**	**8**	**Infill**	**Rejected**	**0 - 0**	**1001 - 3898**		**Line rejected d/t weather**	**57**
38	**W00INV1906R2**	**29-Jan-00**	**188**	**Reshoot**	**Rejected**	**0 - 0**	**3650 - 817**		**Line rejected d/t weather**	**39**
39	**W00INV1906R3**	**29-Jan-00**	**8**	**Reshoot**	**Rejected**	**0 - 0**	**1001 - 3834**		**Line rejected d/t weather**	**40**
40	W00INV1906R4	30-Jan-00	188	Reshoot	Complete	3650 - 817	3650 - 817			
41	W00INV1918I1	31-Jan-00	8	Infill	Complete	1001 - 3821	1001 - 3821			
42	W00INV1894I2	31-Jan-00	188	Infill	Incomplete	3663 - 1839	3663 - 817			
42	**W00INV1894I2**	**31-Jan-00**	**188**		**Reshot**		**Shot Edit**	**1838 - 817**	**Early EOL d/t MIDAS Lock-up**	**43**
43	W00INV1894I3	31-Jan-00	188	Infill Reshoot	Complete	1848 - 817	1848 - 817			
44	W00INV1666P1	01-Feb-00	8	Prime	Incomplete	1001 - 4988	1001 - 4988			
44	**W00INV1666P1**	**01-Feb-00**	**8**		**Coverage OK**		**Trace Edit**	**2912 - 3242**	**Cable 1 : CH 1-368 Cable Depth Control**	
45	W00INV1834P1	01-Feb-00	188	Prime	Complete	4637 - 817	4637 - 817			
46	W00INV1654P1	01-Feb-00	8	Prime	Complete	1001 - 5000	1001 - 5000			
47	W00INV1834I1	02-Feb-00	188	Infill	Complete	4637 - 817	4637 - 817			
48	W00INV1642P1	02-Feb-00	8	Prime	Complete	1001 - 5012	1001 - 5012			
49	W00INV1822P1	03-Feb-00	188	Prime	Incomplete	4649 - 2665	4649 - 817			
49	**W00INV1822P1**	**03-Feb-00**	**188**		**Reshot**		**Shot Edit**	**2664 - 817**	**Early EOL d/t Gun Errors**	**50**
50	W00INV1822P2	03-Feb-00	188	Reshoot	Incomplete	2675 - 817	2675 - 817			
50	**W00INV1822P2**	**03-Feb-00**	**188**				**Shot Edit**	**1344 - 1161**	**CRS/MSX Errors**	**103**
51	W00INV1630P1	03-Feb-00	8	Prime	Complete	1001 - 5024	1001 - 5024			
52	W00INV1810P1	03-Feb-00	188	Prime	Complete	4661 - 817	4661 - 817			

Seq	Linename	Date	Dir	Acquisition	Status	Acquired Good Shots	Required Shotpoints	Missed / Bad Shot Ranges	Comments	Reshot As Seq
53	W00INV1618P1	04-Feb-00	8	Prime	Complete	1001 - 5036	1001 - 5036			
54	W00INV1798P1	04-Feb-00	188	Prime	Incomplete	4673 - 1650	4673 - 817			
54	**W00INV1798P1**	**04-Feb-00**	**188**		**Reshot**		**Shot Edit**	**1649 - 817**	**Early EOL d/t Cable Depth Control**	**60**
55	**W00INV1606P1**	**06-Feb-00**	**8**	**Prime**	**Rejected**	**0 - 0**	**1001 - 5048**		**Line rejected d/t weather**	**58**
56	**W00INV1630I1**	**06-Feb-00**	**8**	**Infill**	**Rejected**	**0 - 0**	**1001 - 5024**		**Line rejected d/t weather**	
57	W00INV1846I2	06-Feb-00	188	Infill	Incomplete	2700 - 817	2700 - 817			
57	**W00INV1846I2**	**06-Feb-00**	**188**		**Coverage OK**		**Trace Edit**	**972 - 928**	**Cable 1 : CH 1-368 Poor Geometry**	
57	**W00INV1846I2**	**06-Feb-00**	**188**		**Coverage OK**		**Trace Edit**	**972 - 928**	**Cable 2 : CH 1-368 Poor Geometry**	
57	**W00INV1846I2**	**06-Feb-00**	**188**		**Coverage OK**		**Trace Edit**	**2080 - 2016**	**Cable 1 : CH 1-368 Poor Geometry**	
57	**W00INV1846I2**	**06-Feb-00**	**188**		**Coverage OK**		**Trace Edit**	**2080 - 2016**	**Cable 2 : CH 1-368 Poor Geometry**	
57	**W00INV1846I2**	**06-Feb-00**	**188**		**Coverage OK**		**Trace Edit**	**2231 - 2191**	**Cable 1 : CH 1-368 Poor Geometry**	
57	**W00INV1846I2**	**06-Feb-00**	**188**		**Coverage OK**		**Trace Edit**	**2231 - 2191**	**Cable 2 : CH 1-368 Poor Geometry**	
57	**W00INV1846I2**	**06-Feb-00**	**188**		**Coverage OK**		**Trace Edit**	**2625 - 2541**	**Cable 1 : CH 1-368 Poor Geometry**	
57	**W00INV1846I2**	**06-Feb-00**	**188**		**Coverage OK**		**Trace Edit**	**2625 - 2541**	**Cable 2 : CH 1-368 Poor Geometry**	
58	**W00INV1606P2**	**07-Feb-00**	**8**		**Rejected**	**0 - 0**	**1001 - 5048**		**Line rejected d/t timebreak problems/poor acoustic data**	**61**
59	W00INV1786P1	07-Feb-00	188	Prime	Incomplete	4685 - 1874	4685 - 817			
59	**W00INV1786P1**	**07-Feb-00**	**188**		**Reshot**		**Shot Edit**	**1873 - 817**	**Early EOL d/t CRS/MSX Errors**	**68**
60	W00INV1798P2	07-Feb-00	188	Reshoot	Complete	1659 - 817	1659 - 817			
61	W00INV1606P3	08-Feb-00	8	Reshoot	Complete	1001 - 5048	1001 - 5048			
62	W00INV1774P1	08-Feb-00	188	Prime	Complete	4697 - 817	4697 - 817			
63	W00INV1594P1	08-Feb-00	8	Prime	Complete	1001 - 5060	1001 - 5060			
64	W00INV1762P1	09-Feb-00	188	Prime	Complete	4709 - 818	4709 - 817			
65	W00INV1594I1	09-Feb-00	8	Infill	Complete	1001 - 5060	1001 - 5060			
66	W00INV1750P1	09-Feb-00	188	Prime	Complete	4721 - 817	4721 - 817			
67	W00INV1582P1	10-Feb-00	8	Prime	Incomplete	1001 - 2500	1001 - 5072			
67	**W00INV1582P1**	**10-Feb-00**	**8**		**Reshot**		**Shot Edit**	**2501 - 5072**	**Early EOL d/t Gun Errors**	**69**
68	W00INV1786P2	10-Feb-00	188	Reshoot	Incomplete	1883 - 1200	1883 - 817			
68	**W00INV1786P2**	**10-Feb-00**	**188**		**Reshot**		**Shot Edit**	**1199 - 817**	**Early EOL d/t Cable Depth Control**	**74**
69	W00INV1582P2	11-Feb-00	8	Reshoot	Complete	2491 - 5072	2491 - 5072			
70	W00INV1750I1	11-Feb-00	188	Infill	Incomplete	4721 - 3250	4721 - 817			
70	**W00INV1750I1**	**11-Feb-00**	**188**		**Reshot**		**Shot Edit**	**3249 - 817**	**Early EOL d/t Cable Depth Control**	**72**
71	W00INV1570P1	16-Feb-00	8	Prime	Incomplete	1850 - 5072	1001 - 5073			
71	**W00INV1570P1**	**16-Feb-00**	**8**		**Reshot**		**Shot Edit**	**1001 - 1849**	**Late SOL d/t Deploying Guns**	**73**
72	W00INV1750I2	16-Feb-00	188	Infill Reshoot	Complete	3259 - 817	3259 - 817			
73	W00INV1570P2	16-Feb-00	8	Reshoot	Complete	1001 - 1859	1001 - 1859			
74	W00INV1786P3	16-Feb-00	188	Reshoot/Infill	Complete	1900 - 817	1900 - 817			

Seq	Linename	Date	Dir	Acquisition	Status	Acquired Good Shots	Required Shotpoints	Missed / Bad Shot Ranges	Comments	Reshot As Seq
75	W00INV1570I1	17-Feb-00	8	Infill	Complete	1001 - 5073	1001 - 5073			
76	W00INV1738P1	17-Feb-00	188	Prime	Complete	4733 - 817	4733 - 817			
77	W00INV1558P1	17-Feb-00	8	Prime	Incomplete	1001 - 2782	1001 - 5073			
77	**W00INV1558P1**	**17-Feb-00**	**8**		**Reshot**		**Shot Edit**	**2783 - 5073**	**Early EOL d/t Gun Errors**	**78**
78	W00INV1558P2	18-Feb-00	8	Reshoot	Complete	2773 - 5073	2773 - 5073			
79	W00INV1726P1	18-Feb-00	188	Prime	Complete	4745 - 817	4745 - 817			
80	W00INV1546P1	18-Feb-00	8	Prime	Complete	1001 - 5073	1001 - 5073			
81	W00INV1714P1	19-Feb-00	188	Prime	Complete	4757 - 817	4757 - 817			
82	W00INV1534P1	19-Feb-00	8	Prime	Complete	1001 - 5073	1001 - 5073			
83	**W00INV1714I1**	**20-Feb-00**	**188**	**Infill**	**Rejected**	**0 - 0**	**4757 - 817**		**Line rejected d/t weather**	**86**
84	**W00INV1534I1**	**27-Feb-00**	**8**	**Infill**	**Rejected**	**0 - 0**	**1001 - 5073**		**Line rejected d/t CRS problems and telemtry errors**	**97**
85	W00INV1522P1	29-Feb-00	8	Prime	Complete	1001 - 5073	1001 - 5073			
86	W00INV1714I2	29-Feb-00	188	Infill	Complete	4757 - 817	4757 - 817			
87	W00INV1510P1	01-Mar-00	8	Prime	Complete	1001 - 5073	1001 - 5073			
88	W00INV1702P1	01-Mar-00	188	Prime	Complete	4768 - 817	4768 - 817			
89	W00INV1678P1	02-Mar-00	8	Prime	Complete	1001 - 4976	1001 - 4976			
90	W00INV1498P1	02-Mar-00	188	Prime	Complete	4889 - 817	4889 - 817			
91	W00INV1690P1	02-Mar-00	8	Prime	Complete	1001 - 4964	1001 - 4964			
92	W00INV1606I1	03-Mar-00	188	Infill	Incomplete	3830 - 817	3830 - 817			
92	**W00INV1606I1**	**03-Mar-00**	**188**		**Coverage OK**		**Trace Edit**	**1883 - 1346**	**Cable 3 : CH 1-368 Cable Depth Control**	
93	**W00INV1702I1**	**03-Mar-00**	**188**	**Infill**	**Rejected**	**0 - 0**	**0 - 0**		**Line rejected d/t weather**	**94**
94	W00INV1702I2	04-Mar-00	188		Complete	4768 - 817	4768 - 817			
95	W00INV1798I1	04-Mar-00	8	Infill	Complete	1001 - 4530	1001 - 4530			
96	**W00INV1846I3**	**05-Mar-00**	**188**	**Infill**	**Rejected**	**0 - 0**	**3714 - 817**		**Line rejected d/t weather**	**103**
97	**W00INV1534I2**	**05-Mar-00**	**8**	**Infill**	**Rejected**	**0 - 0**	**1001 - 5073**		**Line rejected d/t weather**	**98**
98	W00INV1534I3	07-Mar-00	8	Infill	Incomplete	1001 - 2931	1001 - 5073			
98	**W00INV1534I3**	**07-Mar-00**	**8**		**Reshot**		**Shot Edit**	**2932 - 5073**	**Early EOL d/t Gun Errors**	**99**
99	**W00INV1534I4**	**07-Mar-00**	**8**	**Infill**	**Rejected**	**0 - 0**	**1001 - 5073**		**Line rejected d/t weather**	**102**
100	W00INV1690I1	08-Mar-00	188		Complete	4780 - 817	4780 - 817			
100	**W00INV1690I1**	**08-Mar-00**	**188**		**Coverage OK**		**Shot Edit**	**2519 - 1661**	**Coverage not required**	
101	**W00INV1522I1**	**08-Mar-00**	**8**	**Infill**	**Rejected**	**0 - 0**	**1001 - 5073**		**Line rejected d/t weather**	**106**
102	**W00INV1534I5**	**08-Mar-00**	**8**	**Infill**	**Rejected**	**0 - 0**	**2932 - 5073**		**Line rejected d/t weather**	**107**
103	W00INV1846I4	09-Mar-00	188	Infill	Complete	3680 - 1151	3680 - 1151			
103	**W00INV1846I4**	**09-Mar-00**	**188**		**Coverage OK**		**Shot Edit**	**1230 - 1214**	**Gun Errors (Even Shots Only)**	
103	**W00INV1846I4**	**09-Mar-00**	**188**		**Coverage OK**		**Shot Edit**	**1729 - 1355**	**Coverage not required**	
104	W00INV1738I1	09-Mar-00	8	Infill	Incomplete	1001 - 4917	1001 - 4917			

Seq	Linename	Date	Dir	Acquisition	Status	Acquired Good Shots	Required Shotpoints	Missed / Bad Shot Ranges	Comments	Reshot As Seq
104	**W00INV1738I1**	**09-Mar-00**	**8**		**Coverage OK**		**Trace Edit**	**1001 - 4917**	**Cable 4 : CH 1-368 Telemetry Errors (Selected shots)**	
105	W00INV1822I1	10-Mar-00	188	Infill	Incomplete	4600 - 768	4600 - 768		Shot numbering incorrect but coverage location OK	
105	**W00INV1822I1**	**10-Mar-00**	**188**		**Coverage OK**		**Shot Edit**	**2359 - 1701**	**Coverage not required**	
105	**W00INV1822I1**	**10-Mar-00**	**188**		**Coverage OK**		**Shot Edit**	**2438 - 2360**	**Vessel movement too great**	
105	**W00INV1822I1**	**10-Mar-00**	**188**		**Coverage OK**		**Shot Edit**	**3234 - 2621**	**Coverage not required**	
105	**W00INV1822I1**	**10-Mar-00**	**188**		**Coverage OK**		**Trace Edit**	**4600 - 768**	**Cable 4 : CH 1-368 Telemetry Errors (Selected shots)**	
106	W00INV1522I2	10-Mar-00	8		Incomplete	1500 - 5073	1500 - 5073			
106	**W00INV1522I2**	**10-Mar-00**	**8**		**Coverage OK**		**Trace Edit**	**1500 - 5073**	**Cable 4 : CH 1-368 Telemetry Errors (Selected shots)**	
107	W00INV1534I6	10-Mar-00	188	Infill	Incomplete	4889 - 817	4889 - 817			
107	**W00INV1534I6**	**10-Mar-00**	**188**		**Coverage OK**		**Trace Edit**	**4889 - 817**	**Cable 4 : CH 1-368 Telemetry Errors (Selected shots)**	
108	W00INV1642I1	11-Mar-00	8	Infill	Complete	1140 - 4130	1140 - 4130			
108	**W00INV1642I1**	**11-Mar-00**	**8**		**Coverage OK**		**Shot Edit**	**3176 - 3495**	**Coverage not required**	
109	W00INV1570I2	11-Mar-00	188	Infill	Complete	3030 - 817	3030 - 817			
109	**W00INV1570I2**	**11-Mar-00**	**188**		**Coverage OK**		**Shot Edit**	**1565 - 1191**	**Coverage not required**	
110	**W00INV1690I2**	**12-Mar-00**	**8**		**Rejected**	**0 - 0**	**3180 - 4964**		**Line rejected d/t weather**	**111**
111	W00INV1690I3	13-Mar-00	8	Infill	Complete	3180 - 4964	3180 - 4964			
112	W00INV1846I5	13-Mar-00	188	Infill	Complete	3714 - 2300	3714 - 2300			
113	W00INV1330P1	14-Mar-00	8	Prime	Complete	1001 - 5073	1001 - 5073			
114	**W00INV1486P1**	**14-Mar-00**	**188**	**Prime**	**Rejected**	**0 - 0**	**4889 - 817**		**Line rejected d/t weather**	**116**
115	W00INV1318P1	14-Mar-00	8	Prime	Complete	1001 - 5073	1001 - 5073			
116	W00INV1486P2	15-Mar-00	188	Prime	Complete	4889 - 817	4889 - 817			
117	W00INV1306P1	15-Mar-00	8	Prime	Complete	1001 - 5073	1001 - 5073			
118	W00INV1486I1	16-Mar-00	188	Infill	Complete	4889 - 817	4889 - 817			
119	W00INV1294P1	16-Mar-00	8	Prime	Complete	1001 - 5073	1001 - 5073			
120	W00INV1474P1	17-Mar-00	188	Prime	Incomplete	4889 - 817	4889 - 817			
120	**W00INV1474P1**	**17-Mar-00**	**188**		**Coverage OK**		**Trace Edit**	**2480 - 2320**	**Cab 5 : Ch 209-368 Cable tail on surface (replacing bird)**	
121	W00INV1282P1	17-Mar-00	8	Prime	Complete	1001 - 5073	1001 - 5073			
122	W00INV1462P1	17-Mar-00	188	Prime	Complete	4889 - 817	4889 - 817			
123	W00INV1270P1	18-Mar-00	8	Prime	Complete	1001 - 5073	1001 - 5073			
124	W00INV1462I1	18-Mar-00	188	Infill	Complete	4889 - 817	4889 - 817			
125	W00INV1270I1	19-Mar-00	8	Infill	Complete	1001 - 5073	1001 - 5073			
126	W00INV1450P1	19-Mar-00	188	Prime	Complete	4889 - 817	4889 - 817			
127	W00INV1258P1	19-Mar-00	8	Prime	Complete	1001 - 5073	1001 - 5073			
128	**W00INV1438P1**	**20-Mar-00**	**188**	**Prime**	**Rejected**	**4889 - 3656**	**4889 - 817**		**Line rejected d/t weather**	**130**
129	W00INV1246P1	20-Mar-00	8	Prime	Complete	1001 - 5073	1001 - 5073			
130	W00INV1438P2	21-Mar-00	188	Prime	Complete	4889 - 817	4889 - 817			

Seq	Linename	Date	Dir	Acquisition	Status	Acquired Good Shots	Required Shotpoints	Missed / Bad Shot Ranges	Comments	Reshot As Seq
131	W00INV1234P1	21-Mar-00	8	Prime	Incomplete	1001 - 5073	1001 - 5073			
131	**W00INV1234P1**	**21-Mar-00**	**8**		**Coverage OK**		**Trace Edit**	**1407 - 1428**	**Cable 5 : CH 1-368 Cable power tripped out**	
131	**W00INV1234P1**	**21-Mar-00**	**8**		**Coverage OK**		**Trace Edit**	**2664 - 2669**	**Cable 5 : CH 1-368 Cable power tripped out**	
131	**W00INV1234P1**	**21-Mar-00**	**8**		**Coverage OK**		**Trace Edit**	**2704 - 2708**	**Cable 5 : CH 1-368 Cable power tripped out**	
131	**W00INV1234P1**	**21-Mar-00**	**8**		**Coverage OK**		**Trace Edit**	**2734 - 2736**	**Cable 5 : CH 1-368 Cable power tripped out**	
131	**W00INV1234P1**	**21-Mar-00**	**8**		**Coverage OK**		**Trace Edit**	**2783 - 2784**	**Cable 5 : CH 1-368 Cable power tripped out**	
132	W00INV1426P1	22-Mar-00	188	Prime	Complete	4889 - 817	4889 - 817			
133	W00INV1222P1	23-Mar-00	8	Prime	Complete	1001 - 5073	1001 - 5073			
134	W00INV1414P1	24-Mar-00	188	Prime	Complete	4889 - 817	4889 - 817			
135	W00INV1210P1	24-Mar-00	8	Prime	Complete	1001 - 5073	1001 - 5073			
136	W00INV1414I1	25-Mar-00	188	Infill	Complete	4889 - 817	4889 - 817			
137	W00INV1198P1	25-Mar-00	8	Prime	Complete	1001 - 5073	1001 - 5073			
138	W00INV1402P1	25-Mar-00	188	Prime	Complete	4889 - 817	4889 - 817			
139	W00INV1198I1	26-Mar-00	8	Infill	Complete	1001 - 5073	1001 - 5073			
140	W00INV1390P1	26-Mar-00	188	Prime	Complete	4889 - 817	4889 - 817			
141	W00INV1186P1	27-Mar-00	8	Prime	Complete	1001 - 5073	1001 - 5073			
142	W00INV1342P1	31-Mar-00	8	Prime	Complete	1001 - 5073	1001 - 5073			
143	W00INV1378P1	01-Apr-00	188	Prime	Complete	4889 - 817	4889 - 817			
144	W00INV1354P1	01-Apr-00	8	Prime	Complete	1001 - 5073	1001 - 5073			
145	W00INV1366P1	01-Apr-00	188	Prime	Complete	4889 - 817	4889 - 817			
146	W00INV1366I1	02-Apr-00	8	Infill	Complete	1001 - 5073	1001 - 5073			
147	W00INV1342I1	02-Apr-00	188	Infill	Complete	4889 - 1770	4889 - 1770			

15.2 INVESTIGATOR 2D LINES SEQ 148-152

Seq	Linename	Date	Dir	Acquisition	Status	Acquired Good Shots	Required Shotpoints	Missed / Bad Shot Ranges	Comments
148	**W00INV0006P1**	**03-Apr-00**	**112**	**Prime 2D**	**Rejected**	**0 - 0**	**1001 - 2478**		**Line Rejected Due To Incorrect Record Length**
149	W00INV0004P1	04-Apr-00	010	Prime 2D	Complete	1001 - 2508	1001 - 2508		
150	W00INV0007P1	04-Apr-00	188	Prime 2D	Complete	1801 - 909	1801 - 909		
151	W00INV0006P2	04-Apr-00	291	Prime 2D	Incomplete	2386 - 1114	2386 - 1114		
151	**W00INV0006P2**	**04-Apr-00**	**291**				**Shot Edit**	**1113 - 914**	**Early EOL d/t fishing gear**
152	W00INV0005P1	04-Apr-00	142	Prime 2D	Incomplete	2415 - 1820	2415 - 1820		
152	**W00INV0005P1**	**04-Apr-00**	**142**				**Shot Edit**	**1819 - 1775**	**Early EOL d/t weather**

16 APPENDIX 3 - SENSOR OFFSETS

16.1 P2/94 Node Naming Conventions

Each sensor is referenced to a platform. The following Alpha numeric codes are used to refer to the platform :

Vessel	V#	# is an identifying number
Gun Array	G##	## is an identifying number incrementing from stbd to port
Streamer	S##	## is an identifying number incrementing from stbd to port
Tailbuoy	T##	## is an identifying number incrementing from stbd to port

The sensors are identified by the platform, then by the system type, and finally by an identifying number :

Acoustic	T##	## is an identifying number incrementing from front to back
dGPS	G#	# is an identifying number incrementing from front to back
Echosounder	E#	# is an identifying number incrementing from front to back
Gun String	S#	# is an identifying number incrementing from front to back
Gyro	GY#	# is an identifying number incrementing from front to back
Laser	L#	# is an identifying number incrementing from front to back
Pitch/Roll	PR#	# is an identifying number incrementing from front to back
rGPS	R##	## is an id number incrementing from front to back
Water Speed	WS#	# is an identifying number incrementing from front to back
Velocimeter	V#	# is an identifying number incrementing from front to back
User Defined	UD##	## is an id number incrementing from front to back

For example T04R01 refers to the rGPS sensor on tailbuoy 4

Exceptions are the compass and depth sensors on the streamers. These are referenced by the following convention

VC## where V is the vessel number, C by the streamer number, and ## by an identifying number incrementing from front to back

For example 1608 refers to the 8th compass/depth sensor on vessel 1, cable 6

16.2 Vessel And Antennae Offsets

	Fore (+)	Stbd (+)	Height (+)
Navigation Reference Point (NRP V1)	0.00	0.00	0.00
[Primary GPS Antenna at sea level]			
Primary GPS Antenna (V1G1-3)	0.00	0.00	20.29
rGPS Antenna (P2/94 offset, V1R01)	0.00	0.00	0.00* (20.29)
Fanbeam Laser Head (V1L1)	0.00	0.00	18.73
Fathometer	10.71	1.59	-5.94
DigiCOURSE Hull Transducer (V1T01)	-1.51	0.34	-5.60
Gyrocompass 1 (V1GY1)	-3.30	-1.80	-1.80
Gyrocompass 2 (V1GY2)	-3.30	0.60	-1.80

NB : All offsets are in metres and are referenced to the NRP

*Posnet antenna heights are all set to MSL in Spectra as the ranges are slant corrected within the Posnet system

16.3 Tailbuoy (Posnet rGPS and Acoustic Unit) Offsets

		TRP Dist from CRP		Tailbuoy Sensor Offsets from TRP			
Cable	TB ID	Fore (+)	Height (+)	Acoustic ID	Height (+)	rGPS ID	Height (+)
S01	T01	-4732.85	6.00	S01T08	-1.50	T01R01	0.00* (1.80)
S02	T02	-4732.85	6.00	S02T08	-1.50	T02R01	0.00* (1.80)
S03	T03	-4732.85	6.00	S03T08	-1.50	T03R01	0.00* (1.80)
S04	T04	-4732.85	6.00	S04T08	-1.50	T04R01	0.00* (1.80)
S05	T05	-4732.85	6.00	S05T08	-1.50	T05R01	0.00* (1.80)
S06	T06	-4732.85	6.00	S06T08	-1.50	T06R01	0.00* (1.80)

NB : All other offsets not given above are zero.

16.4 Source Sensor (Posnet rGPS, Fanbeam and Acoustic Unit) Offsets

SOURCE #1 (STBD)				
Stbd (Outer) String				
	ID #	**Fore (+)**	**Stbd (+)**	**Up (+)**
Acoustic	G01T01	0.00	6.00	-3.00
rGPS	G01R01	0.00	6.00	5.00* (6.0)
Fanbeam	N/A			
Fore D.I.	101	6.60	6.00	1.00
Mid D.I.	105	-1.00	6.00	1.00
Aft D.I.	108	-8.50	6.00	1.00
Centre String				
	ID #	**Fore (+)**	**Stbd (+)**	**Up (+)**
Acoustic	N/A			
rGPS	G01R02	0.00	0.00	5.00* (6.0)
Fanbeam	G01L01	0.00	0.00	5.50
Fore D.I.	201	6.60	0.00	1.00
Mid D.I.	205	-1.00	0.00	1.00
Aft D.I.	208	-8.50	0.00	1.00
Port (Inner) String				
	ID #	**Fore (+)**	**Stbd (+)**	**Up (+)**
Acoustic	G01T02	0.00	-6.00	-3.00
rGPS	G01R03	0.00	-6.00	5.00* (6.0)
Fanbeam	N/A			
Fore D.I.	301	6.60	-6.00	1.00
Mid D.I.	305	-1.00	-6.00	1.00
Aft D.I.	308	-8.50	-6.00	1.00

SOURCE #2 (PORT)				
Stbd (Inner) String				
	ID #	**Fore (+)**	**Stbd (+)**	**Up (+)**
Acoustic	G02T01	0.00	6.00	-3.00
rGPS	G02R01	0.00	6.00	5.00* (6.0)
Fanbeam	N/A			
Fore D.I.	601	6.60	6.00	1.00
Mid D.I.	605	-1.00	6.00	1.00
Aft D.I.	608	-8.50	6.00	1.00
Centre String				
	ID #	**Fore (+)**	**Stbd (+)**	**Up (+)**
Acoustic	N/A			
rGPS	G02R02	0.00	0.00	5.00* (6.0)
Fanbeam	G02L01	0.00	0.00	5.50
Fore D.I.	701	6.60	0.00	1.00
Mid D.I.	705	-1.00	0.00	1.00
Aft D.I.	708	-8.50	0.00	1.00
Port (Outer) String				
	ID #	**Fore (+)**	**Stbd (+)**	**Up (+)**
Acoustic	G02T02	0.00	-6.00	-3.00
rGPS	G02R03	0.00	-6.00	5.00* (6.0)
Fanbeam	N/A			
Fore D.I.	801	6.60	-6.00	1.00
Mid D.I.	805	-1.00	-6.00	1.00
Aft D.I.	808	-8.50	-6.00	1.00

NB. Source offsets are in metres and are relative to the geometric centre of source (COS)

*Posnet antenna heights are all set to MSL in Spectra as the ranges are slant corrected within the Posnet system

16.5 Streamer Sensor (Bird/Compass and Acoustic Unit) Offsets

16.5.1 Streamer Acoustic Sensors

CABLE #1		CABLE #2		CABLE #3	
ID #	**Fore (+)**	**ID #**	**Fore (+)**	**ID #**	**Fore (+)**
S01T01	-62.67	**S02T01**	-62.67	**S03T01**	-62.67
S01T02	-261.87	**S02T02**	-261.87	**S03T02**	-261.87
S01T03	-461.07	**S02T03**	-461.07	**S03T03**	-461.07
S01T04	-2154.27	**S02T04**	-2154.27	**S03T04**	-2154.27
S01T05	-2253.87	**S02T05**	-2253.87	**S03T05**	-2253.87
S01T06	-4445.07	**S02T06**	-4445.07	**S03T06**	-4445.07
S01T07	-4579.95	**S02T07**	-4579.95	**S03T07**	-4579.95

CABLE #4		CABLE #5		CABLE #6	
ID #	Fore (+)	ID #	Fore (+)	ID #	Fore (+)
S04T01	-62.67	S05T01	-62.67	S06T01	-62.67
S04T02	-261.87	S05T02	-261.87	S06T02	-261.87
S04T03	-461.07	S05T03	-461.07	S06T03	-461.07
S04T04	-2154.27	S05T04	-2154.27	S06T04	-2154.27
S04T05	-2253.87	S05T05	-2253.87	S06T05	-2253.87
S04T06	-4445.07	S05T06	-4445.07	S06T06	-4445.07
S04T07	-4579.95	S05T07	-4579.95	S06T07	-4579.95

16.5.2 Streamer Co-located Compass/Depth Sensors

CABLE #1		CABLE #2		CABLE #3	
ID #	Fore (+)	ID #	Fore (+)	ID #	Fore (+)
1101	+15.65	1201	+15.65	1301	+15.65
1102	-162.27	1202	-162.27	1302	-162.27
1103	-361.47	1203	-361.47	1303	-361.47
1104	-560.67	1204	-560.67	1304	-560.67
1105	-859.47	1205	-859.47	1305	-859.47
1106	-1158.27	1206	-1158.27	1306	-1158.27
1107	-1457.07	1207	-1457.07	1307	-1457.07
1108	-1755.87	1208	-1755.87	1308	-1755.87
1109	-2054.67	1209	-2054.67	1309	-2054.67
1110	-2353.47	1210	-2353.47	1310	-2353.47
1111	-2652.27	1212	-2652.27	1313	-2652.27
1112	-2951.07	1212	-2951.07	1312	-2951.07
1113	-3249.87	1213	-3249.87	1313	-3249.87
1114	-3548.67	1214	-3548.67	1314	-3548.67
1115	-3847.47	1215	-3847.47	1315	-3847.47
1116	-4146.27	1216	-4146.27	1316	-4146.27
1117	-4345.47	1217	-4345.47	1317	-4345.47
1118	-4544.67	1218	-4544.67	1318	-4544.67

CABLE #4		CABLE #5		CABLE #6	
ID #	Fore (+)	ID #	Fore (+)	ID #	Fore (+)
1401	+15.65	1501	+15.65	1601	+15.65
1402	-162.27	1502	-162.27	1602	-162.27
1403	-361.47	1503	-361.47	1603	-361.47
1404	-560.67	1504	-560.67	1604	-560.67
1405	-859.47	1505	-859.47	1605	-859.47
1406	-1158.27	1506	-1158.27	1606	-1158.27
1407	-1457.07	1507	-1457.07	1607	-1457.07
1408	-1755.87	1508	-1755.87	1608	-1755.87
1409	-2054.67	1509	-2054.67	1609	-2054.67
1410	-2353.47	1510	-2353.47	1610	-2353.47
1414	-2652.27	1515	-2652.27	1616	-2652.27
1412	-2951.07	1512	-2951.07	1612	-2951.07
1413	-3249.87	1513	-3249.87	1613	-3249.87
1414	-3548.67	1514	-3548.67	1614	-3548.67
1415	-3847.47	1515	-3847.47	1615	-3847.47
1416	-4146.27	1516	-4146.27	1616	-4146.27
1417	-4345.47	1517	-4345.47	1617	-4345.47

CABLE #4		CABLE #5		CABLE #6	
ID #	**Fore (+)**	**ID #**	**Fore (+)**	**ID #**	**Fore (+)**
1418	-4544.67	**1518**	-4544.67	**1618**	-4544.67

NB : All offsets are in metres and are relative to the Cable Reference Point (CRP) which is the centre of the first group.
Inline (fore is +ve) offsets only are given as all other offsets are zero.

17 DAILY LOG

Please note that all times are approximate and are for operational information. They are not necessarily the final times used for charging. The start and end of line times given refer to the first and last good shot whenever applicable.

17.1 INVESTIGATOR 3D LINES SEQ 001-147

06-December-99 to 07-December-99
In transit

08-December-99
07:00 Anchor off Freemantle for refuelling and resupply
17:30 Anchor raised, continue transit

09-December-99 to 12-December-99
In transit

13-December-99
21:00 Begin deploying cables

14-December-99
Deploying cables
Partial crew change by helicopter

15-December-99
Deploying cables
Complete remaining crew change by helicopter

16-December-99
Deploying cables
Weather increasing to 30-40 kts, 3-4 m seas. Unable to continue deploying. Down for weather
22:45 Tag line between streamers 7 and 8 parted, but unable to retrieve d/t sea state

17-December-99
Down for weather
17:09 Tag line between streamers 1 and 2 parted, but unable to retrieve d/t sea state

18-December-99
Weather moderating
Inner cables recovered and untangled
Deploying cables

19-December-99
Deploying cables
20:30 Techno float on cable 6 tangled on leadin due to heavy swell
22:05 Techno float untangled
22:30 Techno float tangled again
23:30 Techno float untangled

20-December-99
Deploying cables
00:50 Unable to deploy cable 5 as swell is pushing tailbuoy over cable 6. Deploying cable 4 after course adjustment
08:45 Tagline between cables 3 and 4 tangles on Techno float. Cable heads retreived to untangle line.
13:05 Bunkering at sea commences
20:00 Bunkering at sea completed
22:30 All cables deployed. Begin deploying guns

21-December-99
Deploying guns and running CRS test lines
17:00 All guns deployed. Adjusting towing configuration
21:20 Retreiving guns to adjust offsets

22-December-99

Time	Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #

Adjusting towing configuration
04:50 Power failure due to fire in auxilliary generator. Fire extinguished. Propulsion and steering maintained throughout
05:25 Clean power restored
06:15 Recording room instrumentation powered up.

10:01 CMV launched to add birds to outer cables
10:45 CMV operation aborted due to swell

11:57 SOL W00INV2048P1
Line aborted and sequence stratched due to CRS multishot configuration problems. No seismic data recorded.
13:33 EOL W00INV2048P1

Investigator 3D acquisition commences

16:11	SOL	W00INV1840P1	188**0**	6.5 Stbd (West)		9.3 µBar	SE 18 kts	3.0 m	001	
		Line rejected d/t separations. Reshot as Seq# 28*								
17:26	EOL	W00INV1840P1	188	930	**0**	0.7 Stbd (West)	N/A	SE 20 kts	3.0 m	001
22:55	SOL	W00INV2048P1	8	903	**1001**	6.5 Port (West)	6.3 µBar	SE 20 kts	2.5 m	002
		SP 3396-3683: Early EOL d/t Gun Errors. Reshot as Seq# 22								

23-December-99

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
03:16	EOL	W00INV2048P1	8	3516	**3395**	9.3 Port (West)	5.0 µBar	SE 20 kts	2.5 m	002
03:45		Loss of optic data to cable 1 following apparent in water collision								
08:56	SOL	W00INV1936P1	188	3714	**3617**	2.0 Port (East)	8.0 µBar	SSE 20 kts	3.0 m	003
		SP 1913-1887: MSX Lock-up. Reshot as Seq# 36								
		SP 2892-2876: Gun Errors (Even Shots Only). No reshoot required								
		SP 3617-817: Cable 1 : CH 1-368 No Data Telemetry. No reshoot required								
13:54	EOL	W00INV1936P1	188	807	**817**	9.0 Stbd (West)	4.5 µBar	SSE 25 kts	3.0 m	003
		Record length changed from 5.0 seconds to 4.5 seconds								
19:26	SOL	W00INV1952P1	8	903	**1001**	3.5 Stbd (East)	3.7 µBar	SSE 15 kts	2.5 m	004
		SP 1001-3784: Cable 1 : CH 1-368 No Data Telemetry. No reshoot required								

24-December-99

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
00:18	EOL	W00INV1952P1	8	3794	**3784**	4.7 Port (West)	4.4 µBar	SSE 15 kts	2.5 m	004
04:33	SOL	W00INV2032P1	188	3612	**3515**	12.5 Stbd (West	7.1 µBar	SSE 24 kts	2.5 m	005
		SP 3515-817: Cable 1 : CH 1-368 No Data Telemetry. No reshoot required								
08:59	EOL	W00INV2032P1	188	807	**817**	2.0 Port (East)	9.5 µBar	SSE 14 ts	2.0 m	005
13:06	SOL	W00INV2016P1	8**0**	3.8 Port (West)		7.3 µBar	SE 15 kts	2.0 m	006	
		Line rejected d/t acoustics/weather. Reshot as Seq# 9*								
17:58	EOL	W00INV2016P1	8**0**	5.8 Port (West)		10.1 µBar	W 30 kts	3.0-3.5 m	006	
23:51	SOL	W00INV1968P1	188**0**	8.5 Stbd (West)		13.8 µBar	E 30 kts	3.0 m	007	
		Line rejected d/t acoustics/weather. Reshot as Seq# 10*								

25-December-99

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
04:31	EOL	W00INV1968P1	188**0**	10.5 Stbd (West)		6.0 µBar	SE 27 kts	3.0 m	007	
10:53	SOL	W00INV1888P1	8**0**	7.0 Stbd (East)		6.7 µBar	ESE 27kts	3.0 m	008	
		Line rejected d/t acoustics/weather. Reshot as Seq# 14*								
15:56	EOL	W00INV1888P1	8**0**	8.2 Port (West)		4.7 µBar	ENE 35 kts	3.0 m	008	

Down for weather. Retrieving guns
19:00 All guns onboard
Retrieving cables 4 and 5 in order to reduce the number of deployed cables from 8 to 6
22:00 Centre tag tangles with cable 5 due to rough seas. Loss of bird line on cable 5

26-December-99
00:00 Replacing damaged section from cable 5
01:30 Retrieving cables 4 and 5
04:40 Cables 4 and 5 onboard. Retrieving head of cable 1
09:15 Replacing cable 1 lead-in. Damaged sheathing and armour coinciding with optical break approx. 150 m from tail.
17:45 Replacement lead-in failing at head termination. Changing out lead-in again.
19:30 Lead-in tests good. Cable 1 being retrieved to fix failed rGPS on tailbuoy.

27-December-99
Deploying cable 1 and tagging starboard side
Unable to turn back to prospect due to rough sea conditions. Waiting for weather to improve.

28-December-99

Tagging port side until rough weather prevents further work

29-December-99

Waiting for weather to improve

30-December-99

02:25 Weather lessening. Retrieving cable 8
05:23 Port vane wire parts. Retrieving all gear.
13:30 Spotter plane searching for lost vane
20:50 Unable to contiue retrieving cables due to rough weather conditions
21:00 Spotter plane leaves area without locating lost vane

31-December-99

Still unable to contiue retrieving cables due to rough weather conditions
06:25 Smit Lloyd (chase boat) commences search pattern for lost vane
09:30 Spotter plane searching for lost vane
10:45 Smit Lloyd (chase boat) locates vane
Waiting for weather to improve

01-January-00

01:30 Weather lessening. Retrieving cables
04:05 Cables all onboard
12:27 Vane back onboard after retreival operation by CMV
13:05 Deploying cables

02-January-00

Deploying cables
09:56 Bunkering at sea commences
19:26 Bunkering at sea completed

03-January-00

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
	Deploying cables and guns									
05:00	All gear deployed, adjusting offsets									
09:29	SOL	W00INV2026P1	8**0**	1.0 Port (East)		N/A	SW 15 kts	1.0 m	009	
	Line rejected d/t low source volume. Reshot as Seq# 11									
12:01	EOL	W00INV2026P1	8**0**	6.0 Port (East)		N/A	SW 15 kts	1.5 m	009	
13:18	Clean power failure following generator tripping out									
15:01	Power restored and recording room instrumentation back online									
17:02	SOL	W00INV1954P1	188	3696	**3599**	6.0 Port (East)	4.3 µBar	SW 10 kts	2.5 m	010
21:44	EOL	W00INV1954P1	188	807	**817**	6.2 Stbd (West)	3.3 µBar	SW 15 kts	3.0 m	010

04-January-00

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
00:40	SOL	W00INV2026P2	8	904	**1001**	6.0 Port (West)	3.6 µBar	SW 10 kts	2.5 m	011
05:05	EOL	W00INV2026P2	8	3716	**3706**	6.2 Stbd (East)	7.1 µBar	SW 15 kts	3.0 m	011

08:15W00INV2014P1
Line aborted and sequence stratched. No seismic data recorded.
Guns retrieved. Waiting for weather to improve

05-January-00

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
	Waiting for weather to improve									
16:10	Deploying guns									
21:17	SOL	W00INV1918P1	8	904	**0**	2.8 Stbd (East)	14.5 µBar	SW 25 kts	2.5 m	012
	Line rejected d/t weather noise. Reshot as Seq# 31									

06-January-00

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
01:58	EOL	W00INV1918P1	8	3831	**0**	1.7 Stbd (East)	16.6 µBar	S 24 kts	3.0 m	012
05:56	SOL	W00INV1906P1	188	3748	**0**	3.9 Port (East)	12.7 µBar	SSE 15-20 kts	2-2.5 m	013
	Line rejected d/t weather noise. Reshot as Seq# 29									
10:37	EOL	W00INV1906P1	188	807	**0**	2.1 Port (East)	7.9 µBar	SSE 20 kts	2.0 m	013
14:03	SOL	W00INV1894P1	8	904	**1001**	3.9 Port (West)	12.7 µBar	SSE 15-20 kts	2-2.5 m	014
18:45	EOL	W00INV1894P1	8	3858	**3848**	2.1 Port (West)	7.9 µBar	SSE 20 kts	2.0 m	014

17:24	Recording room powered down prior to generator change over.									
23:19	SOL	W00INV2014P1	188	3634	**3536**	3.8 Stbd (West)	8.9 µBar	S 20 kts	2.5 m	015

07-January-00

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
03:50	EOL	W00INV2014P1	188	807	**817**	9.0 Stbd (West)	7.4 µBar	S 20 kts	2.5 m	015
07:14	SOL	W00INV1966P1	8	904	**1001**	1.0 Stbd (East)	6.5 µBar	SSE 15 kts	2.0 m	016
11:51	EOL	W00INV1966P1	8	3780	**3770**	2.0 Port (West)	6.8 µBar	SSE 15 kts	2.0 m	016
14:35	SOL	W00INV1894I1	188	3760	**3663**	8.0 Stbd (West)	7.3 µBar	SSE 18 kts	2-2.5 m	017
19:23	EOL	W00INV1894I1	188	807	**817**	1.5 Stbd (West)	9.6 µBar	SSE 13 kts	3.0 m	017
22:02	SOL	W00INV2002P1	8	903	**1001**	0.8 Port (West)	9.9 µBar	SE 12 kts	3.5 m	018

08-January-00

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
02:42	EOL	W00INV2002P1	8	3742	**3732**	7.3 Port (West)	8.4 µBar	NE 20 kts	2.5 m	018
05:32	SOL	W00INV1882P1	188	3773	**3675**	6.8 Stbd (West)	10.4 µBar	ESE 15 kts	3.5 m	019
10:17	EOL	W00INV1882P1	188	807	**818**	2.6 Port (East)	7.2 µBar	E 20 kts	3.0 m	019
	Guns retreived to repair rGPS on string 1									
17:33	SOL	W00INV1870P1	8	904	**1001**	6.8 Port (West)	10.4 µBar	E 22 kts	3.0 m	020
22:17	EOL	W00INV1870P1	8	3882	**3872**	2.6 Stbd (East)	7.2 µBar	E 25 kts	3.0 m	020

09-January-00

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
01:27	SOL	W00INV1990P1	188	3658	**3561**	3.7 Stbd (West)	5.8 µBar	E 15 kts	E 2.0 m	021
	SP 2039-817: Early EOL d/t Fishing vessel in path. Reshot as Seq# 27									
03:57	EOL	W00INV1990P1	188	2028	**2040**	5.0 Stbd (West)	3.8 µBar	E 15 kts	2.5 m	021
07:55	SOL	W00INV2048R1	8	3288	**3386**	1.8 Port (West)	4.8 µBar	ENE 22 kts	3.5 m	022
08:24	EOL	W00INV2048R1	8	3693	**3683**	0.3 Port (West)	3.6 µBar	ENE 22 kts	3.5 m	022
12:28	SOL	W00INV1870I1	188	3785	**3688**	1.0 Stbd (West)	3.4 µBar	SE 15 kts	1.5 m	023
17:15	EOL	W00INV1870I1	188	809	**817**	0.4 Stbd (West)	2.1 µBar	Light air	1.5 m	023
21:10	SOL	W00INV1942I1	8	1028	**1125**	7.9 Stbd (East)	2.4 µBar	Calm	1.5 m	024
	SP 2541-3119: Coverage not required. No reshoot required									

10-January-00

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
01:36	EOL	W00INV1942I1	8	3806	**3796**	1.7 Port (West)	2.0 µBar	Calm	1.5 m	024
04:22	SOL	W00INV1858P1	188	3799	**3701**	6.8 Stbd (West)	3.1 µBar	Calm	Calm	025
09:06	EOL	W00INV1858P1	188	807	**817**	0.7 Port (East)	1.9 µBar	Calm	Calm	025
	Resupply at sea									
16:24	SOL	W00INV1978P1	8	904	**1001**	3.6 Port (West)	2.5 µBar	Light airs	1.0 m	026
20:59	EOL	W00INV1978P1	8	3767	**3757**	0.6 Stbd (East)	2.3 µBar	SE 12 kts	1.5 m	026

11-January-00

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
00:14	SOL	W00INV1978I1	188	3671	**3573**	1.0 Stbd (West)	2.6 µBar	SE 10 kts	0.5 m	027
04:47	EOL	W00INV1978I1	188	807	**817**	5.0 Stbd (West)	1.6 µBar	SE 6 kts	0.3 m	027
08:53	SOL	W00INV1846P1	8	903	**1001**	2.0 Stbd (East)	2.7 µBar	SE 15 kts	1.5 m	028
13:35	EOL	W00INV1846P1	8	3908	**3898**	3.6 Stbd (East)	2.0 µBar	ENE 16kts	1.0 m	028
16:32	SOL	W00INV1906R1	188**0**	10.5 Port (East)		4.0 µBar	SE 18 kts	2.0 m	029	
	Line rejected d/t vane wire failure. Reshot as Seq# 38									
	Port vane wire parted									
16:33	EOL	W00INV1906R1	188**0**	11.5 Port (East)		N/A	SE 18 kts	2.0 m	029	
16:50	Retreiving guns									
18:53	All guns onboard. Retrieving cables									

12-January-00

00:30	Tailbuoys 2 and 6 tangle
12:45	Cable 2 onboard with tailbuoy 6 still attached. Untangling buoys

13:40 Tailbuoy 6 released
15:30 Tailbuoy 6 towing correctly. Retrieving cables.

13-January-00
11:49 All gear onboard. Heading for lost vane.
16:10 CMV unable to grapple vane due to heavy seas. Waiting for the weather to improve.

14-January-00
Waiting for weather to improve
18:45 Port vane retrieved following recovery operation by CMV. 400 metres of trailing wire cut and let go overboard.
22:50 Deploying cables

length of vane warp increased to further isolate cables from vanes.

15-January-00
Deploying cables. Lead-in on cable 6 replaced (optics failed when vane parted)

16-January-00
Deploying cables

17-January-00

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
	Deploying cables									
06:15	Cables all deployed, deploying guns									
10:06	All gear deployed									
11:02	SOL	W00INV2002I1	8	904	**1001**	0.6 Port (West)	5.2 µBar	SE 15 kts	1.5 m	030
12:59	EOL	W00INV2002I1	8	2182	**2179**	4.1 Stbd (East)	9.6 µBar	SSE 5-10 kts	1.5 m	030

13:05 Retrieving gear prior to heading to port

18-January-00
06:00 All gear retrieved. Raising hull transducer.
09:00 Hull transducer raised. Heading for Portland, Victoria.
13:56 Pilot onboard
14:30 Alongside Portland
Crew Change

19-January-00 to 21-January-00
Alongside Portland. Sailing delayed due to poor weather on prospect.

22-January-00
05:40 Pilot onboard
06:18 Depart Portland
14:45 Weather still too poor to head straight to prospect, heading fair seas instead and waiting for weather to improve.

23-January-00
16:30 Deploying cables

24-January-00
Deploying cables

25-January-00
Deploying cables
08:30 All cables out waiting for weather to improve before deploying guns.
10:30 Cable 3 fails. Picking up cable 3
21:00 Cable 3 fixed and being redeployed.

26-January-00

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
02:25	Deploying guns									
04:30	Guns deployed. Heading for line									
05:30	Fishing vessel in path. Moving offline to avoid									
06:45	Cleared fishing boat and heading back for line									
07:36	SOL	W00INV1918R1	8	902	**0**	10.4 Port (West)	N/A	E 35 kts	4.0 m	031
	Line rejected d/t Fishing vessel. Reshot as Seq# 32									
07:47	EOL	W00INV1918R1	8	1113	**0**	N/A	N/A	E 35 kts	4.0 m	031
14:25	SOL	W00INV1918R2	8	903	**0**	2.8 Port (West)	7.8 µBar	NE 20 kts	3.0 m	032
	Line rejected d/t weather. Reshot as Seq# 34									
14:53	EOL	W00INV1918R2	8	1283	**0**	4.1 Port (West)	N/A	NE 20 kts	3.0 m	032

Waiting for weather to improve, running CRS test line.
22:30 Cable 6 lost al data

27-January-00
01:25 All guns onboard
02:00 Cable 6 slipring bypassed and data good
21:00 Weather moderating. Retrieving cable 2 to fix bird-line leakage

28-January-00

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
05:00	Cable 2 repaired and redeployed									
09:30	CMV lauched to check cable 3 for fishing gear following failure of channels									
10:50	Retrieving cable 3 and reattaching loose bird.									
15:45	All cables deployed. Deploying guns									
17:20	All guns deployed.									
21:45	SOL	W00INV2026I2	188	1371	**1350**	10.0 Stbd (West)	3.4 µBar	SSW 10 kts	1.5 m	033
22:39	EOL	W00INV2026I2	188	807	**817**	3.0 Stbd (West)	N/A	SSW 5 kts	2.0 m	033

29-January-00

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
01:47	SOL	W00INV1918R3	8	904	**1001**	2.6 Stbd (East)	4.4 µBar	SSE 10kts	2.5 m	034
06:22	EOL	W00INV1918R3	8	3831	**3821**	1.9 Port (West)	4.7 µBar	SSE 15kts	1.5 m	034
10:20	SOL	W00INV2038I1	188	3517	**3420**	8.2 Stbd (West)	8.9 µBar	SSW 20kts	2.0 m	035
	SP 3420-3045: Cable 5 : CH 1-368 Cable Depth Control. No reshoot required									
10:58	EOL	W00INV2038I1	188	2951	**3045**	0.0 Stbd (West)	N/A	SSW 20kts	2.0 m	035
12:57	SOL	W00INV1930R1	188	2021	**1923**	0.6 Port (East)	10.0 µBar	SW 20 kts	3.0 m	036
13:01	EOL	W00INV1930R1	188	1867	**1877**	3.0 Stbd (West)	12.0 µBar	SW 20 kts	3.0 m	036
16:25	SOL	W00INV1846I1	8	1602	**0**	7.8 Stbd (East)	8.2 µBar	SW 20 kts	2-2.5 m	037
	Line rejected d/t weather. Reshot as Seq# 57									
17:33	EOL	W00INV1846I1	8	2351	**0**	1.5 Stbd (East)	8.3 µBar	SW 20 kts	3.0 m	037
23:24	SOL	W00INV1906R2	188	3747	**0**	6.6 Stbd (West)	13.4 µBar	SSW 15kts	4.0 m	038
	Line rejected d/t weather. Reshot as Seq# 39									

30-January-00

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
00:45	EOL	W00INV1906R2	188	2607	**0**	1.3 Port (East)	N/A	SSW 15kts	4.0 m	038
07:57	SOL	W00INV1906R3	8**0**	N/A	12.7 µBar	SW 10 kts	3.0 m	039		
	Line rejected d/t weather. Reshot as Seq# 40									
08:17	EOL	W00INV1906R3	8**0**	N/A	N/A	SW 10 kts	3.0 m	039		
08:20	Retrieving guns									
10:05	Guns onboard. Waiting for the weather to improve.									

31-January-00

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
00:00	Deploying guns									
01:40	Guns deployed									
06:06	SOL	W00INV1906R4	188	3748	**3650**	1.3 Port (East)	8.1 µBar	SW 10kts	4.0 m	040
10:46	EOL	W00INV1906R4	188	807	**817**	6.2 Stbd (West)	6.6 µBar	SW 2 kts	3.0 m	040
17:27	SOL	W00INV1918I1	8	803	**1001**	5.1 Stbd (East)	6.5 µBar	SW 5 kts	3.0 m	041
18:42	EOL	W00INV1918I1	8	3831	**3821**	2.0 Stbd (East)	3.3 µBar	SW 15 kts	3.0 m	041
23:26	SOL	W00INV1894I2	188	3861	**3663**	9.1 Stbd (West)	3.6 µBar	SW 15 kts	2.0 m	042
	SP 1838-817: Early EOL d/t MIDAS Lock-up. Reshot as Seq# 43									

01-February-00

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
02:24	EOL	W00INV1894I2	188	1804	**1839**	0.5 Stbd (West)	N/A	SW 20 kts	3.0 m	042
08:59	SOL	W00INV1894I3	188	1946	**1848**	5.0 Stbd (West)	2.6 µBar	E 20kts	2.0 m	043
10:38	EOL	W00INV1894I3	188	807	**817**	2.5 Stbd (West)	N/A	E 25kts	2.0 m	043
13:32	SOL	W00INV1666P1	8	903	**1001**	1.0 Stbd (East)	5.8 µBar	East 25 kts	3.0 m	044
	SP 2912-3242: Cable 1 : CH 1-368 Cable Depth Control. No reshoot required									
20:26	EOL	W00INV1666P1	8	4998	**4988**	5.1 Port (West)	2.1 µBar	East 20kts	1.5 m	044

22:52	SOL	W00INV1834P1	188	4734	**4637**	9.0 Stbd (West)	2.8 µBar	East 15 kts	2.0 m	045
02-February-00										
Time		**Line name**	**Dir**	**Nav SP**	**Good SP**	**Feather**	**Noise**	**Wind**	**Sea**	**Seq #**
05:08	EOL	W00INV1834P1	188	807	**817**	8.3 Port (East)	2.2 µBar	ENE 10Kts	1.5 m	045
07:18	SOL	W00INV1654P1	8	903	**1001**	2.0 Stbd (East)	2.1 µBar	Calm	0.0 m	046
14:00	EOL	W00INV1654P1	8	5010	**5000**	4.0 Port (West)	2.5 µBar	Calm	0.5 m	046
18:39	SOL	W00INV1834I1	188	4735	**4637**	0.8 Port (East)	1.8 µBar	E 10 kts	slight	047
03-February-00										
Time		**Line name**	**Dir**	**Nav SP**	**Good SP**	**Feather**	**Noise**	**Wind**	**Sea**	**Seq #**
01:01	EOL	W00INV1834I1	188	807	**817**	0.4 Port (East)	1.6 µBar	E 8 kts	0.5 m	047
03:17	SOL	W00INV1642P1	8	903	**1001**	0.0	1.5 µBar	E 10kts	0.5 m	048
09:56	EOL	W00INV1642P1	8	5022	**5012**	1.5 Port (West)	1.9 µBar	0 kts	0.5 m	048
11:54	SOL	W00INV1822P1	188	4746	**4649**	7.5 Stbd (West)	1.9 µBar	5 kts	1.0 m	049
	SP 2664-817: Early EOL d/t Gun Errors. Reshot as Seq# 50									
15:13	EOL	W00INV1822P1	188	2624	**2665**	0.5 Stbd (West)	1.6 µBar	10 kts	2.0 m	049
	Working on guns									
19:35	SOL	W00INV1822P2	188	2772	**2675**	5.5 Port (East)	2.7 µBar	South 10 kts	1.5 m	050
22:43	EOL	W00INV1822P2	188	807	**817**	0.5 Stbd (West)	N/A	outh 10 kts	1.5 m	050
04-February-00										
Time		**Line name**	**Dir**	**Nav SP**	**Good SP**	**Feather**	**Noise**	**Wind**	**Sea**	**Seq #**
01:00	SOL	W00INV1630P1	8	904	**1001**	3.8 Port (West)	1.9 µBar	SWN 15kts	2.0 m	051
07:43	EOL	W00INV1630P1	8	5034	**5024**	3.0 Stbd (East)	3.6 µBar	NNE 15kts	SW 2.0 m	051
09:50	SOL	W00INV1810P1	188	4759	**4661**	1.6 Port (East)	2.8 µBar	NE 10 kts	2-3 m	052
16:12	EOL	W00INV1810P1	188	807	**817**	3.8 Port (West)	4.0 µBar	ENE15 kts	3-4 m	052
18:36	SOL	W00INV1618P1	8	903	**1001**	8.5 Stbd (East)	2.5 µBar	ENE 15 kts	SW 3-4 m	053
05-February-00										
Time		**Line name**	**Dir**	**Nav SP**	**Good SP**	**Feather**	**Noise**	**Wind**	**Sea**	**Seq #**
01:24	EOL	W00INV1618P1	8	5046	**5036**	1.9 Port (West)	5.0 µBar	NW 5 kts	SW 2 m	053
	Port engine stut down to repair faulty injectors									
04:44	SOL	W00INV1798P1	188	4770	**4673**	1.6 Port (East)	3.0 µBar	NE 10 kts	2.5 m	054
	SP 1649-817: Early EOL d/t Cable Depth Control. Reshot as Seq# 60									
10:03	EOL	W00INV1798P1	188	1337	**1650**	2.2 Port (East)	11.2 µBar	WSW 25kts	4.0 m	054
	Retrieving guns. Waiting for the weather to improve.									
06-February-00										
Time		**Line name**	**Dir**	**Nav SP**	**Good SP**	**Feather**	**Noise**	**Wind**	**Sea**	**Seq #**
	Waiting for the weather to improve.									
16:20	Deploying guns									
18:50	Guns deployed									
23:29	SOL	W00INV1606P1	8**0**	3.2 Stbd (East)		11.4 µBar	SE 15 kts	1.5 m	055	
	Line rejected d/t weather. Reshot as Seq# 58									
07-February-00										
Time		**Line name**	**Dir**	**Nav SP**	**Good SP**	**Feather**	**Noise**	**Wind**	**Sea**	**Seq #**
03:12	EOL	W00INV1606P1	8**0**	1.1 Stbd (East)		N/A	SE 20 kts	1.5 m	055	
03:59	SOL	W00INV1630I1	8**0**	N/A	N/A	SE 20 kts	1.5 m	056		
	Line rejected d/t weather. Reshot as Seq# 108 (1642I1)									
04:01	EOL	W00INV1630I1	8**0**	N/A	N/A	SE 20 kts	1.5 m	056		
06:45	SOL	W00INV1846I2	188	2798	**2700**	2.2 Stbd (West)	5.2 µBar	ENE 5 kts	3.0 m	057
	SP 972-928, 2080-2016, 2231-2191, 2625-2541: Cable 1 and 2 : CH 1-368 Poor Geometry. No reshoot required									
09:52	EOL	W00INV1846I2	188	807	**817**	5.3 Port (East)	5.2 µBar	SSE 10kts	3.0 m	057
12:19	SOL	W00INV1606P2	8**0**	1.5 Stbd (East)		4.4 µBar	SSE 15 kts	2.0 m	058	
	Line rejected d/t timebreak problems/poor acoustics. Reshot as Seq# 61									
13:38	EOL	W00INV1606P2	8**0**	1.0 Stbd (East)		N/A	SSE 15 KT	2.0 m	058	

Gunstrings 1 and 2 found to be damaged by fishing gear. Tming errors and acoustic loss due to cut electrical lines.

22:37	SOL	W00INV1786P1	188	5009	**4685**	1.0 Port (East)	4.9 µBar	SSE 5kts	2.0 m	059

SP 1873-817: Early EOL d/t CRS/MSX Errors. Reshot as Seq# 68

08-February-00

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
03:34	EOL	W00INV1786P1	188	1868	**1874**	5.1 Stbd (West)	N/A	ESE 10kts	2.0 m	059
08:24	SOL	W00INV1798P2	188	1756	**1659**	2.6 Stbd (West)	N/A	E 10kts	2.0 m	060
09:52	EOL	W00INV1798P2	188	807	**817**	8.8 Port (East)	N/A	Calm	1.0 m	060
14:50	SOL	W00INV1606P3	8	403	**1001**	6.5 Stbd (East)	3.5 µBar	Sth 5kts	1.5 m	061
21:37	EOL	W00INV1606P3	8	5058	**5048**	3.3 Port (East)	5.4 µBar	Sth 5 kts	1.5 m	061
23:35	SOL	W00INV1774P1	188	4794	**4697**	6.0 Stbd (West)	4.4 µBar	Sth 5kts	2.0 m	062

09-February-00

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
06:03	EOL	W00INV1774P1	188	807	**817**	6.3 Stbd (West)	3.2 µBar	SE 5 kts	2.0 m	062
08:15	SOL	W00INV1594P1	8	903	**1001**	4.9 Stbd (East)	2.5 µBar	SW 10 kts	2.0 m	063
15:07	EOL	W00INV1594P1	8	5070	**5060**	7.8 Port (West)	3.1 µBar	East 15kts	2.0 m	063
17:06	SOL	W00INV1762P1	188	4806	**4709**	20 Stbd (West)	4.5 µBar	SE 15-20 kts	2.5 m	064
23:32	EOL	W00INV1762P1	188	807	**818**	7.0 Port	3.3 µBar	ESE15 kts	2.5 m	064

10-February-00

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
02:09	SOL	W00INV1594I1	8	904	**1001**	3.8 Stbd (East)	4.1 µBar	SSW 20kts	2.0 m	065
08:56	EOL	W00INV1594I1	8	5070	**5060**	0.8 Port (West)	2.4 µBar	N 15 kts	1.0 m	065
10:52	SOL	W00INV1750P1	188	4819	**4721**	3.5 Port (East)	2.7 µBar	SSW 15-20kts	2.0 m	066
17:35	EOL	W00INV1750P1	188	807	**817**	.5Stbd (West)	4.0 µBar	SW15-20kts	.0 m	066

Working on guns

22:16	SOL	W00INV1582P1	8	904	**1001**	0.0	5.8 µBar	SW 5 kts	2.0 m	067

SP 2501-5072: Early EOL d/t Gun Errors. Reshot as Seq# 69

11-February-00

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
00:49	EOL	W00INV1582P1	8	2567	**2500**	6.6 Stbd (East)	2.5 µBar	SW 15 kts	1.0 m	067
04:23	SOL	W00INV1786P2	188	1981	**1883**	0.0	5.3 µBar	SW 4 kts	2.0 m	068

SP 1199-817: Early EOL d/t Cable Depth Control. Reshot as Seq# 74

05:33	EOL	W00INV1786P2	188	1127	**1200**	8.0 Stbd (West)	10.8 µBar	SW 15kts	2.5 m	068
11:45	SOL	W00INV1582P2	8	2393	**2491**	4.0 Stbd (East)	6.7 µBar	SW 10-15 kts	2-3 m	069
16:03	EOL	W00INV1582P2	8	5082	**5072**	2.0 Port (West)	8.4 µBar	SW 10 kts	2.0 m	069
18:56	SOL	W00INV1750I1	188	4818	**4721**	10.0 Stbd (West)	7.1 µBar	SW 10 kts	3.0 m	070

SP 3249-817: Early EOL d/t Cable Depth Control. Reshot as Seq# 72

21:22	EOL	W00INV1750I1	188	3147	**3250**	1.5 Stbd (West)	12.1 µBar	SW 10 kts	3.0 m	070

Aborted run-in to line due to excessive swell noise. Waiting for the weather to improve.

12-February-00

Waiting for the weather to improve.

13-February-00

Waiting for the weather to improve. Attempting to retrieve cable 2

14-February-00

Waiting for the weather to improve. Attempting to retrieve cable 2
02:30 Cable 2 and 3 tangle
19:30 Retrieving cables 2 and 3 to untange tail end

15-February-00

03:35 Starboard vane retrieved. Crack found in float bracket.
10:45 Commence preparation for refuelling at sea
11:42 Fuel line parted under strain. No fuel being transferred at the time. Refuelling operation aborted.
14:25 Smit Lloyd alongside (rather than ahead) to reattempt refuelling operation.
17:00 Port vane retrieved and also found to have a cracked float breacket.

17:15 Refuelling at sea completed.
18:40 Vanes repaired. Deploying cables.

16-February-00

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
	Deploying cables									
13:15	All cables deployed. Deploying guns.									
15:00	All guns deployed.									
15:14	SOL	W00INV1570P1	8	1847	**1850**	9.5 Stbd (East)	N/A	SE 5 kts	1.0 m	071
	SP 1001-1849: Late SOL d/t Deploying Guns. Reshot as Seq# 73									
20:34	EOL	W00INV1570P1	8	5083	**5072**	2.5 Port (West)	2.0 µBar	SE 5 kts	1.0 m	071

17-February-00

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
00:43	SOL	W00INV1750I2	188	3356	**3259**	5.x Stbd (West)	2.4 µBar	072		
04:50	EOL	W00INV1750I2	188	807	**817**	5.3 Port (East)	3.1 µBar	E 5 kts	0.5 m	072
07:01	SOL	W00INV1570P2	8	903	**1001**	0.0	2.5 µBar	SE 8 kts	1.0 m	073
08:26	EOL	W00INV1570P2	8	1869	**1859**	4.2 Stbd (East)	2.6 µBar	SE 5 kts	2.0 m	073
11:06	SOL	W00INV1786P3	188	1998	**1900**	9.5 Stbd (West)	2.0 µBar	Light airs	1.0 m	074
12:52	EOL	W00INV1786P3	188	807	**817**	1.8 Stbd (West)	1.8 µBar	SW 5 kts	1.0 m	074
15:07	SOL	W00INV1570I1	8	903	**1001**	5.8 Stbd (West)	2.1 µBar	SE 5 kts	1.0 m	075
21:55	EOL	W00INV1570I1	8	5083	**5073**	6.3 Port (East)	3.7 µBar	SW 5 kts	1.0 m	075

18-February-00

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
00:14	SOL	W00INV1738P1	188	4830	**4733**	12.0 Stbd (West)	3.8 µBar	ESE 12kts	1.5 m	076
06:44	EOL	W00INV1738P1	188	807	**817**	8.8 Port (East)	3.0 µBar	Variable	2.0 m	076
09:07	SOL	W00INV1558P1	8	903	**1001**	9.0 Stbd (East)	2.4 µBar	SE 5kts	2.0 m	077
	SP 2783-5073: Early EOL d/t Gun Errors. Reshot as Seq# 78									
12:08	EOL	W00INV1558P1	8	2913	**2782**	1.2 Stbd (East)	4.0 µBar	SE 5 kts	1.5 m	077
	Working on guns.									
16:33	SOL	W00INV1558P2	8	2675	**2773**	5.0 Stbd (East)	N/A	NE 10 kts	2.0 m	078
20:25	EOL	W00INV1558P2	8	5083	**5073**	1.3 Stbd (East)	2.3 µBar	NE 10 kts	2.0 m	078
23:06	SOL	W00INV1726P1	188	4842	**4745**	4.2 Stbd (West)	2.0 µBar	SW 5 kts	2.0 m	079

19-February-00

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
05:37	EOL	W00INV1726P1	188	807	**817**	12.8 Port(East)	3.6 µBar	SE 5 kts	1.0 m	079
07:54	SOL	W00INV1546P1	8	914	**1001**	23 Stbd (East)	2.3 µBar	NE 10 kts	1.0 m	080
14:43	EOL	W00INV1546P1	8	5083	**5073**	2.3 Port (West)	3.5 µBar	Calm	1.5 m	080
17:40	SOL	W00INV1714P1	188	4836	**4757**	4.2 Port (East)	4.3 µBar	Light 15kts	1.5 m	081

20-February-00

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
00:28	EOL	W00INV1714P1	188	807	**817**	3.8 Stbd (West)	2.6 µBar	Light Air	1.5 m	081
02:42	SOL	W00INV1534P1	8	903	**1001**	3.8 Port (West)	3.4 µBar	Light kts	1.0 m	082
09:38	EOL	W00INV1534P1	8	5083	**5073**	2.7 Stbd (East)	2.5 µBar	ESE 10kts	1.5 m	082
11:47	SOL	W00INV1714I1	188**0**	2.3 Stbd (West)		2.7 µBar	SE 10kts	1.0 m	083	
	Line rejected d/t weather. Reshot as Seq# 86									
12:06	EOL	W00INV1714I1	188**0**	2.5 Stbd (West)		3.6 µBar	SE 10 kts	1.0 m	083	

13:08 Retrieving gear prior to heading to port

21-February-00

02:15 All gear retrieved and hull transducer raised. Heading for Portland, Victoria.
12:35 Pilot onboard
13:20 Alongside Portland

22-February-00

Alongside Portland.
Both vane wires replaced with thicker wire
Crew Change

23-February-00
01:10 Depart Portland
07:30 Deploying cables
18:00 Port vane sinks on deployment.
19:30 Vane retrieved, severely damaged after collison with sea floor. Picking up cables
22:30 All gear retrieved and hull transducer raised. Heading for Portland, Victoria.

24-February-00
08:00 Alongside Portland
Replacing port vane with spare.
18:23 Depart Portland
23:15 Deploying cables

25-February-00
Deploying cables. Some delays due to rough seas and cable maintainance

26-February-00
Deploying cables. Some delays due to rough seas and cable maintainance

27-February-00
Deploying cables. Some delays due to rough seas and cable maintainance
21:55 All cables deployed. Deploying guns.

28-February-00

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
04:30	Guns deployed									
06:59	SOL	W00INV1534I1	8	904	**1001**	3.4 Port (West)	9.6 µBar	SW 10 kts	2.5 m	084
	Line rejected d/t CRS problems and telemtry errors. Reshot as Seq# 97									
13:57	EOL	W00INV1534I1	8	5083	**5073**	0.0	11.0 µBar	SSE 10-15 kts	1.5-2 m	084
16:57	Retriveing guns									
18:10	Guns onboard, retrieving cable 6 to fix telemetry errors									

29-February-00

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
19:20	Cable 6 repaired and deployed. Deploying guns.									
21:35	Guns deployed									
23:32	SOL	W00INV1522P1	8	903	**1001**	5.8 Port (West)	7.2 µBar	NE 20 kts	2.0 m	085

01-March-00

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
06:33	EOL	W00INV1522P1	8	5083	**5073**	0.6 Stbd (East)	3.5 µBar	SSE 12 kts	2.0 m	085
09:20	SOL	W00INV1714I2	188	4855	**4757**	7.0 Stbd (West)	5.5 µBar	SE 5 kts	1.5m	086
15:56	EOL	W00INV1714I2	188	807	**817**	1.7 Port (East)	2.9 µBar	E 10 kts	1.0 m	086
18:14	SOL	W00INV1510P1	8	904	**1001**	0.8 Stbd (East)	3.1 µBar	ESE 12-15 kts	1.5-2 m	087

02-March-00

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
01:11	EOL	W00INV1510P1	8	5083	**5073**	2.6 Port (West)	4.4 µBar	ESE 10 kts	1.5 m	087
03:39	SOL	W00INV1702P1	188	4864	**4768**	5.5 Port (East)	2.9 µBar	ESE 10kts	1.5 m	088
10:06	EOL	W00INV1702P1	188	807	**817**	2.2 Stbd (West)	2.1 µBar	N 12 kts	1.5 m	088
13:23	SOL	W00INV1678P1	8	904	**1001**	2.5 Stbd (East)	2.6 µBar	NNW 10 kts	0.5-1 m	089
19:54	EOL	W00INV1678P1	8	4986	**4976**	1.6 Stbd (East)	2.1 µBar	Light airs	Rippled	089
22:59	SOL	W00INV1498P1	188	4987	**4889**	5.8 Stbd (West)	1.9 µBar	Calm	Calm	090

03-March-00

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
05:49	EOL	W00INV1498P1	188	807	**817**	1.5 Port (East)	1.9 µBar	Calm	0.5 m	090
08:15	SOL	W00INV1690P1	8	904	**1001**	0.7 Port (West)	1.7 µBar	SW 8 kts	1.0 m	091
15:02	EOL	W00INV1690P1	8	4974	**4964**	6.0 Port (West)	11.5 µBar	SW 10-15 kts	2.5-3 m	091
18:38	SOL	W00INV1606I1	188	3927	**3830**	3.2 Port (East)	12.7 µBar	SW 15 kts	3.0 m	092
	SP 1883-1346: Cable 3 : CH 1-368 Cable Depth Control. No reshoot required									

04-March-00

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
00:04	EOL	W00INV1606I1	188	807	**817**	4.0 Stbd (West)	10.2 µBar	SW 25 kts	3.0 m	092
03:05	Line 1534I2 aborted during run-in d/t cable inbalance in rough seas. Sequence scratched. No seismic data recorded. Waiting for the weather to improve.									
13:46	SOL	W00INV1702I1	188**0**	3.0 Stbd (West)		13.7 µBar	SW 10-12 kts	3.0 m	093	
	Line rejected d/t weather. Reshot as Seq# 94									
14:24	EOL	W00INV1702I1	188**0**	4.3 Stbd (West)		N/A	SW 10-12 kts	3.0 m	093	
22:10	SOL	W00INV1702I2	188	4865	**4768**	2.3 Stbd (West)	11.3 µBar	SW 10 kts	3-3.5 m	094
22:10	EOL	W00INV1702I2	188	807	**817**	2.6 Port (East)	16.6 µBar	SW 12 kts	3.0 m	094

05-March-00

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
07:46	SOL	W00INV1798I1	8	904	**1001**	1.4 Stbd (East)	10.3 µBar	SW 10 kts	3.0 m	095
13:40	EOL	W00INV1798I1	8	4550	**4530**	0.4 Stbd (East)	5.8 µBar	SW 10 kts	2.0 m	095
17:35	SOL	W00INV1846I3	188	3767	**0**	2.6 Port (East)	15.1 µBar	SSW 12 kts	3.0 m	096
	Line rejected d/t weather. Reshot as Seq# 103									
21:52	EOL	W00INV1846I3	188	1141	**0**	0.2 Stbd (West)	16.3 µBar	S 20 kts	3-3.5 m	096

06-March-00

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
01:30	SOL	W00INV1534I2	8	904	**0**	5.2 Port (West)	13.0 µBar	S 20-25 kts	3.0 m	097
	Line rejected d/t weather. Reshot as Seq# 98									
08:24	EOL	W00INV1534I2	8	5083	**0**	8.0 Stbd (East)	22.0 µBar	SE 20 kts	3.5 m	097
	Guns retrieved and waiting for the weather to improve.									

07-March-00

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
	Waiting for the weather to improve.									
	Guns deployed									
22:42	SOL	W00INV1534I3	8	904	**1001**	3.7 Stbd (East)	10.0 µBar	ESE 25 kts	3.0 m	098
	SP 2932-5073: Early EOL d/t Gun Errors. Reshot as Seq# 99									

08-March-00

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
01:58	EOL	W00INV1534I3	8	3001	**2931**	5.5 Port (West)	N/A	ESE 25 kts	3.0 m	098
	Working on guns									
06:43	SOL	W00INV1534I4	8**0**	5.3 Port (West)		13.2 µBar	SE 25 kts	3.0 m	099	
	Line rejected d/t weather. Reshot as Seq# 102									
10:15	EOL	W00INV1534I4	8**0**	3.6 Port (West)		12.5 µBar	ESE 25 kts	3.0 m	099	
14:16	SOL	W00INV1690I1	188	4878	**4780**	9.2 Stbd (West)	8.9 µBar	SSE 25-30 kts	2.5-3 m	100
	SP 2519-1661: Coverage not required. No reshoot required									
20:53	EOL	W00INV1690I1	188	807	**817**	3.3 Port (East)	N/A	E 25 kts	3.0 m	100

09-March-00

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
00:05	SOL	W00INV1522I1	8**0**	4.0 Port (West)		N/A	ESE 30 kts	4.0 m	101	
	Line rejected d/t weather. Reshot as Seq# 106									
00:27	EOL	W00INV1522I1	8**0**	7.6 Port (West)		N/A	ESE 40 kts	4.0 m	101	
09:51	SOL	W00INV1534I5	8**0**	1.3 Stbd (East)		14.0 µBar	E 30 kts	2.5 m	102	
	Line rejected d/t weather. Reshot as Seq# 107									
13:25	EOL	W00INV1534I5	8**0**	3.9 Port (West)		8.0 µBar	ENE 20-25 kts		2.0 m	102
17:28	SOL	W00INV1846I4	188	3777	**3680**	13.6 Stbd (West	6.2 µBar	E 26 kts	2.0 m	103
	SP 1230-1214: Gun Errors (Even Shots Only). No reshoot required									
	SP 1729-1355: Coverage not required. No reshoot required									
21:41	EOL	W00INV1846I4	188	1141	**1151**	1.3 Port (East)	3.3 µBar	E 25-30 kts	2.5 m	103

10-March-00

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
04:06	SOL	W00INV1738I1	8	904	**1001**	4.0 Port (West)	2.4 µBar	E 25 kts	2.0 m	104
	SP 1001-4917: Cable 4 : CH 1-368 Telemetry Errors (Selected shots). No reshoot required									
10:51	EOL	W00INV1738I1	8	4927	**4917**	1.0 Port (West)	2.6 µBar	NE 5 kts	1.0 m	104
14:31	SOL	W00INV1822I1	188	4698	**4600**	1.6 Port (East)	2.8 µBar	Light airs	Calm	105

SP 2359-1701: Coverage not required. No reshoot required
SP 2438-2360: Vessel movement too great. No reshoot required
SP 3234-2621: Coverage not required. No reshoot required
SP 4600-768: Cable 4 : CH 1-368 Telemetry Errors (Selected shots). No reshoot required

21:08	EOL	W00INV1822I1	188	758	**768**	0.0	1.9 µBar	Light airs	Calm	105
23:45	SOL	W00INV1522I2	8	1402	**1500**	0.0	1.5 µBar	Light airs	0.5 m	106

SP 1500-5073: Cable 4 : CH 1-368 Telemetry Errors (Selected shots). No reshoot required

11-March-00

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
05:54	EOL	W00INV1522I2	8	5083	**5073**	9.0 Port (West)	2.4 µBar	Light Airs	0.5 m	106
09:09	SOL	W00INV1534I6	188	4986	**4889**	1.0 Stbd (West)	1.9 µBar	Variable	1.0 m	107

SP 4889-817: Cable 4 : CH 1-368 Telemetry Errors (Selected shots). No reshoot required

16:43	EOL	W00INV1534I6	188	807	**817**	8.4 Stbd (West)	1.6 µBar	Light air	Rippled	107
20:07	SOL	W00INV1642I1	8	1042	**1140**	7.3 Port (West)	2.8 µBar	SSW 3-5 kts	Rippled	108

SP 3176-3495: Coverage not required. No reshoot required

12-March-00

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
01:13	EOL	W00INV1642I1	8	4141	**4130**	3.4 Port (West)	2.3 µBar	S 8 kts	0.5 m	108
04:44	SOL	W00INV1570I2	188	3083	**3030**	10.3 Stbd (West	2.6 µBar	ESE 10 kts	1.0 m	109

SP 1565-1191: Coverage not required. No reshoot required

08:24	EOL	W00INV1570I2	188	807	**817**	8.0 Stbd (West	7.5 µBar	SSE 18 Kts	2.0 m	109
13:40	SOL	W00INV1690I2	8**0**	7.3 Stbd (West)		14.7 µBar	S 15-18 kts	2.0 m	110	

Line rejected d/t weather. Reshot as Seq# 111

16:43	EOL	W00INV1690I2	8**0**	6.0 Port (West)		18.0 µBar	E 25-30 kts	3.0 m	110	

Line aborted on run-in due to weather. Guns retrieved Waiting for the weather to improve.

13-March-00

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #

Waiting for the weather to improve.
Guns deployed

21:58	SOL	W00INV1690I3	8	3083	**3180**	3.0 Port (West)	3.1 µBar	W 25 kts	2.0 m	111

14-March-00

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
00:51	EOL	W00INV1690I3	8	4974	**4964**	9.7 Stbd (East)	2.5 µBar	W 20 kts	2.0 m	111
04:37	SOL	W00INV1846I5	188	3811	**3714**	1.0 Stbd (West)	3.5 µBar	SW 20-30 kts	3.0 m	112
07:09	EOL	W00INV1846I5	188	2289	**2300**	1.3 Stbd (West)	7.6 µBar	SW 25 kts	3.0 m	112
11:59	SOL	W00INV1330P1	8	904	**1001**	1.8 Port (West)	8.1 µBar	WSW 25 kts	3.5 m	113
18:45	EOL	W00INV1330P1	8	5083	**5073**	2.3 Port (West)	5.0 µBar	SW 15 kts	3.5 m	113
21:51	SOL	W00INV1486P1	188**0**	2.1 Stbd (West)		9.3 µBar	SW 15 kts	4.0 m	114	

Line rejected d/t weather. Reshot as Seq# 116

22:11	EOL	W00INV1486P1	188**0**	3.0 Stbd (West)		N/A	SW 15 kts	4.0 m	114	

Trying for line in opposite direction

15-March-00

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
08:32	SOL	W00INV1318P1	8	904	**1001**	1.0 Port (West)	9.1 µBar	SSW 8 kts	3.5 m	115
15:20	EOL	W00INV1318P1	8	5083	**5073**	6.9 Stbd (East)	11.1 µBar	SW 10 kts	2.5 m	115
18:55	SOL	W00INV1486P2	188	4986	**4889**	0.0	10.9 µBar	SW 12 kts	3.0 m	116

16-March-00

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
01:45	EOL	W00INV1486P2	188	807	**817**	6.0 Port (East)	3.5 µBar	L/A kts	2.5 m	116
05:06	SOL	W00INV1306P1	8	904	**1001**	4.2 Stbd (East)	3.7 µBar	Light Airs	0.5 m	117
11:55	EOL	W00INV1306P1	8	5083	**5073**	1.0 Stbd (East)	4.6 µBar	Light Airs	2.0 m	117
15:24	SOL	W00INV1486I1	188	4986	**4889**	6.0 Port (East)	7.0 µBar	SE 12 kts	2.5 m	118
22:20	EOL	W00INV1486I1	188	807	**817**	8.6 Stbd (West)	4.7 µBar	SSE 10 kts	3.0 m	118

17-March-00

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
02:00	SOL	W00INV1294P1	8	904	**1001**	1.9 Stbd (East)	4.2 µBar	NE 15 kts	2.0 m	119
09:04	EOL	W00INV1294P1	8	5083	**5073**	4.0 Port (West)	3.9 µBar	NE 15 kts	3.0 m	119
12:17	SOL	W00INV1474P1	188	4987	**4889**	4.1 Stbd (West)	5.0 µBar	NE 8 kts	2.5 m	120
	SP 2480-2320: Cable 5 : CH 209-368 Cable tail on surface. Replacing bird. No reshoot required									
19:07	EOL	W00INV1474P1	188	807	**817**	0.7 Stbd (West)	3.3 µBar	NE 12-15 kts	2.5-3 m	120
21:36	SOL	W00INV1282P1	8	904	**1001**	2.7 Stbd (East)	3.3 µBar	NE 18 kts	2.5 m	121

18-March-00

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
04:56	EOL	W00INV1282P1	8	5083	**5073**	5.0 Stbd (West)	4.0 µBar	NW 33 kts	2.5 m	121
07:29	SOL	W00INV1462P1	188	4987	**4889**	3.9 Port (East)	4.5 µBar	WNW 30 kts	2.0 m	122
14:29	EOL	W00INV1462P1	188	807	**817**	0.7 Stbd (West)	5.5 µBar	SW 15-20 kts	2.5 m	122
17:18	SOL	W00INV1270P1	8	903	**1001**	0.3 Port (West)	5.6 µBar	WSW 18 kts	2.5 m	123

19-March-00

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
00:08	EOL	W00INV1270P1	8	5083	**5073**	7.4 Port (West)	6.2 µBar	SW 10 kts	2.5 m	123
03:31	SOL	W00INV1462I1	188	4987	**4889**	2.2 Port (East)	8.0 µBar	SW 12 kts	2.5 m	124
10:33	EOL	W00INV1462I1	188	807	**817**	1.9 Stbd (West)	8.1 µBar	Variable	3.0 m	124
14:07	SOL	W00INV1270I1	8	904	**1001**	4.0 Port (West)	5.8 µBar	SW 15 kts	2.5-3 m	125
20:52	EOL	W00INV1270I1	8	5083	**5073**	2.1 Stbd (East)	2.8 µBar	SW 10-12 kts	2.5 m	125
23:40	SOL	W00INV1450P1	188	4987	**4889**	0.7 Stbd (West)	4.6 µBar	SW 10-12 kts	2.5 m	126

20-March-00

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
06:44	EOL	W00INV1450P1	188	807	**817**	1.1 Port (East)	5.0 µBar	SW 15 kts	2.0 m	126
10:21	SOL	W00INV1258P1	8	904	**1001**	1.4 Stbd (East)	10.0 µBar	SW 20 kts	3.0 m	127
17:02	EOL	W00INV1258P1	8	5083	**5073**	2.0 Port (West)	6.6 µBar	SSW 15 kts	2.0 m	127
19:57	SOL	W00INV1438P1	188	**4889**		2.6 Port (East)	9.7 µBar	SSW 15 kts	3-4 m	128
	Line rejected d/t weather. Reshot as Seq# 130									
22:06	EOL	W00INV1438P1	188	**3656**		1.4 Port (East)	N/A	SE 20 kts	4.0 m	128
	Trying for line in opposite direction									

21-March-00

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
05:58	SOL	W00INV1246P1	8	903	**1001**	1.8 Port (West)	11.9 µBar	SE 18 kts	4.0 m	129
12:43	EOL	W00INV1246P1	8	5083	**5073**	1.1 Port (West)	10.1 µBar	SSE 12 kts	3.0 m	129
16:02	SOL	W00INV1438P2	188	4986	**4889**	7.0 Stbd (West)	8.7 µBar	SW 25 kts	3.5 m	130
22:49	EOL	W00INV1438P2	188	807	**817**	1.5 Port (East)	4.3 µBar	E 25 kts	3.0 m	130

22-March-00

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
01:56	SOL	W00INV1234P1	8	904	**1001**	4.7 Stbd (East)	4.2 µBar	ENE 25 kts	3.0 m	131
	SP 1407-1428, 2664-2669, 2704-2708, 2734-2736, 2783-2784: Cable 5 power tripped out. No reshoot required									
08:56	EOL	W00INV1234P1	8	5083	**5073**	3.7 Stbd (East)	3.6 µBar	NE 20 kts	3.0 m	131
11:26	SOL	W00INV1426P1	188	4986	**4889**	2.4 Port (East)	2.7 µBar	N 20 kts	2.5 m	132
18:20	EOL	W00INV1426P1	188	807	**817**	3.0 Port (East)	2.9 µBar	W 28-30 kts	2.0 m	132
	Line aborted on run-in due to weather. Guns retrieved Waiting for the weather to improve.									

23-March-00

Waiting for the weather to improve.

24-March-00

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
	Waiting for the weather to improve.									
06:05	Guns deployed									
07:13	SOL	W00INV1222P1	8	904	**1001**	3.5 Stbd (East)	8.4 µBar	ESE 12 kts	3.0 m	133
13:57	EOL	W00INV1222P1	8	5083	**5073**	0.0	9.0 µBar	E 10-15 kts	3.5 m	133

18:20	SOL	W00INV1414P1	188	4986	**4889**	10.0 Stbd (West	4.8 µBar	SE 15-18 kts	2.5 m	134

25-March-00

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
01:02	EOL	W00INV1414P1	188	807	**817**	4.1 Port (East)	8.5 µBar	SE 18 kts	2.5 m	134
04:11	SOL	W00INV1210P1	8	904	**1001**	7.9 Stbd (East)	4.8 µBar	SE 10 kts	2.5 m	135
11:12	EOL	W00INV1210P1	8	5083	**5073**	1.5 Stbd (East)	6.3 µBar	E 8 kts	2.0 m	135
13:38	SOL	W00INV1414I1	188	4986	**4889**	3.3 Port (East)	7.4 µBar	Light airs	3.0 m	136
20:32	EOL	W00INV1414I1	188	807	**817**	0.8 Port (East)	2.9 µBar	E 10 kts	2.5 m	136
23:25	SOL	W00INV1198P1	8	904	**1001**	10.5 Stbd (East	2.8 µBar	SE 10 kts	2.5 m	137

26-March-00

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
06:16	EOL	W00INV1198P1	8	5083	**5073**	6.2 Port (West)	6.8 µBar	Variable	2.0 m	137
08:46	SOL	W00INV1402P1	188	4986	**4889**	5.6 Stbd (West)	5.0 µBar	Variable	2.0 m	138
15:48	EOL	W00INV1402P1	188	807	**817**	0.7 Port (East)	4.6 µBar	S 5-10 kts	2.5-3 m	138
18:20	SOL	W00INV1198I1	8	904	**1001**	3.3 Stbd (East)	5.5 µBar	Var 7-8 kts	2.0 m	139

27-March-00

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
01:09	EOL	W00INV1198I1	8	5083	**5073**	2.3 Stbd (East)	4.7 µBar	E 12-15 kts	2-2.5 m	139
03:36	SOL	W00INV1390P1	188	4986	**4889**	0.2 Port (East)	4.2 µBar	Calm	2.5 m	140
10:33	EOL	W00INV1390P1	188	807	**817**	6.8 Port (East)	4.3 µBar	SW 12 kts	3.0 m	140
13:14	SOL	W00INV1186P1	8	903	**1001**	5.6 Stbd (East)	3.6 µBar	SW 18 kts	3.5 m	141
20:02	EOL	W00INV1186P1	8	5083	**5073**	5.0 Port (West)	4.1 µBar	SW 10 kts	2.5 m	141

22:02 Retrieving gear prior to heading to port

28-March-00
21:55 All gear retrieved and hull transducer raised. Heading for Portland, Victoria.

29-March-00
06:30 Pilot onboard
07:05 Alongside Portland
Crew Change
23:00 Depart Portland

30-March-00
03:00 Deploying cables

31-March-00
11:35 All cables deployed. Waiting for the weather to improve before deploying guns
18:00 Deploying guns
20:00 All guns deployed

01-April-00

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
01:48	SOL	W00INV1342P1	8	904	**1001**	0.7 Stbd (West)	32.6 µBar	SW 25 kts	3.0 m	142
08:26	EOL	W00INV1342P1	8	5083	**5073**	0.3 Stbd (West)	19.8 µBar	SW 25 kts	3.0 m	142
12:09	SOL	W00INV1378P1	188	4987	**4889**	3.4 Stbd (West)	14.4 µBar	SSW 12 kts	3.0 m	143
18:59	EOL	W00INV1378P1	188	807	**817**	2.0 Port (East)	16.1 µBar	SSW 10 kts	3.0 m	143

02-April-00

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
05:37	SOL	W00INV1354P1	8	904	**1001**	2.0 Stbd (East)	14.2 µBar	SSW 10 kts	3.0 m	144
05:36	EOL	W00INV1354P1	8	5083	**5073**	1.2 Stbd(East)	9.1 µBar	S 10 kts	2.0 m	144
09:32	SOL	W00INV1366P1	188	4987	**4889**	0.2 Stbd (West)	6.2 µBar	S 5 kts	2.0 m	145
16:12	EOL	W00INV1366P1	188	807	**817**	0.8 Port (East)	13.5 µBar	S 0 kts	0.5 m	145
19:46	SOL	W00INV1366I1	8	903	**1001**	2.3 Stbd (East)	10.9 µBar	S 5 kts	1.0 m	146

03-April-00

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
02:41	EOL	W00INV1366I1	8	5083	**5073**	3.8 Port (West)	4.6 µBar	S 5 kts	1.0 m	146

06:30	SOL	W00INV1342I1	188	4987	**4889**	2.6 Port (East)	2.7 µBar	S 5 kts	1.0 m	147
11:42	EOL	W00INV1342I1	188	1754	**1770**	5.9 Stbd (West)	3.4 µBar	S 5 kts	1.0 m	147

3D Acquisition completed

17.2 INVESTIGATOR 2D LINES SEQ 148-152

03-April-00

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
	Investigator 2D acquisition commences									
12:24	SOL	W00INV0006P1	112	1001	**0**	1.8 Stbd (West)	4.9 µBar	W 20 kts	2.0m	148
	Line rejected d/t incrrect record length in CRS. Reshot as Seq# 151									
16:51	EOL	W00INV0006P1	112	2483	**0**	4.2 Stbd (East)	2.6 µBar	W 20 kts	2.0 m	148
	Retrieving guns									
19:40	Guns onboard. Start retrieving cables 2-6									

04-April-00

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
07:00	Only cable 1 remaining in water. Deploying guns									
09:50	All guns deployed									
14:33	SOL	W00INV0004P1	10	951	**1001**	1.1 Port (East)	N/A µBar	S 10 kts	2.0 m	149
	Line shutdown once the boundary of block T/30P was reached.									
18:58	EOL	W00INV0004P1	10	2518	**2508**	1.0 Port (East)	N/A µBar	S 10 kts	2.0 m	149
22:01	SOL	W00INV0007P1	188	1898	**1801**	3.0 Stbd (West)	N/A µBar	SE 25 kts	2.5 m	150

05-April-00

Time		Line name	Dir	Nav SP	Good SP	Feather	Noise	Wind	Sea	Seq #
00:36	EOL	W00INV0007P1	188	899	**909**	3.9 Stbd (West)	N/A µBar	SE 25 kts	2.5 m	150
05:39	SOL	W00INV0006P2	291	2427	**2386**	N/A	N/A µBar	S 15-20 kts	2.0 m	151
	Early EOL d/t fishing gear on line.									
09:10	EOL	W00INV0006P2	291	899	**1114**	3.9 Stbd (West)	N/A µBar	SSE 25 kts	1.5 m	151
12:42	SOL	W00INV0005P1	142	2415	**2415**	3.8 Stbd (West)	N/A µBar	SE 25 kts	3.0 m	152
	Early EOL d/t deteriorating weather.									
14:41	EOL	W00INV0005P1	142	1775	**1820**	5.4 Stbd (West)	N/A µBar	S 30 kts	3.5 m	152

2D Acquisition completed

18 APPENDIX 5 - WAYPOINT LISTING

18.1 8 Cable Waypoint Listing Seq 001-008 (3D Survey)

LINE	POINT	LATITUDE	LONGITUDE	EASTINGS	NORTHINGS	RANGE
W00INV1008	3619	38 59 32.2982 S	142 44 1.2685 E	650144.5	5682632.8	0
W00INV1008	4889	38 51 2.3290 S	142 45 31.8858 E	652627.9	5698312.3	15874
W00INV1024	3603	38 59 40.5076 S	142 44 16.5905 E	650508.3	5682372.7	0
W00INV1024	4889	38 51 4.1110 S	142 45 48.3187 E	653023.0	5698249.7	16074
W00INV1040	3587	38 59 48.7165 S	142 44 31.9134 E	650872.1	5682112.5	0
W00INV1040	4889	38 51 5.8923 S	142 46 4.7518 E	653418.1	5698187.2	16274
W00INV1056	3572	38 59 56.5232 S	142 44 47.3088 E	651237.8	5681864.8	0
W00INV1056	4889	38 51 7.6729 S	142 46 21.1851 E	653813.1	5698124.6	16462
W00INV1072	3556	39 0 4.7308 S	142 45 2.6336 E	651601.6	5681604.7	0
W00INV1072	4889	38 51 9.4529 S	142 46 37.6187 E	654208.2	5698062.0	16662
W00INV1088	3540	39 0 12.9379 S	142 45 17.9595 E	651965.4	5681344.6	0
W00INV1088	4889	38 51 11.2322 S	142 46 54.0524 E	654603.3	5697999.5	16862
W00INV1104	3525	39 0 20.7428 S	142 45 33.3576 E	652331.2	5681096.8	0
W00INV1104	4889	38 51 13.0110 S	142 47 10.4863 E	654998.4	5697936.9	17049
W00INV1120	3509	39 0 28.9487 S	142 45 48.6854 E	652694.9	5680836.7	0
W00INV1120	4889	38 51 14.7890 S	142 47 26.9204 E	655393.4	5697874.3	17249
W00INV1136	3494	39 0 36.7524 S	142 46 4.0854 E	653060.7	5680588.9	0
W00INV1136	4889	38 51 16.5664 S	142 47 43.3547 E	655788.5	5697811.7	17437
W00INV1152	3478	39 0 44.9572 S	142 46 19.4151 E	653424.5	5680328.8	0
W00INV1152	4889	38 51 18.3432 S	142 47 59.7893 E	656183.6	5697749.2	17637
W00INV1168	3462	39 0 53.1613 S	142 46 34.7458 E	653788.3	5680068.7	0
W00INV1168	4889	38 51 20.1193 S	142 48 16.2240 E	656578.7	5697686.6	17837
W00INV1184	1001	39 17 23.1435 S	142 43 55.3102 E	649371.0	5649622.4	0
W00INV1184	4889	38 51 21.8947 S	142 48 32.6589 E	656973.7	5697624.0	48599
W00INV1200	1001	39 17 24.9268 S	142 44 11.8452 E	649766.1	5649559.8	0
W00INV1200	4889	38 51 23.6696 S	142 48 49.0941 E	657368.8	5697561.4	48599
W00INV1216	1001	39 17 26.7095 S	142 44 28.3804 E	650161.2	5649497.2	0
W00INV1216	4889	38 51 25.4437 S	142 49 5.5294 E	657763.9	5697498.9	48599
W00INV1232	1001	39 17 28.4914 S	142 44 44.9158 E	650556.2	5649434.6	0
W00INV1232	4889	38 51 27.2172 S	142 49 21.9649 E	658159.0	5697436.3	48599
W00INV1248	1001	39 17 30.2728 S	142 45 1.4514 E	650951.3	5649372.1	0
W00INV1248	4889	38 51 28.9901 S	142 49 38.4007 E	658554.0	5697373.7	48599
W00INV1264	1001	39 17 32.0534 S	142 45 17.9872 E	651346.4	5649309.5	0
W00INV1264	4889	38 51 30.7623 S	142 49 54.8366 E	658949.1	5697311.1	48599
W00INV1280	1001	39 17 33.8334 S	142 45 34.5232 E	651741.5	5649246.9	0
W00INV1280	4889	38 51 32.5339 S	142 50 11.2728 E	659344.2	5697248.6	48599
W00INV1296	1001	39 17 35.6128 S	142 45 51.0595 E	652136.5	5649184.3	0
W00INV1296	4889	38 51 34.3048 S	142 50 27.7091 E	659739.3	5697186.0	48599
W00INV1312	1001	39 17 37.3914 S	142 46 7.5959 E	652531.6	5649121.8	0
W00INV1312	4889	38 51 36.0751 S	142 50 44.1456 E	660134.3	5697123.4	48599
W00INV1328	1001	39 17 39.1695 S	142 46 24.1326 E	652926.7	5649059.2	0
W00INV1328	4889	38 51 37.8447 S	142 51 0.5824 E	660529.4	5697060.8	48599
W00INV1344	1001	39 17 40.9468 S	142 46 40.6695 E	653321.8	5648996.6	0

W00INV1344	4889	38	51	39.6137	S	142	51	17.0193	E	660924.5	5696998.3	48599
W00INV1360	1001	39	17	42.7235	S	142	46	57.2065	E	653716.8	5648934.0	0
W00INV1360	4889	38	51	41.3820	S	142	51	33.4565	E	661319.6	5696935.7	48599
W00INV1376	1001	39	17	44.4996	S	142	47	13.7438	E	654111.9	5648871.5	0
W00INV1376	4889	38	51	43.1497	S	142	51	49.8938	E	661714.6	5696873.1	48599
W00INV1392	1001	39	17	46.2750	S	142	47	30.2813	E	654507.0	5648808.9	0
W00INV1392	4889	38	51	44.9167	S	142	52	6.3314	E	662109.7	5696810.5	48599
W00INV1408	1001	39	17	48.0497	S	142	47	46.8190	E	654902.1	5648746.3	0
W00INV1408	4889	38	51	46.6831	S	142	52	22.7692	E	662504.8	5696748.0	48599
W00INV1424	1001	39	17	49.8238	S	142	48	3.3569	E	655297.2	5648683.7	0
W00INV1424	4889	38	51	48.4488	S	142	52	39.2071	E	662899.9	5696685.4	48599
W00INV1440	1001	39	17	51.5972	S	142	48	19.8950	E	655692.2	5648621.2	0
W00INV1440	4889	38	51	50.2139	S	142	52	55.6453	E	663294.9	5696622.8	48599
W00INV1456	1001	39	17	53.3700	S	142	48	36.4333	E	656087.3	5648558.6	0
W00INV1456	4889	38	51	51.9784	S	142	53	12.0836	E	663690.0	5696560.3	48599
W00INV1472	1001	39	17	55.1421	S	142	48	52.9719	E	656482.4	5648496.0	0
W00INV1472	4889	38	51	53.7421	S	142	53	28.5222	E	664085.1	5696497.7	48599
W00INV1488	1001	39	17	56.9135	S	142	49	9.5106	E	656877.5	5648433.5	0
W00INV1488	4889	38	51	55.5053	S	142	53	44.9609	E	664480.2	5696435.1	48599
W00INV1504	1001	39	17	58.6843	S	142	49	26.0495	E	657272.5	5648370.9	0
W00INV1504	4889	38	51	57.2678	S	142	54	1.3999	E	664875.2	5696372.5	48599
W00INV1520	1001	39	18	0.4544	S	142	49	42.5887	E	657667.6	5648308.3	0
W00INV1520	4889	38	51	59.0296	S	142	54	17.8390	E	665270.3	5696310.0	48599
W00INV1536	1001	39	18	2.2239	S	142	49	59.1280	E	658062.7	5648245.7	0
W00INV1536	4889	38	52	0.7908	S	142	54	34.2784	E	665665.4	5696247.4	48599
W00INV1552	1001	39	18	3.9927	S	142	50	15.6676	E	658457.8	5648183.2	0
W00INV1552	4889	38	52	2.5513	S	142	54	50.7179	E	666060.5	5696184.8	48599
W00INV1568	1001	39	18	5.7608	S	142	50	32.2074	E	658852.8	5648120.6	0
W00INV1568	4889	38	52	4.3112	S	142	55	7.1577	E	666455.5	5696122.2	48599
W00INV1584	1001	39	18	7.5283	S	142	50	48.7473	E	659247.9	5648058.0	0
W00INV1584	4886	38	52	7.2754	S	142	55	23.3867	E	666844.8	5696022.6	48562
W00INV1600	1001	39	18	9.2952	S	142	51	5.2875	E	659643.0	5647995.4	0
W00INV1600	4870	38	52	15.4602	S	142	55	38.7023	E	667208.5	5695762.5	48362
W00INV1616	1001	39	18	11.0613	S	142	51	21.8279	E	660038.1	5647932.9	0
W00INV1616	4854	38	52	23.6444	S	142	55	54.0190	E	667572.3	5695502.4	48162
W00INV1632	1001	39	18	12.8268	S	142	51	38.3685	E	660433.1	5647870.3	0
W00INV1632	4838	38	52	31.8280	S	142	56	9.3365	E	667936.1	5695242.3	47962
W00INV1648	1001	39	18	14.5917	S	142	51	54.9093	E	660828.2	5647807.7	0
W00INV1648	4822	38	52	40.0111	S	142	56	24.6551	E	668299.9	5694982.2	47762
W00INV1664	1001	39	18	16.3559	S	142	52	11.4503	E	661223.3	5647745.1	0
W00INV1664	4806	38	52	48.1936	S	142	56	39.9746	E	668663.7	5694722.1	47562
W00INV1680	1001	39	18	18.1194	S	142	52	27.9915	E	661618.4	5647682.6	0
W00INV1680	4790	38	52	56.3754	S	142	56	55.2950	E	669027.5	5694462.0	47362
W00INV1696	1001	39	18	19.8823	S	142	52	44.5329	E	662013.4	5647620.0	0
W00INV1696	4774	38	53	4.5567	S	142	57	10.6164	E	669391.3	5694201.8	47162
W00INV1712	1001	39	18	21.6445	S	142	53	1.0745	E	662408.5	5647557.4	0
W00INV1712	4759	38	53	12.3358	S	142	57	26.0090	E	669757.0	5693954.1	46975
W00INV1728	1001	39	18	23.4061	S	142	53	17.6163	E	662803.6	5647494.8	0
W00INV1728	4743	38	53	20.5159	S	142	57	41.3323	E	670120.8	5693694.0	46774
W00INV1744	1001	39	18	25.1670	S	142	53	34.1584	E	663198.7	5647432.3	0

W00INV1744	4727	38	53	28.6954	S	142	57	56.6566	E	670484.6	5693433.9	46574
W00INV1760	1001	39	18	26.9272	S	142	53	50.7006	E	663593.7	5647369.7	0
W00INV1760	4711	38	53	36.8743	S	142	58	11.9819	E	670848.4	5693173.7	46375
W00INV1776	1001	39	18	28.6868	S	142	54	7.2430	E	663988.8	5647307.1	0
W00INV1776	4695	38	53	45.0527	S	142	58	27.3081	E	671212.2	5692913.6	46174
W00INV1792	1001	39	18	30.4457	S	142	54	23.7857	E	664383.9	5647244.6	0
W00INV1792	4679	38	53	53.2305	S	142	58	42.6353	E	671576.0	5692653.5	45974
W00INV1808	1001	39	18	32.2040	S	142	54	40.3285	E	664779.0	5647182.0	0
W00INV1808	4663	38	54	1.4076	S	142	58	57.9634	E	671939.8	5692393.4	45775
W00INV1824	1001	39	18	33.9616	S	142	54	56.8716	E	665174.0	5647119.4	0
W00INV1824	4647	38	54	9.5842	S	142	59	13.2926	E	672303.5	5692133.3	45575
W00INV1840	1001	39	18	35.7186	S	142	55	13.4148	E	665569.1	5647056.8	0
W00INV1840	3719	39	0	24.0737	S	142	58	24.7462	E	670884.0	5680613.5	33975
W00INV1856	1001	39	18	37.4748	S	142	55	29.9583	E	665964.2	5646994.3	0
W00INV1856	3702	39	0	32.6525	S	142	58	40.0277	E	671245.8	5680341.1	33762
W00INV1872	1001	39	18	39.2305	S	142	55	46.5019	E	666359.3	5646931.7	0
W00INV1872	3685	39	0	41.2306	S	142	58	55.3102	E	671607.6	5680068.6	33550
W00INV1888	1001	39	18	40.9854	S	142	56	3.0458	E	666754.3	5646869.1	0
W00INV1888	3668	39	0	49.8082	S	142	59	10.5937	E	671969.5	5679796.2	33337
W00INV1904	1001	39	18	42.7397	S	142	56	19.5898	E	667149.4	5646806.5	0
W00INV1904	3651	39	0	58.3852	S	142	59	25.8782	E	672331.3	5679523.7	33125
W00INV1920	1001	39	18	44.4934	S	142	56	36.1341	E	667544.5	5646744.0	0
W00INV1920	3634	39	1	6.9616	S	142	59	41.1637	E	672693.1	5679251.3	32912
W00INV1936	1001	39	18	46.2464	S	142	56	52.6786	E	667939.6	5646681.4	0
W00INV1936	3617	39	1	15.5374	S	142	59	56.4502	E	673055.0	5678978.8	32700
W00INV1952	1001	39	18	47.9987	S	142	57	9.2233	E	668334.6	5646618.8	0
W00INV1952	3600	39	1	24.1126	S	143	0	11.7378	E	673416.8	5678706.3	32487
W00INV1968	1001	39	18	49.7504	S	142	57	25.7681	E	668729.7	5646556.2	0
W00INV1968	3583	39	1	32.6873	S	143	0	27.0263	E	673778.6	5678433.9	32275
W00INV1984	1001	39	18	51.5014	S	142	57	42.3132	E	669124.8	5646493.7	0
W00INV1984	3566	39	1	41.2613	S	143	0	42.3159	E	674140.5	5678161.4	32062
W00INV2000	1001	39	18	53.2517	S	142	57	58.8585	E	669519.9	5646431.1	0
W00INV2000	3549	39	1	49.8348	S	143	0	57.6065	E	674502.3	5677889.0	31850
W00INV2016	1001	39	18	55.0014	S	142	58	15.4040	E	669914.9	5646368.5	0
W00INV2016	3532	39	1	58.4076	S	143	1	12.8981	E	674864.1	5677616.5	31637
W00INV2032	1001	39	18	56.7505	S	142	58	31.9497	E	670310.0	5646305.9	0
W00INV2032	3515	39	2	6.9799	S	143	1	28.1908	E	675226.0	5677344.0	31425
W00INV2048	1001	39	18	58.4988	S	142	58	48.4956	E	670705.1	5646243.4	0
W00INV2048	3499	39	2	15.1500	S	143	1	43.5542	E	675589.8	5677083.9	31224

18.2 6 Cable Waypoint Listing Seq 009-147 (3D Survey)

LINE	POINT	LATITUDE	LONGITUDE	EASTINGS	NORTHINGS
W00INV1006	3621	38 59 31.27 S	142 43 59.35 E	650099.0	5682665.2
W00INV1006	4889	38 51 2.11 S	142 45 29.83 E	652578.5	5698320.1
W00INV1018	3609	38 59 37.43 S	142 44 10.85 E	650371.9	5682470.2
W00INV1018	4889	38 51 3.44 S	142 45 42.15 E	652874.8	5698273.2
W00INV1030	3597	38 59 43.59 S	142 44 22.34 E	650644.7	5682275.1
W00INV1030	4889	38 51 4.78 S	142 45 54.48 E	653171.1	5698226.2
W00INV1042	3585	38 59 49.74 S	142 44 33.83 E	650917.5	5682080.0
W00INV1042	4889	38 51 6.12 S	142 46 6.80 E	653467.4	5698179.3

W00INV1054	3573	38 59 55.90 S	142 44 45.32 E	651190.4	5681884.9
W00INV1054	4889	38 51 7.45 S	142 46 19.13 E	653763.7	5698132.4
W00INV1066	3562	39 0 1.65 S	142 44 56.89 E	651465.2	5681702.2
W00INV1066	4889	38 51 8.79 S	142 46 31.45 E	654060.0	5698085.4
W00INV1078	3550	39 0 7.81 S	142 45 8.38 E	651738.0	5681507.1
W00INV1078	4889	38 51 10.12 S	142 46 43.78 E	654356.3	5698038.5
W00INV1090	3538	39 0 13.97 S	142 45 19.88 E	652010.9	5681312.0
W00INV1090	4889	38 51 11.46 S	142 46 56.10 E	654652.6	5697991.6
W00INV1102	3526	39 0 20.12 S	142 45 31.37 E	652283.7	5681116.9
W00INV1102	4889	38 51 12.79 S	142 47 8.43 E	654949.0	5697944.7
W00INV1114	3514	39 0 26.28 S	142 45 42.86 E	652556.5	5680921.8
W00INV1114	4889	38 51 14.12 S	142 47 20.76 E	655245.3	5697897.7
W00INV1126	3503	39 0 32.03 S	142 45 54.43 E	652831.3	5680739.1
W00INV1126	4889	38 51 15.46 S	142 47 33.08 E	655541.6	5697850.8
W00INV1138	3491	39 0 38.18 S	142 46 5.93 E	653104.2	5680544.0
W00INV1138	4889	38 51 16.79 S	142 47 45.41 E	655837.9	5697803.9
W00INV1150	3479	39 0 44.34 S	142 46 17.43 E	653377.0	5680348.9
W00INV1150	4889	38 51 18.12 S	142 47 57.73 E	656134.2	5697756.9
W00INV1162	3467	39 0 50.49 S	142 46 28.93 E	653649.9	5680153.8
W00INV1162	4889	38 51 19.45 S	142 48 10.06 E	656430.5	5697710.0
W00INV1174	1001	39 17 22.03 S	142 43 44.98 E	649124.1	5649661.4
W00INV1174	4889	38 51 20.79 S	142 48 22.39 E	656726.8	5697663.1
W00INV1186	1001	39 17 23.37 S	142 43 57.38 E	649420.4	5649614.5
W00INV1186	4889	38 51 22.12 S	142 48 34.71 E	657023.1	5697616.1
W00INV1198	1001	39 17 24.70 S	142 44 9.78 E	649716.7	5649567.6
W00INV1198	4889	38 51 23.45 S	142 48 47.04 E	657319.4	5697569.2
W00INV1210	1001	39 17 26.04 S	142 44 22.18 E	650013.0	5649520.6
W00INV1210	4889	38 51 24.78 S	142 48 59.36 E	657615.7	5697522.3
W00INV1222	1001	39 17 27.38 S	142 44 34.58 E	650309.3	5649473.7
W00INV1222	4889	38 51 26.11 S	142 49 11.69 E	657912.0	5697475.3
W00INV1234	1001	39 17 28.71 S	142 44 46.98 E	650605.6	5649426.8
W00INV1234	4889	38 51 27.44 S	142 49 24.02 E	658208.3	5697428.4
W00INV1246	1001	39 17 30.05 S	142 44 59.38 E	650901.9	5649379.8
W00INV1246	4889	38 51 28.77 S	142 49 36.34 E	658504.6	5697381.5
W00INV1258	1001	39 17 31.39 S	142 45 11.78 E	651198.2	5649332.9
W00INV1258	4889	38 51 30.10 S	142 49 48.67 E	658800.9	5697334.6
W00INV1270	1001	39 17 32.72 S	142 45 24.19 E	651494.5	5649286.0
W00INV1270	4889	38 51 31.43 S	142 50 1.00 E	659097.2	5697287.6
W00INV1282	1001	39 17 34.06 S	142 45 36.59 E	651790.8	5649239.0
W00INV1282	4889	38 51 32.76 S	142 50 13.33 E	659393.6	5697240.7
W00INV1294	1001	39 17 35.39 S	142 45 48.99 E	652087.1	5649192.1
W00INV1294	4889	38 51 34.08 S	142 50 25.66 E	659689.9	5697193.8
W00INV1306	1001	39 17 36.73 S	142 46 1.39 E	652383.4	5649145.2
W00INV1306	4889	38 51 35.41 S	142 50 37.98 E	659986.2	5697146.8
W00INV1318	1001	39 17 38.06 S	142 46 13.80 E	652679.8	5649098.3
W00INV1318	4889	38 51 36.74 S	142 50 50.31 E	660282.5	5697099.9
W00INV1330	1001	39 17 39.39 S	142 46 26.20 E	652976.1	5649051.3
W00INV1330	4889	38 51 38.07 S	142 51 2.64 E	660578.8	5697053.0
W00INV1342	1001	39 17 40.73 S	142 46 38.60 E	653272.4	5649004.4
W00INV1342	4889	38 51 39.40 S	142 51 14.96 E	660875.1	5697006.0

W00INV1354	1001	39	17	42.06 S	142	46 51.01 E	653568.7	5648957.5
W00INV1354	4889	38	51	40.72 S	142	51 27.29 E	661171.4	5696959.1
W00INV1366	1001	39	17	43.39 S	142	47 3.41 E	653865.0	5648910.5
W00INV1366	4889	38	51	42.05 S	142	51 39.62 E	661467.7	5696912.2
W00INV1378	1001	39	17	44.72 S	142	47 15.81 E	654161.3	5648863.6
W00INV1378	4889	38	51	43.37 S	142	51 51.95 E	661764.0	5696865.3
W00INV1390	1001	39	17	46.05 S	142	47 28.21 E	654457.6	5648816.7
W00INV1390	4889	38	51	44.70 S	142	52 4.28 E	662060.3	5696818.3
W00INV1402	1001	39	17	47.39 S	142	47 40.62 E	654753.9	5648769.7
W00INV1402	4889	38	51	46.02 S	142	52 16.60 E	662356.6	5696771.4
W00INV1414	1001	39	17	48.72 S	142	47 53.02 E	655050.2	5648722.8
W00INV1414	4889	38	51	47.35 S	142	52 28.93 E	662652.9	5696724.5
W00INV1426	1001	39	17	50.05 S	142	48 5.42 E	655346.5	5648675.9
W00INV1426	4889	38	51	48.67 S	142	52 41.26 E	662949.2	5696677.5
W00INV1438	1001	39	17	51.38 S	142	48 17.83 E	655642.8	5648628.9
W00INV1438	4889	38	51	49.99 S	142	52 53.59 E	663245.5	5696630.6
W00INV1450	1001	39	17	52.71 S	142	48 30.23 E	655939.1	5648582.0
W00INV1450	4889	38	51	51.32 S	142	53 5.92 E	663541.8	5696583.7
W00INV1462	1001	39	17	54.04 S	142	48 42.63 E	656235.4	5648535.1
W00INV1462	4889	38	51	52.64 S	142	53 18.25 E	663838.1	5696536.7
W00INV1474	1001	39	17	55.36 S	142	48 55.04 E	656531.7	5648488.2
W00INV1474	4889	38	51	53.96 S	142	53 30.58 E	664134.5	5696489.8
W00INV1486	1001	39	17	56.69 S	142	49 7.44 E	656828.0	5648441.2
W00INV1486	4889	38	51	55.29 S	142	53 42.91 E	664430.8	5696442.9
W00INV1498	1001	39	17	58.02 S	142	49 19.84 E	657124.3	5648394.3
W00INV1498	4889	38	51	56.61 S	142	53 55.24 E	664727.1	5696395.9
W00INV1510	1001	39	17	59.35 S	142	49 32.25 E	657420.7	5648347.4
W00INV1510	4889	38	51	57.93 S	142	54 7.56 E	665023.4	5696349.0
W00INV1522	1001	39	18	0.68 S	142	49 44.66 E	657717.0	5648300.4
W00INV1522	4889	38	51	59.25 S	142	54 19.89 E	665319.7	5696302.1
W00INV1534	1001	39	18	2.00 S	142	49 57.06 E	658013.3	5648253.5
W00INV1534	4889	38	52	0.57 S	142	54 32.22 E	665616.0	5696255.2
W00INV1546	1001	39	18	3.33 S	142	50 9.47 E	658309.6	5648206.6
W00INV1546	4889	38	52	1.89 S	142	54 44.55 E	665912.3	5696208.2
W00INV1558	1001	39	18	4.66 S	142	50 21.87 E	658605.9	5648159.6
W00INV1558	4889	38	52	3.21 S	142	54 56.88 E	666208.6	5696161.3
W00INV1570	1001	39	18	5.98 S	142	50 34.27 E	658902.2	5648112.7
W00INV1570	4889	38	52	4.53 S	142	55 9.21 E	666504.9	5696114.4
W00INV1582	1001	39	18	7.31 S	142	50 46.68 E	659198.5	5648065.8
W00INV1582	4888	38	52	6.25 S	142	55 21.47 E	666799.3	5696055.1
W00INV1594	1001	39	18	8.63 S	142	50 59.08 E	659494.8	5648018.9
W00INV1594	4876	38	52	12.39 S	142	55 32.96 E	667072.1	5695860.0
W00INV1606	1001	39	18	9.96 S	142	51 11.49 E	659791.1	5647971.9
W00INV1606	4864	38	52	18.53 S	142	55 44.44 E	667344.9	5695664.9
W00INV1618	1001	39	18	11.28 S	142	51 23.89 E	660087.4	5647925.0
W00INV1618	4852	38	52	24.67 S	142	55 55.93 E	667617.8	5695469.8
W00INV1630	1001	39	18	12.61 S	142	51 36.30 E	660383.7	5647878.1
W00INV1630	4840	38	52	30.81 S	142	56 7.42 E	667890.6	5695274.8
W00INV1642	1001	39	18	13.93 S	142	51 48.70 E	660680.0	5647831.1
W00INV1642	4828	38	52	36.94 S	142	56 18.91 E	668163.5	5695079.7

W00INV1654	1001	39	18	15.25	S	142	52	1.11	E	660976.3	5647784.2
W00INV1654	4816	38	52	43.08	S	142	56	30.40	E	668436.3	5694884.6
W00INV1666	1001	39	18	16.58	S	142	52	13.52	E	661272.6	5647737.3
W00INV1666	4804	38	52	49.22	S	142	56	41.89	E	668709.1	5694689.5
W00INV1678	1001	39	18	17.90	S	142	52	25.92	E	661568.9	5647690.3
W00INV1678	4792	38	52	55.35	S	142	56	53.38	E	668982.0	5694494.4
W00INV1690	1001	39	18	19.22	S	142	52	38.33	E	661865.3	5647643.4
W00INV1690	4780	38	53	1.49	S	142	57	4.87	E	669254.8	5694299.3
W00INV1702	1001	39	18	20.54	S	142	52	50.74	E	662161.6	5647596.5
W00INV1702	4768	38	53	7.62	S	142	57	16.36	E	669527.7	5694104.3
W00INV1714	1001	39	18	21.86	S	142	53	3.14	E	662457.9	5647549.6
W00INV1714	4757	38	53	13.36	S	142	57	27.92	E	669802.5	5693921.5
W00INV1726	1001	39	18	23.19	S	142	53	15.55	E	662754.2	5647502.6
W00INV1726	4745	38	53	19.50	S	142	57	39.42	E	670075.3	5693726.4
W00INV1738	1001	39	18	24.51	S	142	53	27.95	E	663050.5	5647455.7
W00INV1738	4733	38	53	25.63	S	142	57	50.91	E	670348.2	5693531.4
W00INV1750	1001	39	18	25.83	S	142	53	40.36	E	663346.8	5647408.8
W00INV1750	4721	38	53	31.76	S	142	58	2.40	E	670621.0	5693336.3
W00INV1762	1001	39	18	27.15	S	142	53	52.77	E	663643.1	5647361.8
W00INV1762	4709	38	53	37.90	S	142	58	13.90	E	670893.8	5693141.2
W00INV1774	1001	39	18	28.47	S	142	54	5.17	E	663939.4	5647314.9
W00INV1774	4697	38	53	44.03	S	142	58	25.39	E	671166.7	5692946.1
W00INV1786	1001	39	18	29.79	S	142	54	17.58	E	664235.7	5647268.0
W00INV1786	4685	38	53	50.17	S	142	58	36.89	E	671439.5	5692751.0
W00INV1798	1001	39	18	31.11	S	142	54	29.99	E	664532.0	5647221.0
W00INV1798	4673	38	53	56.30	S	142	58	48.38	E	671712.4	5692555.9
W00INV1810	1001	39	18	32.43	S	142	54	42.39	E	664828.3	5647174.1
W00INV1810	4661	38	54	2.43	S	142	58	59.88	E	671985.2	5692360.8
W00INV1822	1001	39	18	33.74	S	142	54	54.80	E	665124.6	5647127.2
W00INV1822	4649	38	54	8.56	S	142	59	11.37	E	672258.0	5692165.8
W00INV1834	1001	39	18	35.06	S	142	55	7.21	E	665420.9	5647080.2
W00INV1834	4637	38	54	14.70	S	142	59	22.87	E	672530.9	5691970.7
W00INV1846	1001	39	18	36.38	S	142	55	19.62	E	665717.2	5647033.3
W00INV1846	3714	39	0	26.74	S	142	58	30.57	E	671022.3	5680528.3
W00INV1858	1001	39	18	37.70	S	142	55	32.02	E	666013.5	5646986.4
W00INV1858	3701	39	0	33.27	S	142	58	42.02	E	671293.2	5680320.9
W00INV1870	1001	39	18	39.01	S	142	55	44.44	E	666309.9	5646939.5
W00INV1870	3688	39	0	39.81	S	142	58	53.46	E	671564.1	5680113.4
W00INV1882	1001	39	18	40.33	S	142	55	56.84	E	666606.2	5646892.5
W00INV1882	3675	39	0	46.34	S	142	59	4.91	E	671835.0	5679906.0
W00INV1894	1001	39	18	41.64	S	142	56	9.25	E	666902.5	5646845.6
W00INV1894	3663	39	0	52.47	S	142	59	16.42	E	672107.8	5679710.9
W00INV1906	1001	39	18	42.96	S	142	56	21.66	E	667198.8	5646798.7
W00INV1906	3650	39	0	59.01	S	142	59	27.87	E	672378.7	5679503.5
W00INV1918	1001	39	18	44.28	S	142	56	34.07	E	667495.1	5646751.7
W00INV1918	3637	39	1	5.54	S	142	59	39.31	E	672649.6	5679296.1
W00INV1930	1001	39	18	45.59	S	142	56	46.47	E	667791.4	5646704.8
W00INV1930	3624	39	1	12.07	S	142	59	50.76	E	672920.5	5679088.6
W00INV1942	1001	39	18	46.90	S	142	56	58.88	E	668087.7	5646657.9
W00INV1942	3612	39	1	18.20	S	143	0	2.28	E	673193.3	5678893.6

W00INV1954	1001	39	18	48.22	S	142	57	11.29	E	668384.0	5646610.9
W00INV1954	3599	39	1	24.73	S	143	0	13.73	E	673464.2	5678686.1
W00INV1966	1001	39	18	49.53	S	142	57	23.70	E	668680.3	5646564.0
W00INV1966	3586	39	1	31.27	S	143	0	25.18	E	673735.1	5678478.7
W00INV1978	1001	39	18	50.85	S	142	57	36.11	E	668976.6	5646517.1
W00INV1978	3573	39	1	37.80	S	143	0	36.63	E	674006.0	5678271.3
W00INV1990	1001	39	18	52.16	S	142	57	48.52	E	669272.9	5646470.2
W00INV1990	3561	39	1	43.92	S	143	0	48.14	E	674278.8	5678076.2
W00INV2002	1001	39	18	53.47	S	142	58	0.92	E	669569.2	5646423.2
W00INV2002	3548	39	1	50.46	S	143	0	59.60	E	674549.7	5677868.7
W00INV2014	1001	39	18	54.78	S	142	58	13.33	E	669865.5	5646376.3
W00INV2014	3535	39	1	56.99	S	143	1	11.05	E	674820.6	5677661.3
W00INV2026	1001	39	18	56.09	S	142	58	25.74	E	670161.8	5646329.4
W00INV2026	3522	39	2	3.52	S	143	1	22.50	E	675091.5	5677453.9
W00INV2038	1001	39	18	57.41	S	142	58	38.15	E	670458.1	5646282.4
W00INV2038	3510	39	2	9.64	S	143	1	34.02	E	675364.3	5677258.8
W00INV2050	1001	39	18	58.72	S	142	58	50.56	E	670754.4	5646235.5
W00INV2050	3497	39	2	16.17	S	143	1	45.47	E	675635.2	5677051.4

Note: **a)** Line numbers 1006-1186 were not acquired at the request of the client.
b) The 6 Cable waypoints were generated onboard the M/V Western Pride and verified by the client prior to production.

18.3 2D Survey Waypoint Listing

LINE	POINT	LATITUDE	LONGITUDE	EASTINGS	NORTHINGS	RANGE
W00INV0001	1001	39 1 18.7789 S	142 40 47.1924 E	645414.8	5679437.7	0
W00INV0001	2885	38 41 18.0572 S	142 57 58.6678 E	671017.5	5715957.1	44600
W00INV0002	1001	39 0 12.2377 S	142 40 3.2183 E	644394.9	5681508.5	0
W00INV0002	3361	39 0 53.0600 S	143 19 11.0138 E	700839.7	5679012.6	56499
W00INV0003	1001	39 10 20.1297 S	142 57 56.8017 E	669814.1	5662251.9	0
W00INV0003	2610	38 56 16.2095 S	143 16 52.6254 E	697725.0	5687632.2	37725
W00INV0004	1001	39 32 3.6800 S	143 0 40.1789 E	672839.9	5621976.1	0
W00INV0004	3135	39 4 58.7673 S	143 6 40.7948 E	682619.4	5671876.9	50850
W00INV0005	1001	39 16 40.3815 S	142 47 31.3105 E	654571.9	5650839.9	0
W00INV0005	2515	39 31 38.2905 S	143 2 49.8328 E	675953.1	5622689.1	35350
W00INV0006	1001	39 16 15.2313 S	142 50 18.3018 E	658589.0	5651535.0	0
W00INV0006	2486	39 23 14.7043 S	143 12 39.3069 E	690408.9	5637882.8	34624
W00INV0007	1001	39 29 41.1126 S	142 56 55.7239 E	667576.4	5626489.6	0
W00INV0007	1801	39 18 58.4978 S	142 58 48.4960 E	670705.1	5646243.4	20000

Note: Line numbers 0001-0003 were not acquired.
Shotpoint numbers adjusted from original waypoints so that all lines started at 1001