ACQUISITION REPORT

PGS Geophysical

M/V Orient Explorer

2003084

Woodside Energy Ltd

Antares 3D Survey,
NSW, Australia

17 October – 12 November 2003

version 1

AUTHORISATION

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Singapore

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REVISED VERSIONS

NUMBER	CHANGES	AUTHOR	DATE

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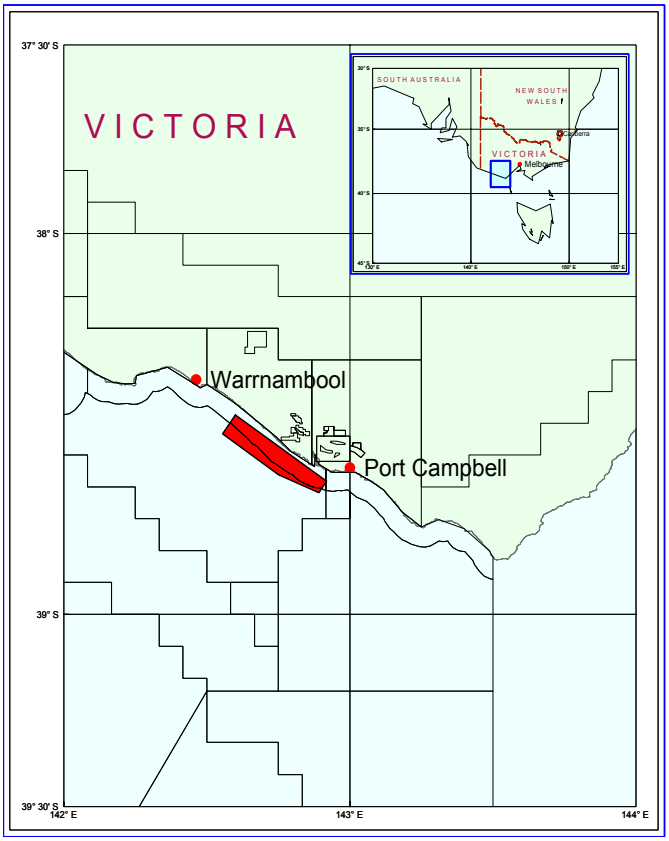
1 Introduction

1.1 Summary



The MV ORIENT EXPLORER was contracted by Woodside Energy Ltd. to conduct a 3D seismic survey offshore Victoria, Australia.

The vessel mobilised in Portland 17 October 2003 and on the same date an AMSA inspection, Woodside Maritime Audit and Helicopter deck audit was carried out onboard the vessel. The vessel was cleared to sail on 19 October 2003 and deployment started on the same day.

The deployment was stopped just before midnight on 20 October 2003 due to weather and the vessel stayed in shelter until 22 October when the vessel left port and started to deploy once again.

The first accepted sequence commenced on 25 October.

On 28 October, the vessel recovered the streamers and crew change was carried out in Portland on 29 October 2003.

The M/V ORIENT EXPLORER was back in production on 1 November after re-deployment and standby for weather.

After acquiring 49 sequences the acquisition was completed on the 11 of November 2003 and the M/V ORIENT EXPLORER completed the de-mobilisation at sea on 12 November 2003.

1.2 Key parameters

Source	:	2 x 2500 in^3
Streamers	:	4 x 4050 m
Streamer spacing	:	100 m
Near trace offset	:	125 m

1.3 Systems

Source type	:	Bolt guns
Streamer type	:	Syntron/Teledyne LDA
Recording system	:	Syntron 960-24, with direct link to Seismic QC
Navigation	:	StarFix DGPS
	:	SkyFix DGPS
Float positioning	:	Seatrack RGPS
Acoustic ranging	:	Sonardyne SIPS S1

1.4 Production

	Sail line km	**CDP km**
Prime full fold, chargeable	1057.26	8458.05
Prime run-out	66.83	534.60
Infill	164.61	1316.85
Total	**1288.69**	**10309.50**

1.5 Survey timing

	Hours		Hours	% of total
Production	247.02	Production prime	145.68	23.8
		Production infill	20.92	3.4
		Line change	68.20	11.1
		Line change standby	10.50	1.7
		Local travel (extended LC)	1.72	0.3
Standby	154.08	Fishing	2.25	0.4
		Obstructions	0.18	0.0
		Awaiting clearance	11.00	1.8
		Crew change	38.97	6.4
		Weather	65.73	10.7
		Client Request	35.95	5.9
Mob / demob	98.63	Mob	91.25	14.9
		Demob	7.38	1.2
Downtime	113.26	Instruments	64.28	10.5
		Navigation	2.53	0.4
		Mechanical	7.95	1.3
		Maritime	38.50	6.3
Total	**612.99**			100

Note:

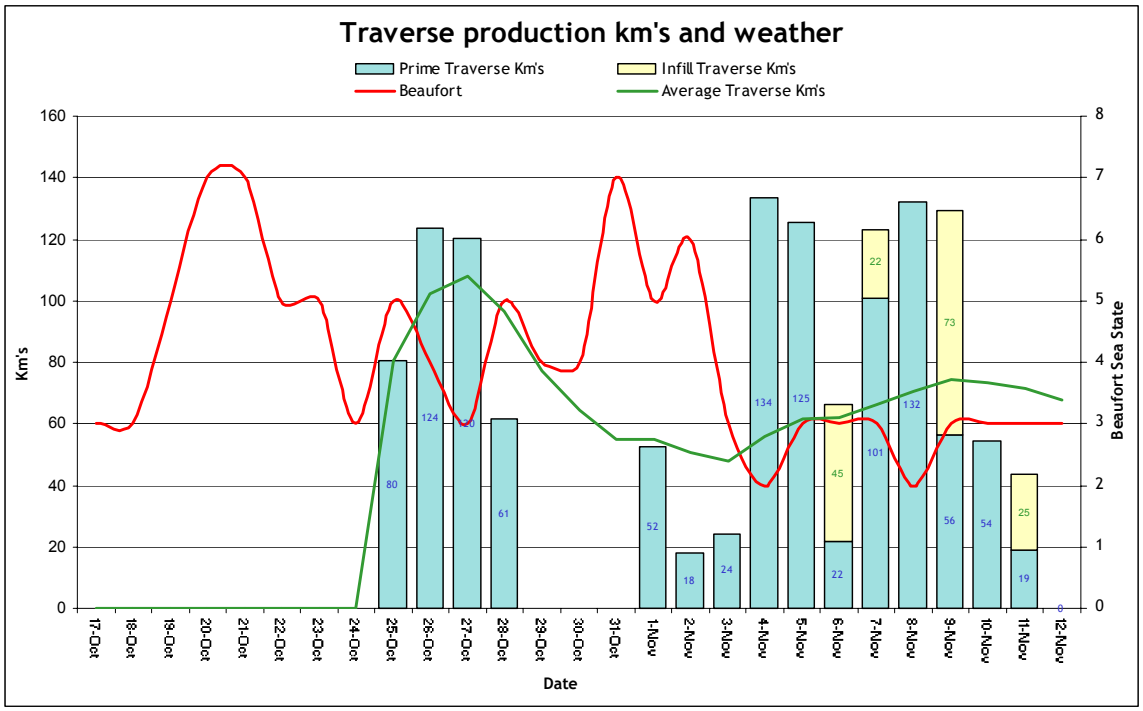
- Start of survey (local times) 17 Oct 2003 at 11:00 hrs to 12 Nov 2003 at 12:00 hrs
- Times for production prime also includes time for shooting run out.
- Line change standby used for chargeable line changes after infill production.
- Local travel used for extended line change due to survey geometry or line choice limitations.

2 Sequence of events

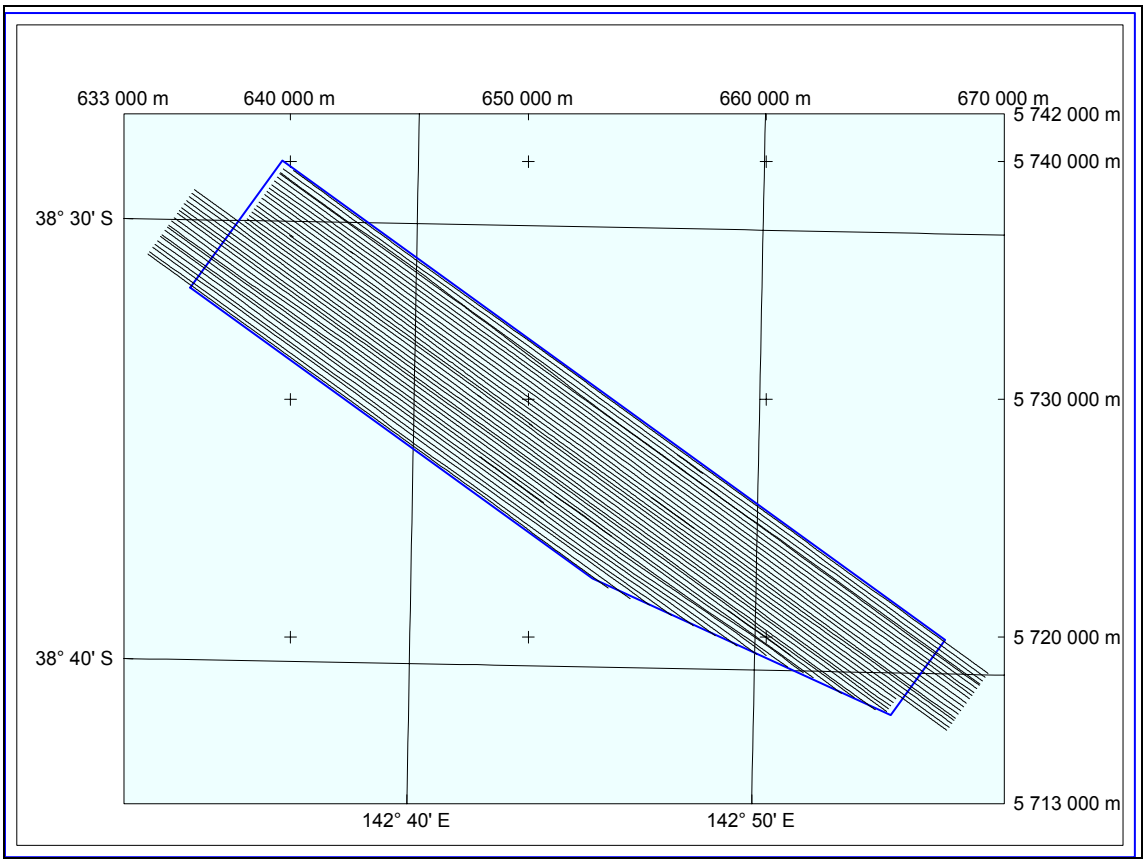
2.1 Daily log

Date	Daily Prime Km's	Daily Infill Km's	Sea State Beaufort	Location	Comments
17-Oct-03			3	Portland	Startup meeting in Portland. AMSA inspection; Woodside maritime audit; Helideck audit.
18-Oct-03			3	Portland	Staying in Portland to correct defects highlighted by AMSA inspection.
19-Oct-03			5	Portland / Open sea	Staying in port due to problems emptying #12 ballast tank. Leave Portland at 1200hrs. Begin deployment at 1615hrs. Weather poor.
20-Oct-03			7	Portland / Open sea	Deploying. Weather interferring with deployment, having to recover stmr #4 before deploying #1 for balancing. Stop deploying at 2300hrs due to worsening weather.
21-Oct-03			7	Portland Bay	Recover strm #1, andf head for Portland Bay for shelter, together with Southern Salvor. Perfect Lady is in Port Fairy, and she will wait there until further notice.
22-Oct-03			5	Portland Bay / Open sea	Towing tests in Portland Bay, followed by heading out to sea to commence deployment.
23-Oct-03			5	Open Sea / Prospect	Deploying. Spotter plane up to check for whales in the afternoon, but stmr #3 has to come back in for balancing. Perfect Lady checking prospect for signs of fishing and whales.
24-Oct-03			3	Prospect area	Deploying. Guns take a little while to get going, as they have been on deck for over 4 weeks.
25-Oct-03	80.42		5	Prospect area	Start production seq #1 - 4
26-Oct-03	123.64		4	Prospect area	Production Seq #5 - 7
27-Oct-03	120.43		3	Prospect area	Production Seq #8 - 10
28-Oct-03	61.43		5	Prospect area	Production Seq #11-13. Start recovery at 12:35 hrs for crew change in Portland
29-Oct-03			4	Portland	Arrived 07:00 in Portland. Departure 17:30 heading for open sea to deploy streamers
30-Oct-03			4	Open Sea / South of Prospect	Deployment of streamers continues
31-Oct-03			7	Prospect area	Deployment of streamers completed 16:07. Standby for weather.
01-Nov-03	52.46		5	Prospect area	Standby for weather. Start of production 13:59. Production seq. 14
02-Nov-03	18.15		6	Prospect area	Production seq.15. Recovery of streamer 4 d/t bird and ballast problems at 2:34
03-Nov-03	23.93		3	Prospect area	Continue ballast. Lead-in change on streamer #4. Production starts at 17:16 (seq #17)
04-Nov-03	133.69		2	Prospect area	Production Seq# 18-21
05-Nov-03	125.44		3	Prospect area	Production Seq# 22-24
06-Nov-03	21.92	44.57	3	Prospect area	Production Seq# 25-27. Recovery of front of streamer#3 d/t extraction errors
07-Nov-03	100.93	22.20	3	Prospect area	Production Seq# 28-31
08-Nov-03	131.85		2	Prospect area	Production Seq# 32-35
09-Nov-03	56.49	72.90	3	Prospect area	Production Seq# 36-39
10-Nov-03	54.47		3	Prospect area	Production Seq# 40-45
11-Nov-03	18.84	24.94	3	Prospect area	Production Seq# 46-49. Survey complete 16:37. De-mobilising at sea.
12-Nov-03	0.00		3	Prospect area	De-mobilisation completed at sea 12:00

2.2 Daily production and sea state



2.3 Post plotted vessel positions



3 Key personnel

	Period 1 (17.10-29.10)	**Period 2 (29.10-12.11)**
Party chief	Stephen Beer	Esben Jettestad
Chief observer	Udo Bar	Werner Beneke
Chief navigator	Stephen Pitcher	Geofrey Weaver
Chief mechanic	Karl Holkestad	Pat Stoltz
Chief geophysicist	Ashok Pandey	Guy Alleman
Client representative onboard	Ken Haig Stephen Burt	Ken Haig Stephen Burt
Client contacts onshore	Ralph Weiss	Ralph Weiss

4 HSE

4.1 Statistics

Exposure hours	Marine crew	15600
	Seismic crew	13464
	Third party crew	1872
	Total	30936
Workboat operations		10
Workboat exposure hours		45.40

4.2 Incidents

Report no.	Date	Classification	Comments
ORI0316	25 Oct 03	Personnel	One man on the chase vessel Perfect Lady passed out for a short while. The chase vessel immediately went to port and got the man to hospital
ORI0317	5 Nov 03	Near Miss	Corroded Lithium batteries left unattended.

5 Survey operations review

The weather was expected to impact on the survey and it did cause the vessel to be on standby for 10.5 % of the survey time. The dominating long swell from the SW combined with wind force 7 or higher made the operation unsafe on the back deck during the first deployment and during the re-deployment after crew change. The vessel went on standby for weather on both occasions until the weather came down and it was again safe to deploy streamers.

There was very little current in the survey area. The dominating direction was in line direction, and therefore the feathering angles for the job due to tides were negligible and in the order of +/- 2° for the majority of the survey. The infill percentage was 14.8% based on total prime km's acquired. One might say that the infill percentage was high with the low feather, but 2 of the infill lines had to be shot to cover just 2 columns of infill.

The long swell from SW was in the range 1.5m to 4.0m. Due to the direction, it had very little impact on the seismic data.

The M/V ORIENT EXPLORER was guarded by the chaseboat "PERFECT LADY". The fishing activity was low for the duration of the survey. One fishing vessel was acting very impolite when he was asked to move out of the turning area of ORIENT EXPLORER on the morning of 6 November. Another fishing vessel was very co-operative and asked for our next 24 hrs operating areas before he put out his nets.

The survey was completed just 3 days before the crayfish season started on 15 November 2003 at 09:00.

The other guard vessel was the tugboat "M/V SOUTHERN SALVOR" which was acting as an emergency-towing vessel. The "M/V SOUTHERN SALVOR" was always within 1nm of the M/V ORIENT EXPLORER in case of main engine shut down. Towing drills were performed at the start of the survey and after crew change on 29 October 2003.

The survey area is a seasonal feeding area for whales and the survey was done when the number of whales was expected to be at minimum. Whale watching was performed during the survey. Soft start procedures were followed and aerial surveys done before production started on 25 October and 1 November. No cetaceans were observed from the vessel, but on 5 November, a Southern Right Whale was spotted in the NW turning area from ashore. The information was brought to the attention of the vessel by Woodside, and no guns were fired during the following line change. A normal soft start procedure was done prior to the start of the next line in the SE direction.

The pipe layer barge "SEMAC 1" was operating in the SE turning area. It was expected that this operation, which had priority, would have an impact on the seismic survey. However, the "SEMAC 1" did not start to move before 8 November and therefore did not interfere with the seismic survey. The three supply and anchor handling vessels working with "SEMAC 1" were very co-operative throughout the survey. Daily contact with the Captain of "SEMAC 1" was maintained throughout the survey.

6 System performance

6.1 Source

The source was performing very well on this survey. The Bolt guns proved to have a better performance in colder water as experienced on this survey. A total of 7.95 hours downtime was caused by two edits. One for autofiring guns on sequence 001 and the other for an air leakage during sequence 011.

6.2 Streamers

48.98 hours downtime was caused by bird motor failure, streamer balancing, failing lead-in and extractions errors on streamers 3 and 4.

After sequence 15 bird 13 on streamer 4 had a motor failure. Due to the weather being too rough for changing out the bird by workboat, the streamer had to be recovered. During recovery, sections with little oil were filled up, but not enough lead was put on to compensate for the weight difference. Therefore, the streamer had to be brought back in to re-compensate for the now too light streamer.

Lead-in number 3 failed and was changed between sequence 015 and 016.

After sequence 26 an extraction count error developed on streamer number 3. The front of the streamer was suspected to cause this problem, and the boots were changed out at the front. All connectors were opened at the front and cleaned. The extraction count error stopped on streamer 3 after this.

Later the same day extractions errors on streamer 4 started to occur. Two modules were changed out (module 6 and 7) and the extraction count error very low after this.

6.3 Recording system

The recording caused 15.30 hours downtime. This time does not actually reflect the number of edits caused by the recording system crashing or tapes quitting. A total of 8 edits were caused by the Syntrak system failing, but 2 of the edits were picked while shooting an infill line.

6.4 Navigation

The navigation systems performed very well during the survey. On the first sequence after crew change (sequence 014) the triggers of the GCS90 gun controller failed. By re-initialising the navigation closure unit, this problem was solved, but it is uncertain if it was the navigation closure unit, the cabling or the GCS90 gun controller that caused this. Navigation was given the 2.53 hrs downtime for this edit.

7 Seismic data quality

7.1 General

The data quality was very good even if the seas were quite rough most of the time. The background noise ranged from 5-7 μBar and higher on the occasions there was some rough weather. Mud Roll and Strum Noise was present on almost all the lines shot. At the Eastern part of the prospect pipeline lying activity generated some noise similar to ship noise.

7.2 Seismic interference

There was no seismic interface during the survey.

7.3 Swell noise

A few sequences had some swell noise that can be noticed on the stacks and RMS window displays. The swell was high during almost the whole acquisition period. As a consequence of shooting parallel to the swell direction, the noise remained low. Sequence 14 (line 1092) and 15 (Line 1164) exhibit a higher level of swell noise but still remain within specifications.

7.4 Strum noise

Strum noise (or Tug Noise) was constantly monitored from the RMS and shot displays, ensuring that it remained within acceptable limits. During the course of this survey, it has been visible on most lines. It was low of a low frequency nature and intermittent on all streamers, sometimes noticeable on more than 10 near channels.

7.5 Mud Roll

A strong Mud Roll (similar to Ground Roll in land seismic) is visible on the raw shots in those shallow waters with soft bottom.

7.6 Ship noise

There was more noise to the Eastern end of the lines due to the pipe laying activity. This is visible on some RMS graphs (see below).

7.7 Bad channels

The number of bad channels has stayed very low on this survey. Even the channels near birds or acoustic devices were quiet. It was also noticed that the average noise on those channels was lower when the vessel speed was decreasing. **Random spiking** due to swell was observed at different trace locations and times. Some shots were flagged in the Syntrak Log with **Extraction errors** on streamer 3 or 4 on some lines. Those were checked on screen. The streamer with corrupted data was added as an edit for the affected shot. The shot before and after each flagged extraction error was also checked as it happened that sometimes the wrong shot was flagged in the P7 logs and the SEGD header.

7.8 RMS and noise analysis

Gif files of RMS displays were delivered to the client onboard and added to the Seismic QC CD delivered at the end of the survey. The RMS analysis was using Syntrak data

Water Column noise window, (120 to 170 ms on Syntrak*), (Colour bar range fixed at 0-20µbar)

The water column noise window displays the ambient background noise levels. This window was chosen as a reference for noise analysis. This attribute display clearly shows the lines affected by external sources of noise, e.g. swell, strum, ship noise, impacts etc. The average ambient background noise level for the survey was 5-7 µbar. In conjunction with the Syntrak Noise Record Displays, the shot and channel edits were confirmed/established on a line-by-line basis from screen displays of this window.

Signal Window, (1620 to 2120 ms on Syntrak*)

This signal window display shows the signal strength of the source. It is used to give an indication of the signal and noise in the zone of interest. The patterns on this display can reflect the geology of the area.

Intermediate window, (3120 to 3620 ms on Syntrak*)

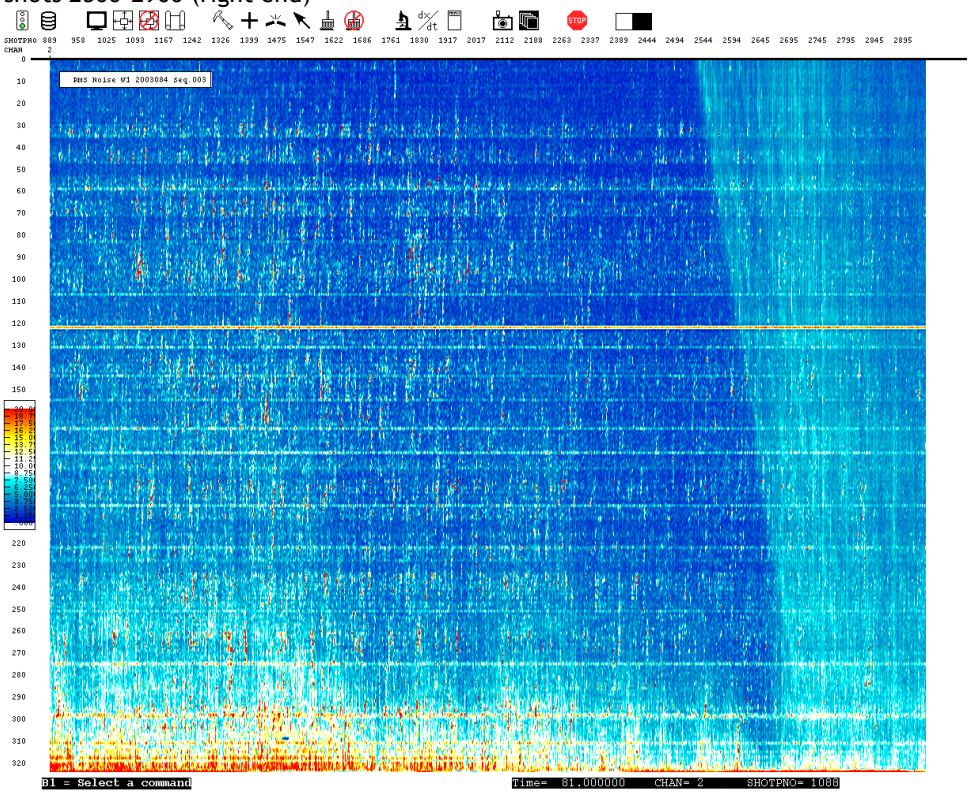
This window was used as an indication of the signal and noise deeper in the record.

End of Record noise window (deep), (5620 to 6120 ms on Syntrak*), (Colour bar range fixed at 0-20µbar)

The end of record RMS level was used to aid in noise estimation.

* The RMS amplitude values where measured in µBar after a 5Hz Low Cut Filter.

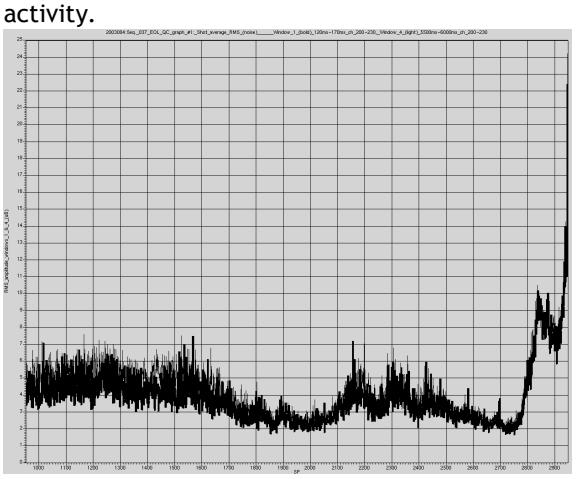
RMS Noise window 1 on seq 003 showing bad/spiky channels, strum and swell noise on streamer 2. Some "ship noise" from a pipeline barge is also visible between shots 2500-2900 (right end)



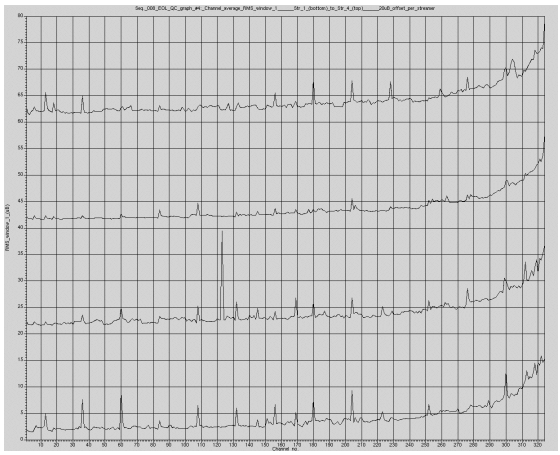
RMS graphs displaying all channel values for the noise window (W1) were a useful tool to identify the different types of noise encountered. The geophysical QC mainly takes into account the average shot point RMS noise display to check ambient noise levels. The average RMS channel plots and signal window screen displays are also checked for bad channels.

The shot point average RMS of the noise window is an important display for geophysical QC as it gives information on the combined effect of the sea state, any external noise sources and allows background noise estimation. On this survey, the background noise was ranging from 5-7 µBars. Some of the RMS displays were still affected by strong diffractions or other events from preceding shots.

RMS Graph showing a shot average over channels 230-260* for window 1 and 4 on sequence 080. The high RMS values are due to pipe laying activity.



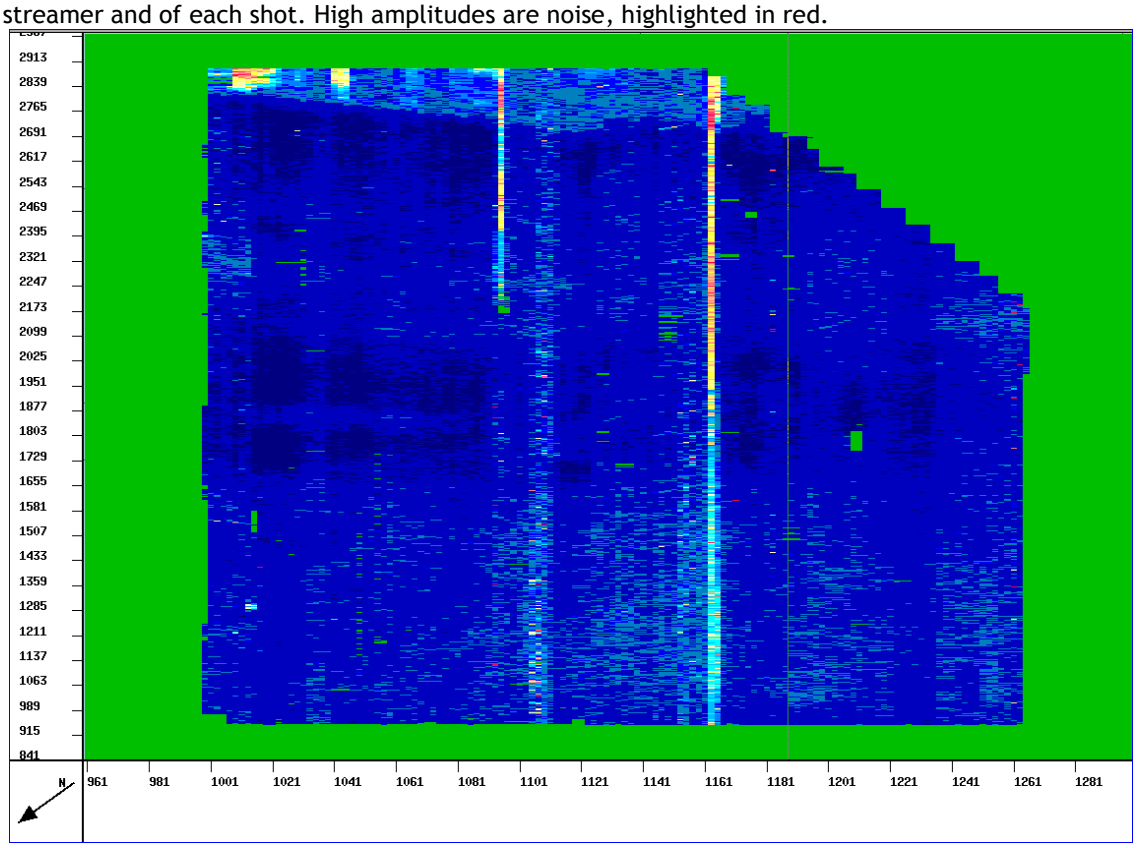
RMS Graph on sequence 008 showing a channel average over each streamer. Weak and bad channels are visible. Channels with birds are more noisier.



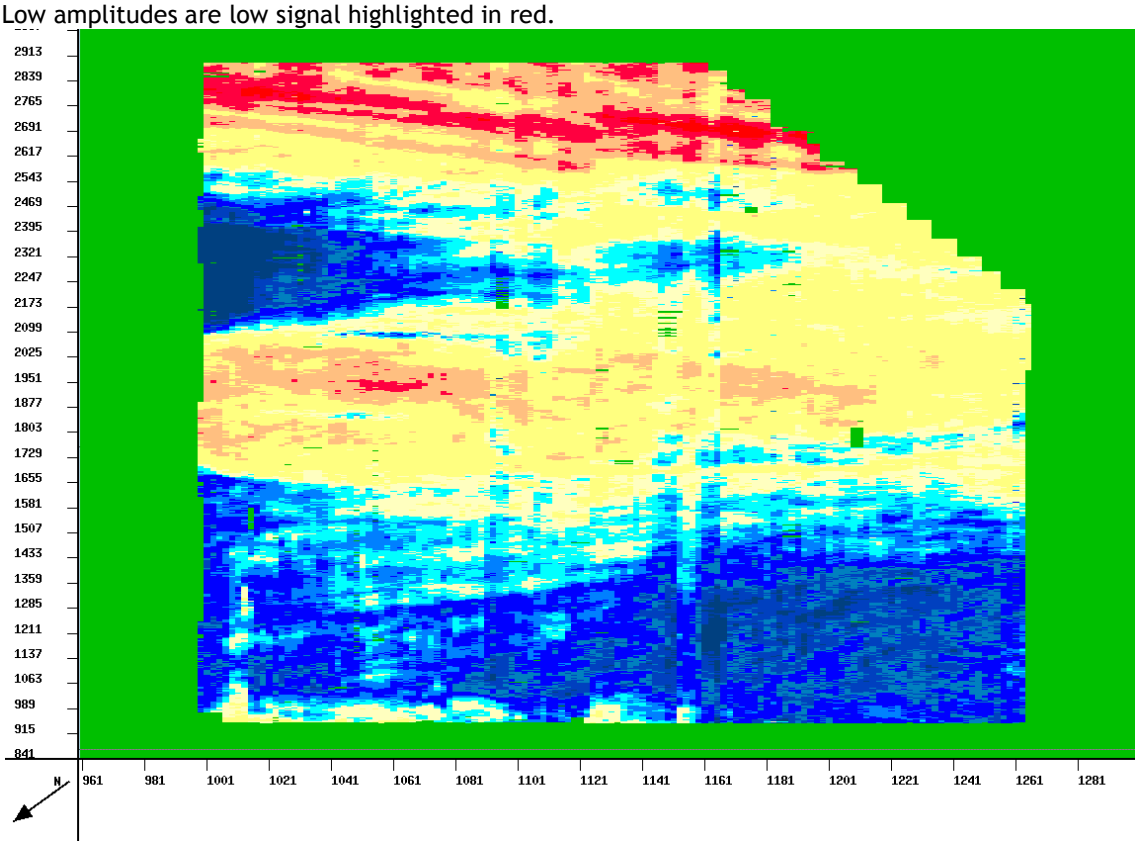
* Caption on graph is not correct

In addition to a line-by-line analysis, some aerial displays of different RMS windows were generated, in order to compare the amplitudes over the whole survey. A Noise window and a Signal window are displayed here. They show the very good quality and consistency of the data.

Amplitude Map of Noise RMS window1 (120-170 ms) averaged over chann els230-260 of each streamer and of each shot. High amplitudes are noise, highlighted in red.



Amplitude Map of Noise RMS window2 (1620-2120 ms) averaged over each streamer of each shot. Low amplitudes are low signal highlighted in red.



Some shots were sometimes not read by our QC system and generated some minor holes on the Real Time QC displays. For example, when there was a Syntrak crash, it took a few shots for our QC system to be able to capture data again; or on occasion when the system was overloaded some shots were dropped by our bit 3 card. This does not affect the quality of data on tape.

Some sequences had more swell than the others: Sequence 14 (line 1092) and 15 (Line 1164) display such a higher level of swell noise. There was also more noise to the Eastern end due to the pipe laying activity. But the overall noise level was very low.

RMS Window 2 shows a very consistent continuity from line to line, the high amplitudes in the East being an effect of the pipe laying activity.

7.9 First break / P1 offset check

Navigation QC plots were generated with the Cobra system (PGS Proprietary Software) and ProMAX. They were checked on a line-to-line basis. The navigation QC was not possible as the direct arrival was not always the first break, the refractions interfering sometimes with the direct arrivals in shallow waters with hard bottom.

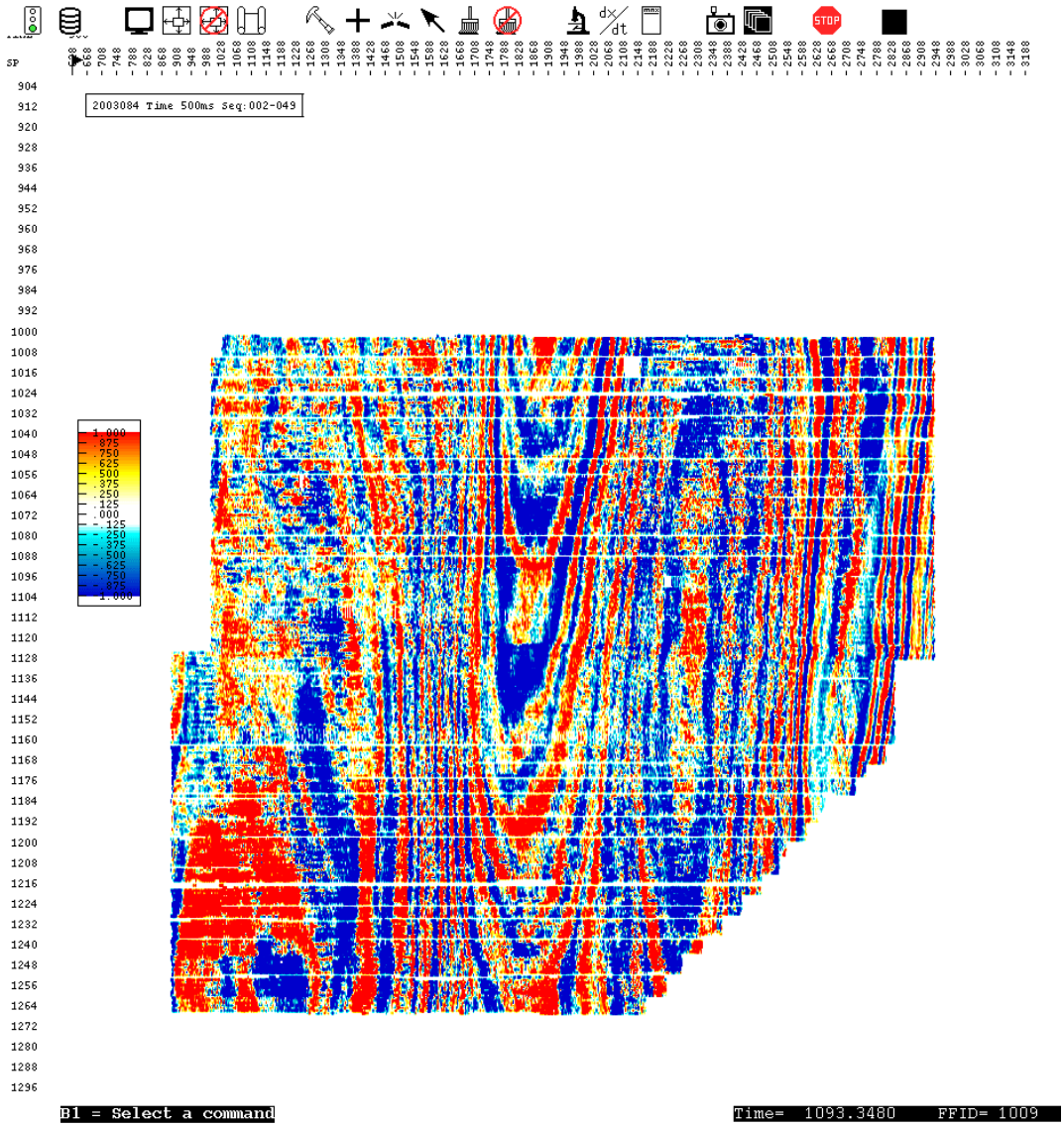
7.10 Common offset cube Navigation / Seismic merge QC

A Nominal Common Offset Cube (200 m) was generated with Cobra (PGS proprietary software) from real time bit 3 captured data or tape reading when the online system failed. Some processing problems on the first 20 sequences showed wrong amplitudes in the very shallow (between 0-100ms). This was only due to an extra shift of 76 ms that was erroneously applied by our software. The data on tape is not affected. This results in the first 76 msec for the 20 first sequences being zeroed on the cube. This does not affect the navigation QC that the cube allows us to perform.

Once loaded to the cube, inline, cross-line, and time-slice displays were viewed to check for potential navigation merge errors. The cube as a whole performed a positive QC of the P190 data. Even if this was not the primary target for this cube, some geological features were visible as it can be seen on the time slice displayed here.

The common offset cube was written to tape in SEGY format.

Near Trace Cube Time slice at 500ms.



7.11 Brute stack QC

The brute stacks were produced online with parameters from the closest line already shot. Hence the processing flow was optimised for noise detection. However some good and deep geology was often visible on the stack displays. Diffractions and multiples were present throughout the survey area. Multiples were visible in patches. Ship Noise, Tug Noise and swell were sometimes stacking in.

The Real Time QC Brute stacks were written to SEGY on disk and archived to tape using a standard Unix tar command on a regular basis.

7.12 Tape copy and QC

Each field tape was copied using a standard Unix tcopy command. Reading the data back from tape and checking the headers and the seismic data did validating those copies and the original tapes at the same time.

7.13 Syntrak Logs

The Logs automatically generated by the Syntrak Acquisition System (P7 format) and delivered in pdf format were on occasion corrupted. In order to accept those shots some specific header QC was done to ensure that FFID, Shot, Year, Julian Day, Time and GunMAsk were correct for those shots. We also checked that there were no missing shots and that the guns were not out of sequence. The data was also checked by producing a maximum amplitude display, in order to check for spikes. Any problem was logged in the observer log.

7.14 Autofires

All autofires were checked on screen on the auxiliary channel displays, to confirm that they were not falsely flagged by the GCS90. The shot before and after each flagged autofire was also checked.

8 Positioning data quality

8.1 Vessel position

Two Differential Global Positioning Systems (DGPS) were utilised through out the survey, namely Fugro's StarFix and Thales' SkyFix. The corrections systems were used with three different software packages MRDGPS (StarFix), Seadiff (StarFix) and MultiFix 4 (SkyFix). Four systems were input to the INS as detailed in the sub sections below and all were used in processing. The quality of data was generally very high with very little atmospheric influences.

The inter-system comparisons were very good. The mean discrepancies were 0.0m for Easting and 0.5m for Northing. The last sequence showed a larger northing value, this due to such a short line.

8.1.1 System I – Starfix (MRDGPS)

This system was configured in height-aided mode for the duration of the survey. StarFix performed well throughout the survey.

8.1.2 System II – SkyFix (Multifix 4)

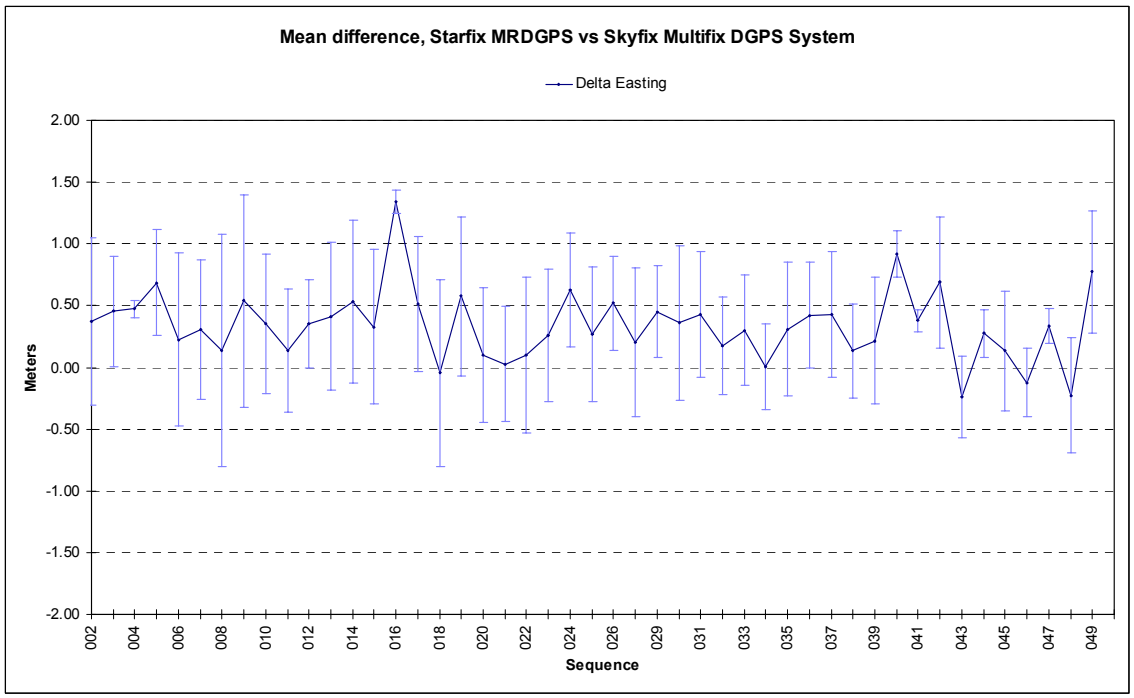
This system was configured in height-aided mode for the duration of the survey.
Multifix was generally stable throughout the survey.

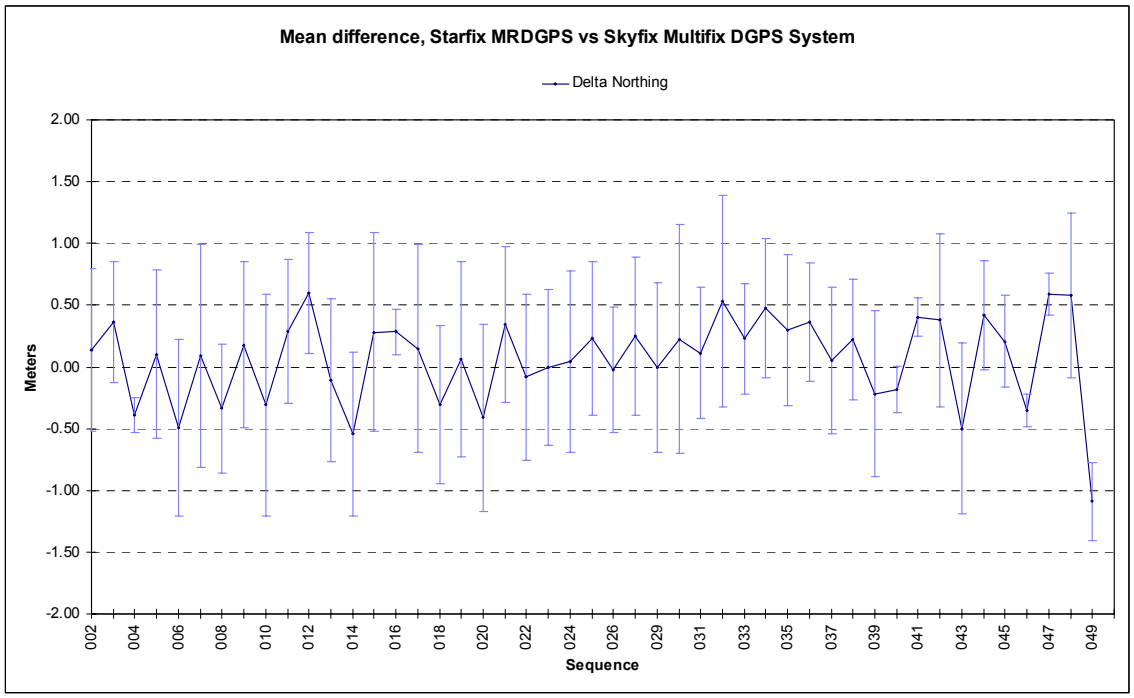
8.1.3 System III - StarFix (Seadiff)

This system was configured in height-aided mode for the duration of the survey. This system is generally slightly noisier than the other systems but preformed well throughout the duration of the survey.

8.1.4 System IV – SkyFix (Multifix 4)

This system is set up the same as System II but using a different computer and receiver. It was not used in processing. This system was changed from height aided to 3D solution from sequence 017 as a check of the geoid – spheroid separation height, at the request of the onboard client.





The above graphs show the mean difference in the Easting and Northing values over the whole line for the Starfix MRDGPS and Skyfix Multifix systems. The error bars represent the sample standard deviation for the mean differences.

8.2 Acoustic ranges

The acoustic ranges were generally good and only the front network was constantly affected by reflections. The reflected ranges were water depth related and were easily recognised and removed from the solution. At certain depth, one or two tail ranges and one mid range became affected by reflections. Only two vessel ranges were constantly removed from the network.

8.3 RGPS

RGPS pods were attached to all the gun floats and all tail-buoys. Typically the performance of all the units was exceptionally good with update rates of between 1 and 2 seconds.

On only one occasion for approximately 100 shots did a system fail. On this one occasion the fault was due to an antenna failure. This was replaced immediately and no loss of positioning accuracy was incurred.

8.4 Compass data

Compass data was, for the most part, excellent throughout the survey with very little or no editing required.

There were only five occasions where single compasses were removed from the solution due to bias.

8.5 Water depth

The Master transducer in Spectra was the 220 KHz unit. The water depth data during post processing was despiked but not filtered. The propagation velocity set in the echo sounder was 1500 metres per second. The Z offset of the echo sounder transducer is -5.50 metres from the vessel reference point at sea level.

Transducer depth, water velocity and tidal corrections were applied to all water depth records (MSL).

A draft correction of 5.5m was applied

Three profiles were used for sound velocity corrections. See section 11.3.6.

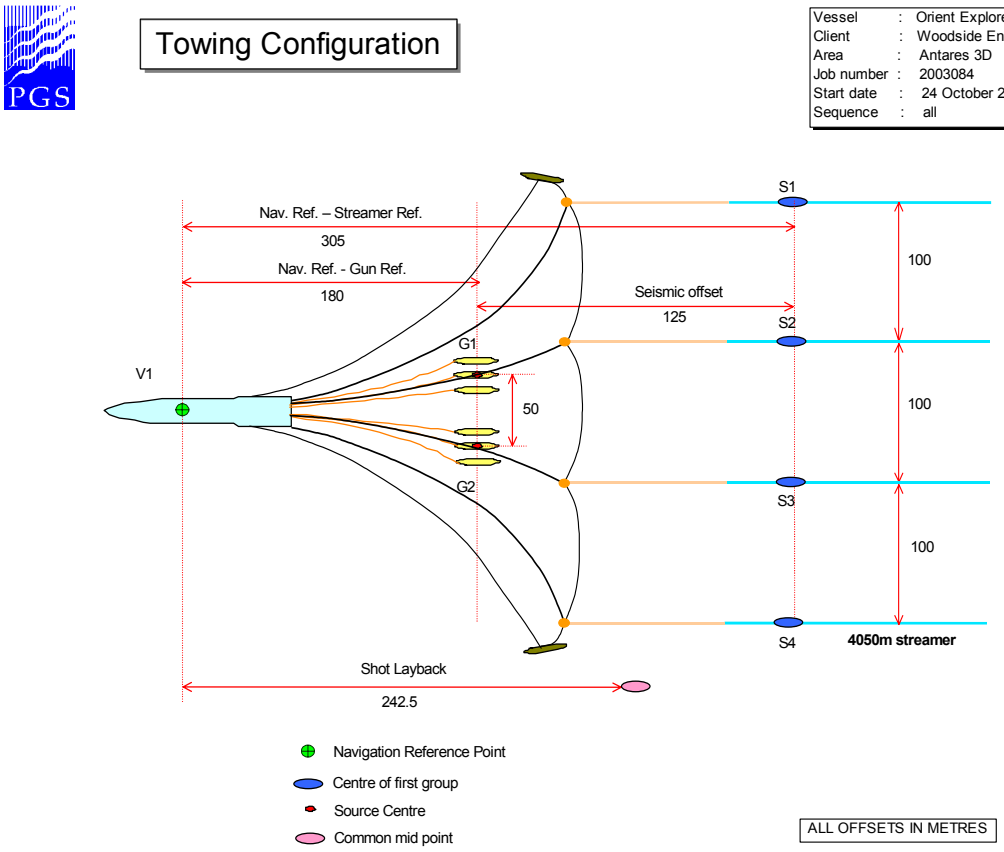
Tidal data was supplied by the client and was referenced to MSL and Port Campbell.

9 Seismic energy source

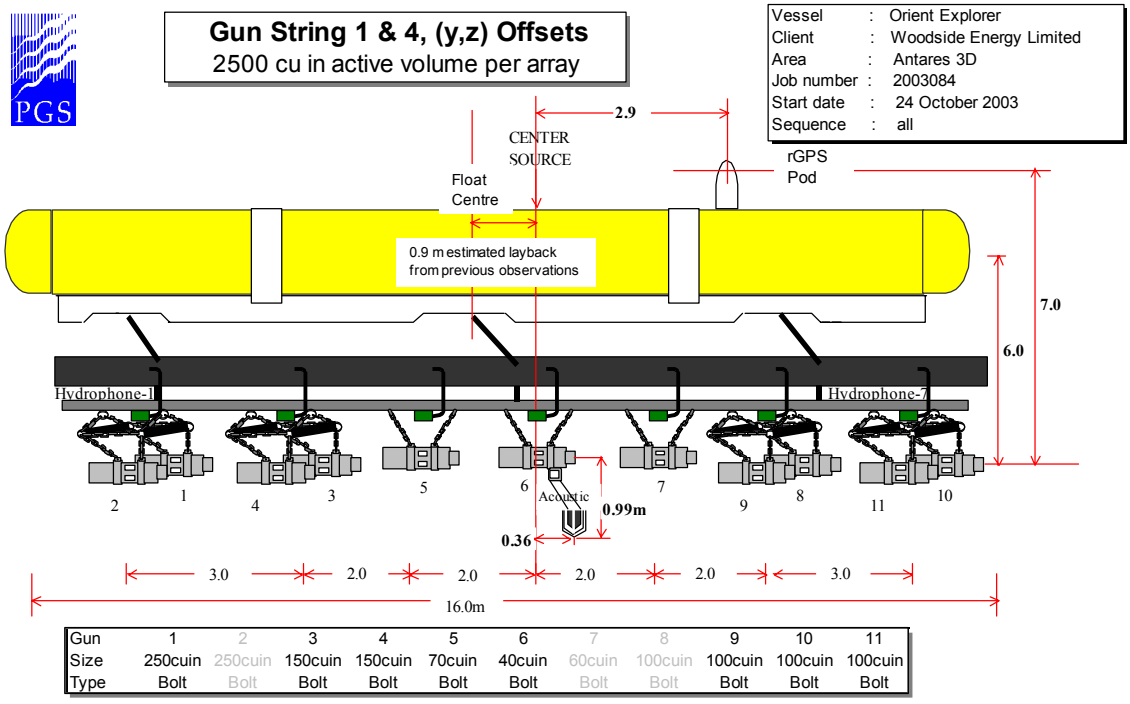
9.1 Source details

Source type	:	Bolt air guns
Air pressure	:	1800 psi
Volume	:	2500 in^3
Number of sources	:	2
Number of sub-arrays	:	6
Source separation	:	50 m
Sub-array separation	:	10 m
Source length	:	14 m
Gun synchronisation	:	± 1.0 ms
Drop-out specification	:	90 % of Elements within ± 1.0 ms 10 % of Elements within ± 1.5 ms
Shot interval	:	18.75 m
Depth	:	6 m
Depth control	:	Fixed depth ropes
Depth monitoring	:	Syntron depth transducers, GCS-90
Spacing control	:	Spread-ropes on sliding collars
Near field signatures	:	7 phones per subarray
Compressors	:	5 x Hamworthy 565
Source controller	:	GCS-90
Modelled source signature	:	See Appendix section 14.2

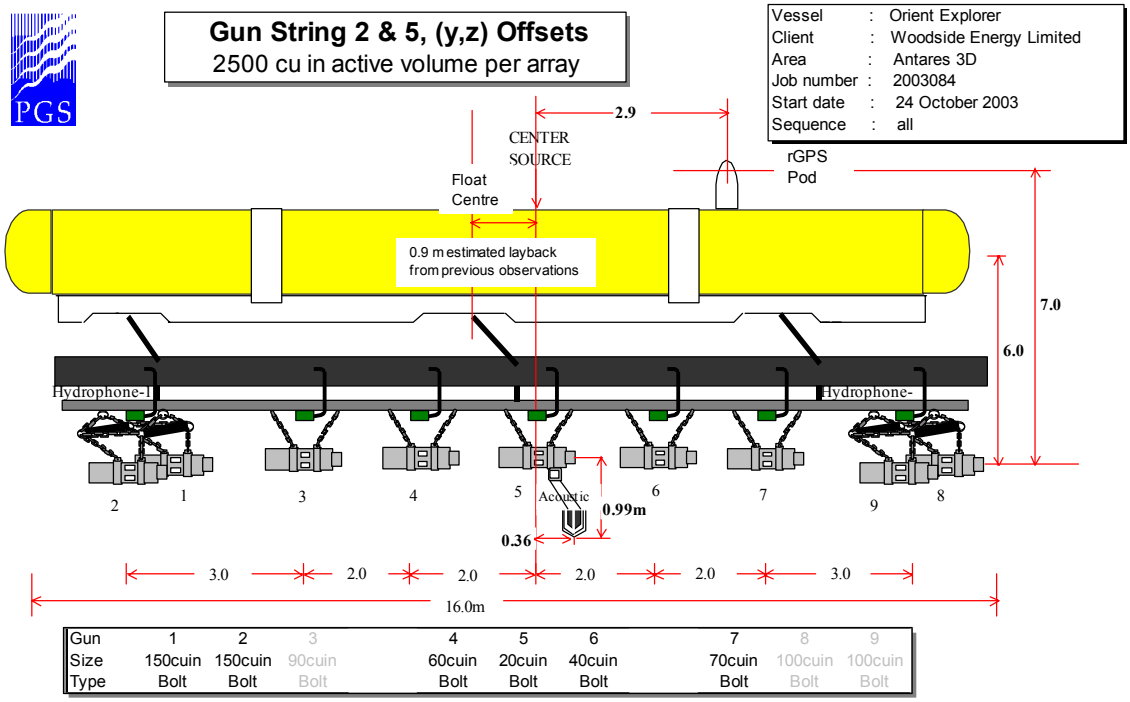
9.2 Offset diagram



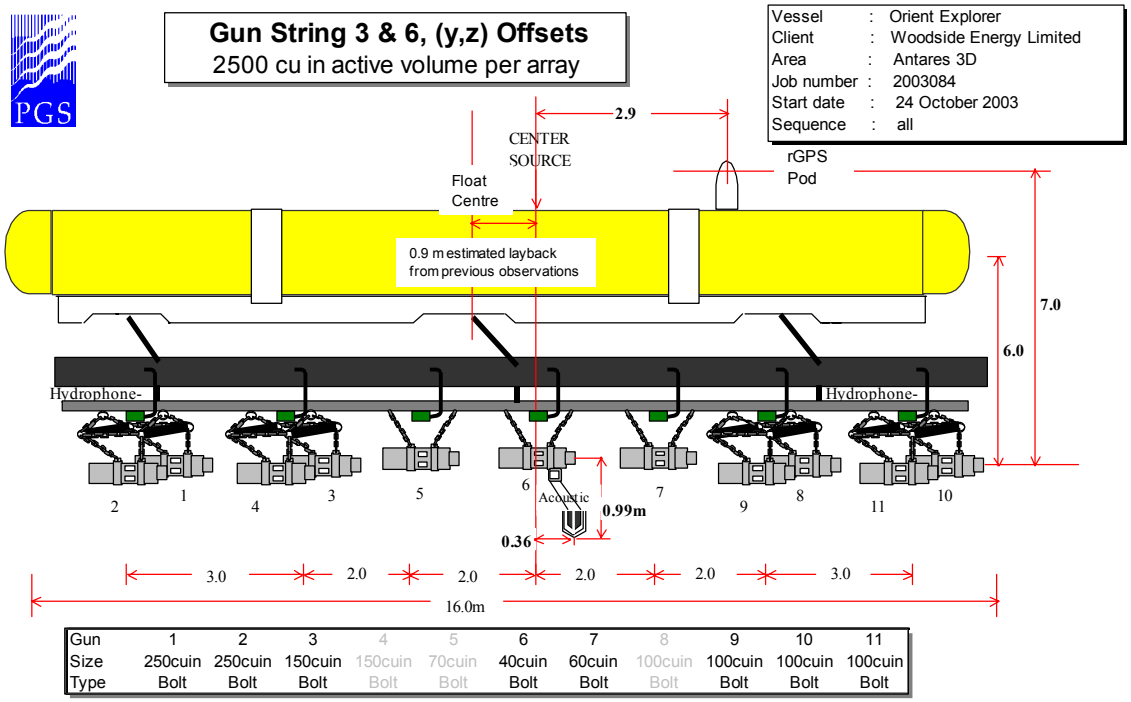
9.3 Gun array layout



Gun	1	2	3	4	5	6	7	8	9	10	11
Size	250cuin	250cuin	150cuin	150cuin	70cuin	40cuin	60cuin	100cuin	100cuin	100cuin	100cuin
Type	Bolt	Bolt	Bolt	Bolt	Bolt	Bolt	Bolt	Bolt	Bolt	Bolt	Bolt



Gun	1	2	3	4	5	6	7	8	9
Size	150cuin	150cuin	90cuin	60cuin	20cuin	40cuin	70cuin	100cuin	100cuin
Type	Bolt	Bolt	Bolt	Bolt	Bolt	Bolt	Bolt	Bolt	Bolt

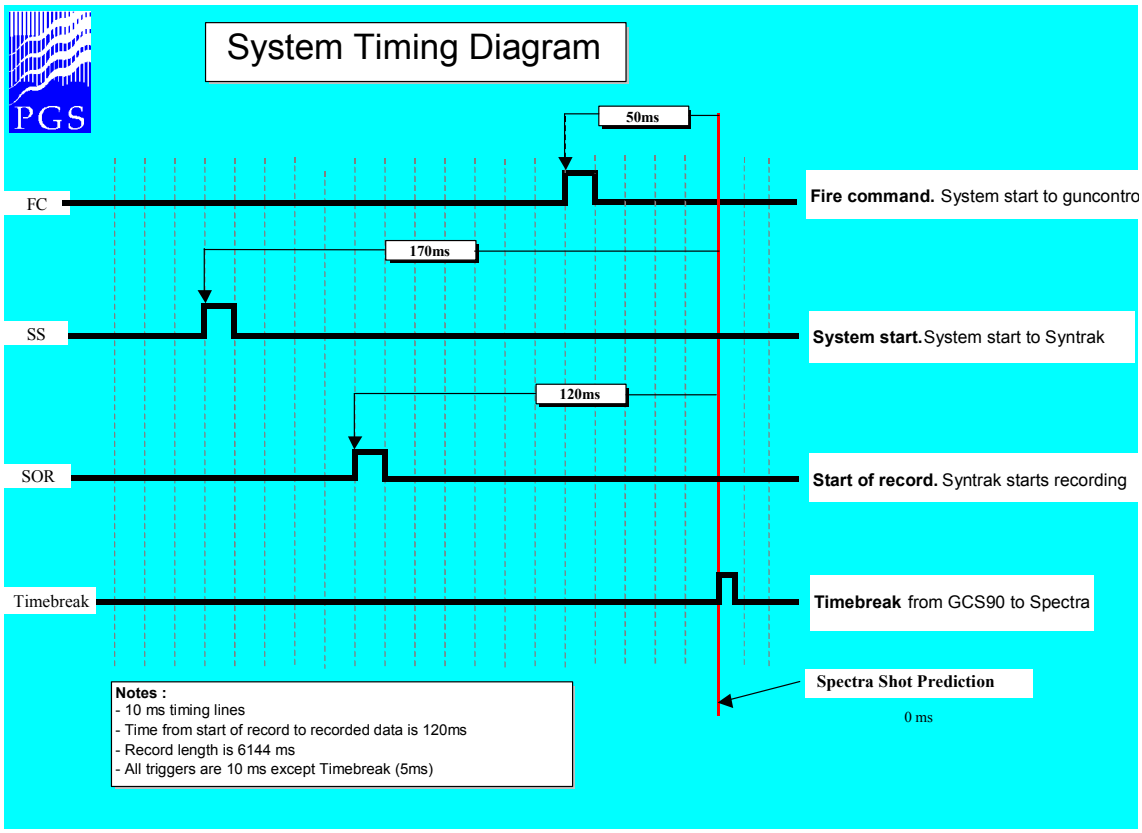

Gun String 3 & 6, (y,z) Offsets
2500 cu in active volume per array
Vessel : Orient Explorer
Client : Woodside Energy Limited
Area : Antares 3D
Job number : 2003084
Start date : 24 October 2003
Sequence : all
2.9
CENTER SOURCE
rGPS Pod
Float Centre
0.9 m estimated layback from previous observations
7.0
6.0
Hydrophone-
Hydrophone-
2
1
4
3
5
6
Acoustic
0.99m
0.36
7
9
8
11
10
3.0
2.0
2.0
2.0
2.0
3.0
16.0m
Gun 1 2 3 4 5 6 7 8 9 10 11
Size 250cuin 250cuin 150cuin 150cuin 70cuin 40cuin 60cuin 100cuin 100cuin 100cuin 100cuin
Type Bolt Bolt Bolt Bolt Bolt Bolt Bolt Bolt Bolt Bolt Bolt

10 Seismic acquisition system

10.1 System details

Recording System	:	Syntrak 960-24, with direct VME link to ProMAX
Software Version	:	3.65
Amplitude resolution	:	24 bit
Data Channels	:	1296
Auxiliary Channels	:	48 Append to streamer #1
Tape Transports	:	3 x IBM 3590 cartridge drives
Tape Format	:	SEG D, 8058, Ref 1
Recording Media	:	3590 Cartridges
Record Length	:	6144 ms
Deep water delay	:	0 ms
Sample Rate	:	2 ms
High Cut Filter	:	206 Hz / 276 dB/octave
Low Cut Filter	:	3 Hz / 12 dB/octave
Gain Setting	:	12 dB
Sensitivity	:	20 V/bar
Amplifier	:	Voltage Mode Differential
Input Range	:	0-2048 mV
A/D Converter	:	Delta Sigma Architecture
Distortion	:	< 0.0005% (-106 dB)
Cross-Feed	:	> 110 dB
Power Consumption	:	7.5 W per module
Polarity Convention	:	SEG, positive pressure gives negative number
SEG-D header description	:	See Appendix section 14.3

10.2 System timing



10.3 Streamers

10.3.1 Streamer details

Type of streamer	:	LDA Teledyne/PGS LDA
Number of streamers	:	4
Streamer sensitivity	:	20 V/bar
Streamer length	:	4050 m
Number of groups	:	324
Group interval	:	12.5 m
Group length	:	12.5 m
Hydrophone type	:	T-2
Streamer depth control	:	Digibird 5011
Streamer depth	:	7.5 m
Number of compass-birds	:	17 on each streamer

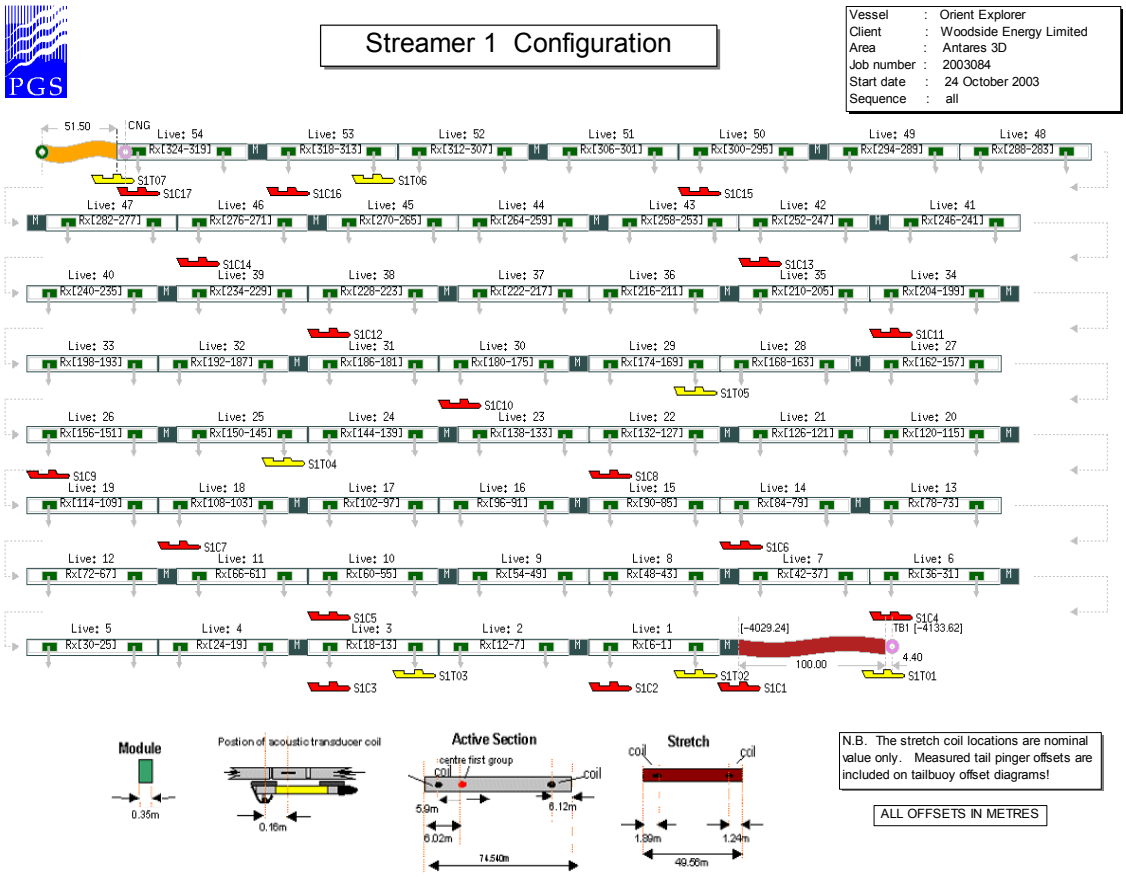
10.3.2 Trace Numbering

STREAMER	TRACE
Streamer 1	1 to 324
Streamer 2	325 to 648
Streamer 3	649 to 972
Streamer 4	972 to 1296
Auxiliaries	1 to 48

10.3.3 Component dimensions

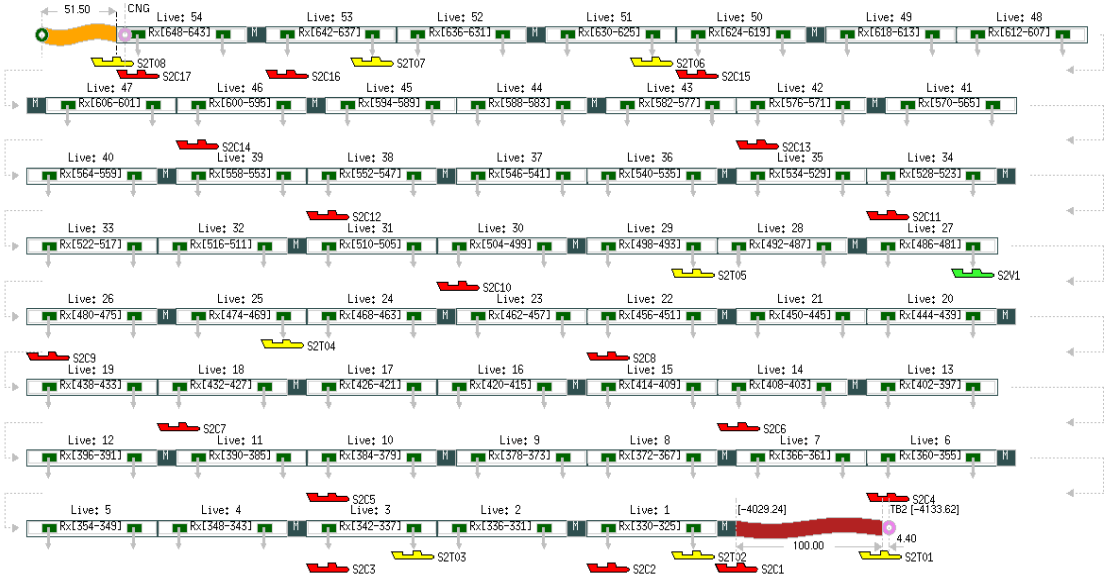
	NUMBER per STREAMER	NOMINAL LENGTH (m)
Lead-in	1	
Head Stretch Sections	1	3
Head Stretch Sections	1	50
Syntrak Module	27	0.358
Live Sections	54	74.54
Tail Stretch Sections	2	50
Power Adapter Section	1	3.80

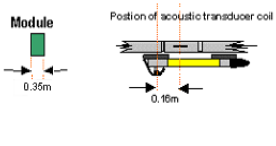
10.4 Streamer layout



Streamer 2 Configuration

Vessel	:	Orient Explorer
Client	:	Woodside Energy Limited
Area	:	Antares 3D
Job number	:	2003084
Start date	:	24 October 2003
Sequence	:	all



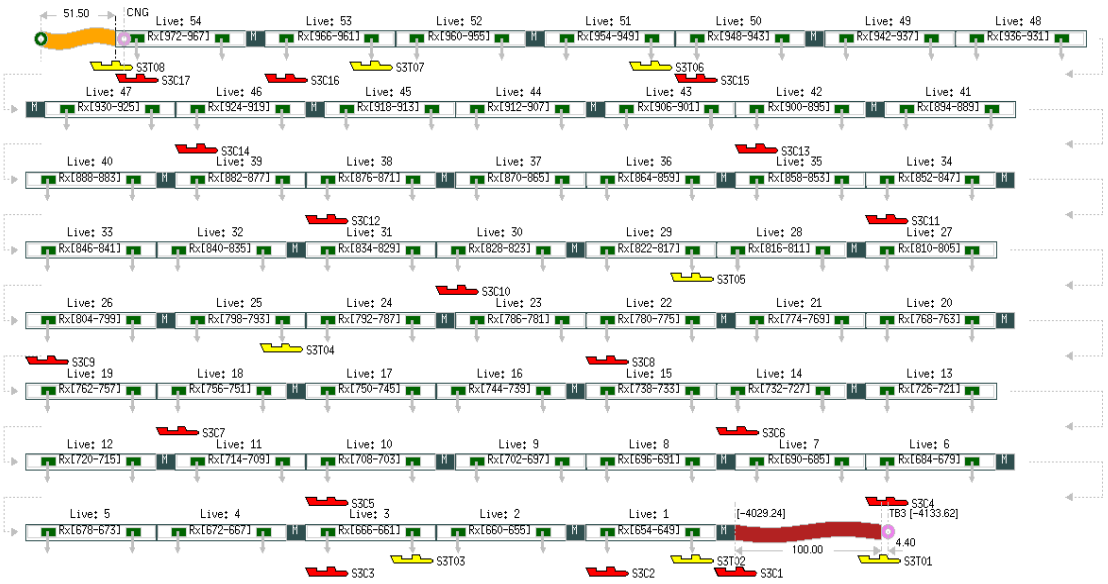


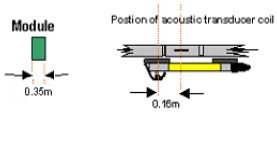
N.B. The stretch coil locations are nominal value only. Measured tail pinger offsets are included on tailbuoy offset diagrams!

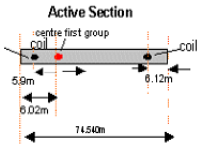
ALL OFFSETS IN METRES

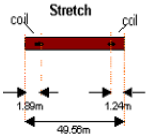
Streamer 3 Configuration

Vessel	:	Orient Explorer
Client	:	Woodside Energy Limited
Area	:	Antares 3D
Job number	:	2003084
Start date	:	24 October 2003
Sequence	:	all







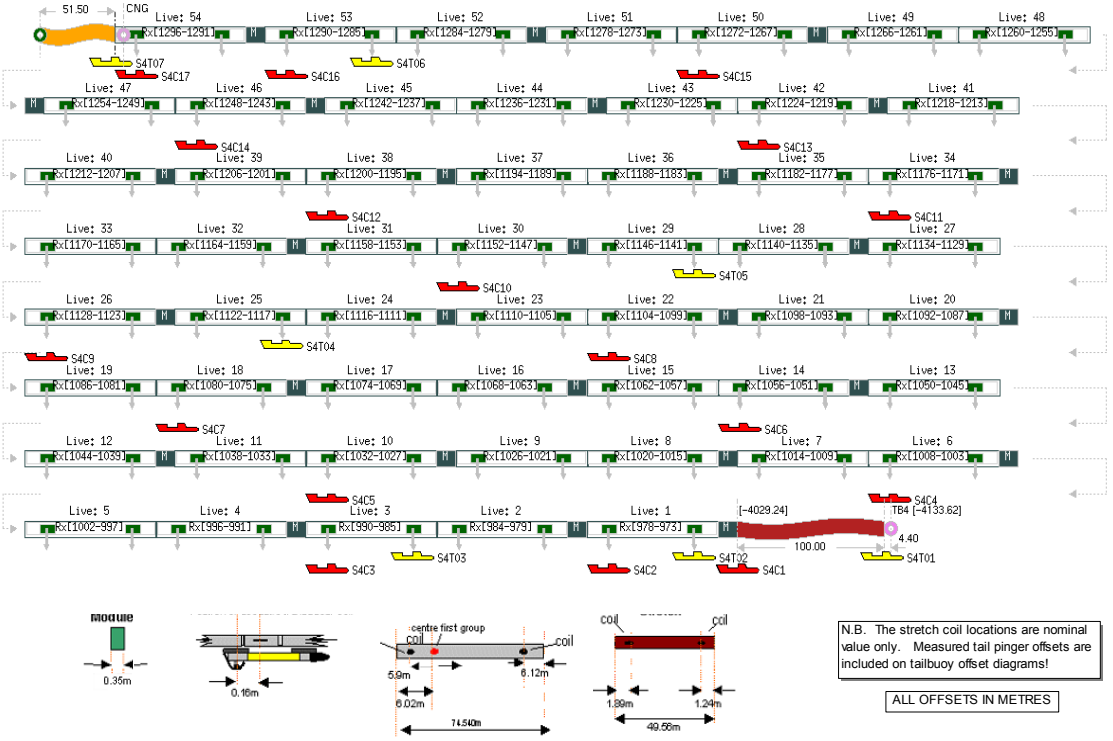


N.B. The stretch coil locations are nominal value only. Measured tail pinger offsets are included on tailbuoy offset diagrams!

ALL OFFSETS IN METRES

Streamer 4 Configuration

Vessel	:	Orient Explorer
Client	:	Woodside Energy Limited
Area	:	Antares 3D
Job number	:	2003084
Start date	:	24 October 2003
Sequence	:	all



N.B. The stretch coil locations are nominal value only. Measured tail pinger offsets are included on tailbuoy offset diagrams!

ALL OFFSETS IN METRES

11 Navigation system

11.1 Geodetic reference

11.1.1 Datums

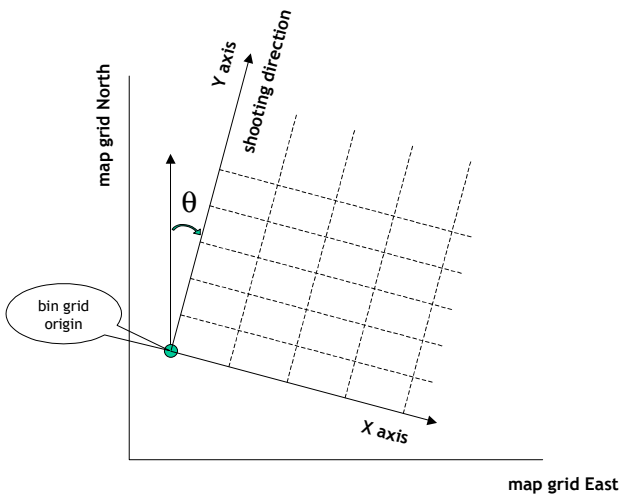
Survey datum	:	GDA 94
Ellipsoid	:	GRS 80
Semi Major Axis	:	6 378 137 m
1/Flattening	:	298.257222101
GPS Datum	:	WGS84
Ellipsoid	:	WGS84
Semi Major Axis	:	6 378 137 m
1/Flattening	:	298.257223563
Datum shift from WGS84 to		
X translation	:	0 m
Y translation	:	0 m
Z translation	:	0 m
Geoid height	:	-1.6 m (EGM 96)

Note: GDA94 is a realisation WGS 84, coincident to within 1.5m.

11.1.2 Map projection

Projection	:	MGA
Projection System	:	Transverse Mercator
Zone	:	Zone 54
Central Meridian	:	141° E
Scale Factor on Central Meridian	:	0.9996
Latitude of Origin	:	0° S
False Northing	:	10 000 000 m
False Easting	:	500 000 m
P1 header description	:	See Appendix section 14.4

11.1.3 Binning grid



Origin Easting (m)	:	637814.9197
Origin Northing (m)	:	5742625.3140
Rotation (deg)	:	125.875

	X	Y
Origin bin number	961	841
Bin number increment	1	0.33333
Area size (m)	8575.00	40406.25
Bin interval (m)	25	6.25
Bin size minimum (m) at 125 m offset	25	6.25
Bin size maximum (m) at 4175 m offset	75	6.25

P6/98 Full fold coverage perimeter listing : See Appendix section 14.5

11.2 Surface positioning

11.2.1 System I

Type	:	StarFix DGPS (single frequency)
Receiver	:	Trimble 4000Si, 9 channel, Nav. version.7.29
Differential Corrections via	:	Optus Spot
Reference stations	:	Melbourne 220 km distant Adelaide 550 km distant Cobar 840 km distant Bathurst 850 km distant
Software	:	MRDGPS v2.06.07
Sub-Contractor	:	Fugro Survey AS, Norway

11.2.2 System II

Type	:	SkyFix DGPS (single frequency)
Receiver	:	Trimble MS750, 12 channel, version 1.33
Differential Corrections via	:	Optus Spot, Inmarsat POR
Reference stations	:	Melbourne 200 km distant Adelaide 520 km distant Sydney 920 km distant Brisbane 1570 km distant
Software	:	Multifix 4, Version 1.01
Sub-Contractor	:	Thales Geosolutions, Norway

11.2.3 Float positioning

Relative GPS	:	Seatrack 320 (source & head floats) Seatrack 220 (tailbuoys)
GPS receiver	:	Ashtech G 12-L
UHF communication	:	Wood&Douglas, freq. 457.100 and 457.350 MHz
Software version	:	Integrated with Seadiff v7.05n and MRDGPS RGPS v2.08.02

11.2.4 Heading reference

GPS Heading / Attitude system	:	Seapath 200, MRU 5.2
Software	:	SCC 1.02.06, MRC 2.52
Gyro 1	:	Vega
Repeater/Converter	:	Scandinavian Micro Systems LR40
Gyro 2	:	Litton **C.Plath** Fabrik Nautischer Instrumente
Repeater/Converter	:	Scandinavian Micro Systems LR40

The Seapath 200 was used as the prime heading sensor for the duration of the survey.

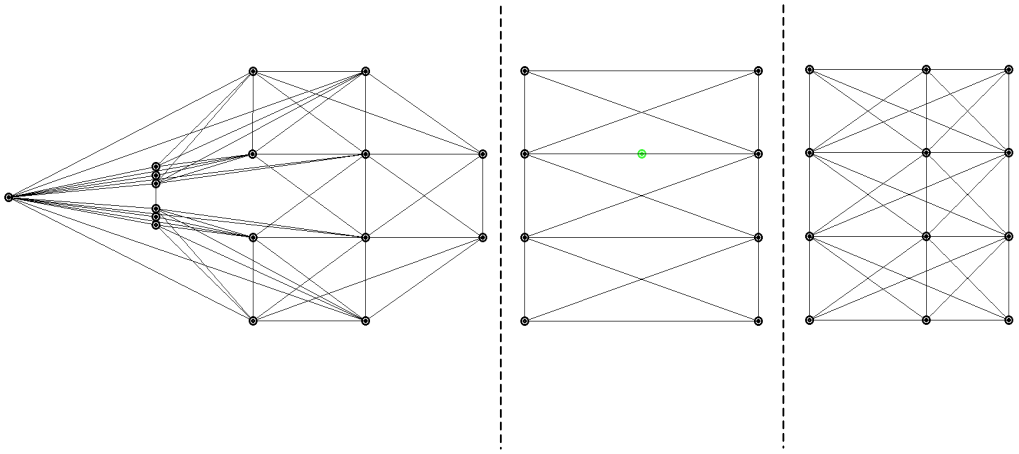
Seapath GPS heading reference worked extremely well throughout the entire survey. It was compared on a line by line basis with the secondary and tertiary gyros, which showed little drift

11.3 Underwater positioning

11.3.1 Acoustic ranging system

System name	:	Sonardyne SIPS1
Software version	:	7.00.05-T
Frequency	:	65.789 to 100 kHz

11.3.2 Acoustic network



11.3.3 Magnetic compasses

Bird Compasses	:	DigiCOURSE System 3, 5011 Bird
Software version	:	System 3, version 3.1.2
Magnetic variation	:	10.9°

11.3.4 Echosounder

Type and model	:	Krupp Atlas Electronic, Atlas Deso 25
Transceiver frequency	:	210kHz, 33kHz (210KHz set to Master in Spectra)
Draught	:	5.5m
Heave compensated	:	No

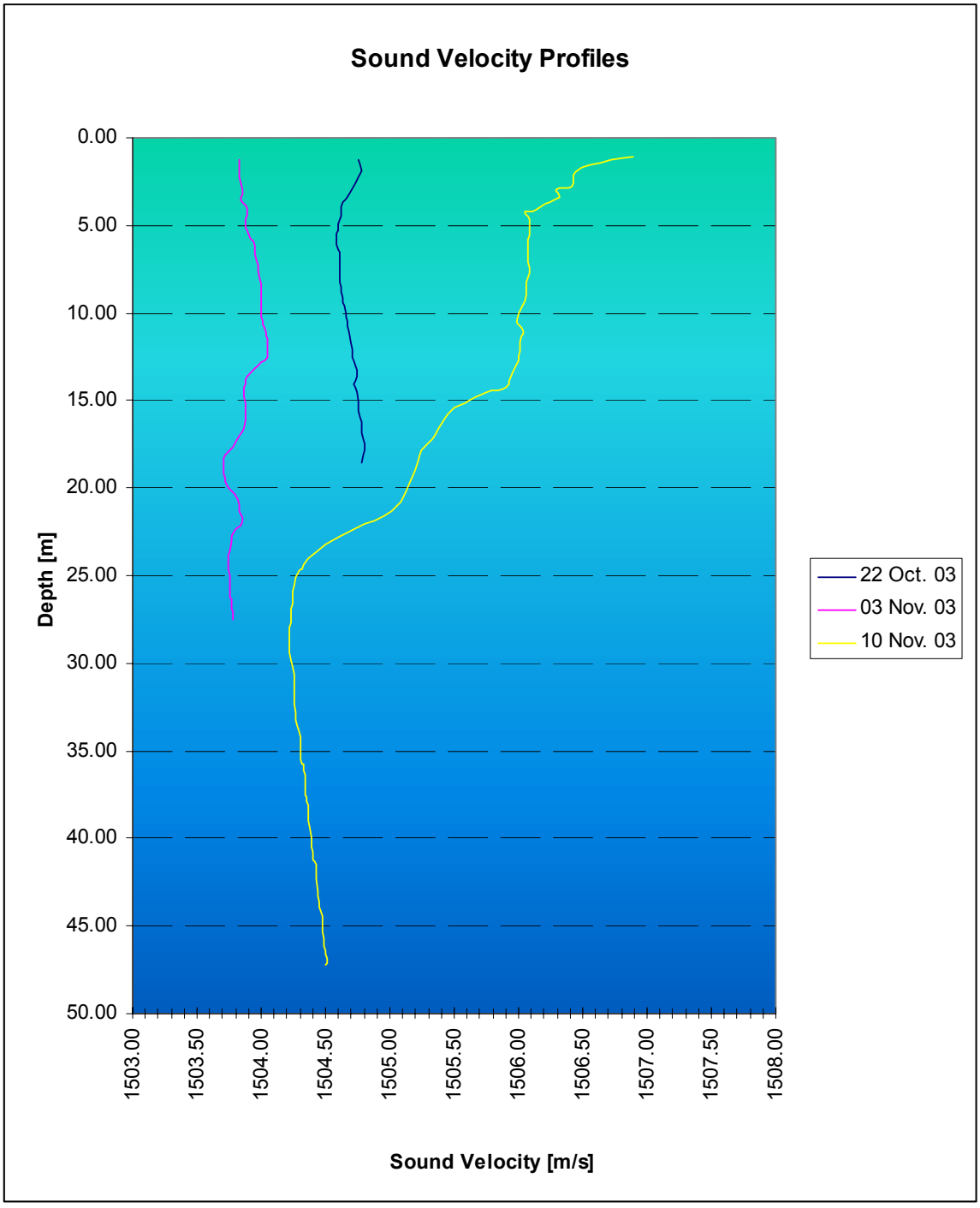
11.3.5 Sound velocity

CDT probe	:	Valeport 600 S/N 18626

11.3.6 Sound velocity profile

Full column Sound velocity measurements were taken weekly if weather allowed using the workboat and a self-contained recording CTD sensor. Sound velocity measurements used were calculated using the Chen-Millero(1977) formula. The current speed of sound in water value was checked in post processing on a line-by-line basis, using observations from the acoustic network. A summary of all readings is shown below.

Dip	Date	Time UTC	Location	Average Temp Streamer Depth °C	Average Salinity Streamer Depth (PSU)	Speed of Sound Streamer depth m/s	Max. Depth
1	22 Oct 03	4:08	38°21.8'S 141°41.3'E	14.06 °C	35.69	1504.61 m/s	19 m
2	03 Nov 03	15:42	38°33'39"S 142°45'17"E	13.87 °C	35.65	1503.96 m/s	28 m
3	10 Nov 03	9:49	38°31'38"S 142°33'16"E	14.51 °C	35.66	1506.03 m/s	47 m


Sound Velocity Profiles
0.00
5.00
10.00
15.00
20.00
25.00
30.00
35.00
40.00
45.00
50.00
Depth [m]
1503.00
1503.50
1504.00
1504.50
1505.00
1505.50
1506.00
1506.50
1507.00
1507.50
1508.00
Sound Velocity [m/s]
22 Oct. 03
03 Nov. 03
10 Nov. 03

11.4 Computer systems

11.4.1 Integrated navigation system

Type	:	SPECTRA
Supplier	:	Concept Systems Ltd.
Software version	:	v. 9.8.05
Real Time Interface	:	RTNU (OS9 v. 3.03)
Machine type	:	IBM RC/6000
Tape storage	:	IBM 3590 Tape Drives

11.4.2 Binning system

Type	:	CENSUS
Supplier	:	I/O Inc.
Software Version	:	4.4.1
Machine type	:	IBM RS/6000
Tape storage	:	IBM 3590 Tape Drives

12 Seismic processing

12.1 Online QC

The PGS Cobra QC system was used to provide real time online QC screen displays that included:

- Real Time Stack (displayed online and plotted at the end of each line).
- Real Time Auxiliary Sub Array Display for Air Leak detection (Hilbert Transform applied).
- Real Time Auxiliary Stack Display for autofire detection.
- Real Time Display of each auxiliary for each shot at a large scale
- Real Time Display of Raw Shots (each 5) for selected streamer
- Real Time Display of RMS noise (120-170ms) values. This enabled ambient (background) noise estimates to be made while online in addition to noise pollutants such as ship noise, etc.
- Real Time Display of streamer and gun statistics and specifications. (streamer depths, reported errors, flagged gun misfires/autofires, etc.)

When our QC system was overloaded (for example when there was intensive velocity picking going on) the bit3 card was dropping shots. Those shots are present on tape. This resulted in some "holes' on some QC displays. If the bit3 card was dropping too many shots, they were read from SEGD tape. Cobra/ProMAX/Cube Manager processing system were then utilised for the subsequent offline QC processing. Problems that occurred during production were investigated using all means available. At the end of each line, in addition to the Syntrak standard QC displays, the following 36 inches plots were produced using ProMAX

- Raw Shot Plot of a nominated streamer for every 2km
- Near Trace Plot
- Selected NMO'd CDP gathers Plot
- Auxiliary Sub Array Stack Plot
- Auxiliary Hilbert Transform Plot
- Brute Stack Plot
- P190 navigation merge QC
- Maximum amplitude RMS display
- One shot all streamer display from tape

Syntrak real-time RMS calculations were displayed for all 1292 channels of each shot in four different time windows after a 5Hz Low Cut Filter. Gif files were made available to the client reps:

	From Syntrak	**After Intrument Delay correction**
'Water column' window	120 – 170 ms	0 – 50 ms
'Signal' window	1620 – 2120 ms	1500 – 2000 ms
'Intermediate' window	3120 – 3620 ms	3000 – 3500 ms
'End of record' window	5620 – 6120 ms	5500 – 6000 ms

For each sail-line, a 2D QC brute stack was generated using the following sequence:

- Real-time data capture — Using bit3 card to capture all data, including auxiliary traces and RMS values from the Syntrak system
- Static Correction — Digital filter delay –120 ms
- Trace edits — From bad channels checklist of preceding sequence
- Anti-alias band pass filter — 0-5-90-120 Hz
- Resample — 2 ms to 4ms
- Gain and dBGain — T*V to the power 1.5 plus 2 dB/s
- Geometry Assignment — Assign 2D geometry: 288 channels
- Mute — 1st break mute
- Minimum phase predictive Decon — Time lags: 24-240ms
- NMO — using 2D velocities, picked at 2 km interval
- Mute — Post NMO mute
- Stack
- Gun & Cable static correction — +9ms
- Display — Raw stack

12.2 Offline QA/QC sequence

12.2.1 Navigation / Direct Arrival QC

Navigation QC was performed using the Cobra system first. Near traces at each shot point were collected and merged with the final P1/90 navigation data. A comparison was then made between the seismic and predicted direct arrival times to QC the navigation data. The navigation-derived offsets were used to apply a linear move out on the near traces and a check was made for residual anomalies in the navigation/seismic tie. A common offset cube was also generated to check for eventual shifts between lines.

12.2.2 Velocity Analysis.

Velocities were picked every second line, every 2km in the CDP direction. Isovelocity screen displays and 36" Stack NMO corrected CDP plots were displayed for each line to check the validity of the picked velocity. The Real Time Brute Stack was generated using the velocities of the closest picked line.

12.2.3 Gun QC

The output of the 42 near field hydrophones mounted on the gun array strings was recorded on the auxiliary channels, together with the system time-break in order to identify gun-timing errors (Aux Channel 1). The auxiliaries of all gun array strings were stacked together as a real-time autofire QC display. A paper copy of the stacked auxiliary traces was also generated for the QC file. All Auxiliaries were displayed on screen. In addition, a real-time QC screen was produced in which a Hilbert transform was applied to the auxiliary traces stack for each sub-array to assist in spotting air-leaks. For every line a 36-inch plot was also generated in which a Hilbert transform was applied to each auxiliary to check for air-leaks or other gun related problems.

The auxiliary channels were connected to the near field hydrophones as following:

Aux Chan	Hydr.	Aux Chan	Hydr.	Aux Chan	Hydr.	Aux Chan	Hydr.	Aux Chan	Hydr.	Aux Chan	Hydr.
7	1.1	14	2.1	21	3.1	28	4.1	35	5.1	42	6.1
8	1.2	15	2.2	22	3.2	29	4.2	36	5.2	43	6.2
9	1.3	16	2.3	23	3.3	30	4.3	37	5.3	44	6.3
10	1.4	17	2.4	24	3.4	31	4.4	38	5.4	45	6.4
11	1.5	18	2.5	25	3.5	32	4.5	39	5.5	46	6.5
12	1.6	19	2.6	26	3.6	33	4.6	40	5.6	47	6.6
13	1.7	20	2.7	27	3.7	34	4.7	41	5.7	48	6.7

A model of the gun arrays used was set up in PGS's Nucleus survey design sofware and could be used to check the dropouts or the replacement strategy as soon as a change was done to the gun arrays.

12.2.4 2D QC stack

12.2.5 3D QC stack

12.2.6 Navigation / seismic merge QC

12.2.7 Common offset cube

12.2.8 Other QC products

12.3 Computer systems

The ProMAX/Cobra/Cube Manager system hardware on the Orient Explorer is set up as follows…

- Data capture via a Bit-3 model 477-1 adaptor (U/S)
- 1st IBM 595 Workstation for Real Time data capture: 2 x 256 Mb Physical memory, 2 x 73 Gb Disk, 2 x 9 Gb Disk, 2 x IBM GTX150M Graphic Adapter.
- 2nd IBM 595 Workstation for Offline QC Processing: 2 x 256 Mb Physical memory, 2 x 73 Gb Disk, 2 x 9 Gb Disk, 2 x IBM GTX150M Graphic Adapter.
- Four 3590 tape drives attached to the first IBM 595 exclusively and two others attached to the second IBM 595 station shared with the SP2 system.
- Network Plotters and printers:
    - Oyo Geospace GS 636 thermal plotter
    - Tektronix Phaser 300I colour printer
    - Hewlett Packard Laser Jet 4000
    - Eltron Label TLP2042 Printer

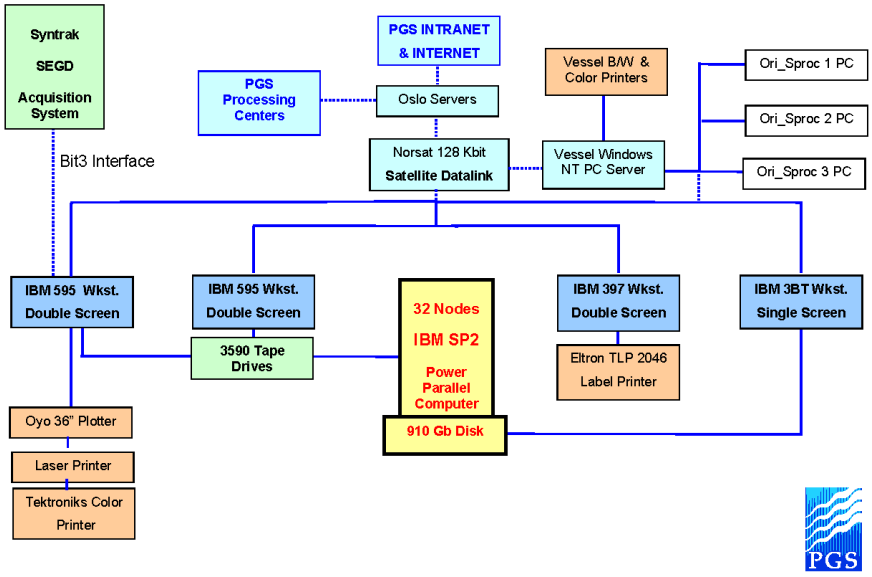
In addition to the QC system described in the preceding page, there is a full 32 node SP2 mainly dedicated to onboard processing:

- 32 node IBM SP2 nodes (120 Mhz/160Mhz, 512 Mb/1 Gb RAM and 910 Gb of combined hard disk)
- A Control Work Station: IBM 397 Workstation (256 Mb RAM)
- A file server: IBM 3BT Workstation (296 Mb RAM)
- A double screen station for velocity picking and QC: IBM 3BT Workstation (256 Mb RAM)
- Nine 3590 tape drives. Two of the 3590 tape drives are shared with the second QC system IBM 595 station described above.

This system is attached to the same plotters and printers as the Acquisition QA & QC System.

Orient Explorer Onboard Processing Centre and QC System

ORIENT EXPLORER PROCESSING CENTER SYSTEM CONFIGURATION



13 Navigation processing

13.1 Introduction

Data were processed using SPRINT. The processing was comprised of the following steps:

- Data import
- Data pre-processing
- Network adjustments
- Data export
- Final quality control

Each of these steps is covered in more detail below.

13.2 Data import

Raw data were recorded to tape and disk in P2/94 format. After the end of the line these data were checked, and if necessary, corrections were made to the header to produce a final archived version. These data were then imported into Sprint, and a QC report generated. Included in this report were:

- P2/94 format errors or inconsistencies
- differences in configuration between successive files
- changes in gun sequence
- time between shots not within specified limit
- jump in shot numbers
- number of headers

13.3 Pre-processing

All data were pre-processed to ensure consistent results in the adjustment phase.

During pre-processing, observations were grouped by sensor type. Predefined spike rejection gates and noise suppression filters were applied to the raw data. Configuration files were used to save all gating and filter values. After analysis, the final values were applied in a batch mode.

Where circumstances dictated, the values were changed interactively before the data were batched.

After pre-processing of all the observations, a quality report was generated containing the following information:

Nobs	:	Number of raw observations.
Nrej	:	Number of data observations missing after processing.
Bad block	:	Maximum block of missing raw data (in seconds).
Nomina	:	Nominal values computed from the logged offsets, or user assigned.
Mean	:	Mean value of the observation.
Max. Delta	:	The maximum shot to shot increment.
Units	:	In which unit data is recorded.

13.4 Network adjustments

The network adjustment stage consisted of a least squares adjustment of the processed observations for each shot point. The software allows the observations to be treated as either a complete net, or a series of sub nets (e.g.: vessel antenna, front net, tail net, etc.). Sub nets were used for analysis of problem lines. A complete net was used for final adjustment after the individual sub nets were solved.

The streamer-shaping algorithm in use was an arc of curve fit through the pre-processed compasses. The streamer shape is adjusted through network computed node positions.

At the end of the net adjustment, a quality report was generated. Items included were:

- Network configuration
- Statistics on node covariances
- All observations scale/correction/SD in use
- Statistics on node shot point intervals
- Statistics on observation residuals
- Statistics on network variance factor and degrees of freedom
- The error ellipse (semi-major axis/skew) of all defined nodes
- Streamer rotation

13.5 Data analysis

Data analysis were performed for all lines and allowed all data from the Ingres database to be displayed. There were two main uses for this facility. The first was to produce a standard set of QC plots for each line, and the second was to act as an investigation tool for problems seen at any stage of processing.

Configuration files were defined to create a standard set of QC plots for every line.

The following plots were included:

Inline misclosure
Streamer rotations
Streamer separation
Distance vessel-sources, vessel-streamer heads
Shot point interval (distance and time) of vessel ref. position
Gyro and course made good of vessel ref.
Position comparisons (Field position vs. Post-processed position)
Network variance factor and degrees of freedom

13.6 Data export, P1/90 output

During the export process the receiver positions were computed and a P1/90-file was generated. The in-line misclosure error was accounted for by applying a linear distribution of the error to computed receiver positions. A header was added to the data during export.
The data were written to 3590 tape cartridges.

13.7 Data quality control procedures

Three lines were selected by the client to be processed in their office for comparison. The lines sent in was: W03ANT1156P1, W03ANT1108P1 and W03ANT1148P1. These lines were thoroughly checked and accepted as processed onboard.

The first line was sent to the PGS office for QC.

Both the P1 and P2 headers were checked. The line was processed and the solution was compared with the P190 file from the vessel. This procedure was repeated after each crew change to make sure there were no errors introduced. In addition, lines were sent to the office when the QC parameters exceeded the thresholds given in the PGS standard procedures, or the Client's specifications.

The final P2/94 tapes were checked using PGS internal software **p2list**. This program checked and returned the following information:

- Which files were on a tape and if each file had a complete header.
- Number of end-of-file markers and if the last record had an EOF mark.
- The filename, the sequence, the media label identifier (H0003), the number of shots, the number of shot inconsistencies (missing or double shots) and the number of records.
- A checksum, which were used to verify that data on tape were identical to data on disk.
- For every file the first and last E1000 record was printed.
- If there were shot inconsistencies, the E1000 records surrounding the inconsistency were printed.

Final quality control performed on the data included a number of streamer comparisons, both inline and streamer-to-streamer.

- Vessel, source and receiver positions were checked for internal consistency.
- The applied streamer rotations and the inline misclosures were checked.
- Latitude/longitude and grid coordinates were checked against the datum/projection defined in the header.
- PGS internal software was used to plot the rotated and unrotated streamer shapes. The unrotated plots provided a plan view of the post-processing results. The rotated plots displayed the streamer shapes for every shot at a 90 degree rotation, this allowed the shot to shot consistency to be checked. Feather plots were produced each line during the survey.

The final P1/90 files were also checked using a Sprint QC tool, which checked:

- Contents of the first and last vessel record.
- Source id of the first and last source record.
- Number of even and odd shot points with different source id.
- Number of header records found.
- Number of vessel, source, tail buoy and receiver records expected and how many were found.
- Number of new line characters found.

The final P1/90 files were checked using a PGS internal software **p1plot**. This program checked and returned the following information:

- Tape name and date of issue.
- Datum/projection information from the header.
- For every line in the file: start/end shot and start/end co-ordinates.
- Standard comment record (H2600) concerning lines and shots in the file.
- Linefeeds in the file.
- All records 80 bytes long.
- Number of end-of-file markers and if the last record had an EOF mark.
- Grid co-ordinates correspond to the latitude and longitude with the given datum and projection.
- A checksum, which were used to verify that data on tape were identical to data on disk.

The final P1/90 tapes were checked using PGS internal software **p1list**. This program checked and returned the following information:

- Which files were on a tape and if each file had a complete header.
- Number of end-of-file markers and if the last record had an EOF mark.
- The filename, the tape version identifier (H0202) and the number of records.
- A checksum, which were used to verify that data on tape were identical to data on disk.
- For every line in the file the line name, FSP, LSP and the position of SOL and EOL was given.

Results of the P2list, P1list and p1plot were saved and copies are archived in the Oslo office.

All tape labels were created using PGS internal software **mklab**. All information on the labels was extracted from the files on the tapes.

13.8 Computer systems

Computer	:	IBM RS/6000 390
Operating System	:	AIX 4.3.3.0
Tape storage	:	1 x IBM 3590 B1A Tape drive
External disks	:	72 GB
Type	:	SPRINT 3D
Software version	:	3.1.13
Supplier	:	Concept Systems Ltd.
Printer / Plotter	:	HP LaserJet 4100 / DesignJet 755CM

14 Appendix

14.1 Data shipments

14.2 Source modelling

14.3 SEG-D header

14.4 P1/90 header

14.5 P6/98 Full fold coverage perimeter

14.6 Coverage plots

14.6.1 Alls No Flex

14.6.2 Nears No Flex

14.6.3 Nearmids No Flex

14.6.4 Farmids No Flex

14.6.5 Fars No Flex

14.1 Data shipments

Date	Proforma	Content	Boxes	Wt	Shipping address	Comment
13.11.2003	ORI12800411	Job 2003084 seq. 1-49 Set 1 (originals) 174 Tapes SEG-D 2 Tapes P1/90 Nav 2 Tapes P2/94 Nav 1 Data CD with logs and drawings	6	48 kg	Compustor 10 Cowcher Place Belmont WA 6104 Australia Attn : Mr. P. Manford Phone : +61 8 9348 5270 Fax : +61 8 9348 4464	Shipped via chase vessel Perfect Lady to Portland Agent: Heabich Provedoring PO Box 567 Portland Victoria Australia Attn: Robert Hope Phone: +61 3 5523 3372 Fax: +61 3 5523 3790
19.11.2003	ORI12800412	Job 2003084 seq. 1-49 Set 2 (copies) 174 Tapes SEG-D 2 Tapes P1/90 Nav 2 Tapes P2/94 Nav 1 Data CD with logs and drawings 6 Tapes Aux Channels 1 Tape: Brute Stack 1 Tape: QC velocities 1 Tape: CO Cube 1 CD Seismic QC Seismic QC folders Syntrak QC plots	16	175	Compustor 10 Cowcher Place Belmont WA 6104 Australia Attn : Mr. P. Manford Phone : +61 8 9348 5270 Fax : +61 8 9348 4464	Shipped via chase vessel Perfect Lady to Port Fairy. Agent: Heabich Provedoring PO Box 567 Portland Victoria Australia Attn: Robert Hope Phone: +61 3 5523 3372 Fax: +61 3 5523 3790
10.12.2003	NP-112-2003	1 Tapes P1/90 W03ANTV011 1 Tapes P1/90 W03ANTE011 1 Vessel Pos.plot 1 Depth Contour plot 1 set Coverage plots 1 CD			Woodside Energy Ltd 1 Adelaide Terrace Perth WA 6000 Australia Attn : Mr. Ralph Weiss Phone : +61 8 9348 4617 Fax : +61 8 9348 4464	Vessel pos. files Echo sounder pos.filesl Scale 1:50 000 Scale 1:50 000 All Zones, No flex Plots as cgm files and P6/98 file.

Shipping Invoice # : ORI12800411A

Node : Orient Explorer (128)
Company : PGS Geophysical AS (EXANO)
Department : Seismic

11 Nov 2003

Shipper : Haebich Provedoring PO Box 567 Portland Victoria Australia **Attn :** Mr. Robert Hope **Phone :** +61 3 5523 3372 **Fax :** +61 3 5523 3790	**Destination :** CompuStor 10 Cowcher Place Belmont WA 6104 Australia **Attn :** Mr. P. Manford **Phone :** +61 8 9348 5270 **Fax :** +61 8 9348 4464

Type of freight : As fast as possible

Order Date : 12/11/2003

Certified true and correct.
Values are for Customs purposes only.
Delivery terms : Ex. Works

On behalf of PGS Geophysical AS, Marine Acquisition :

Sign : Werner Beneke

Info :

DATA SHIPMENT - PROJECT #:2003084.
Consignee EMail: SeisOps@woodside.com.au
Please acknowledge receipt by signing and returning the enclosed copy, either by mail, e-mail or telefax.

Proforma invoice / Packing List

Box	Quantity	Serial #	Description	Weight	Value
1	30.00 Pcs		Data Shipment - See Details. 30 x SEG-D 3590 Original Tapes Seq.# 001 - 008	8.00	(USD) 90.00
2	30.00 Pcs		Data Shipment - See Details. 30 x SEG-D 3590 Original Tapes Seq.# 008 - 015	8.00	(USD) 90.00
3	30.00 Pcs		Data Shipment - See Details. 30 x SEG-D 3590 Original Tapes Seq.# 016 - 023	8.00	(USD) 90.00
4	30.00 Pcs		Data Shipment - See Details. 30 x SEG-D 3590 Original Tapes Seq.# 024 - 030	8.00	(USD) 90.00
5	30.00 Pcs		Data Shipment - See Details. 30 x SEG-D 3590 Original Tapes Seq.# 030 - 037	8.00	(USD) 90.00
6	30.00 Pcs		Data Shipment - See Details. 24 x SEG-D 3590 Data Tapes, 1 x 3590 Tape with monthly test, 2 x 3590 Tapes P1/90, Navigation 2 x 3590 Tapes P2/94, Navigation 1 x Data CD with logs and drawings	8.00	(USD) 90.00

Total # of boxes : 6 **Total weight : 48.00 kg** **Total value : (USD) 540.00**

Page 1

Shipping Invoice # : ORI12800412A

Node : Orient Explorer (128)
Company : PGS Geophysical AS (EXANO)
Department : Seismic processing

14 Nov 2003

Shipper : Haebich Provedoring PO Box 567 Portland Victoria Australia **Attn :** Mr Robert Hope **Phone :** +63 3 5523 3372 **Fax :** +63 3 5523 3790	**Destination :** CompuStor 10 Cowcher Place Belmont WA 6104 Australia **Attn :** Mr. P Manford **Phone :** +61 8 9348 5270 **Fax :** +61 8 9348 4464
Type of freight : As fast as possible	**Order Date :** 14/11/2003

Certified true and correct.
Values are for Customs purposes only.
Delivery terms : Ex. Works

On behalf of PGS Geophysical AS, Marine Acquisition :

Sign : Guy Alleman

Info :

DATA SHIPMENT - PROJECT #:2003084.
Copy Tapes and QC products.
Consignee Email: SeisOps@woodside.com.au
Please aknowledge receipt by signing and returning the enclosed copy, either by e-mail or telefax.

Proforma invoice / Packing List

Box	Quantity	Serial #	Description	Weight	Value
1	30.00 Pcs		Data Shipment - See Details. 30 x SEG-D 3590 Copy Tapes Seq. # 001-008	8.00	(USD) 90.00
2	30.00 Pcs		Data Shipment - See Details. 30 x SEG-D 3590 Copy Tapes Seq. # 008-015	8.00	(USD) 90.00
3	30.00 Pcs		Data Shipment - See Details. 30 x SEG-D 3590 Copy Tapes Seq. # 016-023	8.00	(USD) 90.00
4	30.00 Pcs		Data Shipment - See Details. 30 x SEG-D 3590 Copy Tapes Seq. # 024-030	8.00	(USD) 90.00
5	30.00 Pcs		Data Shipment - See Details. 30 x SEG-D 3590 Copy Tapes Seq. # 030-037	8.00	(USD) 90.00
6	29.00 Pcs		Data Shipment - See Details. 24 x SEG-D 3590 Copy Tapes Seq. # 038-049 2 x 3590 Tapes P1/90 Navigation 2 x 3590 Tapes P2/94 Navigation 1 x CD with logs and drawings	8.00	(USD) 87.00
7	10.00 Pcs		Data Shipment - See Details. 6 x 3590 tapes: Aux Channels Archives 1 x 8 mm tape: Brute Stacks archives 1 x 8 mm tape: QC Velocities in text format 1 x 3590 tape: CO Cube in SEGY Tape Format 1 x CD with Seismic QC products	8.00	(USD) 30.00

Page 1

Shipping Invoice # : ORI12800412A

Node : Orient Explorer (128)
Company : PGS Geophysical AS (EXANO)
Department : Seismic processing

15 Nov 2003

Box	Quantity	Serial #	Description	Weight	Value
8	9.00 Pcs		Data Shipment - See Details. Seismic QC Folder with 36 Plots Seq # 002-010	12.00	(USD) 27.00
9	8.00 Pcs		Data Shipment - See Details. Seismic QC Folder with 36 Plots Seq # 011-018	12.00	(USD) 24.00
10	7.00 Pcs		Data Shipment - See Details. Seismic QC Folder with 36 Plots Seq # 019-025	12.00	(USD) 21.00
11	7.00 Pcs		Data Shipment - See Details. Seismic QC Folder with 36 Plots Seq # 026-032	12.00	(USD) 21.00
12	6.00 Pcs		Data Shipment - See Details. Seismic QC Folder with 36 Plots Seq # 033-038	12.00	(USD) 18.00
13	11.00 Pcs		Data Shipment - See Details. Seismic QC Folder with 36 Plots Seq # 039-049	12.00	(USD) 33.00
14	1.00 Pcs		Data Shipment - See Details. Syntrak QC Shot and Near Trace Plots	20.00	(USD) 20.00
15	1.00 Pcs		Data Shipment - See Details. Syntrak QC Shot and Near Trace Plots	22.00	(USD) 20.00
16	1.00 Pcs		Data Shipment - See Details. Syntrak QC Shot and Near Trace Plots	5.00	(USD) 5.00

Total # of boxes : 16 **Total weight : 175.00 kg** **Total value : (USD) 756.00**

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*****DATA TRANSMITTAL*****

Woodside Energy Ltd.
1 Adelaide Terrace
Perth, WA, 6000
Australia

Attn.: Mr. Ralph Weiss

SHIPMENT No.: NP112/2003
Date: 22.12.03

Project: 3D Antares, Otway Basin **PGS job# 2003084**

Box	Qty	Contents	Media	Sequences	Tape Name/Item	Description
1	1	P1/90	3590 Tape	001-049	W03ANTV011	Vessel positions
1	1	P1/90	3590 Tape	001-049	W03ANTE011	Echo sounder positions
1	1	Plot	Paper	001-049	Vessel position plot	Scale 1:50 000
1	1	Plot	Paper	001-049	Depth Contour plot	Scale 1:50 000
1	5	Plot	Paper	001-049	Coverage plots	All Zones, No flex, Scale 1:50 000
1	1	Plot	CD	001-049	Final plots as cgm files & P6/98	

Dispatched by Navigation Processing Department 09.12.03

AWB No.: 4914193314

Please aknowledge receipt and return enclosed copy to Ellen Katrine Mellum

Received by: Date:

.....

PGS Geophysical Marine Acquisition
Strandveien 4, Box 290, 1326 Lysaker, Norway - Tel.: +47 67 52 64 00 - Fax: +47 67 52 64 64

14.2 Source modelling

SIGNATURES FROM MARINE AIRGUN SOURCE LIBRARY
NUCLEUS - Marine Source Modeling 4.1.2
Modeling by Andrew Long, PGS Technology, July 2003

Survey name	:	Antares
PGS project No	:	2003419
Survey area	:	VIC/P37 and P44, Otway Basin
Vessel	:	M/V ORIENT EXPLORER
Array	:	2500LB_600_1800_100
Source type	:	Bolt gun
Source volume	:	2500 cu.in.
Air pressure	:	1800 psi
Source depth	:	6.0 m
Subarray separation	:	10.0 m
Recording filter	:	Syntrak-24bit system, 3(12) – 206(276) Hz (dB/oct.)
Receiver depth	:	7.5 m
Hydrophone group length	:	12.5 m
Compensating p-plugs	:	in
Full system response* filter name	:	S-24 g-6.25
Sea temperature	:	14° C

Enclosed are:

Figure 1: Array configuration top view, i.e. positive Y denotes starboard.
Figure 2: Modeled far-field signature and amplitude spectrum with 24bit recording filter (without receiver ghost).
Figure 3: Modeled far-field signature and amplitude spectrum with DFS-V recording filter (without receiver ghost).
Figure 4: Modeled far-field signature and amplitude spectrum with recording and hydrophone filter effect applied (without receiver ghost).
Figure 5: Far-field signature listing with 2 ms sampling interval (without receiver ghost).
Figure 6: Modeled far-field signature and amplitude spectrum with recording and hydrophone filter effect applied (with receiver ghost).
Figure 7: Far-field signature listing with 2 ms sampling interval (with receiver ghost).
Figure 8: Directivity plot for constant azimuth of 0° and 90°.

* Full system response contains the effect of the recording filter including the effects due to the hydrophone capacitors connected in parallel.

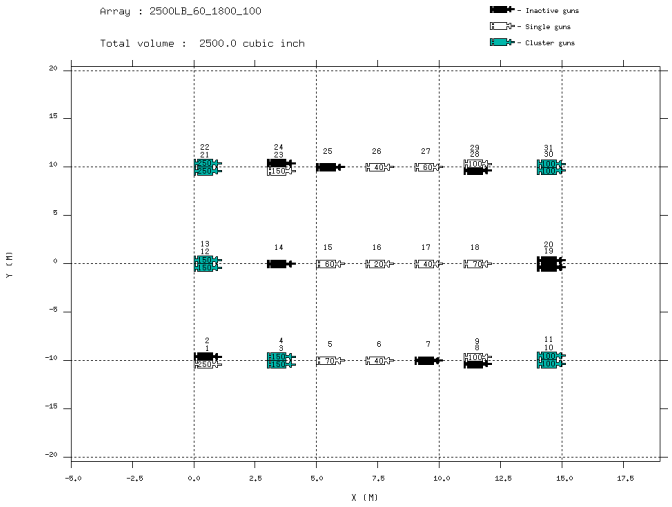


Figure 1: Array configuration top view, i.e. positive Y denotes starboard.

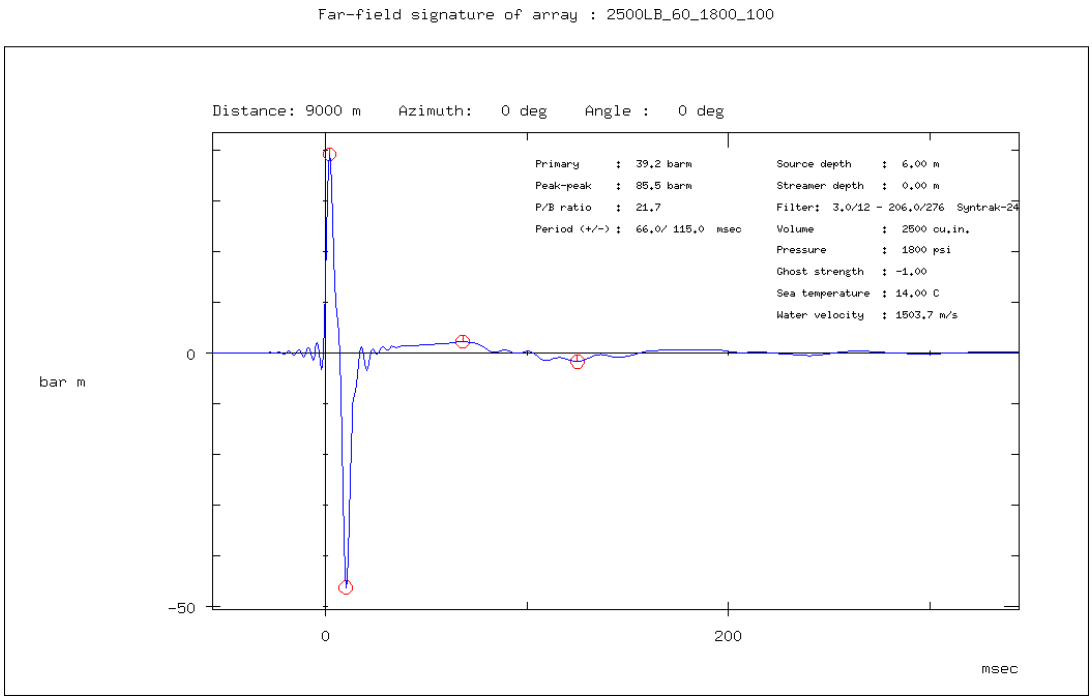
ARRAY LISTING

ARRAY NAME : 2500LB_60_1800_100
NUMBER OF ACTIVE GUNS: 22
TOTAL ACTIVE VOLUME : 2500 CU.IN.
NUMBER OF SPARE GUNS : 9

GUN #	GUN TYPE	X (m)	Y (m)	Z (m)	VOLUME (cu.in)	PRESSURE (psi)	WSK	DELAY (ms)	CLUSTER NUMBER
1	13	0.00	-10.40	6.00	250	1800	1.00	0.00	0
2	13	0.00	-9.60	6.00	250	SPARE	1.00	0.00	0
3	13	3.00	-10.40	6.00	150	1800	1.00	0.00	1
4	13	3.00	-9.60	6.00	150	1800	1.00	0.00	1
5	13	5.00	-10.00	6.00	70	1800	1.00	0.00	0
6	2	7.00	-10.00	6.00	40	1800	1.00	0.00	0
7	13	9.00	-10.00	6.00	60	SPARE	1.00	0.00	0
8	13	11.00	-10.35	6.00	100	SPARE	1.00	0.00	0
9	13	11.00	-9.65	6.00	100	1800	1.00	0.00	0
10	13	14.00	-10.35	6.00	100	1800	1.00	0.00	2
11	13	14.00	-9.50	6.00	100	1800	1.00	0.00	2
12	13	0.00	-0.40	6.00	150	1800	1.00	0.00	3
13	13	0.00	0.40	6.00	150	1800	1.00	0.00	3
14	13	3.00	0.00	6.00	90	SPARE	1.00	0.00	0
15	13	5.00	0.00	6.00	60	1800	1.00	0.00	0
16	2	7.00	0.00	6.00	20	1800	1.00	0.00	0
17	2	9.00	0.00	6.00	40	1800	1.00	0.00	0
18	13	11.00	0.00	6.00	70	1800	1.00	0.00	0
19	13	14.00	-0.35	6.00	100	SPARE	1.00	0.00	0
20	13	14.00	0.35	6.00	100	SPARE	1.00	0.00	0
21	13	0.00	9.60	6.00	250	1800	1.00	0.00	4
22	13	0.00	10.40	6.00	250	1800	1.00	0.00	4
23	13	3.00	9.60	6.00	150	1800	1.00	0.00	0
24	13	3.00	10.40	6.00	150	SPARE	1.00	0.00	0
25	13	5.00	10.00	6.00	70	SPARE	1.00	0.00	0
26	2	7.00	10.00	6.00	40	1800	1.00	0.00	0
27	13	9.00	10.00	6.00	60	1800	1.00	0.00	0
28	13	11.00	9.65	6.00	100	SPARE	1.00	0.00	0
29	13	11.00	10.35	6.00	100	1800	1.00	0.00	0
30	13	14.00	9.65	6.00	100	1800	1.00	0.00	5
31	13	14.00	10.35	6.00	100	1800	1.00	0.00	5

THE GUN TYPES ARE:
13: BOLT 1500 LL
2: BOLT 1900C

"WSK" IS THE RATIO BETWEEN THE PRIMARY
VOLUME AND TOTAL CHAMBER VOLUME
IN A BOLT 1500C GUN (TYPE 1)
WITH WAVESHAPE KIT



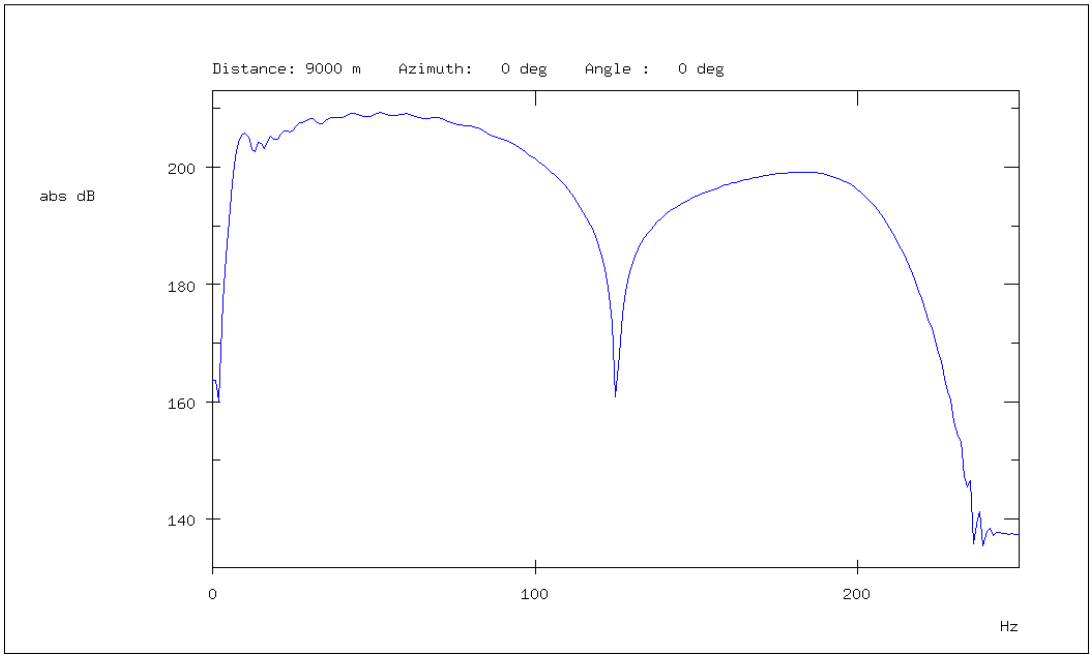


Figure 2: Modeled far-field signature and amplitude spectrum with 24bit recording filter (without receiver ghost).

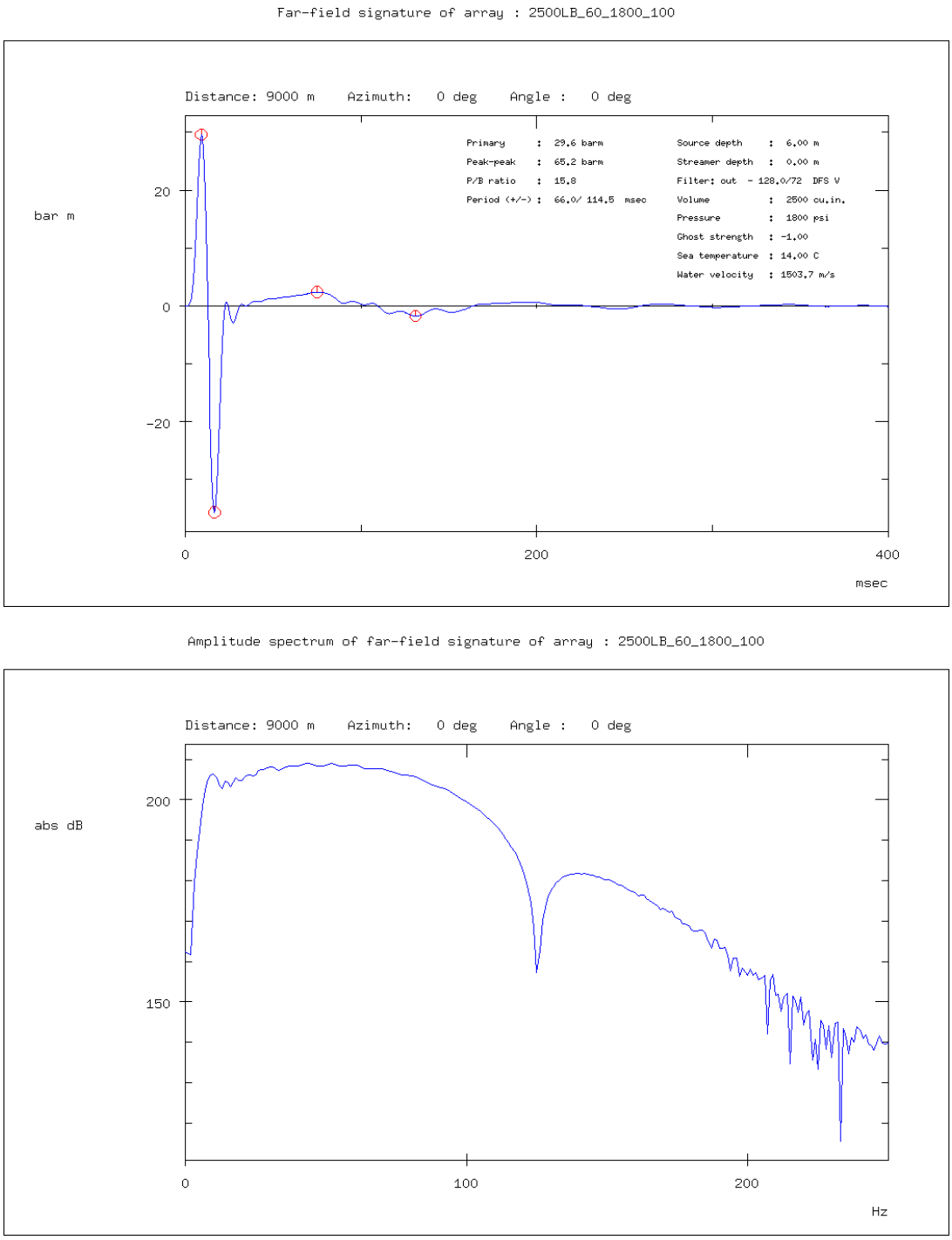


Figure 3: Modeled far-field signature and amplitude spectrum with DFS-V recording filter (without receiver ghost).

Full system response with source ghost only

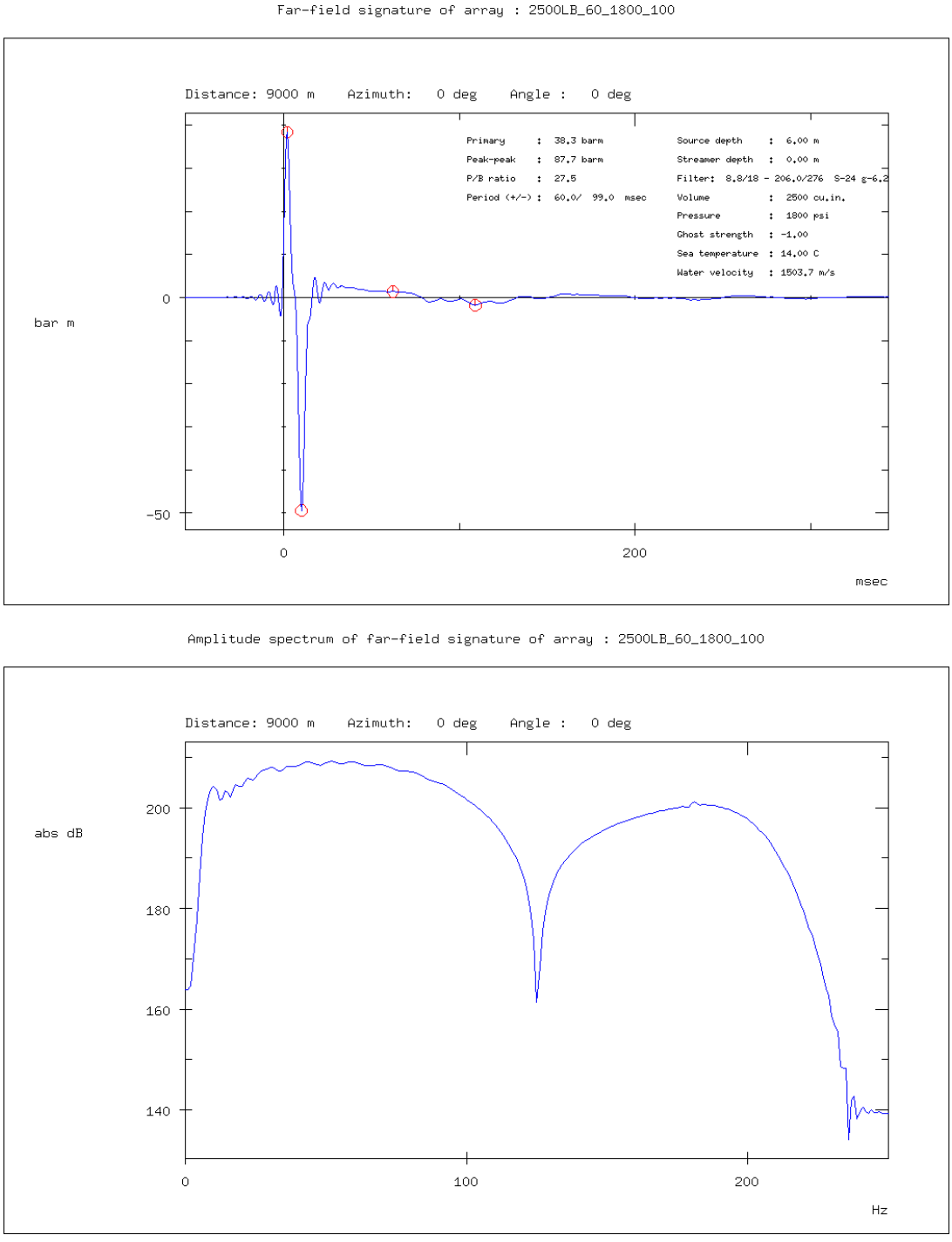


Figure 4: Modeled far-field signature and amplitude spectrum with recording and hydrophone filter effect applied (without receiver ghost).

Full system response with source ghost only

```
FAR-FIELD SIGNATURE LISTING

Array name          :  2500LB_60_1800_100
Total volume        :    2500 cu.in.
Source depth        :    6.00 m
Streamer depth      :    0.00 m
Group length        :    0.00 m
Average pressure    :    1800 psi
Ghost strength      :   -1.00
Primary amplitude   :   38.31 bar m
Peak-peak amplitude :   87.72 bar m
P/B-ratio           :   28.22
Bubble period (+)   :   60.00 msec
Bubble period (-)   :   98.00 msec
Seawater temperature:   14.00 C
Seawater velocity   :  1503.7 m/s
Filter              :
  Low-cut frequency :    8.80 Hz
  Low-cut slope     :   18.00 dB/oct
  High-cut frequency:  206.00 Hz
  High-cut slope    :  276.00 dB/oct
  Instrument        :  S-24 g-6.25
  Time of 1st sample:  -56.00 msec i.e. index of time zero =  29.0
Sample interval     :    2.00 msec
Far-field position  :
  Distance          : 9000.00 m
  Azimuth           :    0.00 deg
  Angle of vertical :    0.00 deg

Amplitudes are in bar m
Time is increasing horizontally

     0.000     0.000     0.000     0.002     0.004    -0.026    -0.006
     0.019    -0.024     0.057    -0.029    -0.041     0.094    -0.051
     0.162    -0.020     0.039     0.012    -0.253     0.236    -0.568
     0.553    -0.386     0.089     0.735    -1.545     2.638    -4.288
    13.741    38.308    13.049     1.297   -22.071   -49.413   -21.849
    -5.868    -1.374     4.558    -0.991     1.972     2.874     1.984
     3.273     2.275     2.592     2.582     2.236     2.360     2.219
     1.960     1.853     1.752     1.520     1.484     1.434     1.352
     1.451     1.384     1.306     1.381     1.282     1.278     1.305
     1.086     0.992     0.835     0.460     0.108    -0.488    -0.983
    -0.928    -0.709    -0.413    -0.322    -0.665    -0.838    -0.789
    -0.646    -0.344    -0.457    -0.948    -1.344    -1.728    -1.728
    -1.317    -1.097    -0.920    -0.882    -1.135    -1.191    -1.203
    -1.156    -0.787    -0.502    -0.180     0.224     0.287     0.286
     0.186    -0.150    -0.240    -0.258    -0.293    -0.033     0.151
     0.329     0.663     0.728     0.780     0.857     0.697     0.700
     0.713     0.596     0.678     0.639     0.530     0.592     0.460
     0.400     0.494     0.393     0.425     0.475     0.330     0.338
     0.242     0.010    -0.018    -0.141    -0.231    -0.129    -0.193
    -0.170    -0.088    -0.181    -0.089    -0.053    -0.159    -0.092
    -0.197    -0.316    -0.280    -0.471    -0.549    -0.494    -0.589
    -0.485    -0.389    -0.421    -0.253    -0.199    -0.182     0.041
     0.102     0.198     0.391     0.354     0.418     0.476     0.326
     0.367     0.335     0.201     0.268     0.161     0.063     0.116
    -0.043    -0.088    -0.070    -0.220    -0.187    -0.203    -0.320
    -0.241    -0.286    -0.315    -0.164    -0.180    -0.115     0.006
    -0.065    -0.016    -0.006    -0.101    -0.001     0.044     0.061
     0.196     0.185     0.190     0.247     0.161     0.161     0.185
     0.124     0.169     0.155     0.090     0.109
```

Figure 5: Far-field signature listing with 2 ms sampling interval (without receiver ghost).

Full system response with source and receiver ghost

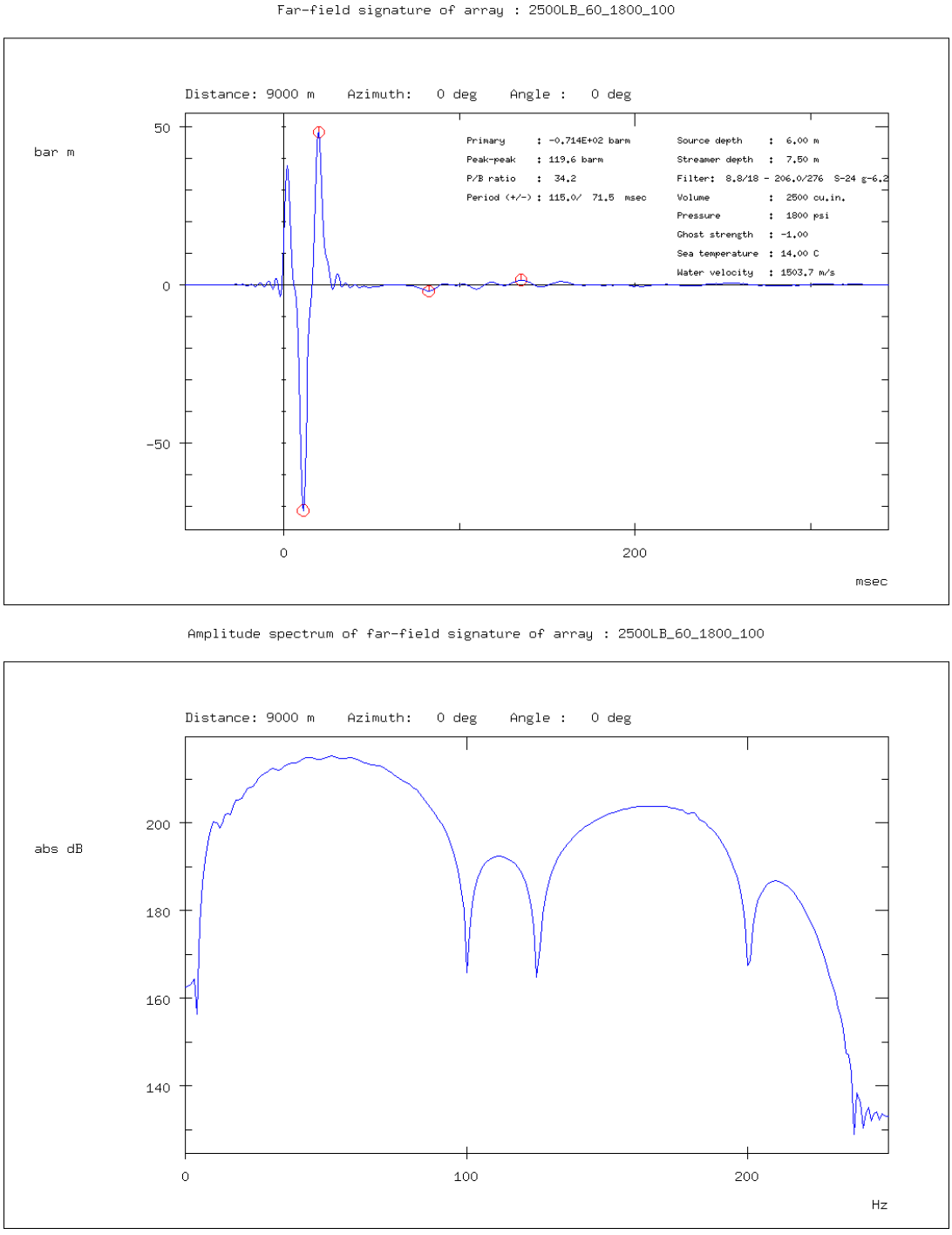


Figure 6: Modeled far-field signature and amplitude spectrum with recording and hydrophone filter effect applied (with receiver ghost).

Full system response with source and receiver ghost

```
FAR-FIELD SIGNATURE LISTING

Array name          :  2500LB_60_1800_100
Total volume        :    2500 cu.in.
Source depth        :    6.00 m
Streamer depth      :    7.50 m
Group length        :   12.50 m
Average pressure    :    1800 psi
Ghost strength      :   -1.00
Primary amplitude   :  -63.58 bar m
Peak-peak amplitude :  111.78 bar m
P/B-ratio           :   32.76
Bubble period (+)   :  116.00 msec
Bubble period (-)   :   72.00 msec
Seawater temperature:   14.00 C
Seawater velocity   :  1503.7 m/s
Filter              :
  Low-cut frequency :    8.80 Hz
  Low-cut slope     :   18.00 dB/oct
  High-cut frequency:  206.00 Hz
  High-cut slope    :  276.00 dB/oct
  Instrument        :  S-24 g-6.25
  Time of 1st sample:  -56.00 msec i.e. index of time zero =  29.0
Sample interval     :    2.00 msec
Far-field position  :
  Distance          : 9000.00 m
  Azimuth           :    0.00 deg
  Angle of vertical :    0.00 deg

Amplitudes are in bar m
Time is increasing horizontally

     0.000     0.000     0.000     0.002     0.004    -0.026    -0.006
     0.019    -0.026     0.053    -0.003    -0.035     0.076    -0.028
     0.105     0.011     0.077    -0.080    -0.203     0.074    -0.545
     0.510    -0.390     0.333     0.507    -0.982     2.078    -3.880
    13.607    37.620    14.551    -1.297   -17.788   -63.584   -59.958
   -18.613    -2.578    27.096    48.193    23.431     8.718     3.234
    -1.225     3.274     0.574    -0.259     0.234    -0.900    -0.048
    -0.634    -0.718    -0.481    -0.835    -0.728    -0.521    -0.498
    -0.295    -0.132    -0.175    -0.049    -0.068    -0.171    -0.075
    -0.219    -0.386    -0.444    -0.817    -1.193    -1.570    -1.973
    -1.758    -1.164    -0.515     0.173     0.318     0.086    -0.084
    -0.237    -0.020     0.211    -0.111    -0.557    -1.087    -1.386
    -0.855    -0.146     0.426     0.846     0.586     0.120    -0.110
    -0.240     0.096     0.633     1.009     1.426     1.438     1.067
     0.684     0.024    -0.465    -0.544    -0.578    -0.215     0.303
     0.568     0.921     1.018     0.810     0.705     0.364     0.036
    -0.013    -0.185    -0.176    -0.056    -0.169    -0.119    -0.134
    -0.279    -0.142    -0.137    -0.165     0.018    -0.071    -0.154
    -0.150    -0.416    -0.491    -0.469    -0.569    -0.367    -0.201
    -0.151     0.055     0.048     0.040     0.140     0.008    -0.003
    -0.016    -0.229    -0.225    -0.312    -0.457    -0.295    -0.274
    -0.205     0.083     0.126     0.241     0.389     0.301     0.430
     0.521     0.449     0.591     0.533     0.375     0.374     0.126
    -0.024    -0.018    -0.218    -0.206    -0.165    -0.304    -0.216
    -0.243    -0.355    -0.228    -0.284    -0.302    -0.158    -0.233
    -0.170    -0.065    -0.129     0.040     0.139     0.125     0.293
     0.248     0.147     0.174     0.012    -0.007     0.109     0.076
     0.203     0.286     0.189     0.204     0.098    -0.035     0.000
    -0.067    -0.077    -0.004    -0.072    -0.074
```

Figure 7: Far-field signature listing with 2 ms sampling interval (with receiver ghost).

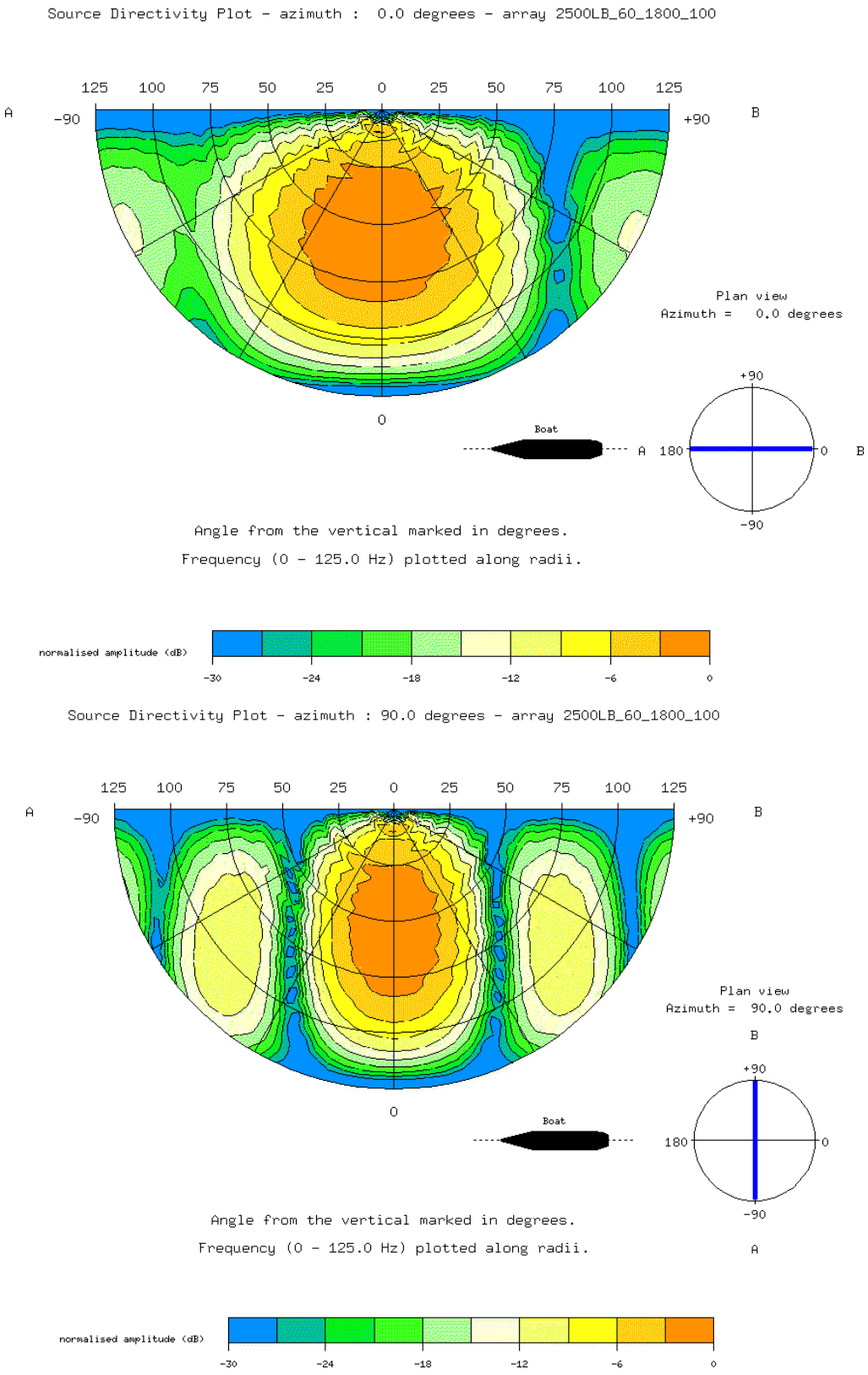
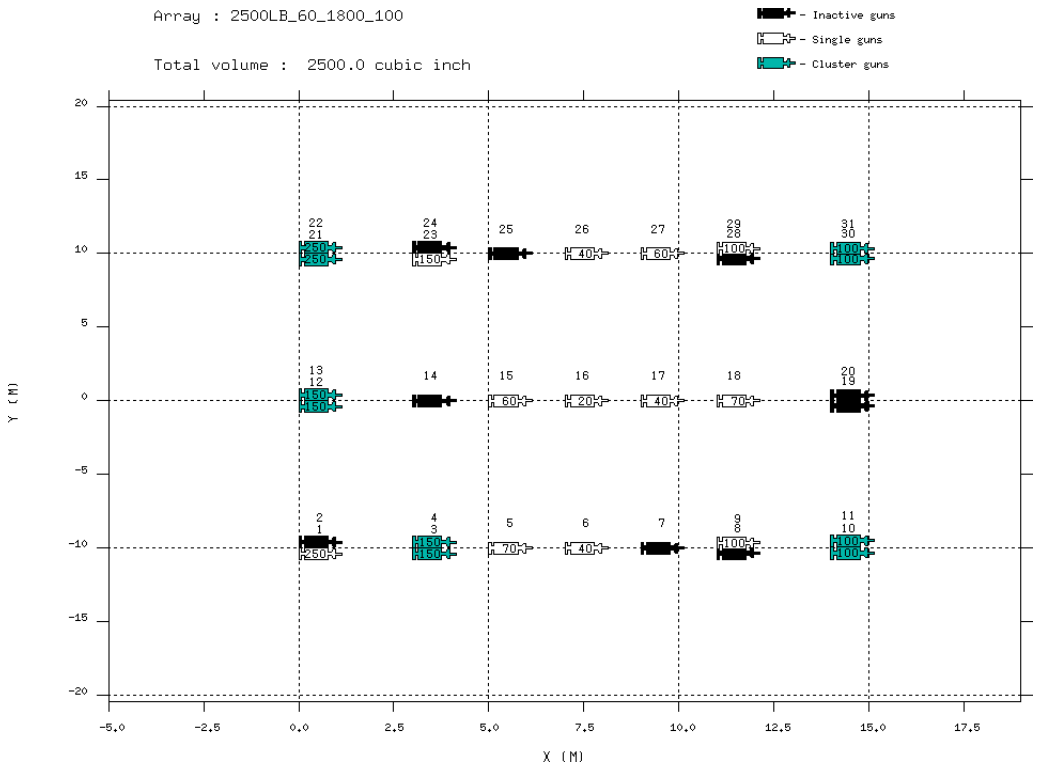


Figure 8: Directivity plot for constant azimuth of 0° and 90°.



Drop-out specification of array:

2500LB_60_1800_100

Bolt 1500LL/600B gun 2500 cu.in. array,

6.0 m depth, 1800 psi pressure,

10.0 m subarray spacing

AUGUST 2003

The drop-out specification covered by this report was performed with NUCLEUS-V 6.1.1 (masomo v.4.1.3) modeling software by Barbara Kajl, PGS Technology – Geophysical Support.
A Hz(dB/oct) filter is used for the modeling.

The drop-out specification enclosed is given for the following criteria:
- ✓ Loss in peak amplitude ≤ 10% compared to nominal signature
- ✓ Loss in peak-to-bubble ≤ 10% compared to nominal signature

APPENDIX A: ARRAY DESCRIPTION

APPENDIX B: DROP-OUT RESULTS FROM THE MODELING

APPENDIX C: DROP-OUT SPECIFICATION

APPENDIX A: ARRAY DESCRIPTION

ARRAY LISTING

ARRAY NAME : 2500LB_60_1800_100
NUMBER OF ACTIVE GUNS: 22
TOTAL ACTIVE VOLUME : 2500 CU.IN.
NUMBER OF SPARE GUNS : 9

GUN #	GUN TYPE	X (m)	Y (m)	Z (m)	VOLUME (cu.in)	PRESSURE (psi)	WSK	DELAY (ms)	CLUSTER NUMBER
1	13	0.00	-10.40	6.00	250	1800	1.00	0.00	0
2	13	0.00	-9.60	6.00	250	SPARE	1.00	0.00	0
3	13	3.00	-10.40	6.00	150	1800	1.00	0.00	1
4	13	3.00	-9.60	6.00	150	1800	1.00	0.00	1
5	13	5.00	-10.00	6.00	70	1800	1.00	0.00	0
6	2	7.00	-10.00	6.00	40	1800	1.00	0.00	0
7	13	9.00	-10.00	6.00	60	SPARE	1.00	0.00	0
8	13	11.00	-10.35	6.00	100	SPARE	1.00	0.00	0
9	13	11.00	-9.65	6.00	100	1800	1.00	0.00	0
10	13	14.00	-10.35	6.00	100	1800	1.00	0.00	2
11	13	14.00	-9.50	6.00	100	1800	1.00	0.00	2
12	13	0.00	-0.40	6.00	150	1800	1.00	0.00	3
13	13	0.00	0.40	6.00	150	1800	1.00	0.00	3
14	13	3.00	0.00	6.00	90	SPARE	1.00	0.00	0
15	13	5.00	0.00	6.00	60	1800	1.00	0.00	0
16	2	7.00	0.00	6.00	20	1800	1.00	0.00	0
17	2	9.00	0.00	6.00	40	1800	1.00	0.00	0
18	13	11.00	0.00	6.00	70	1800	1.00	0.00	0
19	13	14.00	-0.35	6.00	100	SPARE	1.00	0.00	0
20	13	14.00	0.35	6.00	100	SPARE	1.00	0.00	0
21	13	0.00	9.60	6.00	250	1800	1.00	0.00	4
22	13	0.00	10.40	6.00	250	1800	1.00	0.00	4
23	13	3.00	9.60	6.00	150	1800	1.00	0.00	0
24	13	3.00	10.40	6.00	150	SPARE	1.00	0.00	0
25	13	5.00	10.00	6.00	70	SPARE	1.00	0.00	0
26	2	7.00	10.00	6.00	40	1800	1.00	0.00	0
27	13	9.00	10.00	6.00	60	1800	1.00	0.00	0
28	13	11.00	9.65	6.00	100	SPARE	1.00	0.00	0
29	13	11.00	10.35	6.00	100	1800	1.00	0.00	0
30	13	14.00	9.65	6.00	100	1800	1.00	0.00	5
31	13	14.00	10.35	6.00	100	1800	1.00	0.00	5

THE GUN TYPES ARE:
13: BOLT 1500 LL
2: BOLT 1900C

"WSK" IS THE RATIO BETWEEN THE PRIMARY
VOLUME AND TOTAL CHAMBER VOLUME
IN A BOLT 1500C GUN (TYPE 1)
WITH WAVESHAPE KIT

APPENDIX B: DROP-OUT RESULTS FROM THE MODELING

Array : 2500LB_60_1800_100
Gun type : Bolt 1500LL/600B gun
Volume : 2500 cu.in.
Depth : 6.0 m
Air pressure : 1800 psi
Subarray separation : 10.0 m
Sea temperature : Syntrak 24-bit: 3.0(12) - 206.0(276)
Filter : Hz (dB/oct.)
Bubble window : 60 – 200 ms

# = gun dropped,
P = primary (barm),
%ch = %change,
P/B = Peak/Bubble ratio,
x-corr = normalized cross correlation coefficient.
AvgdB = average deviation (dB) in frequency domain 10 – 70 Hz
maxdB = max deviation (dB) in frequency domain 10 – 70 Hz

Drop-out combinations:

Dropped #		Dropped gun volumes		P	%ch P	P/B	%ch P/B	x-corr	avgdB	maxdB
1st	*2nd*	*1st*	*2nd*							
Full	arr	ay.		39.16	0	21.68	0	1	0	0
1		250		36.14	-7.7	19.2	-11.4	0.99956	0.66	1.56
3		150		37.96	-3.1	17.96	-17.2	0.9983	0.4	2.14
4		150		37.95	-3.1	18.02	-16.9	0.99834	0.4	2.12
5		70		37.9	-3.2	20.58	-5.1	0.9997	0.23	0.73
6		40		38.11	-2.7	21.12	-2.6	0.99984	0.15	0.31
9		100		37.14	-5.2	20.71	-4.4	0.99958	0.4	1.33
10		100		37.94	-3.1	19.13	-11.7	0.997	0.55	-2.36
11		100		37.95	-3.1	19.23	-11.3	0.99702	0.54	-2.39
12		150		37.77	-3.6	18.64	-14	0.99885	0.41	1.44
13		150		37.77	-3.6	18.57	-14.3	0.99886	0.41	1.47
15		60		37.66	-3.8	21.09	-2.7	0.99952	0.27	0.97
16		20		38.54	-1.6	20.78	-4.1	0.99982	0.08	0.21
17		40		38.2	-2.4	20.99	-3.2	0.99973	0.17	0.61
18		70		37.54	-4.1	21.11	-2.6	0.9991	0.39	1.75
21		250		37.78	-3.5	16.02	-26.1	0.99768	0.47	2.34
22		250		37.76	-3.6	15.92	-26.6	0.99769	0.48	2.36
23		150		36.63	-6.4	20.77	-4.2	0.99965	0.49	1.28
26		40		38.09	-2.7	21.08	-2.7	0.99984	0.16	0.3
27		60		37.91	-3.2	21.2	-2.2	0.99977	0.23	0.53
29		100		37.35	-4.6	20.6	-4.9	0.99927	0.41	1.57
30		100		38.07	-2.8	18.65	-14	0.99697	0.52	-2.24
31		100		38.08	-2.8	18.69	-13.8	0.99693	0.53	-2.27

1	3	250	150	34.87	-10.9	15.13	-30.2	0.9964	1.02	3.42
1	4	250	150	34.88	-10.9	15.18	-30	0.9964	1.02	3.43
1	5	250	70	34.89	-10.9	19.63	-9.5	0.99956	0.89	1.49
1	6	250	40	35.1	-10.4	18.46	-14.8	0.9994	0.83	2.01
1	9	250	100	34.12	-12.9	19.98	-7.8	0.99924	1.07	1.86
1	10	250	100	34.92	-10.8	16.8	-22.5	0.99599	1.08	2.52
1	11	250	100	34.93	-10.8	17.01	-21.5	0.9961	1.07	2.54
1	12	250	150	34.74	-11.3	15.61	-28	0.99684	1.04	3.3
1	13	250	150	34.75	-11.3	15.66	-27.8	0.99684	1.04	3.33
1	15	250	60	34.65	-11.5	19.42	-10.4	0.99936	0.93	1.58
1	16	250	20	35.52	-9.3	18.65	-14	0.99947	0.74	1.66
1	17	250	40	35.18	-10.2	18.66	-13.9	0.99933	0.83	1.91
1	18	250	70	34.51	-11.9	19.47	-10.2	0.99895	1.02	1.78
1	21	250	250	34.76	-11.2	15.57	-28.2	0.99728	1.03	3.04
1	22	250	250	34.74	-11.3	15.56	-28.2	0.99738	1.04	3.02
1	23	250	150	33.62	-14.2	20.21	-6.8	0.9994	1.18	1.79
1	26	250	40	35.07	-10.4	18.55	-14.4	0.99942	0.83	1.95
1	27	250	60	34.89	-10.9	19.72	-9	0.99955	0.88	1.42
1	29	250	100	34.33	-12.3	18.59	-14.2	0.99869	1.06	1.85
1	30	250	100	35.05	-10.5	16.46	-24.1	0.99594	1.05	2.65
1	31	250	100	35.06	-10.5	16.63	-23.3	0.99592	1.05	2.66
3	4	150	150	35.65	-9	16.09	-25.8	0.99779	0.72	2.15
3	5	150	70	36.59	-6.6	18	-17	0.99813	0.56	1.74
3	6	150	40	36.91	-5.7	17.34	-20	0.99789	0.52	2.48
3	9	150	100	35.94	-8.2	17.58	-18.9	0.9978	0.68	2.1
3	10	150	100	36.75	-6.2	18.79	-13.3	0.99673	0.67	-2.72
3	11	150	100	36.76	-6.1	19.01	-12.3	0.99674	0.66	-2.72
3	12	150	150	36.57	-6.6	15.19	-29.9	0.99476	0.78	3.95
3	13	150	150	36.57	-6.6	15.08	-30.4	0.99471	0.79	3.86
3	15	150	60	36.47	-6.9	17.91	-17.4	0.99771	0.62	2.29
3	16	150	20	37.35	-4.6	17.21	-20.6	0.99794	0.46	2.22
3	17	150	40	37.01	-5.5	17.43	-19.6	0.99786	0.53	2.36
3	18	150	70	36.34	-7.2	18.11	-16.4	0.9975	0.7	1.85
3	21	150	250	36.58	-6.6	12.77	-41.1	0.9944	0.8	3.47
3	22	150	250	36.57	-6.6	12.74	-41.2	0.99444	0.8	3.5
3	23	150	150	35.44	-9.5	17.77	-18	0.99851	0.71	1.97
3	26	150	40	36.9	-5.8	17.26	-20.4	0.99792	0.52	2.47
3	27	150	60	36.72	-6.2	18.38	-15.2	0.99824	0.52	1.93
3	29	150	100	36.16	-7.7	17.54	-19.1	0.9975	0.66	2.05
3	30	150	100	36.87	-5.8	18.59	-14.2	0.99666	0.65	-2.62
3	31	150	100	36.88	-5.8	18.52	-14.6	0.99657	0.65	-2.68
4	5	150	70	36.57	-6.6	17.91	-17.4	0.99803	0.56	1.77
4	6	150	40	36.9	-5.8	17.23	-20.5	0.99783	0.53	2.58
4	9	150	100	35.93	-8.2	17.55	-19	0.99772	0.68	2.17
4	10	150	100	36.73	-6.2	18.87	-13	0.99671	0.66	-2.72
4	11	150	100	36.74	-6.2	18.78	-13.3	0.99661	0.67	-2.77
4	12	150	150	36.56	-6.6	14.96	-31	0.99483	0.78	3.87
4	13	150	150	36.56	-6.6	15.19	-29.9	0.99487	0.77	3.85
4	15	150	60	36.46	-6.9	18.04	-16.8	0.99772	0.61	2.31
4	16	150	20	37.34	-4.7	17.29	-20.3	0.998	0.45	2.18
4	17	150	40	36.99	-5.5	17.16	-20.8	0.99782	0.53	2.32
4	18	150	70	36.33	-7.2	18.41	-15.1	0.99759	0.69	1.86
4	21	150	250	36.57	-6.6	12.66	-41.6	0.99429	0.8	3.51
4	22	150	250	36.55	-6.7	12.66	-41.6	0.99444	0.8	3.5
4	23	150	150	35.43	-9.5	17.67	-18.5	0.99843	0.71	1.97

4	26	150	40	36.89	-5.8	17.33	-20.1	0.99791	0.52	2.48
4	27	150	60	36.71	-6.3	18.29	-15.6	0.99816	0.52	1.97
4	29	150	100	36.14	-7.7	17.38	-19.8	0.99747	0.66	2.06
4	30	150	100	36.86	-5.9	18.52	-14.6	0.99659	0.65	-2.63
4	31	150	100	36.87	-5.8	18.59	-14.2	0.99662	0.64	-2.67
5	6	70	40	36.69	-6.3	20.07	-7.4	0.99927	0.4	0.94
5	9	70	100	35.89	-8.3	19.61	-9.5	0.99888	0.65	1.65
5	10	70	100	36.68	-6.3	20.7	-4.5	0.9971	0.64	-2.08
5	11	70	100	36.69	-6.3	20.92	-3.5	0.99718	0.64	-2.07
5	12	70	150	36.51	-6.8	19.09	-11.9	0.99871	0.57	-1.15
5	13	70	150	36.51	-6.8	19.1	-11.9	0.99871	0.57	-1.16
5	15	70	60	36.41	-7	19.66	-9.3	0.99862	0.51	1.84
5	16	70	20	37.29	-4.8	19.61	-9.5	0.99919	0.3	0.82
5	17	70	40	36.95	-5.6	20.76	-4.2	0.99909	0.38	1.33
5	18	70	70	36.29	-7.3	19.02	-12.2	0.998	0.63	2.68
5	21	70	250	36.52	-6.7	15.58	-28.1	0.99686	0.66	3.28
5	22	70	250	36.51	-6.8	15.57	-28.2	0.9969	0.67	3.33
5	23	70	150	35.38	-9.6	19.65	-9.3	0.99906	0.72	1.48
5	26	70	40	36.84	-5.9	20.73	-4.4	0.99926	0.37	0.98
5	27	70	60	36.66	-6.4	19.64	-9.4	0.99902	0.46	1.02
5	29	70	100	36.1	-7.8	19.54	-9.9	0.99859	0.6	2.12
5	30	70	100	36.81	-6	19.72	-9	0.99706	0.61	2.12
5	31	70	100	36.82	-6	19.75	-8.9	0.99703	0.61	2.14
6	9	40	100	36.08	-7.9	20.43	-5.7	0.99926	0.57	1.48
6	10	40	100	36.9	-5.8	18.99	-12.4	0.99677	0.64	-2.18
6	11	40	100	36.91	-5.7	19.07	-12	0.99675	0.64	-2.19
6	12	40	150	36.72	-6.2	18.02	-16.9	0.99859	0.55	1.83
6	13	40	150	36.72	-6.2	18.17	-16.2	0.99863	0.54	1.78
6	15	40	60	36.62	-6.5	21.08	-2.7	0.99901	0.42	1.19
6	16	40	20	37.5	-4.2	20.57	-5.1	0.99939	0.23	0.42
6	17	40	40	37.16	-5.1	20.13	-7.1	0.99925	0.32	0.89
6	18	40	70	36.5	-6.8	21.33	-1.6	0.99875	0.51	2.12
6	21	40	250	36.73	-6.2	15.54	-28.3	0.99744	0.59	2.54
6	22	40	250	36.72	-6.2	15.53	-28.4	0.99748	0.6	2.53
6	23	40	150	35.59	-9.1	20.73	-4.4	0.99925	0.65	1.34
6	26	40	40	37.05	-5.4	20.4	-5.9	0.99935	0.32	0.66
6	27	40	60	36.87	-5.8	21.14	-2.5	0.99937	0.37	0.77
6	29	40	100	36.31	-7.3	20.18	-6.9	0.99885	0.54	1.88
6	30	40	100	37.03	-5.4	18.27	-15.7	0.99675	0.61	2.25
6	31	40	100	37.03	-5.4	18.28	-15.7	0.99675	0.61	2.26
9	10	100	100	35.87	-8.4	20.91	-3.5	0.99762	0.8	2.81
9	11	100	100	35.87	-8.4	20.88	-3.7	0.99762	0.79	2.77
9	12	100	150	35.75	-8.7	19.17	-11.6	0.99851	0.7	1.55
9	13	100	150	35.74	-8.7	19.23	-11.3	0.9985	0.7	1.51
9	15	100	60	35.65	-9	20.33	-6.2	0.99887	0.67	1.85
9	16	100	20	36.52	-6.7	19.95	-8	0.99914	0.47	1.38
9	17	100	40	36.18	-7.6	20.7	-4.5	0.99907	0.57	1.83
9	18	100	70	35.52	-9.3	19.69	-9.2	0.99833	0.79	2.67
9	21	100	250	35.76	-8.7	15.47	-28.6	0.99721	0.83	2.3
9	22	100	250	35.74	-8.7	15.53	-28.4	0.99725	0.84	2.28
9	23	100	150	34.62	-11.6	19.89	-8.2	0.99886	0.91	2.06
9	26	100	40	36.08	-7.9	20.71	-4.5	0.99923	0.56	1.53
9	27	100	60	35.9	-8.3	20.21	-6.8	0.99901	0.63	1.89
9	29	100	100	35.33	-9.8	19.92	-8.1	0.99764	0.82	3.15
9	30	100	100	36.05	-7.9	20.83	-3.9	0.99714	0.73	2.82
9	31	100	100	36.06	-7.9	20.98	-3.2	0.99711	0.73	2.81

10	11	100	100	35.86	-8.4	20.88	-3.7	0.99809	0.82	2.75
10	12	100	150	36.55	-6.7	18.83	-13.1	0.99621	0.77	-2.83
10	13	100	150	36.55	-6.7	18.93	-12.7	0.99619	0.77	-2.84
10	15	100	60	36.45	-6.9	20.83	-3.9	0.9968	0.67	2.07
10	16	100	20	37.33	-4.7	18.74	-13.5	0.99679	0.59	-2.29
10	17	100	40	36.98	-5.6	18.89	-12.8	0.99692	0.63	-1.99
10	18	100	70	36.32	-7.2	20.88	-3.7	0.99657	0.75	2.19
10	21	100	250	36.56	-6.6	16.22	-25.2	0.99539	0.79	-2.44
10	22	100	250	36.54	-6.7	16.07	-25.9	0.9953	0.8	-2.43
10	23	100	150	35.42	-9.6	16.8	-22.5	0.99531	0.95	3.08
10	26	100	40	36.88	-5.8	18.53	-14.5	0.99678	0.65	-2.2
10	27	100	60	36.7	-6.3	19.4	-10.5	0.99675	0.65	2.16
10	29	100	100	36.13	-7.7	20.08	-7.4	0.99718	0.75	2.62
10	30	100	100	36.85	-5.9	12.24	-43.5	0.98735	1.08	4.72
10	31	100	100	36.86	-5.9	12.25	-43.5	0.98737	1.08	4.7
11	12	100	150	36.56	-6.6	19.02	-12.2	0.99618	0.77	-2.87
11	13	100	150	36.56	-6.6	18.94	-12.6	0.99622	0.76	-2.85
11	15	100	60	36.46	-6.9	20.62	-4.9	0.99669	0.67	2.11
11	16	100	20	37.34	-4.7	18.79	-13.3	0.99675	0.59	-2.31
11	17	100	40	36.99	-5.5	18.82	-13.2	0.99684	0.63	-2.02
11	18	100	70	36.33	-7.2	20.72	-4.4	0.99648	0.76	2.24
11	21	100	250	36.57	-6.6	16.14	-25.5	0.99537	0.79	-2.49
11	22	100	250	36.55	-6.7	16.13	-25.6	0.99532	0.8	-2.46
11	23	100	150	35.43	-9.5	16.73	-22.8	0.9952	0.95	3.12
11	26	100	40	36.89	-5.8	18.54	-14.4	0.99676	0.64	-2.22
11	27	100	60	36.71	-6.3	19.37	-10.6	0.99669	0.65	2.22
11	29	100	100	36.14	-7.7	19.83	-8.5	0.99707	0.76	2.65
11	30	100	100	36.86	-5.9	12.26	-43.5	0.98733	1.08	4.75
11	31	100	100	36.87	-5.8	12.22	-43.6	0.98733	1.08	4.72
12	13	150	150	35.06	-10.5	18.84	-13.1	0.99912	0.93	1.53
12	15	150	60	36.27	-7.4	18.85	-13	0.99827	0.66	1.65
12	16	150	20	37.15	-5.1	18.19	-16.1	0.99865	0.47	1.48
12	17	150	40	36.81	-6	18.07	-16.6	0.9984	0.56	1.73
12	18	150	70	36.15	-7.7	18.88	-12.9	0.99784	0.73	1.73
12	21	150	250	36.39	-7.1	15.55	-28.3	0.99679	0.75	3.03
12	22	150	250	36.37	-7.1	15.61	-28	0.99683	0.75	2.99
12	23	150	150	35.24	-10	19.81	-8.6	0.99906	0.78	1.74
12	26	150	40	36.7	-6.3	17.96	-17.1	0.99859	0.56	1.79
12	27	150	60	36.52	-6.7	19.34	-10.8	0.99883	0.56	1.32
12	29	150	100	35.96	-8.2	17.89	-17.5	0.99824	0.68	1.52
12	30	150	100	36.68	-6.3	18.17	-16.2	0.9956	0.77	-2.73
12	31	150	100	36.69	-6.3	18.14	-16.3	0.99562	0.77	-2.74
13	15	150	60	36.27	-7.4	18.92	-12.7	0.99827	0.66	1.65
13	16	150	20	37.15	-5.1	18.11	-16.4	0.99866	0.47	1.49
13	17	150	40	36.81	-6	18.1	-16.5	0.99838	0.57	1.73
13	18	150	70	36.15	-7.7	19	-12.4	0.99791	0.72	1.72
13	21	150	250	36.38	-7.1	15.37	-29.1	0.99671	0.75	3.08
13	22	150	250	36.37	-7.1	15.7	-27.6	0.9968	0.76	3.04
13	23	150	150	35.24	-10	19.75	-8.9	0.99911	0.78	1.71
13	26	150	40	36.7	-6.3	17.79	-17.9	0.99859	0.56	1.82
13	27	150	60	36.52	-6.7	19.25	-11.2	0.99883	0.56	1.3
13	29	150	100	35.96	-8.2	17.79	-17.9	0.99822	0.68	1.56
13	30	150	100	36.68	-6.3	18.19	-16.1	0.99552	0.77	-2.77
13	31	150	100	36.68	-6.3	18.24	-15.9	0.9955	0.77	-2.82
15	16	60	20	36.92	-5.7	20.17	-7	0.99886	0.37	0.97
15	17	60	40	36.69	-6.3	21.14	-2.5	0.9987	0.46	1.5
15	18	60	70	36.05	-7.9	19.45	-10.3	0.99729	0.7	2.88

15	21	60	250	36.28	-7.3	15.8	-27.1	0.99679	0.7	3.51
15	22	60	250	36.27	-7.4	15.67	-27.7	0.99684	0.71	3.54
15	23	60	150	35.14	-10.3	20.41	-5.8	0.99899	0.76	1.42
15	26	60	40	36.6	-6.5	21.35	-1.5	0.999	0.43	1.23
15	27	60	60	36.42	-7	20.47	-5.6	0.99875	0.5	1.33
15	29	60	100	35.86	-8.4	20.19	-6.9	0.99881	0.62	2.15
15	30	60	100	36.58	-6.6	19.97	-7.9	0.99666	0.66	2.01
15	31	60	100	36.58	-6.6	20.03	-7.6	0.99659	0.66	2.03
16	17	20	40	37.48	-4.3	20.59	-5	0.99914	0.26	0.69
16	18	20	70	36.91	-5.7	19.87	-8.3	0.99849	0.47	1.93
16	21	20	250	37.16	-5.1	15.43	-28.8	0.99733	0.54	2.43
16	22	20	250	37.15	-5.1	15.55	-28.3	0.99744	0.54	2.42
16	23	20	150	36.02	-8	19.99	-7.8	0.9992	0.57	1.24
16	26	20	40	37.48	-4.3	20.55	-5.2	0.9994	0.24	0.38
16	27	20	60	37.3	-4.8	20.24	-6.6	0.99932	0.3	0.56
16	29	20	100	36.74	-6.2	19.81	-8.6	0.99882	0.48	1.68
16	30	20	100	37.46	-4.3	18.19	-16.1	0.99677	0.57	2.25
16	31	20	100	37.46	-4.3	18.15	-16.3	0.99668	0.57	2.27
17	18	40	70	36.41	-7	21.79	0.5	0.9985	0.59	2.21
17	21	40	250	36.82	-6	15.62	-27.9	0.99743	0.6	2.69
17	22	40	250	36.8	-6	15.59	-28.1	0.99752	0.6	2.7
17	23	40	150	35.68	-8.9	20.55	-5.2	0.99914	0.66	1.35
17	26	40	40	37.14	-5.2	19.95	-7.9	0.99923	0.33	0.86
17	27	40	60	36.95	-5.6	21.45	-1.1	0.99922	0.38	1.03
17	29	40	100	36.39	-7.1	20.35	-6.1	0.9987	0.56	2.19
17	30	40	100	37.11	-5.2	18.32	-15.5	0.99679	0.61	2.11
17	31	40	100	37.12	-5.2	18.24	-15.9	0.99683	0.61	2.1
18	21	70	250	36.16	-7.7	15.89	-26.7	0.99639	0.8	4.08
18	22	70	250	36.14	-7.7	15.76	-27.3	0.99636	0.81	4.12
18	23	70	150	35.02	-10.6	19.88	-8.3	0.9985	0.87	1.86
18	26	70	40	36.47	-6.9	20.85	-3.8	0.9987	0.53	2.11
18	27	70	60	36.29	-7.3	19.58	-9.7	0.99811	0.63	2.14
18	29	70	100	35.73	-8.8	19.84	-8.5	0.99819	0.76	2.95
18	30	70	100	36.45	-6.9	20.28	-6.4	0.9964	0.75	2.03
18	31	70	100	36.46	-6.9	20.32	-6.2	0.9964	0.75	2.05
21	22	250	250	34.7	-11.4	17.67	-18.5	0.99841	1.06	2.58
21	23	250	150	35.19	-10.1	16.09	-25.8	0.99755	0.89	2.35
21	26	250	40	36.71	-6.2	15.82	-27	0.99752	0.6	2.66
21	27	250	60	36.53	-6.7	15.88	-26.7	0.99733	0.66	2.85
21	29	250	100	35.97	-8.1	15.47	-28.6	0.99732	0.79	2.4
21	30	250	100	36.69	-6.3	16.68	-23.1	0.99594	0.74	-2.39
21	31	250	100	36.7	-6.3	16.68	-23	0.99586	0.74	-2.41
22	23	250	150	35.19	-10.1	16.1	-25.7	0.9976	0.89	2.32
22	26	250	40	36.7	-6.3	15.75	-27.3	0.99754	0.61	2.63
22	27	250	60	36.51	-6.8	15.83	-26.9	0.9974	0.67	2.86
22	29	250	100	35.95	-8.2	15.4	-28.9	0.99729	0.8	2.42
22	30	250	100	36.67	-6.4	16.5	-23.9	0.99577	0.76	-2.37
22	31	250	100	36.68	-6.3	16.58	-23.5	0.99582	0.75	-2.37
23	26	150	40	35.55	-9.2	20.2	-6.8	0.99931	0.69	1.38
23	27	150	60	35.4	-9.6	20.38	-6	0.99917	0.74	1.84
23	29	150	100	34.82	-11.1	19.81	-8.6	0.99838	0.92	2.34
23	30	150	100	35.55	-9.2	16.26	-25	0.99537	0.91	3.14
23	31	150	100	35.56	-9.2	16.16	-25.4	0.99527	0.91	3.15
26	27	40	60	36.69	-6.3	20.85	-3.8	0.99942	0.42	0.71
26	29	40	100	36.27	-7.4	19.93	-8	0.99906	0.56	1.77
26	30	40	100	37.01	-5.5	18.15	-16.3	0.99672	0.63	2.28
26	31	40	100	37.01	-5.5	18.01	-16.9	0.99675	0.63	2.28

27	29	60	100	35.89	-8.4	20.23	-6.7	0.9991	0.67	1.98
27	30	60	100	36.83	-6	19.93	-8	0.99691	0.62	2.24
27	31	60	100	36.83	-5.9	19.9	-8.2	0.99691	0.63	2.22
29	30	100	100	36.22	-7.5	20.71	-4.5	0.99742	0.76	2.65
29	31	100	100	36.22	-7.5	20.71	-4.5	0.99751	0.75	2.62
30	31	100	100	35.98	-8.1	21.2	-2.2	0.99806	0.77	2.47

APPENDIX C: DROP-OUT SPECIFICATION

The array contains the following active elements:

Number elements	Name	Type	Total Volume (cu.in)	No of gun in element
2	2x200C	Cluster	400 cu.in	2
2	2x150C	Cluster	300 cu.in.	2
1	2x100C	Cluster	200 cu.in.	2
1	2x70C	Cluster	140 cu.in.	2
1	2x60C	Cluster	120 cu.in.	2
1	200	Single gun	200 cu.in.	1
1	150	Single gun	150 cu.in.	1
1	100	Single gun	100 cu.in.	1
1	90	Single gun	90 cu.in.	1
2	70	Single gun	70 cu.in.	1
2	60	Single gun	60 cu.in.	1
3	40	Single gun	40 cu.in.	1
3	20	Single gun	20 cu.in.	1

The specification below is referring to net drop-outs, i.e. after using available spare guns.

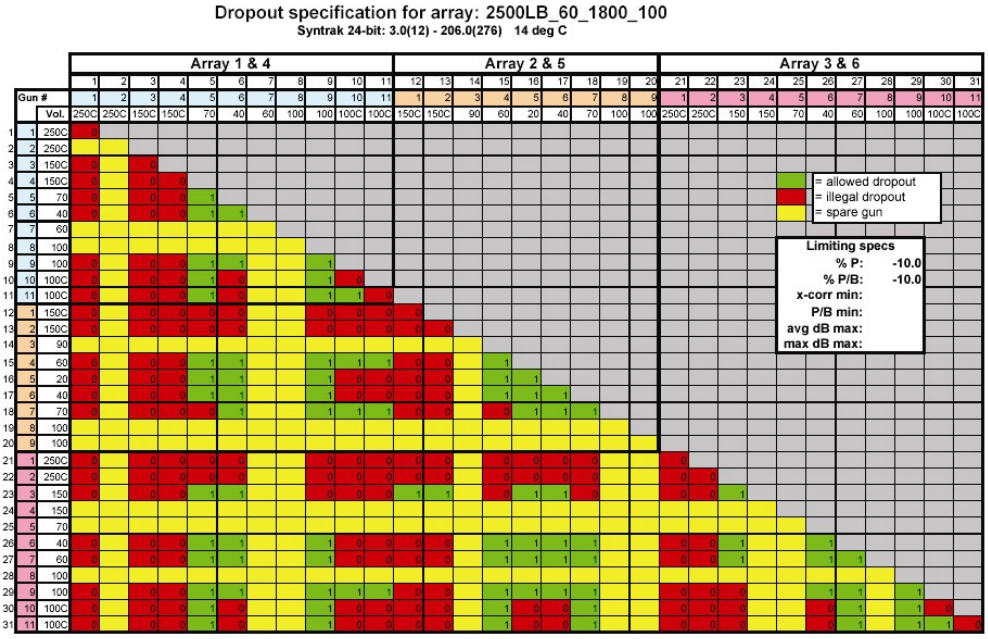


Figure 9: Single (on diagonal) and two gun drop-out diagram. Illegal combinations denoted in red.

14.3 SEG-D header

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SEGD header version 1.0 + PGS external header decoder releas 4 (August '98)


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*** General Header #1 information ***

SByte- EByte   | Format | Description
   1 -    2    | 2 I    | FFID                        = 5000
   3 -    4    | 2 I    | Format                      = 8058
   5 -   10    | 6 I    | General Constant            = 000002003084
  11 -   11    | 1 I    | Year                        = 03
  12 -   12    | 1 I    | # extra blks in gen. header= 23
  13 -   13    | 1 I    | Julian Day                  = 09
  14 -   16    | 3x1 I  | Time                        = 13:14:59
  17 -   17    | 1 I    | Manufacturer Code           = 34
  18 -   19    | 1 I    | Manufacturer S/N            = 0006
  20 -   22    | 3 I    | Bytes per Scan              = 100000
  23 -   23    | 1 I    | Scans Interval              = 2
  24 -   24    | 1 I    | Polarity & Scans/block exp = 10
  25 -   25    | 1 I    | Scans Block                 = 00
  26 -   26    | 1 I    | Record Type                 = 8
  27 -   27    | 1 I    | Record Length               = 6144
  28 -   28    | 1 I    | Scan / Types record         = 01
  29 -   29    | 1 I    | Channel Sets                = 5
  30 -   30    | 1 I    | Skew Blocks                 = 00

*** General Header #2 information ***

SByte- EByte   | Format | Description
  38 -   39    | 2 I    | Extended Header Blocks #2   = 16544
  40 -   41    | 2 I    | External Header Blocks #2   = 32
  43 -   44    | 2 I    | SEG-D Revision Number       = 01.00


*** Channel Set Headers ***

SByte- EByte   | Format | Description
  97 -   97    | 1 I    | Scan Type Number            = 01
  98 -   98    | 1 I    | Channel Set Number          = 01
  99 -  100    | 2 I    | Channel Set Start Time      = 0
 101 -  102    | 2 I    | Channel Set End Time        = 6144
 103 -  103    | 2 I    | Preamplifier Gain Setting   = 0
 105 -  106    | 2 I    | Number of Channels          = 0324
 107 -  107    | .5 I   | Channel Set Type            = 10
 108 -  108    | .5 I   | Samples/Channel             = 1
 108 -  108    | .5 I   | Channel Gain (IFP Gain)     = 9
 109 -  110    | 2 I    | Alias Filter Frequency      = 0206
 111 -  112    | 2 I    | Alias Filter Slope          = 0276
 113 -  114    | 2 I    | Low Cut Filter              = 0003
 115 -  116    | 2 I    | Low Cut Filter Slope        = 0012

 129 -  129    | 1 I    | Scan Type Number            = 01
 130 -  130    | 1 I    | Channel Set Number          = 02
 131 -  132    | 2 I    | Channel Set Start Time      = 0
 133 -  134    | 2 I    | Channel Set End Time        = 6144
 135 -  135    | 2 I    | Preamplifier Gain Setting   = 0
 137 -  138    | 2 I    | Number of Channels          = 0048
 139 -  139    | .5 I   | Channel Set Type            = 60 IE AUX !
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 140 - 140    | .5 I    | Samples/Channel            = 1
 140 - 140    | .5 I    | Channel Gain (IFP Gain)    = 9
 141 - 142    | 2 I     | Alias Filter Frequency     = 0206
 143 - 144    | 2 I     | Alias Filter Slope         = 0276
 145 - 146    | 2 I     | Low Cut Filter             = 0003
 147 - 148    | 2 I     | Low Cut Filter Slope       = 0012

 161 - 161    | 1 I     | Scan Type Number           = 01
 162 - 162    | 1 I     | Channel Set Number         = 03
 163 - 164    | 2 I     | Channel Set Start Time     = 0
 165 - 166    | 2 I     | Channel Set End Time       = 6144
 167 - 167    | 2 I     | Preamplifier Gain Setting  = 0
 169 - 170    | 2 I     | Number of Channels         = 0324
 171 - 171    | .5 I    | Channel Set Type           = 10
 172 - 172    | .5 I    | Samples/Channel            = 1
 172 - 172    | .5 I    | Channel Gain (IFP Gain)    = 9
 173 - 174    | 2 I     | Alias Filter Frequency     = 0206
 175 - 176    | 2 I     | Alias Filter Slope         = 0276
 177 - 178    | 2 I     | Low Cut Filter             = 0003
 179 - 180    | 2 I     | Low Cut Filter Slope       = 0012

 193 - 193    | 1 I     | Scan Type Number           = 01
 194 - 194    | 1 I     | Channel Set Number         = 04
 195 - 196    | 2 I     | Channel Set Start Time     = 0
 197 - 198    | 2 I     | Channel Set End Time       = 6144
 199 - 199    | 2 I     | Preamplifier Gain Setting  = 0
 201 - 202    | 2 I     | Number of Channels         = 0324
 203 - 203    | .5 I    | Channel Set Type           = 10
 204 - 204    | .5 I    | Samples/Channel            = 1
 204 - 204    | .5 I    | Channel Gain (IFP Gain)    = 9
 205 - 206    | 2 I     | Alias Filter Frequency     = 0206
 207 - 208    | 2 I     | Alias Filter Slope         = 0276
 209 - 210    | 2 I     | Low Cut Filter             = 0003
 211 - 212    | 2 I     | Low Cut Filter Slope       = 0012

 225 - 225    | 1 I     | Scan Type Number           = 01
 226 - 226    | 1 I     | Channel Set Number         = 05
 227 - 228    | 2 I     | Channel Set Start Time     = 0
 229 - 230    | 2 I     | Channel Set End Time       = 6144
 231 - 231    | 2 I     | Preamplifier Gain Setting  = 0
 233 - 234    | 2 I     | Number of Channels         = 0324
 235 - 235    | .5 I    | Channel Set Type           = 10
 236 - 236    | .5 I    | Samples/Channel            = 1
 236 - 236    | .5 I    | Channel Gain (IFP Gain)    = 9
 237 - 238    | 2 I     | Alias Filter Frequency     = 0206
 239 - 240    | 2 I     | Alias Filter Slope         = 0276
 241 - 242    | 2 I     | Low Cut Filter             = 0003
 243 - 244    | 2 I     | Low Cut Filter Slope       = 0012


***  Extended Header information ***

SByte- EByte  | Format  | Description
 257 - 257    | 1 I     | External Header Status            = 01
 258 - 258    | .5 I    | Tape Unit used to write           = 2
 258 - 258    | .5 I    | Buffer Used                       = 0
 259 - 260    | 2 I     | Number of Raw Channels Streamer 1 = 0324
 260 - 261    | 2 I     | Number of Raw Channels Streamer 2 = 0324
 263 - 264    | 2 I     | Number of Raw Channels Streamer 3 = 0324
 265 - 266    | 2 I     | Number of Raw Channels Streamer 4 = 0324
 267 - 268    | 2 I     | Number of Raw Channels Streamer 5 = 0000
 269 - 270    | 2 I     | Number of Raw Channels Streamer 6 = 0000
 271 - 272    | 2 I     | Number of Raw Channels Streamer 7 = 0000
 273 - 274    | 2 I     | Number of Raw Channels Streamer 8 = 0000
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 284 - 284    | 1 I    | Header Revision                   = 0.6
 285 - 285    | 1 I    | Host Software Revision Level      = 1.8
 286 - 287    | 2 I    | No. of 32 byte blocks after SEG-D = 0000
 288 - 288    | 1 I    | Number of Streamers               = 4
 289 - 296    | 8 A    | Streamer  1 User ID               = 1196P1
 297 - 304    | 8 A    | Streamer  2 User ID               = 1196P1
 305 - 312    | 8 A    | Streamer  3 User ID               = 1196P1
 313 - 320    | 8 A    | Streamer  4 User ID               = 1196P1
 337 - 352    | 16 A   | Reel Number                       = 35706
 353 - 368    | 16 A   | Client                            =  WOODSIDE ENERGY
 369 - 384    | 16 A   | Contractor                        = PGS ASIA PACIFIC

*** START OF EXTERNAL HEADER AT BYTE 16769 ***

SByte - EByte   | Format | Description
16769 - 16770   | 2 A    | Master Block ID                   = $1
16771 - 16774   | 4 I    | Length of External Header         = 1666
16775 - 16778   | 4 I    | Program Revision                  = 0002
16779 - 16780   | 2 I    | Shot Switch                       = 03
16781 - 16804   | 24 A   | Shot Time                         = 131459.5617062003
16805 - 16810   | 6 I    | Shot Number                       = 001958
16811 - 16826   | 16 A   | Navigation Line Name              =     W03ANT1196P1
16827 - 16837   | 11.6 F | Master Latitude                   =  -38.602869
16838 - 16848   | 11.6 F | Master Longitude                  =  142.736890
16849 - 16854   | 6.1 F  | Water Depth                       =   43.8
16855 - 16865   | 11.6 F | Source Latitude                   =  -38.604052
16866 - 16876   | 11.6 F | Source Longitude                  =  142.738382
16877 - 16881   | 5.1 F  | Master Gyro                       = 307.5
16882 - 16886   | 5.1 F  | Master CMG                        = 304.7
16887 - 16890   | 4.1 F  | Master Speed                      =  4.2
16891 - 16896   | 6 A    | ID String                         = *GCS90
16897 - 16900   | 4 I    | Record Length                     = 1550
16901 - 16906   | 6 I    | Gun Line Number                   = 1196P1
16907 - 16910   | 4 I    | Gun Shot Number                   = 1958
16911 - 16912   | 2 I    | Active Array Mask                 = 07
16913 - 16913   | A 1    | Trigger Mode                      = E
16914 - 16915   | 2 I    | Gun Sequence                      = 02
16916 - 16918   | 3 I    | Number of Gun Subarrays           = 006
16919 - 16921   | 3 I    | Number of Guns in Array           = 066
16922 - 16924   | 3 I    | Number of Active Guns             = 022
16925 - 16927   | 3 I    | Number of Delta Errors            = 000
16928 - 16930   | 3 I    | Number of Auto Fires              = 000
16931 - 16933   | 3 I    | Number of Misfires                = 000
16934 - 16936   | 3 I    | Delta Spread                      = 013
16937 - 16942   | 6 I    | Volume Fired                      = 002500
16957 - 16960   | 4 I    | Manifold Pressure                 = 0000
16961 - 16964   | 4 I    | Deep Tow                          = 0000
16965 - 16968   | 4 I    | Subarray String Pressure 1        = 1841
16969 - 16972   | 4 I    | Subarray String Pressure 2        = 1827
16973 - 16976   | 4 I    | Subarray String Pressure 3        = 1829
16977 - 16980   | 4 I    | Subarray String Pressure 4        = 1779
16981 - 16984   | 4 I    | Subarray String Pressure 5        = 1852
16985 - 16988   | 4 I    | Subarray String Pressure 6        = 1843
```

14.4 P1/90 header

```
H0100 AREA                        ANTARES 3D SURVEY,OTWAY BASIN AUSTRALIA
H0101 GENERAL SURVEY DETAILS      3D, SINGLE VESSEL, DUAL SOURCE, FOUR STREAMERS
H0102 VESSEL DETAILS              M/V ORIENT EXPLORER         1
H0103 SOURCE DETAILS              STBD SOURCE G1              1   1
H0103 SOURCE DETAILS              PORT SOURCE G2              1   2
H0104 STREAMER DETAILS            STREAMER  1 324CH (STBD)   1       1   1
H0104 STREAMER DETAILS            STREAMER  2 324CH          1       2   2
H0104 STREAMER DETAILS            STREAMER  3 324CH          1       3   3
H0104 STREAMER DETAILS            STREAMER  4 324CH          1       4   4
H0105 OTHER DETAILS               N/A
H0200 DATE OF SURVEY              24 OCTOBER 2003 - CONTINUING
H0201 DATE OF ISSUE OF TAPE       ?? OCTOBER 2003
H0202 TAPE VERSION IDENTIFIER     W03ANTP011
H0203 LINE PREFIX                 W03ANT
H0300 CLIENT                      WOODSIDE ENERGY LTD
H0400 GEOPHYSICAL CONTRACTOR      PGS GEOPHYSICAL, MARINE ACQUISITION
H0500 POSITIONING CONTRACTOR      FUGRO-SURVEY AS / THALES GEOSOLUTIONS NORGE AS
H0600 POSITIONING PROCESSING      PGS GEOPHYSICAL, MARINE ACQUISITION
H0700 POSITIONING SYSTEM          NAV SYSTEM 1: STARFIX SPOT / OPTUS SPOT
H0700 POSITIONING SYSTEM          NAV SYSTEM 2: SKYFIX  SPOT / OPTUS SPOT INMARSAT
H0700 POSITIONING SYSTEM          NAV SYSTEM 3: STARFIX / SEADIFF V7.05N
H0700 POSITIONING SYSTEM          INTEGRATED NAV SYSTEM : SPECTRA VERSION 9.8.03
H0800 COORDINATE LOCATION         CENTER OF SOURCE
H0900 OFFSET SYSTEM TO SOURCE 1     1   2   25.00 -180.00
H0901 OFFSET SYSTEM TO SOURCE 2     1   2  -25.00 -180.00
H0902 OFFSET SYSTEM TO VAN E/S      1   2    0.00   35.14
H0903 OFFSET SYS TO NAV REF PT      1   2    0.00    0.00
H1000 CLOCK TIME                  GMT
H1100 RECEIVER GROUPS PER SHOT    1296
H1400 GEODETIC DATUM: SURVEY      GDA94       GRS80        6378137.000 298.2572221
H1401 DATUM SHIFT GDA94-WGS84       0.0   0.0   0.0 0.000 0.000 0.000 0.0000000
H1500 GEODETIC DATUM: POSTPROC.   GDA94       GRS80        6378137.000 298.2572221
H1501 DATUM SHIFT GDA94-WGS84       0.0   0.0   0.0 0.000 0.000 0.000 0.0000000
H1600 DATUM SHIFTS                  0.0   0.0   0.0 0.000 0.000 0.000 0.0000000
H1700 VERTICAL DATUM              MSL                     ECHO SOUNDER POSITION
H1800 PROJECTION                  003 MGA94, TRANSVERSE MERCATOR
H2000 GRID UNITS                  1 INTERNATIONAL METERS    1.000000000000
H2001 HEIGHT UNITS                1 INTERNATIONAL METERS    1.000000000000
H2200 CENTRAL MERIDIAN            141 0 0.000E
H2301 GRID ORIGIN                   0 0 0.000N141 0 0.000E
H2302 GRID ORIGIN COORDINATES     500000.00E10000000.00N
H2401 SCALE FACTOR                0.9996
H2402 SCALE FACTOR LAT/LONG         0 0 0.000N141 0 0.000E
H2600*****************************************************************************
H2600 THE ECHO SOUNDER DEPTH DATA HAS BEEN CORRECTED FOR PITCH, ROLL AND HEAVE
H2600 IN THE ECHO SOUNDER PRIOR TO BEING PASSED TO SPECTRA.
H2600
H2600 THE WATER DEPTHS HAS BEEN CORRECTED FOR DRAFT, SOUND VELOCITY
H2600 AND TIDE.
H2600 DRAFT: 5.5 METERS
H2600
H2600 A TIDE CORRECTION FILE WAS PROVIDED BY WOODSIDE ENERGY LTD.
H2600 PORT:  PORT CAMPBELL (ANTARES 3D OFF OTWAY)
H2600 TIMEZONE: GMT
H2600 DATUM:    MSL
H2600
H2600 THE SOUND VELOCITY SET IN THE ECHO SOUNDER WAS 1500 METERS/SECOND.
H2600 TS-DIPS WHICH ARE USED TO CALCULATE THE SOUND VELOCITY DEPTH
H2600 CORRECTIONS:
H2600 PROFILE #:    DATE:          POSITION:
```

```
H2600           #        dd.mm.yy           ddd mm ssS  ddd mm ssE
H2600           1        22.10.03            38 21 76S  141 41 25E
H2600           2        03.11.03            38 33 39S  142 45 17E
H2600
H2600
H2600************************************************************************
H2600             FORMAT OF SHOT RECORDS
H2600      COLUMN           DESCRIPTION
H2600           1           'V', 'E', 'Z', 'S', 'T' OR 'C'
H2600                         V= VESSEL REFERENCE POINT
H2600                         E= ECHO SOUNDER
H2600                         Z= INDIVIDUAL SOURCE POSITION
H2600                         S= CENTER OF SOURCE
H2600                         T= TAILBUOY POSITION
H2600                         C= COMMON MID POINT
H2600         2-13           LINE NAME
H2600           17            VESSEL IDENTIFIER
H2600           18             SOURCE IDENTIFIER
H2600           19            TAILBUOY/OTHER IDENTIFIER
H2600        20-25           SHOT POINT NUMBER
H2600        26-35           LATITUDE (DDMMSS.SS)
H2600        36-46           LONGITUDE (DDDMMSS.SS)
H2600        47-55           MAP GRID EASTING IN METERS
H2600        56-64           MAP GRID NORTHING IN METERS
H2600        65-70           WATER DEPTH
H2600        71-73           JULIAN DAY OF YEAR
H2600        74-79           TIME (HHMMSS)
H2600
H2600             FORMAT OF RECEIVER RECORD
H2600      COLUMN
H2600           1             'R'
H2600         2-5            RECEIVER NUMBER
H2600         6-14           MAP GRID EASTING IN METERS
H2600        15-23           MAP GRID NORTHING IN METERS
H2600        24-27           RECEIVER DEPTH REFERENCED TO SEA LEVEL
H2600        28-31           RECEIVER NUMBER
H2600        32-40           MAP GRID EASTING IN METERS
H2600        41-49           MAP GRID NORTHING IN METERS
H2600        50-53           RECEIVER DEPTH REFERENCED TO SEA LEVEL
H2600        54-57           RECEIVER NUMBER
H2600        58-66           MAP GRID EASTING IN METERS
H2600        67-75           MAP GRID NORTHING IN METERS
H2600        76-79           RECEIVER DEPTH REFERENCED TO SEA LEVEL
H2600           80           STREAMER CODE
H2600************************************************************************
H2600 STREAMER AND TAILBUOY NUMBERING INCREMENTS FROM STARBOARD TO PORT.
H2600
H2600 STREAMER  1: RECEIVERS NUMBERED    1 (FAR) TO  324 (NEAR)
H2600 STREAMER  2: RECEIVERS NUMBERED  325 (FAR) TO  648 (NEAR)
H2600 STREAMER  3: RECEIVERS NUMBERED  649 (FAR) TO  972 (NEAR)
H2600 STREAMER  4: RECEIVERS NUMBERED  973 (FAR) TO 1296 (NEAR)
H2600
H2600************************************************************************
H2600 STREAMER ROTATIONS HAVE BEEN APPLIED ON A SHOT BY SHOT BASIS.
H2600
H2600 SPRINT CALCULATED INLINE MISCLOSURES ARE DERIVED ON A SHOT BY SHOT BASIS.
H2600 THESE INLINE MISCLOSURE VALUES ARE DISTRIBUTED LINEARLY OVER THE ACTIVE
H2600 STREAMER LENGTH. THE CORRECTED STREAMER LENGTH IS USED TO COMPUTE THE
H2600 FINAL RECEIVER POSITIONS.
H2600
H2600 SPRINT VERSION 3.1.13 USED FOR ONBOARD NAVIGATION PROCESSING.
H2600
H2600 EPSG TRANSFORMATION CODE WGS84 TO GDA94: 1150
```

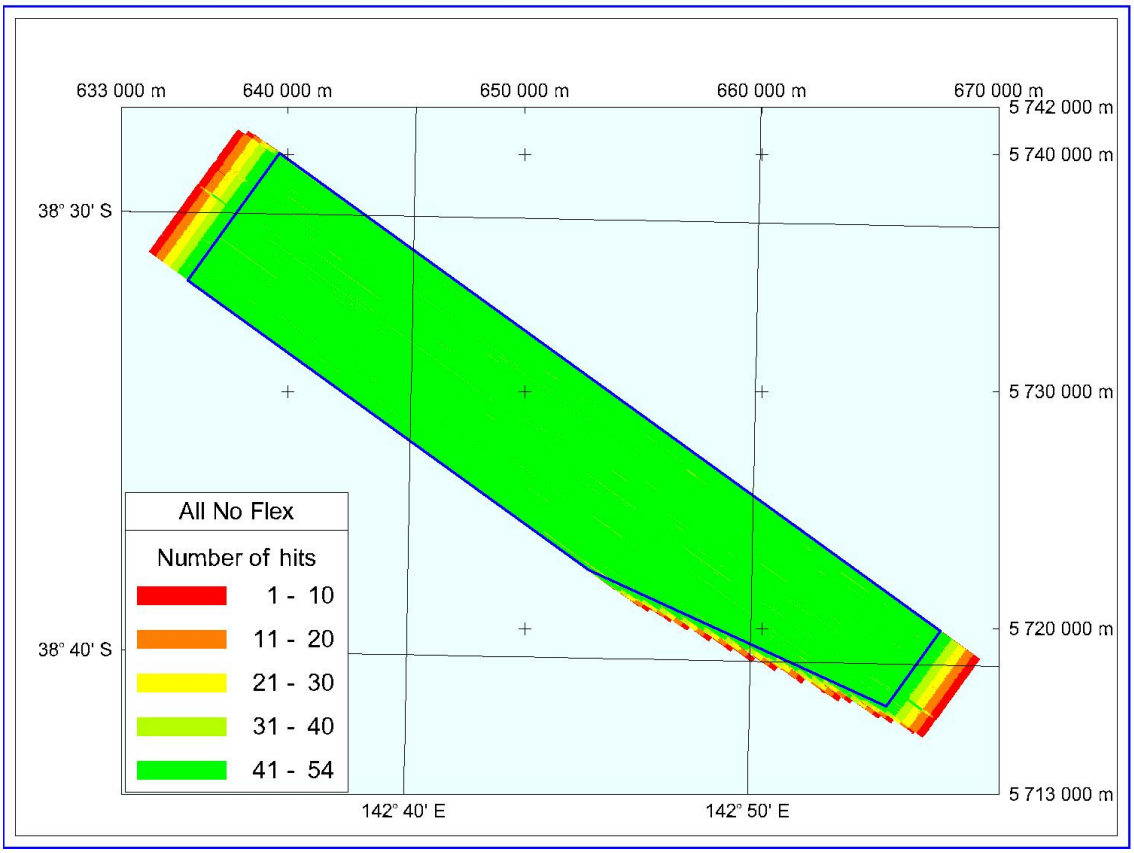
```
H2600
H2600 PGS JOB NUMBER 2003084
H2600
H2600 ALL SHOTS FOR ALL STREAMERS ARE INCLUDED IN THIS FILE, DATA NOT TO BE
H2600 PROCESSED (NTBP) IS INDICATED BELOW AS NECESSARY.
H2600
H2600 LINES CONTAINED IN THIS FILE:
H2600
H2600 LINE: xxxxxxxx              SEQUENCE:  xxx   FSP:   xxxx   LSP:   xxxx
H2600
```

14.5 P6/98 Full fold coverage perimeter

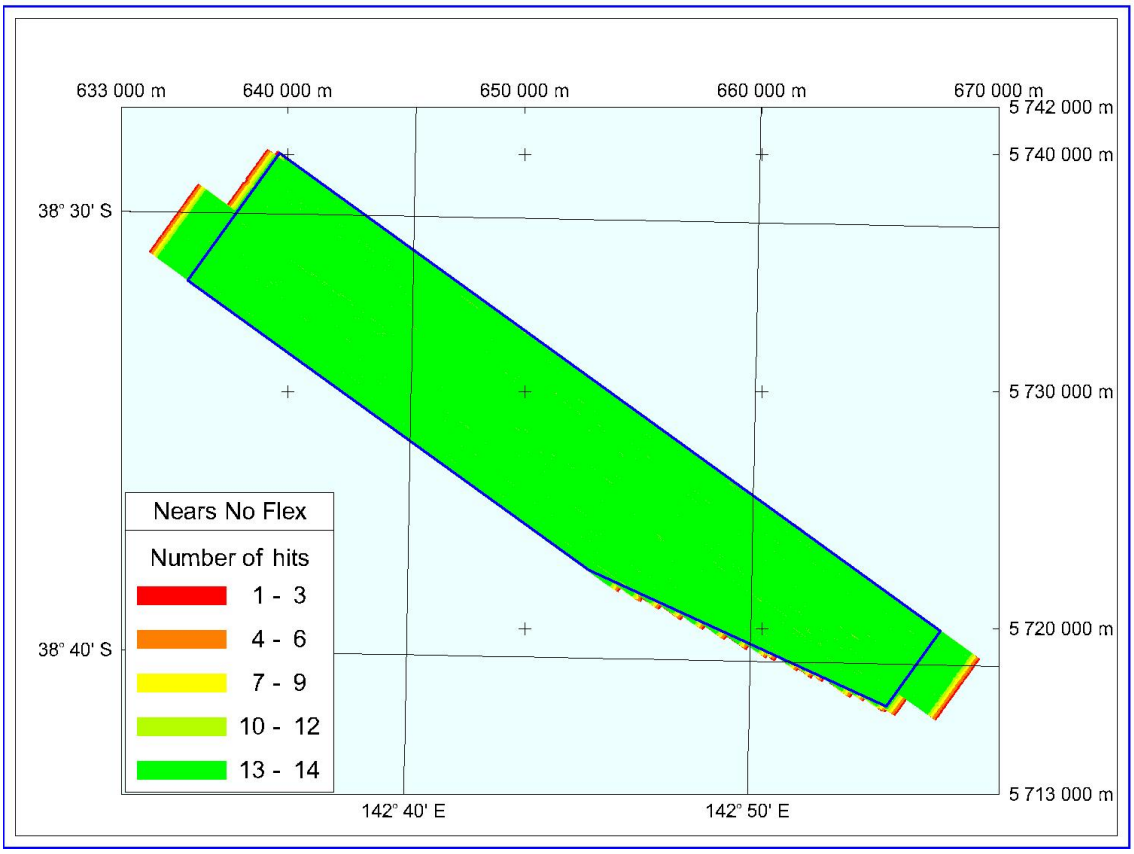
```
H0100 3D SURVEY NAME            ANTARES, OTWAY BASIN AUSTRALIA
H0200 BIN GRID DESCRIPTOR       ACQUISITION
H0300 GEODETIC DATUM NAME       GDA94
H0400 ELLIPSOID-AXIS-INV FLAT   GRS80        6378137.000 298.2572221
H0500 PROJECTION METHOD         003   MGA94     TRANSVERSE MERCATOR
H0530 LON OF CM (DMS E/W)        141 0 0.000E
H0540 GRID ORIGIN (DMS N/E)        0 0 0.000N  141 0 0.000E
H0550 GRID ORIGIN (E/N)            500000.00E  10000000.00N
H0560 SCALE FACTOR              0.9996
H0570 SCALE FACTOR LAT/LONG        0 0 0.000N  141 0 0.000E
H0600 DESCR OF LINEAR UNITS     1 INTERNATIONAL METERS     1.000000000000
H0700 DESCR OF ANGULAR UNITS    1  DEGREES
H0800 BIN GRID ORIGIN (Io,Jo)     1001.0000   1001.0000
H0900 BIN GRID ORIGIN (E,N)        639655.00E   5740045.00N
H1000 SCALE FACTOR AT (I,J)     1.0000000000   1001.0000   1001.0000
H1100 NOM BIN WIDTH ON I AXIS    25.0000
H1150 NOM BIN WIDTH ON J AXIS    18.7500
H1200 GRID BEAR J AXIS (DMS)     1255230.000
H1300 BIN NODE INCREMENT I AXIS     1.000
H1350 BIN NODE INCREMENT J AXIS     1.000
H1400 COORDS (I,J,E,N) FST NODE   1001.0000   1001.0000    639655.00  5740045.00
H1401 COORDS (LAT,LON) FST NODE   382837.183S  1423603.710E
H1410 COORDS (I,J,E,N) SEC NODE   1001.0000   2835.0000    667519.10  5719893.28
H1420 COORDS (I,J,E,N) GEN PNT    1264.0000   2114.0000    652711.82  5722487.81
H2300 DATA EXTENT BIN GRID        2835.0000   1001.0000   1264.0000   1001.0000
H2400 DATA EXTENT MAP GRID        5740045.00  5716712.86   667519.10   635801.93
H2501 DATA EXTENT GEOG (N/S)      382837.183S   384058.001S
H2502 DATA EXTENT GEOG (E/W)     1425530.559E  1423328.466E
H2700 NUMBER OF PERIMETERS       1
H3101 FULL FOLD COV # OF NODES     5
H3201 FULL FOLD COV (I,J,E,N)     1001.0000   1001.0000    639655.00  5740045.00
H3201 FULL FOLD COV (I,J,E,N)     1001.0000   2835.0000    667519.10  5719893.28
H3201 FULL FOLD COV (I,J,E,N)     1158.0000   2835.0000    665218.98  5716712.86
H3201 FULL FOLD COV (I,J,E,N)     1264.0000   2114.0000    652711.82  5722487.81
H3201 FULL FOLD COV (I,J,E,N)     1264.0000   1001.0000    635801.93  5734717.29
H3201 FULL FOLD COV (I,J,E,N)     1001.0000   1001.0000    639655.00  5740045.00
H8002 EPSG PROJECTED CS NAME    GDA94  / MGA ZONE 54
H8003 EPSG PROJECTED CS CODE    28354
H8006 EPSG DATABASE VERSION     6.4
```

14.6 Coverage plots

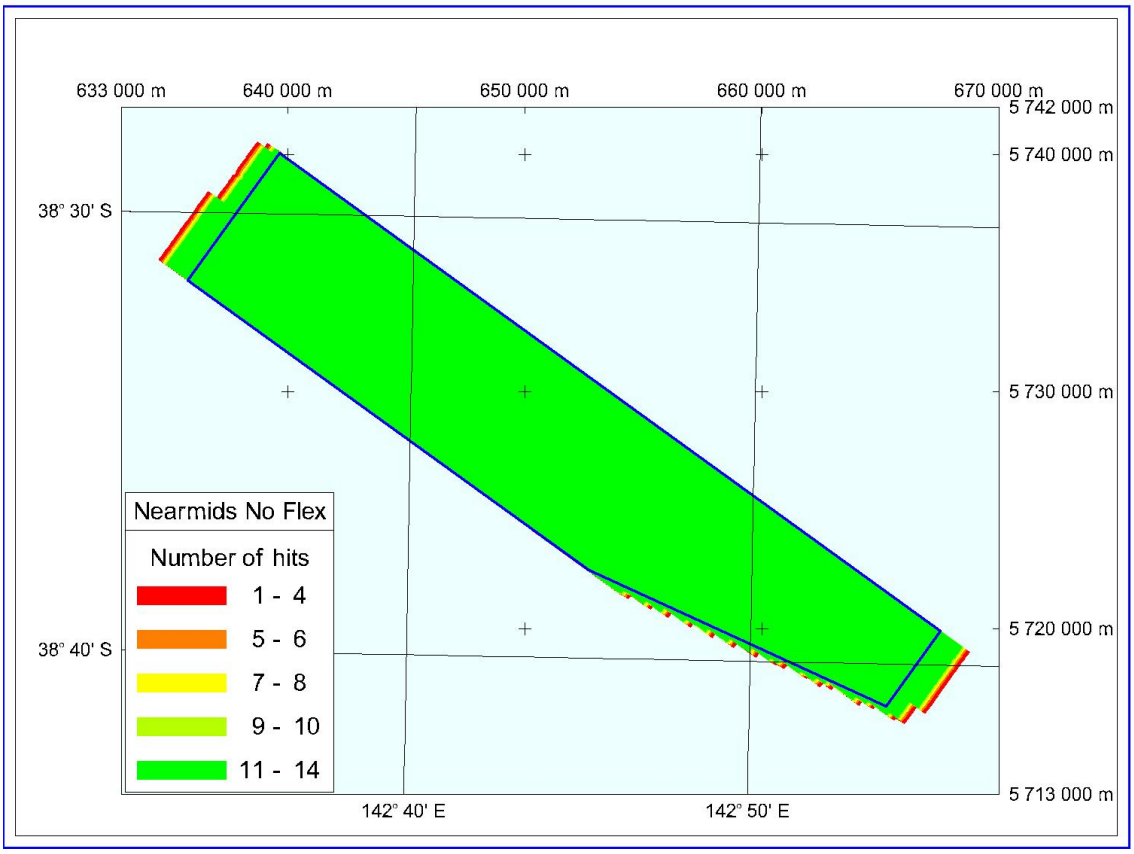
14.6.1 Alls No Flex



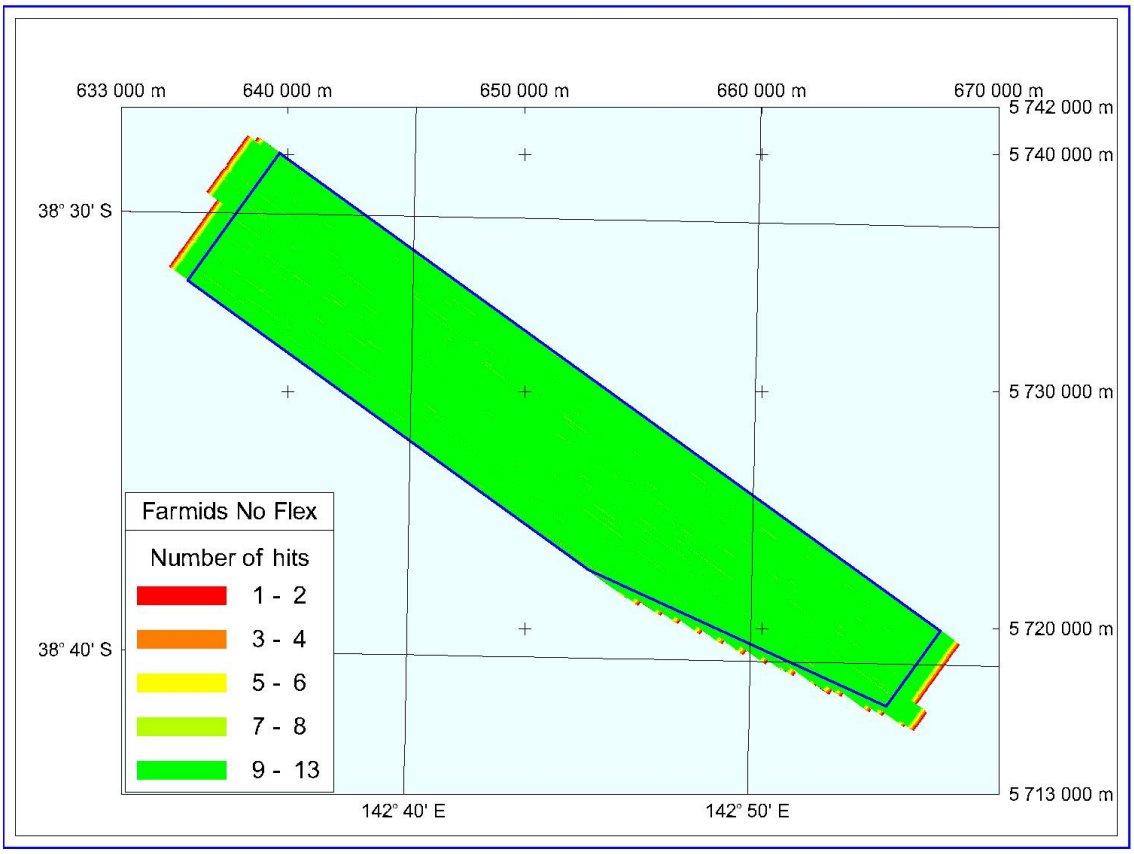
14.6.2 Nears No Flex



14.6.3 Nearmids No Flex



14.6.4 Farmids No Flex



14.6.5 Fars No Flex