ACQUISITION REPORT

PGS Geophysical

Santos Australia Limited

M/V PACIFIC EXPLORER

2008 Strahan 3D MSS
Block T/36P
Offshore Tasmania, Australia

2007113

28th March to 22nd April 2008

version 1

PGS Geophysical – Marine Acquisition, Singapore

AUTHORISATION

Leif-Inge Iversen
Operations Manager

Singapore
15th May 2008

DISTRIBUTION

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REVISED VERSIONS

NUMBER	CHANGES	AUTHOR	DATE

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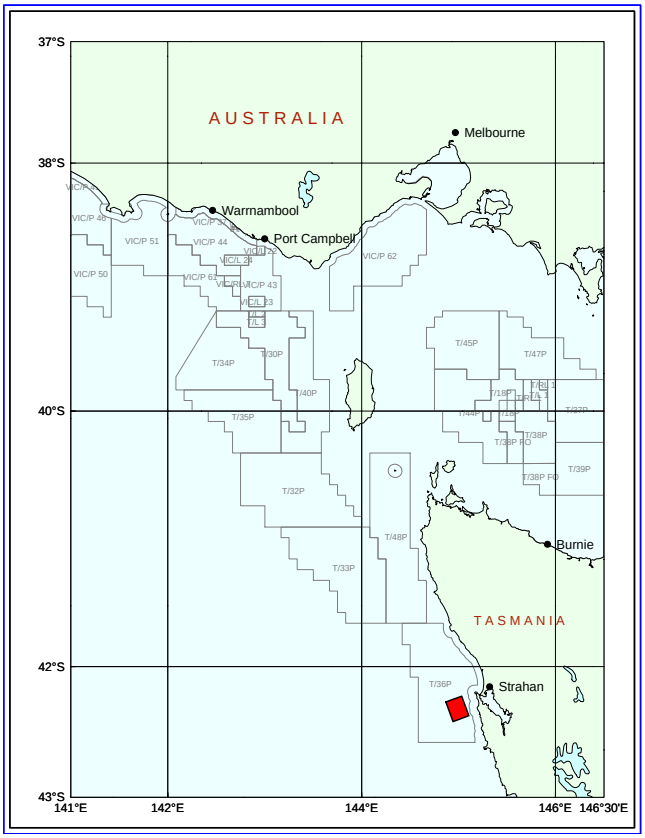
1 Introduction

1.1 Summary

PGS was contracted by Santos Australia Limited to acquire the Strahan 3D survey using the M/V PACIFIC EXPLORER.



The seismic survey area was situated approximately 10 nm south west of Cape Sorell, on the west coast of Tasmania.

The vessel had just completed the Brandt 3D survey approximately 165 nm to the northwest and the plan was to transit with all gear deployed to the Strahan 3D survey. On 28th March 2008, during the transit, very poor weather was forecasted and it was decided to recover all the equipment and head for shelter north of Tasmania. During the recovery, one of the onboard mechanics suffered an injury to his hand which required onshore medical treatment. The vessel sailed to Burnie, Tasmania and remained alongside until Thursday 03rd April 2008, when weather conditions improved. During the time in port, PGS onshore personnel arrived on the vessel to assist with the investigation into the "lost time incident".

On departing Burnie, the weather was still not suitable for deployment of seismic equipment. Streamer deployment started in the afternoon of Friday, 05th April, with sea swell still running at 5m. The streamers were deployed one at a time, which took longer than would normally be expected. All seismic equipment was deployed and production began on Wednesday 09th April 2008.

Good production was maintained until Saturday 03rd April, when the weather deteriorated. Production ceased and we were on standby for approximately 24 hours. Production resumed on Sunday 13th April. On resuming production, streamer 6 failed, with leakage to ground at module 38. It was decided to continue production without the last 36 traces of streamer 36. Several attempts at repairing this problem were made; changing sections, modules and cleaning all the connectors in the area, but on each occasion the problem resurfaced after some hours. The intermittent nature of the problem made trouble shooting from the workboat very difficult, so it was decided to complete the survey without these receiver groups.

On Friday, 18th April 2008 weather conditions deteriorated once again, but the vessel remained in the production cycle. However, Sequences 41 and 42 were scratched due to swell noise. Towards the end of the survey there were several cetacean sightings. One caused Sequence 47 to be terminated 16 shot points before the end of the line. On approach to Sequence 52, whales within the exclusion zone caused the vessel to circle back around for another attempt. The survey was completed on Tuesday 22nd April 2008, with Sequence 59 being the last acquired sequence.

1.2 Key parameters

Source	:	2 x 3090 in^3
Source depth	:	6 m
Streamers	:	6 x 6000 m
Streamer spacing	:	100 m
Streamer depth	:	7 m +/-1m
Near trace offset	:	104 m

1.3 Systems

Source type	:	Bolt LLXT guns
Streamer type	:	PGS RDH-S
Recording system	:	NTRS
Navigation	:	SkyFix XP DGPS
	:	StarFix HP DGPS
Float positioning	:	Fugro RGPS
Acoustic ranging	:	I/O Digicourse

1.4 Production

	Traverse km		**CMP km**		**Square km**
Prime	852.24	Prime	10,226.92	Prime	255.67
prime run out	143.68	Prime run out	1,724.18	Prime run out	43.10
Infill	70.28	Infill	843.30	Infill	21.08
Infill run out	12.00	Infill run out	144.00	Infill run out	3.60
total	**1078.20**	**total**	**12,938.40**	**total**	**328.43**

Infill percentage : 8.25%

1.5 Survey timing

	Hours	% of total		Hours	% of total
Production	243.68	39.7%	Prime Production	97.58	15.9%
			Line Change	120.13	19.6%
			Infill	8.17	1.3%
			Run Out (Prime)	16.43	2.7%
			Run Out (Infill)	1.37	0.2%
Standby	288.80	47.0%	Weather	262.58	42.8%
			Local Transit / Prospect Change	18.70	3%
			Client Request	0.20	N/A
			Cetaceans	3.73	0.6%
			Line Change Standby	3.58	0.6%
Mob / Demob	22.85	3.7%	General Demob	17.85	3.7%
Downtime	59.05	9.6%	Leakage, x-feed. Telemetry	33.49	5.5%
			Bolt airgun airleak	16.23	2.6%
			Compass / Bird	2.50	0.4%
			Hardware in sea - Tailbuoy	2.58	0.4%
			Operator error - streamers	2.45	0.4%
			Source separation	0.05	N/A
			Mechanical – gun floats	0.55	0.1
			Bolt airgun misfire	0.52	0.1
			Source depth system	0.45	0.1
			Modules	0.22	N/A
TOTAL	**614.38**				

2 Sequence of events

2.1 Daily log

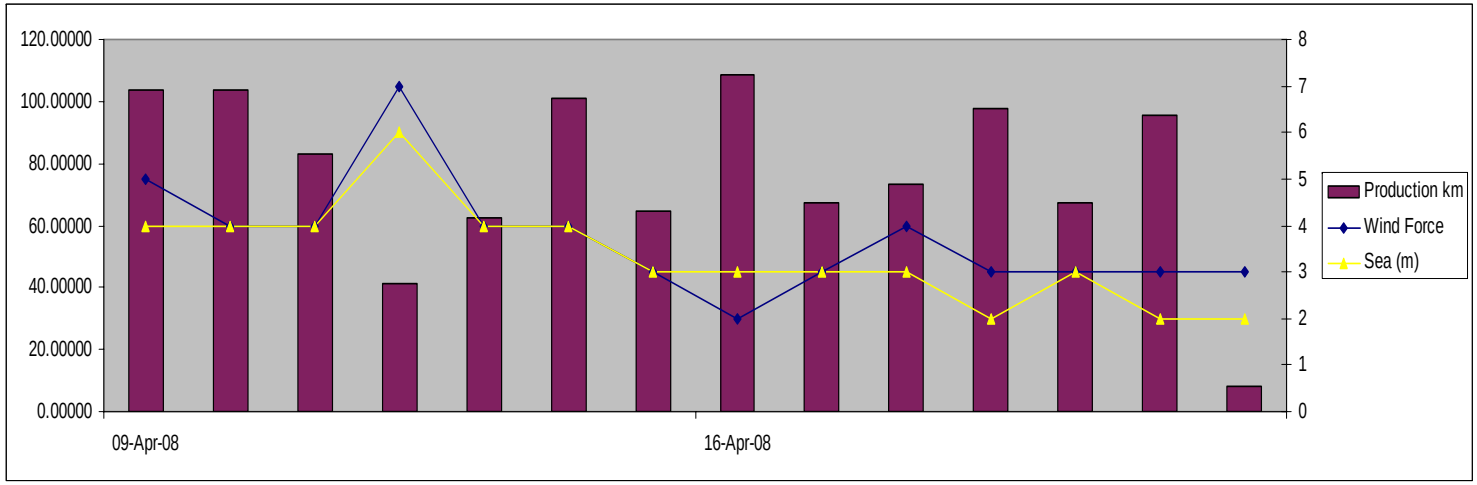
Date	Total Km	Prime FF	Prime RO	Infill FF	Infill RO	wind f'ce	sea state	comments
28/03/2008	0.000000	0.000000	0.000000	0.000000	0.000000	4	Moderate	Inter survey transit, to be charged to shared partners. Workboat operation again aborted due to streamer lift arm breaking. Workboat launched again in afternoon but operation aborted before work complete as it was decided to reccover all equipment due to poor forecast. Recovering streamers at midnight.
29/03/2008	0.000000	0.000000	0.000000	0.000000	0.000000	6	Rough	Inter survey time estimated based on progress to half way point. All equipment recovered and the vessel headed for Burnie. Medical arrangements made for mechanic injured during recovery.
30/03/2008	0.000000	0.000000	0.000000	0.000000	0.000000	6	Rough	Arrived in Burnie at 06:55. mechanic taken to hospital, new S/L mechanic came onboard. John Hammond in Strahan reported 7m seas in work area.
31/03/2008	0.000000	0.000000	0.000000	0.000000	0.000000	8	High	Alongside Burnie, waiting on weather. 08:00-12:20 took on 200cm fuel. Starboard door changed to spare. Weather is as reported from work area by John Hammond.
01/04/2008	0.000000	0.000000	0.000000	0.000000	0.000000	6	Rough	Alongside Burnie, waiting on weather.
02/04/2008	0.000000	0.000000	0.000000	0.000000	0.000000	11	Very High	Alongside Burnie, waiting on weather. Two mooring lines parted at dock due to weather conditions. PGS HSE Manager and PGS Project Manager onboard to carry out incident investigation.

03/04/2008	0.000000	0.000000	0.000000	0.000000	0.000000	7	Very Rough	Alongside Burnie, waiting on weather. Conclusion of incident 2914/08/MA investigation, Investigation team departed the vessel at 15:30. Vessel departed Burnie at 17:09. Weather reported in work area in morning as reported by John Hammond in Strahan, Wx: WF8, Seas 8-10m.
04/04/2008	0.000000	0.000000	0.000000	0.000000	0.000000	6	Rough	Remained North Tasmania until morning when we headed out to examine possibility of deploying. 15:30 Weather still too rough, headed fair seas. 20:05 With weather appearing to moderate decided to head out closer to the work area.
05/04/2008	0.000000	0.000000	0.000000	0.000000	0.000000	3	Slight	Weather decreased throughout the early part of the day but picked up again in the evening. Persistent 5-6m swell. Deployed streamer 6 and port door. Half of streamer 1 deployed at midnight.
06/04/2008	0.000000	0.000000	0.000000	0.000000	0.000000	3	Slight	25 HOUR DAY - LOCAL CLOCKS BACK 1 HOUR. Deploying streamers. Deployment suspended in morning until 07:00 as it was too rough to deploy starboard door. Large swell meant that streamers would only go down to depth on deployment when heading into the seas. This restricted us to deploying one streamer at a time. Telemetry and bird acoustic line problems with streamer 2 on deployment.
07/04/2008	0.000000	0.000000	0.000000	0.000000	0.000000	3	Slight	Deployed streamers throughout day. All streamers out at 22:40. Deployment delayed today with bird / acoustic line comms problems on streamer 5 and failure of acoustic on TB 4 causing it to be recovered. Deploying guns at midnight, arrays 5 and 6 out.

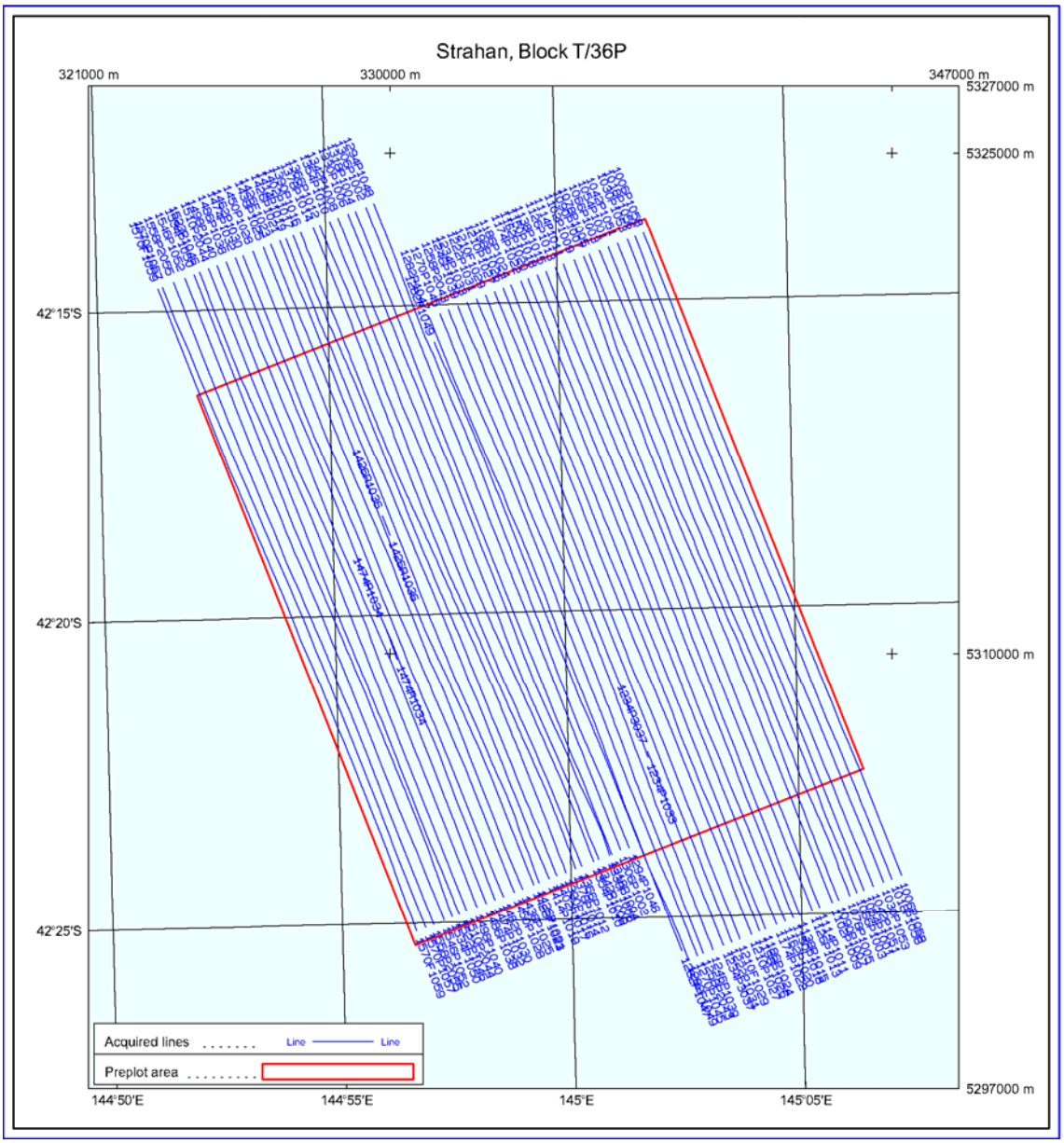
08/04/2008	0.000000	0.000000	0.000000	0.000000	0.000000	4	Slight	Airleak on approach to first line caused a circle. On second attempt streamer 3 lost telemetry. Recovered guns for streamer work. First two active sections on streamer 4 also changed due to water intrusion causing the front end to go deep. S/L mechanic Heino Jenssen and trainee observer Alexandre Gavrilkine came onboard via chaseboat.
09/04/2008	103.743750	88.743750	15.000000	0.000000	0.000000	5	Moderate	In production, Sequences 01, 02, 03, 04, 05.
10/04/2008	103.781250	88.781250	15.000000	0.000000	0.000000	4	Moderate	In production, Sequences 06, 07, 08, 09, 10. Strong rip tide encountered in the middle of the work area.
11/04/2008	83.025000	71.025000	12.000000	0.000000	0.000000	4	Moderate	In production, Sequences 11, 12, 13, 14. Downtime due to airleak on approach to line.
12/04/2008	41.512500	35.512500	6.000000	0.000000	0.000000	7	Very Rough	In production in the morning, Sequence 15, 16. 08:55 Shutdown and headed northwest into weather. 18:45 Turned back towards work area.
13/04/2008	62.268750	53.268750	9.000000	0.000000	0.000000	4	Moderate	Started the day waiting on weather, one attempt at shooting aborted due to swell noise. 11:08 re-started production, Sequences 17, 18, 19.
14/04/2008	101.193750	71.025000	9.412500	17.756250	3.000000	4	Moderate	In production, Sequences 20, 21, 22, 23, 24 Streamer 6 last 36 traces dead due to leakage problem. Workboat operation to repair streamer failed today.
15/04/2008	64.856250	53.268750	11.587500	0.000000	0.000000	3	Slight	Production, Sequences 25, 26, 27. Stopped production to carry out three workboat operations to find the ground fault leakage on streamer 6, change TB1 combi-box and change birds. Production resumed at 19:55

16/04/2008	108.337500	75.581250	12.000000	17.756250	3.000000	2	Smooth (wavelets)	In production, Sequences 28, 29, 30, 31, 32, 33 started. Workboat launched to change streamer 6 section 77 and module 40. Streamer worked for two sequences and tripped again on seq. 32.
17/04/2008	67.593750	58.593750	9.000000	0.000000	0.000000	3	Slight	In production. Sequences 33, 34 35, 36, 37, 38, 39. Sequence 33 and 37 one complete line. Sequence. 34 and 36 reshoots. Sequence 35 NTBP. Sequences 38 and 39 prime, (38 with a 10 SP hole). Two operator errors and an airleak caused several reshoots today. Parity errors on streamer 6 towards end of day.
18/04/2008	73.125000	61.125000	12.000000	0.000000	0.000000	4	Slight	In production, Sequences 40, 43, 44, 45 Sequences. 41 & 42 NTBP for swell noise.
19/04/2008	97.931250	69.225000	8.700000	17.006250	3.000000	3	Smooth (wavelets)	In production, Sequences.46, 47, 48, 49, 50. Sequences. 47 cut 16 SPs short on run out due to whale sighting. Workboat launched to change combi-box in TB1 and check other TBs prior to upcoming recovery.
20/04/2008	67.068750	55.068750	12.000000	0.000000	0.000000	3	Slight	In production, Sequences 51, 52, 53 Workboat operations for streamer maintenance cut short due to streamer lift arm breaking. FRC launched for driving and rescue practice. Sequence 54 NTBP due to airleak.
21/04/2008	95.718750	71.025000	11.981250	12.712500	0.000000	3	Smooth (wavelets)	In production, Sequences 55, 56, 57, 58, 59 started.
22/04/2008	8.043750	0.000000	0.000000	5.043750	3.000000	3	Smooth (wavelets)	**SURVEY COMPLETE**

2.2 Daily production and sea state



2.3 Post plotted vessel positions



3 Key personnel

	28th March 2008 to 22nd April 2008
Party Chief	Mike Moran
Chief observer	Mike Coble
Chief navigator	Nikolai Gritsenko
Chief mechanic	Larry Granzin
Chief geophysicist	Rune Strømme
Client representative onboard	Alex White
	Ray Doughty
Client contacts onshore	Andrew White

4 HSE

Statistics

Total Man Hours (uncorrected)	33240
Correction Ratio	0.98
Survey Hours	609.38
Hours in Calculation (# daily Conds. * 24)	624.00
Total Man Hours (corrected)	32,461.38
Small Boat Launches	14
Small Boat Exposure (man hours)	91.53
Incident Reports	1
Toolbox Meetings	22
Drills	4
MMO Sightings	10
MMO where action reqd.	2

4.1 Incidents

Focus Report Number	Marine Report	Seismic Report	Action by	Event Date	Event	Result
2914/08/MA		X	PGS	29-Mar-08	Personnel: Crushed finger, loss of finger tip.	LTI
3845/08/MA		X	PGS	21-Apr-08	Personnel: Muscle spasm in back while bending - no lifting involved.	RWC

The first incident resulted in the mechanic losing the tip of the small finger of his right hand. The mechanic received medical treatment in Burnie, Tasmania and flew home the next day. A full investigation was carried out by PGS following Top-Set procedures and a report sent to Santos Australia Ltd.

The mechanic is now well recovered and will be fit to return to work on his next rotation.

The second incident, which did not involve any manual lifting or handling, was that the mechanic experienced a sharp pain in his back after bending. He was assigned to light duties and will undergo a medical before his next work period.

5 Survey operations review

5.1 Survey area information

Oilfield installations & activity

There were no oilfield installations or activity in the area.

Shipping Activity

There was no shipping activity, other than transiting fishing vessels, in or near the survey area.

Sea Conditions, Tides And Currents

The start of the survey was delayed due to some extremely bad weather conditions, with 80 knot winds and 12–14 metre seas. The vessel remained in Burnie throughout this period. After production started, two short periods of bad weather caused operations to be suspended. The predominant swell was from the south west and often necessitated lowering the streamer depth to 9m. Tides and currents were weak in the area and not much infill was generated due to feather miss-matches.

In Sea Dangers

No specific in-sea dangers were identified other than the ambient temperature (~17°C) which required small boat crew to don survival suits before taking part in any in-sea operations.

Time sharing

There was no other seismic activity in the area.

Fishing Activity

No fishing activity within the survey area was encountered. Any fishing vessels that came near the area were informed of our activities by the Edward J. Farnie.

Weather

262.58 hours of time was lost to weather which equates to 42.8% of the time on the survey. The weather had been predicted to be worse than experienced.

The predominant swell was from the south west varying from 2 to 4 metres. This did limit the use of the workboat for some periods during the survey.

Cetaceans

A dedicated marine mammal observer (MMO) was present throughout the survey, there were several sightings but only two caused a shutdown of operations. Sequence 47 was terminated 16 shots before the end of the line. On approach to sequence 52, whales within the exclusion zone meant the vessel could not initiate the soft start so the vessel had to circle for another attempt.

Naval Activity Including Civil Unrest

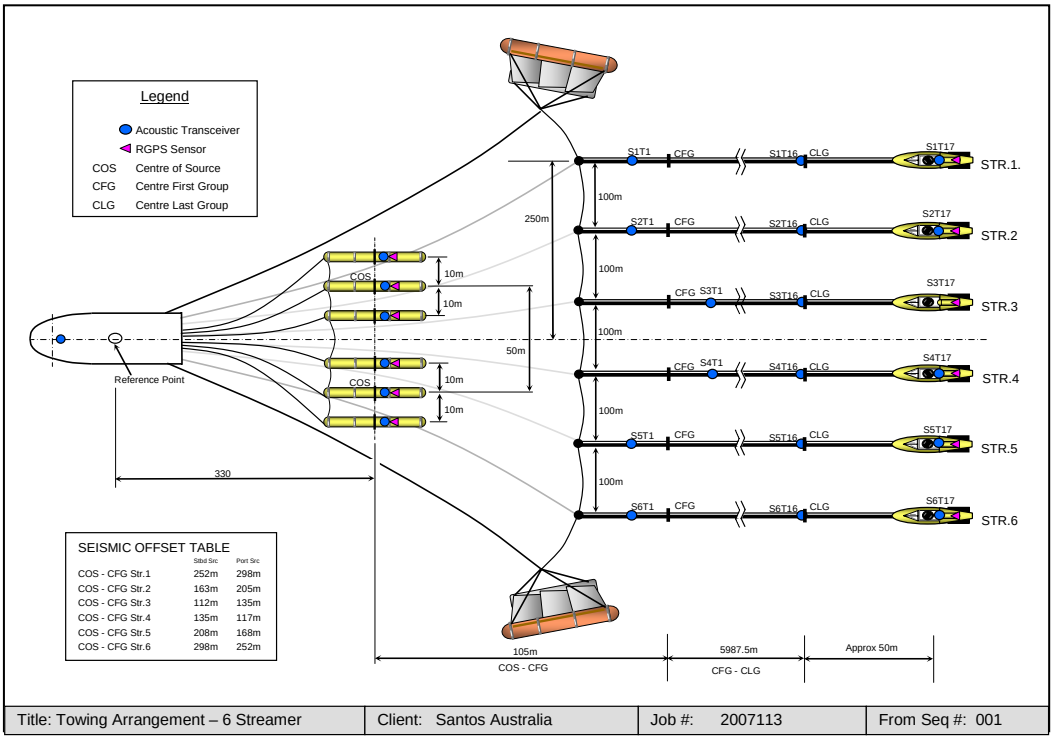
There were no naval activities during the survey.

6 Seismic energy source

6.1 Source details

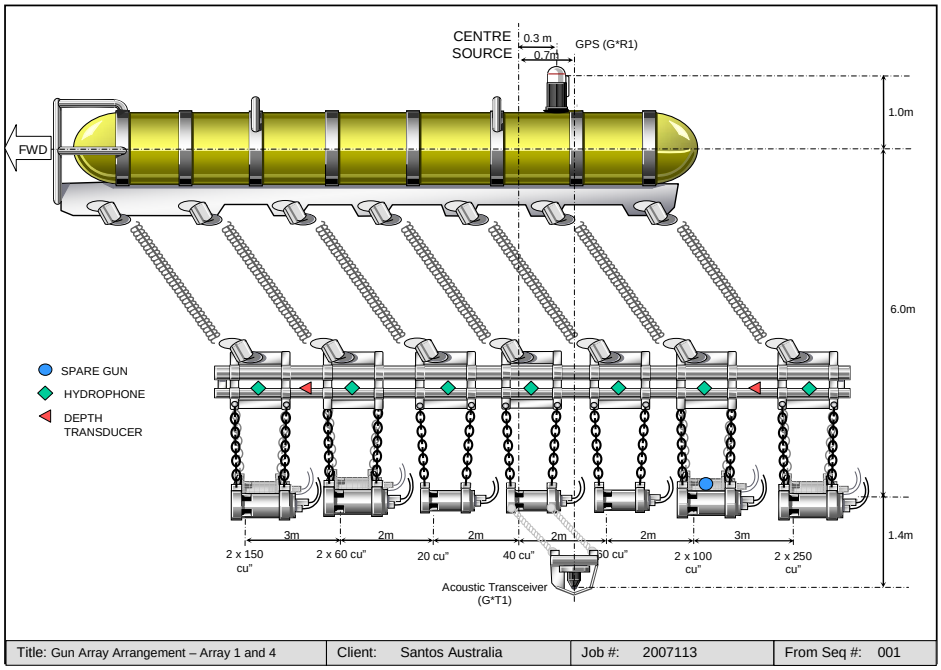
Source type	:	Bolt 1900 LLXT air guns
Air pressure	:	2000 psi
Volume	:	3090 in^3
Number of sources	:	2
Number of sub-arrays	:	6 (2x3)
Source separation	:	50 m
Sub-array separation	:	10 m
Source length	:	14 m
Gun synchronisation	:	± 1.0 ms
Drop-out specification	:	5 %
Shot interval	:	18.75 m
Depth	:	6 +/-1 m
Depth control	:	Fixed depth ropes
Depth monitoring	:	AGG depth transducers, GCS-90
Spacing control	:	Spread-ropes on sliding collars
Near field signatures	:	7 phones per subarray
Compressors	:	4 x Chirco
Source controller	:	GCS-90
Modelled source signature	:	See Appendix section 11.2

6.2 Offset diagram

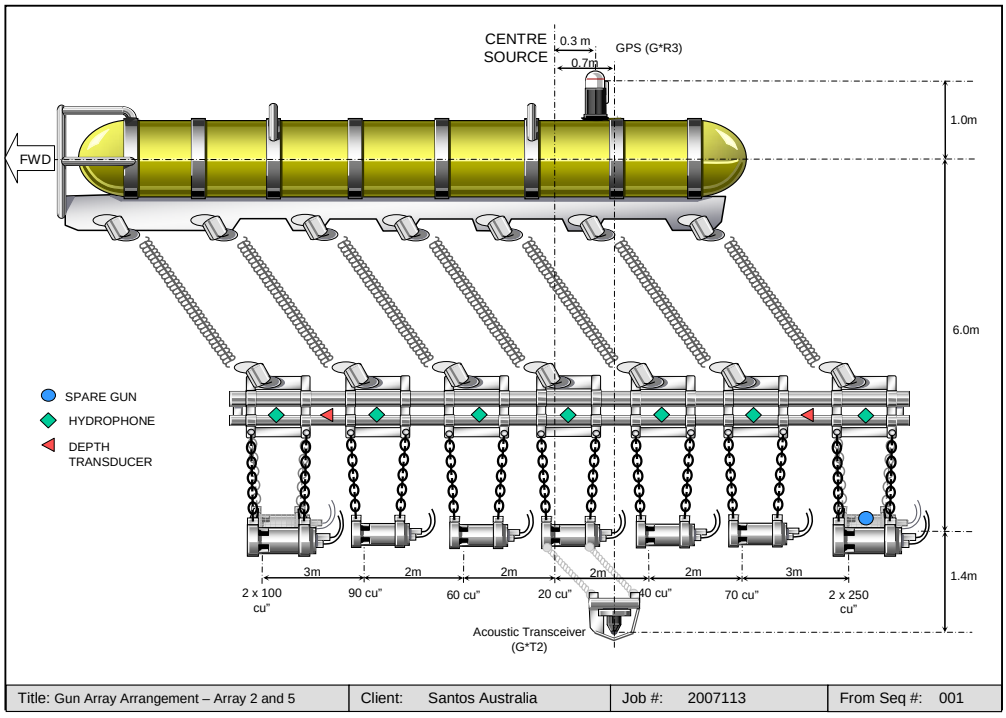


6.3 Gun array layout

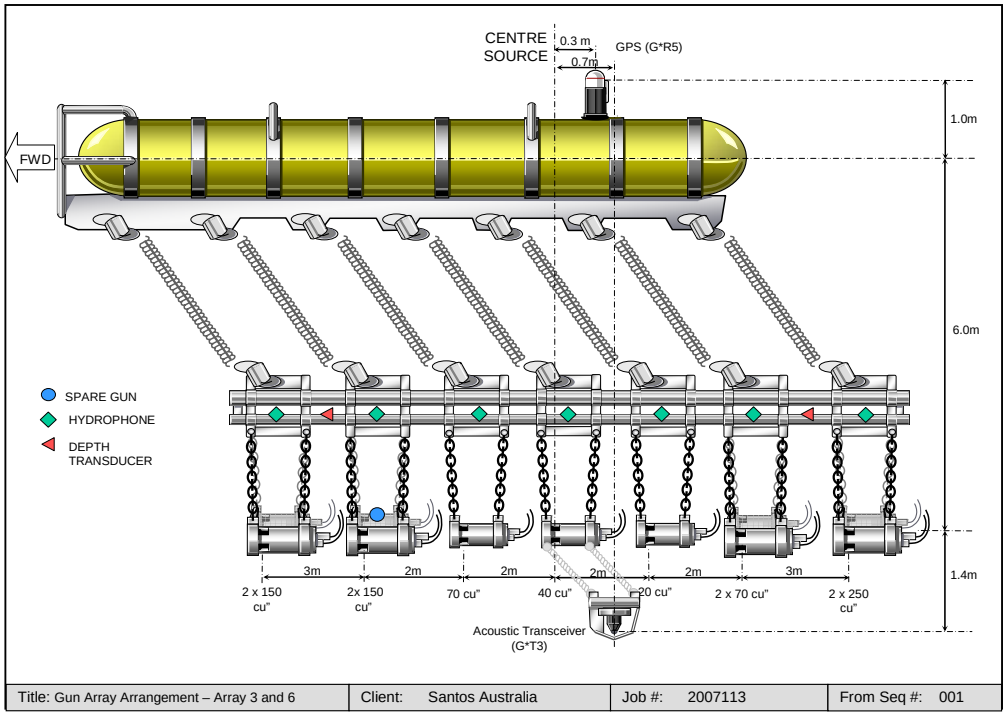
Array #1 & 4



Array #2 & 5



Array #3 & 6


CENTRE SOURCE
0.3 m
0.7m
GPS (G*R5)
FWD
1.0m
6.0m
1.4m
SPARE GUN
HYDROPHONE
DEPTH TRANSDUCER
3m
2m
2 x 150 cu"
2x 150 cu"
70 cu"
40 cu"
20 cu"
2 x 70 cu"
2 x 250 cu"
Acoustic Transceiver (G*T3)
Title: Gun Array Arrangement – Array 3 and 6
Client: Santos Australia
Job #: 2007113
From Seq #: 001

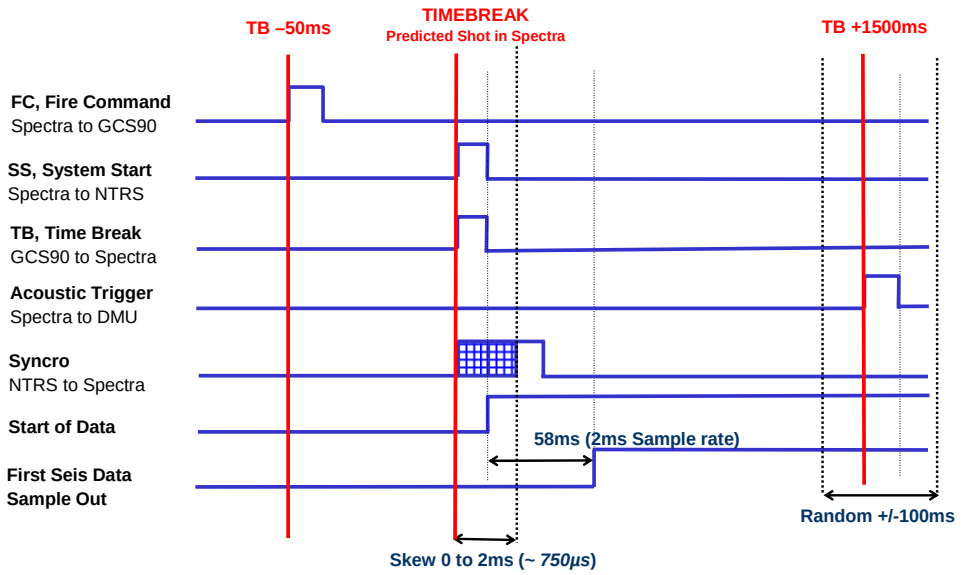
7 Seismic acquisition system

7.1 System details

Recording System	:	NTRS / gAS
Software Version	:	Version A.70a build 10581
Amplitude resolution	:	24 bit
Data Channels	:	6 x 480 = 2880
Auxiliary Channels	:	48 channels recorded to tape
Tape Transports	:	4 x IBM 3592 cartridge drives
Tape Format	:	8036 SEG D,
Recording Media	:	IBM 3592
Record Length	:	6144 ms
Deep water delay	:	0 ms
Sample Rate	:	2 ms
High Cut Filter	:	206 Hz /276. 00dB/octave
Low Cut Filter	:	4.60 Hz /6.00dB/octave
Gain Setting	:	12 dB
Polarity Convention	:	SEG, positive pressure gives negative number
SEG-D header description	:	see Appendix section 11.3

7.2 System timing

NOTES
1. Timebreak recorded on Aux channel 1



Title: System Timing Diagram	Client: Santos Australia	Job #: 2007113	From Seq #: 001

7.3 Streamers

7.3.1 Streamer details

Type of streamer	:	Teledyne RDH-S
Number of streamers	:	6
Streamer sensitivity	:	20 V/bar
Streamer length	:	6000m
Number of groups	:	6 per section
Group interval	:	12.5 m
Group length	:	12.5 m
Hydrophone type	:	T-2
Streamer depth control	:	Digibird 5011
Streamer depth	:	7m
Number of compass-birds	:	23/streamer (extra bird for outer streamers to compensate for door wash)

7.3.2 Trace Numbering

STREAMER	TRACE
Streamer 1	1 to 480
Streamer 2	481 to 960
Streamer 3	961 to 1440
Streamer 4	1441 to 1920
Streamer 5	1921 to 2400
Streamer 6	2101 to 2880
Auxiliaries	1 to 48

7.3.3 Component dimensions

	NUMBER per STREAMER	NOMINAL LENGTH (m)
Lead-in	1	700
Mini Lead-in Boot	1	3.5
Head Conventional Boot	1	2.7
Head AP Stretch Section	1	5
Head Dead section	1	15
Hydroscience Module	41	0.350
Live Sections	80	75
Tail Stretch Sections	1	50
Power Adapter Tail Swivel	1	0.340

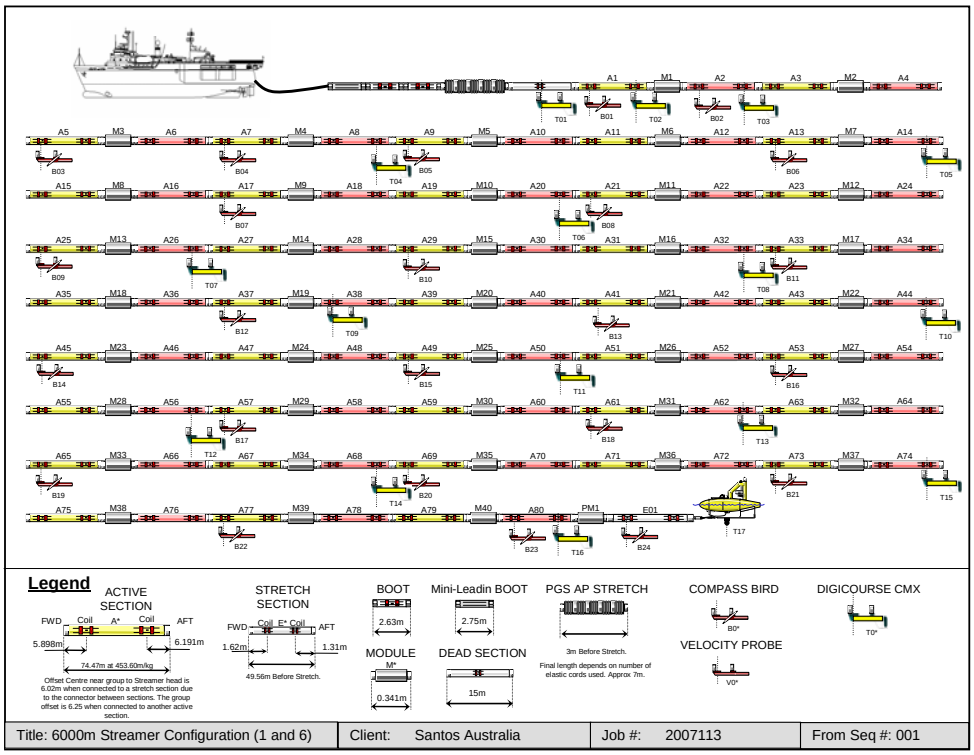
7.4 Recording System

7.4.1 Recording System performance

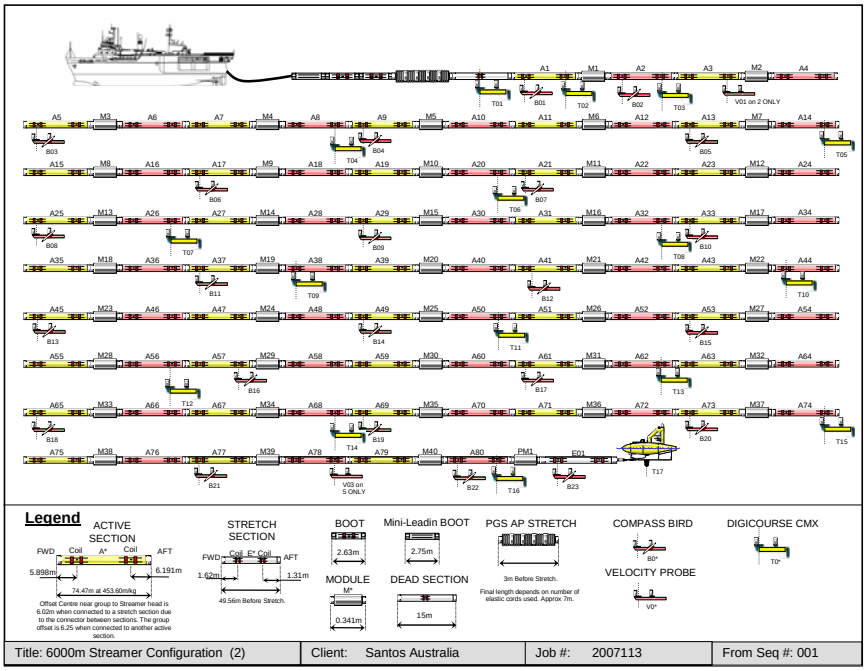
The NTRS and gAS systems performed well throughout the job.

7.5 Streamer layout

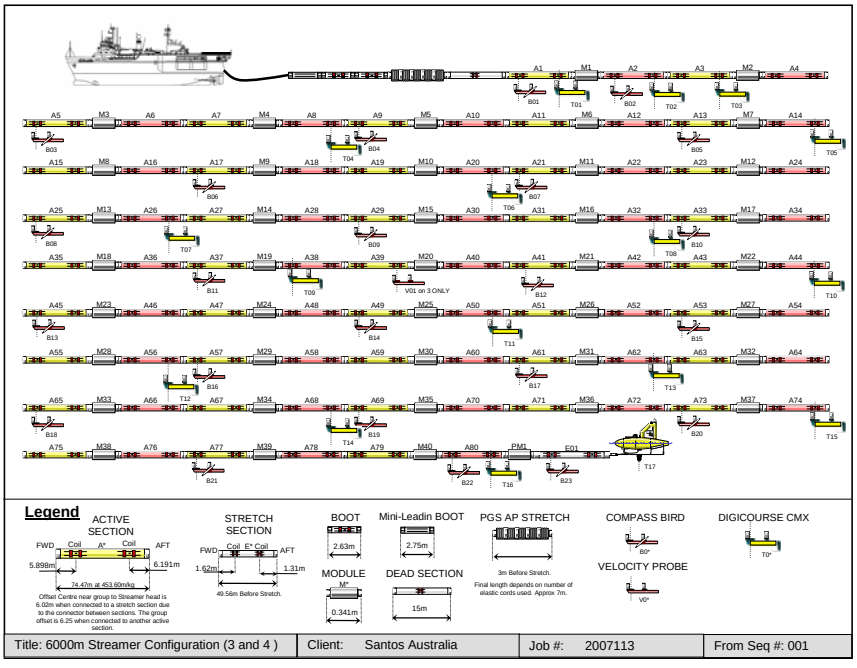
Streamer #1 & 6



Streamer #2 & 5



Streamer #3 & 4



7.6 Geodetic reference

7.6.1 Survey Datum

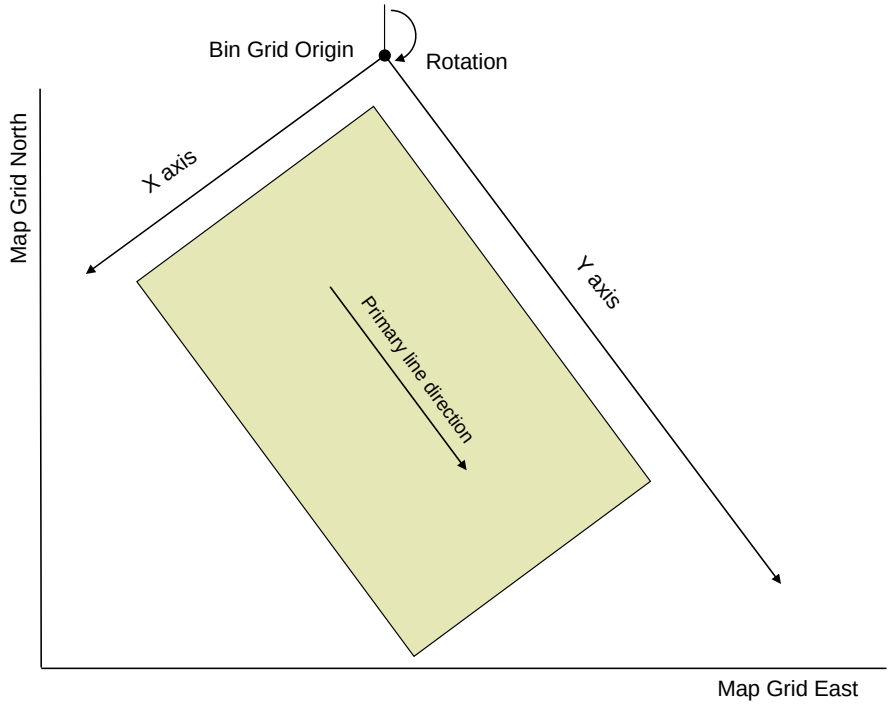
Survey Datum	:	WGS84
Ellipsoid	:	WGS84
Semi Major Axis	:	6378137 m
1/Flattening	:	298.257223563
GPS Datum	:	WGS84
Ellipsoid	:	WGS84
Semi Major Axis	:	6378137 m
1/Flattening	:	298.257223563
Geoid height EGM90 model	:	-6.57m

(calculated for centre of survey position 42º19'31.4''S 144º59'15.6''E)

7.6.2 Map projection

Projection	:	Universal Transverse Mercator
Projection System	:	UTM
Zone	:	55 (South)
Central Meridian	:	147° East
Scale Factor on Central Meridian	:	0.9996
Latitude of Origin	:	0º
False Northing	:	10,000,000 m
False Easting	:	500,000 m

7.6.3 Binning grid



Origin Easting (m)	:	336,724.40
Origin Northing (m)	:	5,326,707.05
Rotation (deg)	:	158.43

	X	Y
Origin bin number	981	801
Bin number increment	1	0.33
Area size (m)	15375	31987.5
Bin interval (m)	25	6.25
Bin size minimum (m) at 100 m offset	50	6.25
Bin size maximum (m) at 6100 m offset	75	6.25

To assist the real time acquisition, guidelines were set for the required fold and the permissible number of adjacent columns that failed to meet this level, which should provide the requisite coverage essential for this survey.

For steering the spread during acquisition:

	% Nominal Fold	Nominal Fold	Required Fold	Max nominal missing cols
For near offset segment (100 m to 1600 m)	70	20	14	2
For near-mid offset segment (1600 m to 3100 m)	80	20	16	1
For far-mid offset segment (3100 m to 4600 m)	70	20	14	2
For Far offset segment (4600 m to 6100 m)	65	20	13	3

For analysis of the coverage from the final navigation data, linearly tapered flex displays were produced to determine where additional infill may be necessary.

For INFILL ALLOCATION:

	% Nominal Fold	Nominal Fold	Required Fold	Flex applied Beg / End
For near offset segment (100 m to 1600 m)	75	20	15	100% /125%
For near-mid offset segment (1600 m to 3100 m)	85	20	17	125% /150%
For far-mid offset segment (3100 m to 4600 m)	75	20	15	150% /175%
For Far offset segment (4600 m to 6100 m)	65	20	13	175% /200%

7.7 Surface positioning

7.7.1 System I

Type	:	SkyFix.XP, SDGPS Orbit and Clock Corrected
System Corrections via	:	Inmarsat (POR) and AP-SAT High Power Spot
Software	:	Multifix 4, version 2.01
Sub-Contractor	:	Fugro Survey AS
GPS Receiver	:	SPM 2000 TopCon

The SkyFix.XP service uses a technique called Satellite Differential GPS (SDGPS); a worldwide network of reference stations is used to calculate, in real time, the orbital information (ephemeris) of each GPS satellite with more precision than that transmitted by the satellite. Corrections to the broadcast ephemeris are then uploaded to the user via the existing SkyFix/StarFix satellite communication infrastructure.

7.7.2 System II

Type	:	StarFix.HP, DGPS
Differential Corrections via	:	Inmarsat (POR) and AP-SAT High Power Spot
Reference Stations in use	:	Melbourne 500 km distant Bathurst 1070 km distant Cobar 1210 km distant Ceduna 1510 km distant
Software	:	SPM 2000 version 4.26, StarFix Suite 7.2
Sub-Contractor	:	Fugro Survey AS
GPS Receiver	:	SPM 2000 TopCon

The StarFix.HP service provides centimetre-level accuracy by measuring the carrier-phase differences on both GPS signal frequencies (L1 and L2) to more accurately model the state of the ionosphere, minimising errors associated with the transmission path between the satellite and the receiver. As with standard Differential GPS networks, corrections are derived by a network of reference stations located within the geographical area of operations and transmitted to the user via geostationary satellite links to provide coverage over wide areas

7.7.3 Float positioning

Relative GPS	:	Seatex models 320 & 220
GPS receiver	:	Ashtech G 12-L
UHF communication	:	Wood & Douglas, frequency 450-470 MHz
Software version	:	StarFix Suite 7.2, RGPS v3.02.04

The relative GPS system works through using the pseudo-range phase differencing technique to provide the true range and bearing from the master antenna on the vessel to the GPS receivers on the in-sea equipment.

Heading reference

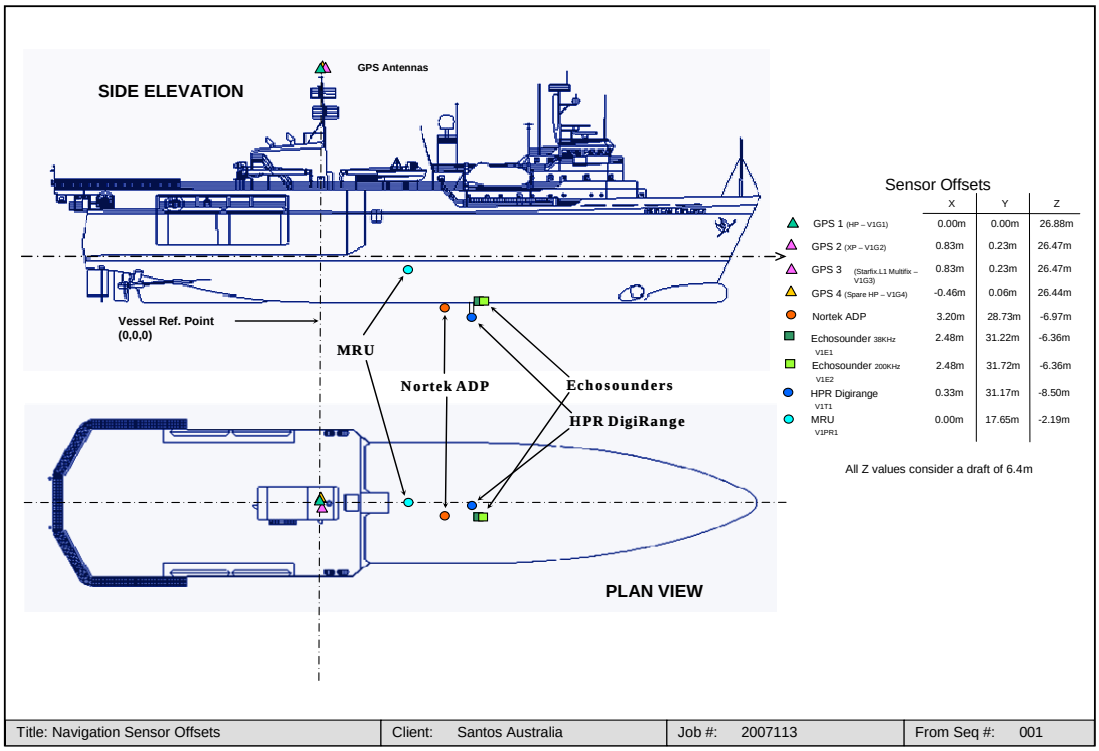
GPS Heading / Attitude system	:	Seapath 200

Gyro : SG Brown 1000S Gyro Compass

The Seapath 200 is an integrated GPS/Inertial attitude and positioning system. It is comprised of dual GPS antennae determining heading and position using carrier phase measurement. Inertial data from the Motion Reference Unit provides acceleration and angular information about three axes. Static speed and latitude corrections were applied to the gyrocompass via the internal controls and not automatically from the navigation system.

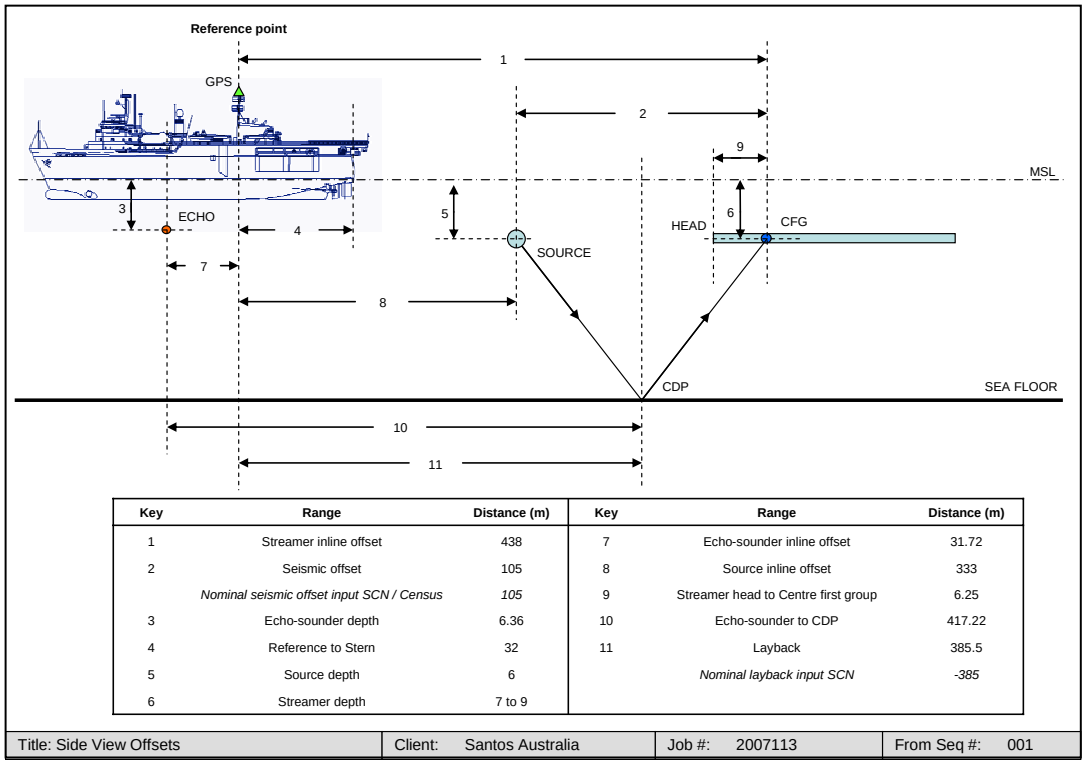
The Seapath 200 was used as main heading reference throughout the survey.

7.7.5 Navigation Sensor Offsets



Title: Navigation Sensor Offsets	Client: Santos Australia	Job #: 2007113	From Seq #: 001

7.7.6 Navigation Offsets



Key	Range	Distance (m)	Key	Range	Distance (m)
1	Streamer inline offset	438	7	Echo-sounder inline offset	31.72
2	Seismic offset	105	8	Source inline offset	333
	Nominal seismic offset input SCN / Census	*105*	9	Streamer head to Centre first group	6.25
3	Echo-sounder depth	6.36	10	Echo-sounder to CDP	417.22
4	Reference to Stern	32	11	Layback	385.5
5	Source depth	6		*Nominal layback input SCN*	*-385*
6	Streamer depth	7 to 9			

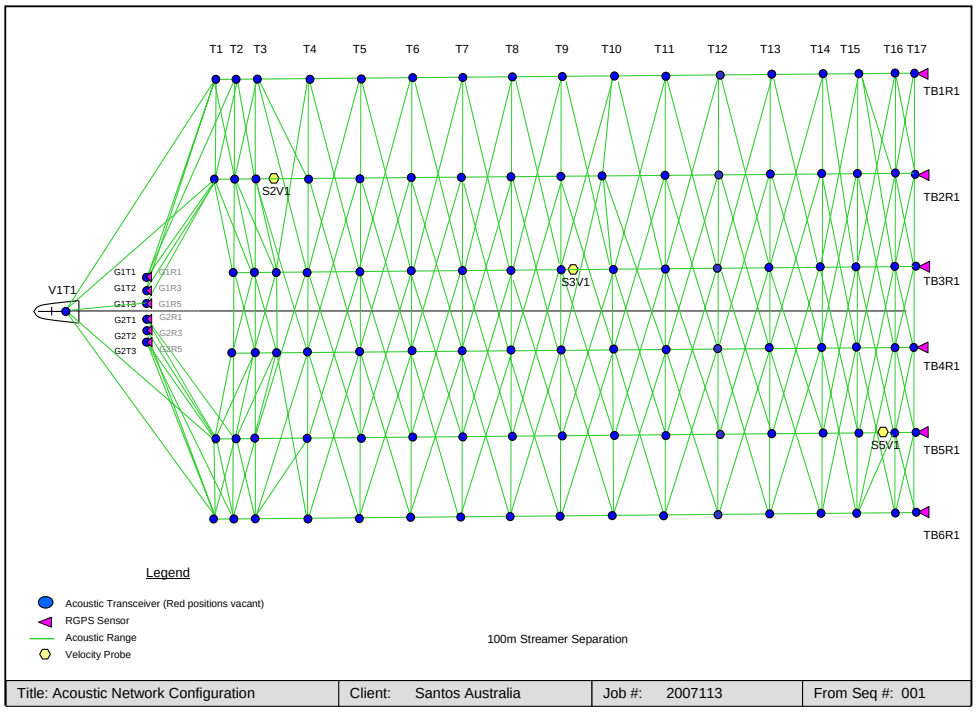
Title: Side View Offsets	Client: Santos Australia	Job #: 2007113	From Seq #: 001

7.8 Underwater positioning

7.8.1 Acoustic ranging system

System name	:	DigiRANGE
Software version	:	System 3, version 6.01
Operating frequency	:	50 – 100 kHz in 5 discrete frequencies

7.8.2 Acoustic network



7.8.3 Magnetic compasses

Bird Compasses	:	DigiCOURSE 5011 Compass/Bird
Software version	:	System 3, version 6.01
Compass Filtering	:	2s Sample rate, 14s filtering time

Magnetic variation : 13.4°
This value was derived using the IGRF 2005 model for the survey centre position.

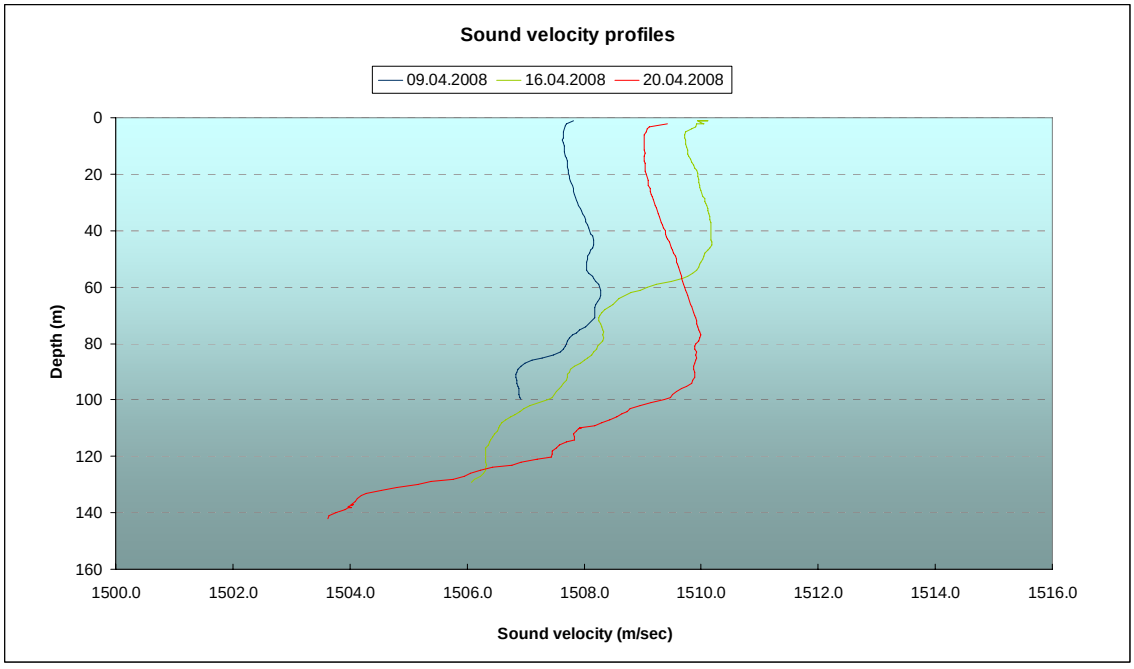
7.8.4 Echosounder

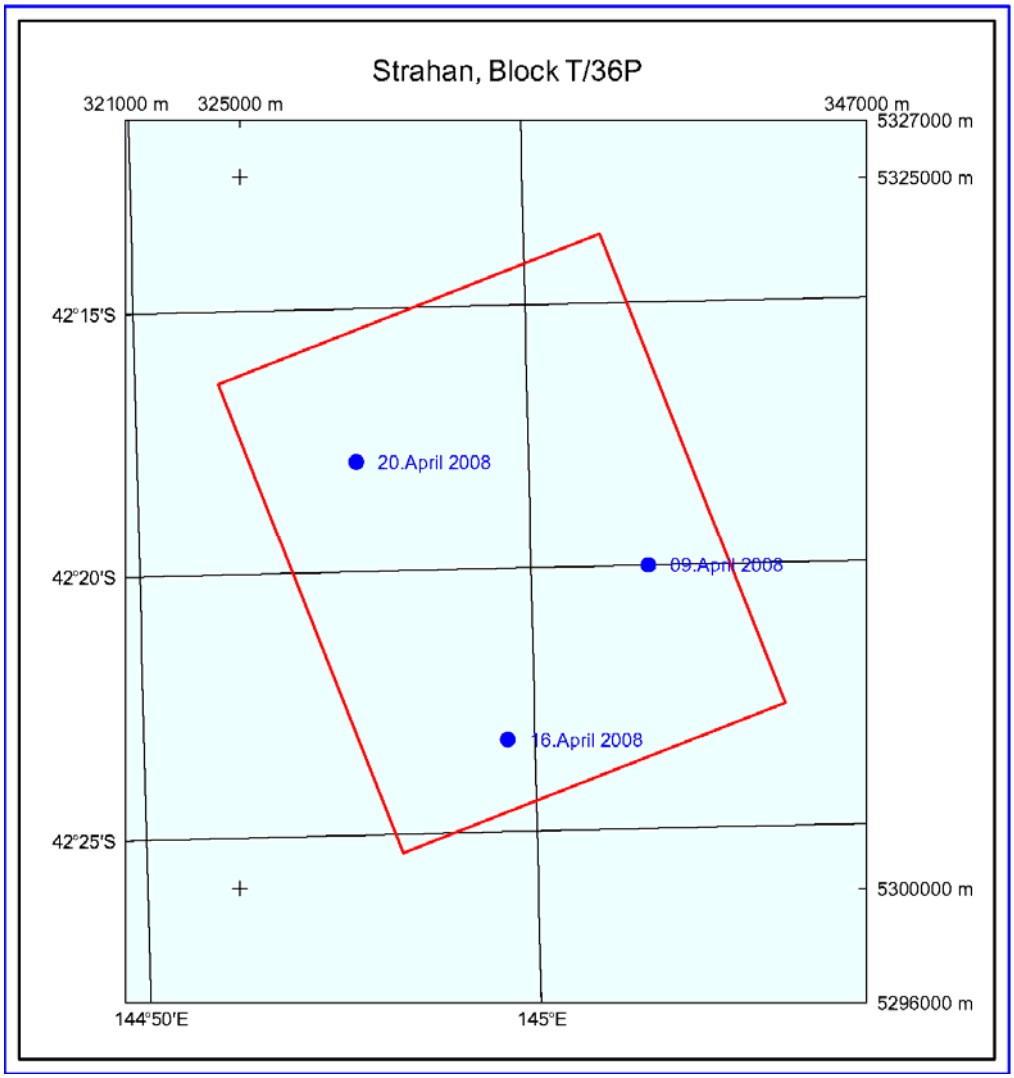
Type and model	:	Simrad EA500
Transceiver frequencies	:	38 kHz, 200 kHz
Heave compensated	:	Yes
Pitch & Roll corrected	:	No

7.8.5 Sound velocity

CTD probe	:	Model 600 CTD (1000μbar)
Serial	:	13884
Calibration Date	:	17th August 2007
Supplier	:	Valeport
Real time sensors	:	DigiCOURSE model 7000 (Velocimeter)
Software version	:	System 3, version 6.01

The following chart shows the results produced with data from the Valeport probe. A total of three profiles were collected during the course of the survey.





Sound velocity profiles location

7.9 Navigation and binning systems

7.9.1 Integrated navigation system

Type	:	SPECTRA
Operating System	:	Linux Redhat 9
Supplier	:	Concept Systems Ltd.
Software version	:	10.09.01
Real Time Interface	:	PowerRTNU version 4.4.2
Machine type	:	2 x IBM X325 Servers 2 x IBM Intellstation
Tape storage	:	IBM 3590 / DAT
Disk Storage per Server	:	240GB
Disk Storage per Workstation	:	35GB
Disk storage device	:	RAID

7.9.2 Binning system

Type	:	Census
Supplier	:	Input / Output Systems
Software Version	:	4.4.1
Machine type	:	IBM RS6000 model 44P
Operating System	:	IBM AIX 4.3.3
Tape storage	:	IBM 3590
Hard Disk storage	:	75GB online, 75GB offline

7.10 Navigation System Performance

7.10.1 Vessel position

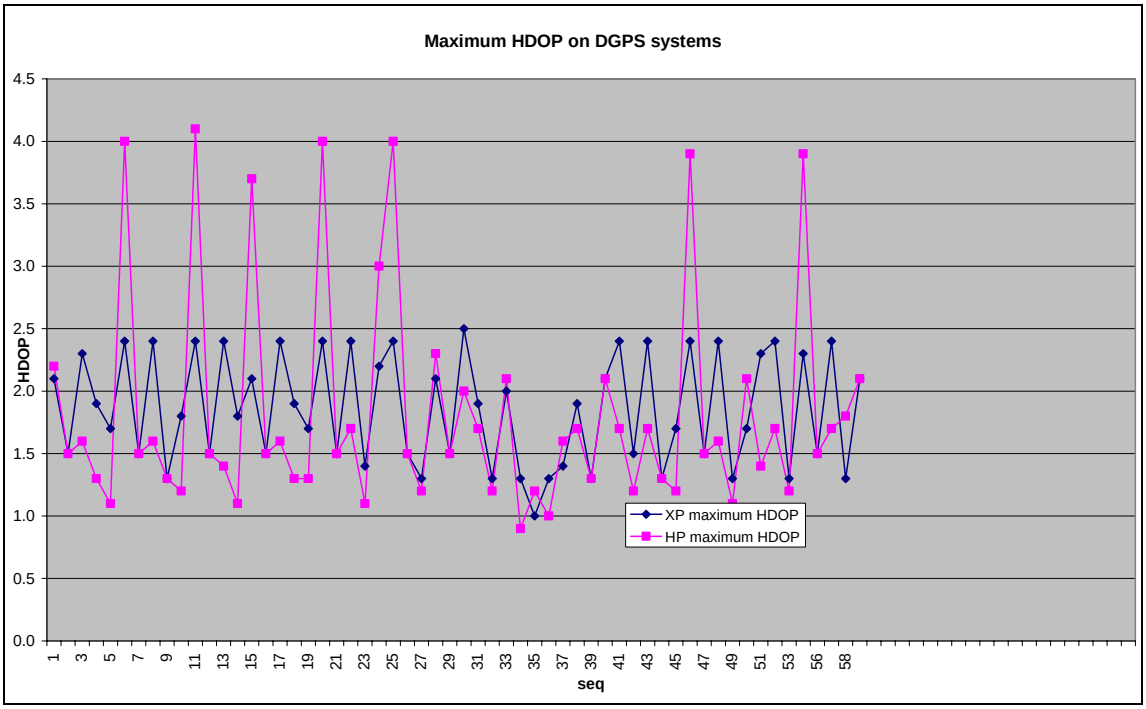
Two DGPS systems were operational for vessel positioning, SkyFix.XP and StarFix.HP. During the project, comparisons between the systems for the computed vessel position (Easting and Northing axis) indicated both systems performed well, with the mean difference less than 1.0 metre and the maximum difference less than 1.0 metres.

7.10.1.1 SkyFix.XP

The SkyFix.XP solution performed well for the entire survey with only one 2-shot drop out.

7.10.1.2 StarFix.HP

The StarFix.HP solution also performed well for the survey period. However, on some occasions the HDOP was higher than the predicted value due to satellite #1 being decommissioned during mid March. Also satellite #11 was orbit corrected on the 15th of April so was unusable that day. Most of the lines with higher HDOP were shot between 01:30 and 05:00 local time.



7.10.2 Acoustic ranges

Acoustic positioning for this survey was generally of good quality. A total of seventeen acoustic units were deployed per streamer creating a full acoustic network. Dynamic sound velocity was recorded using three individual velocity meters at the head, middle and at the tail of the network. The velocities recorded were used to calculate the acoustic ranges on a shot by shot basis and were used in the network adjustments of all the sequences.

The poorest performance was seen in the ranges between streamers 3 & 4 in the front of the net and ranges between vessel and guns, these being the areas directly affected by the prop wash and gun bubble with its associated aerated water. This is traditionally a problem area and very difficult to improve upon.

Due to the full acoustic network the vessel was able to shoot through fairly poor weather conditions around sequences 15-20 and 40-46.

7.10.3 Compass Data

Twenty-four compasses were deployed on each of the outer streamers and twenty-three on each of the remaining inner streamers. The compass data were good throughout the survey. Compass data for all sequences were analysed for biases, stuck values and excessive noise, with unacceptable compasses being rejected from the post-processing solution and physically replaced on the streamers when appropriate.

During the marginal weather conditions when the compass data did become unacceptably noisy with the streamers set at the contractual depth of 7m, there were a number of lines that were acquired with the streamers at a depth of 8m or 9m. An assessment was made on the approach to each of these lines, based on Spectra's real-time unit variance and the expected weather conditions, as to the most suitable depth to use for the entirety of the line.

7.10.4

7.10.5 Remote Positioning

Positioning of the remote targets, 6 source arrays and 6 tail buoys, was generally very reliable, though with some noisy gun rGPS data during periods of large swells, and tail buoy 1 rGPS unit not working for 8 sequences. The units had all been recently used on the previous survey and continued to operate within the expected standards of accuracy.

7.10.6 Echo Sounder

The echo sounder data output in the final P1/90 depth records was derived from the 200 KHz transducer, which performed well throughout the survey. The raw data were not draft corrected but compensation for vessel heave was applied, using data interfaced from the MRU. A fixed water velocity of 1500m/s was used internally by the echo sounder. Final bathymetry data were produced after survey completion in the PGS Oslo office.

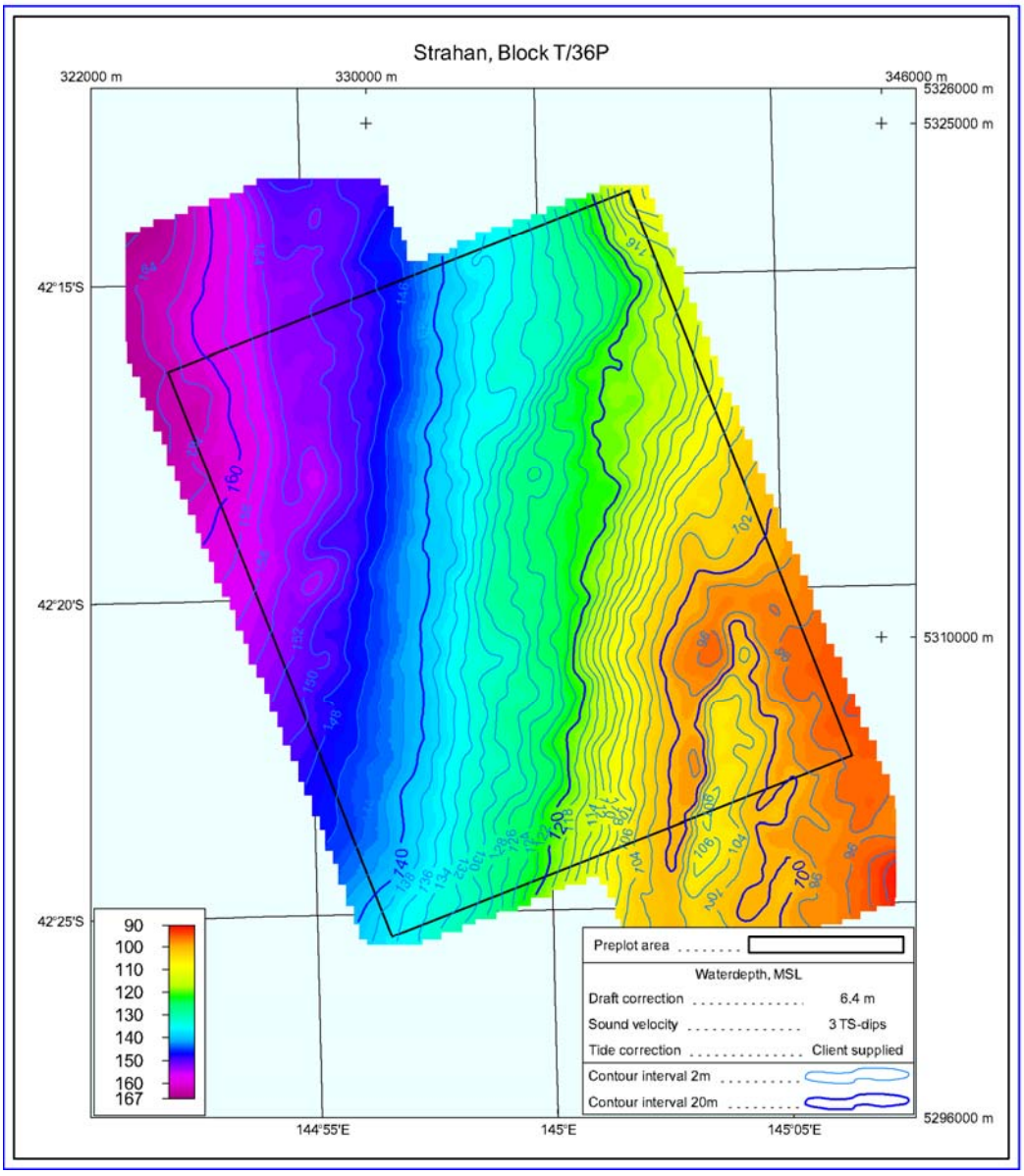
A special echo sounder tape was created, with depths corrected for draft, sound velocity and tide (MSL).

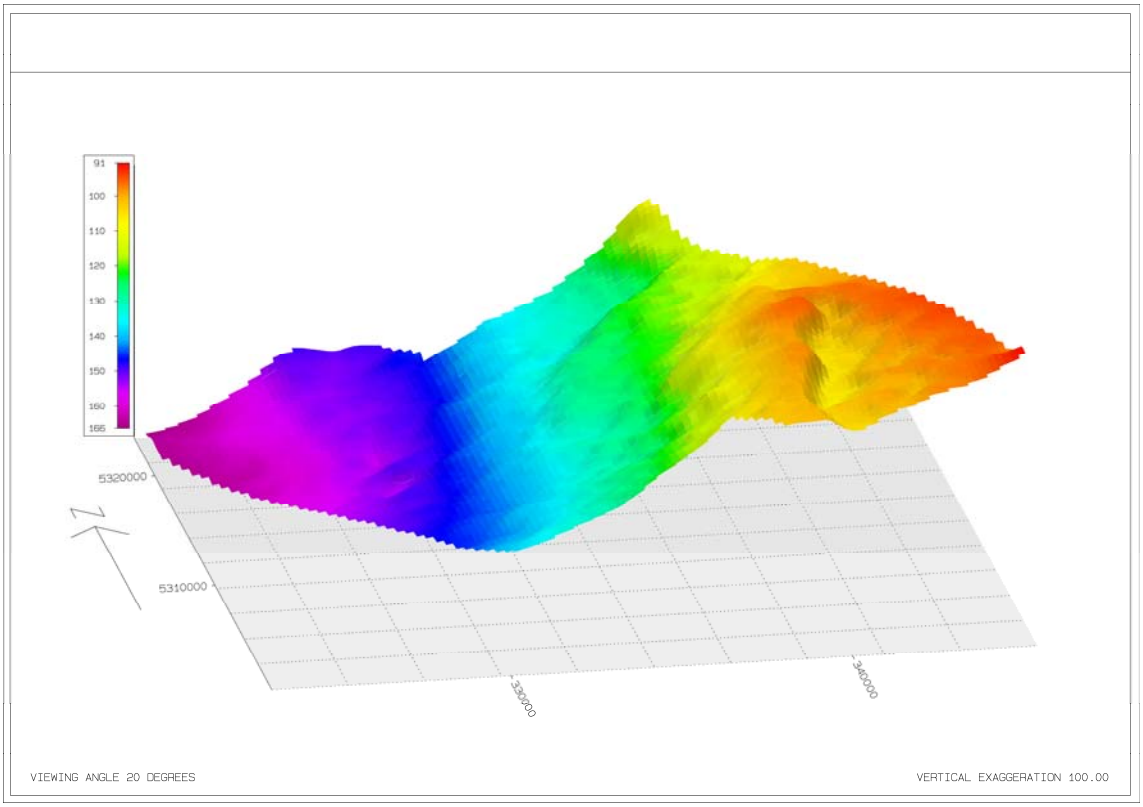
Draft corrections applied : 6.4m

3 sound velocity profiles were collected in the area during the survey period. These were used to scale waterdepth values for sound velocity variations.

PROFILE #:	DATE	POSITION	
1	09.04.08	42°20'S	145°03'E
2	14.04.08	42°23.25'S	144°59.3' E
3	20.04.08	42°17.9'S	144°55.6'E

Tide corrections in MSL were supplied by the client, file name : STRAHAN.txt
Location : 42°19'20"S 144° 59'30"E





3D view

7.10.7 Heading Sensors

The Seapath system was used as the primary vessel-heading indicator for all sequences while the conventional SG Brown gyrocompass served as back-up and a redundancy check. Seapath performed without interruption and was used as the heading indicator for all sequences. The heading data was de-spiked to remove gross outliers, but not filtered.

7.11 Delivered P1/90 and P2/94

Raw navigation data were recorded in UKOOA P2/94 format during acquisition and verified for accuracy before a deliverable P2/94 dataset was produced. These datasets were recorded to 3590 tape cartridge. One set of P2/94 tapes client tapes was included with the seismic data delivered to the processing centre at CGG Veritas in Perth, one set included with the copy of the seismic data sent to the Santos Adelaide office, and a final set shipped to the PGS office in Lysaker for archiving. The format for these tapes is:

Data Format:	ASCII
Record Length:	80 bytes (no LF)
Tape Format:	dd, block size = 8000

Processed navigation data were delivered in UKOOA P1/90 format, recorded on 3590 tape cartridge. Each dataset included position records for vessel, sources, tail buoys, echo sounder and all receiver groups. One set of P1/90 tapes was included with the seismic data delivered to the processing centre at CGG Veritas in Perth, one set included with the copy of the seismic data sent to the Santos Adelaide office, and a final set shipped to the PGS office in Lysaker for archiving. The format for these tapes is:

Data Format:	ASCII
Record Length:	80 bytes (no LF)
Tape Format:	dd, block size = 8000

8 Navigation processing

8.1 Introduction

The final P190 was generated using either the NRT or SPRINT post processing systems. NRT is the SPECTRA near real time navigation processing module. The NRT system delivers a delayed position solution (P190) and associated quality assessment a few minutes after completion of the survey line. The delayed solution minimises the impact of latencies in certain observation streams and provides access to a portion of future data. This ensures that the NRT will provide a valid positioning solution significantly more often than is possible in the real-time solution. If manual processing were required, either due to NRT reported problems, abnormal QC statistical results, or observed situations on-line, the data was reprocessed using SPRINT.

8.2 NRT

The NRT is a separate licensed Spectra module. It gets the required information, data and from the Spectra Data-server and a NRT specific parameter file. The NRT data flow:

1. **NCN Calculated Positions**
   NRT uses the real time positions calculated by Spectra as the basis for gating outlying observations.
2. **Raw Sensor Data**
   Raw DGPS, RGPS, Acoustic, Compass, Velocimeter, Gyro, Echo sounder, Depth sensor data acquired by Spectra.
3. **Outlier Rejection**
   Based on the Spectra NCN calculated positions and observations, outliers in the raw sensor data (spikes and biases) are rejected. Note that this does not apply to compass observations, as these generally have low redundancy.
4. **30 Shot Filter Buffer**
   Raw observations (after outliers have been removed) are filtered to remove noise. Future data (60 shots) is used to improve the quality of filtering. Secondary spike rejection – based on time series – is applied to remove remaining spikes. This is particularly useful for compass observations.
5. **Compass Drift Detection**
   Temporary biases (drifts) in compasses are removed based on deviations from the smoothness of the streamers.
6. **Least Squares Adjustment**
   All filtered observations are used to update the positions in the network in a least squares adjustment. The weights of these observations are proportional to the quality of the data.
7. **Qualifier**
   An extensive set of checks is applied to the data and the solution. Which quality flag is assigned to the data is determined on the basis of the results of these checks.
8. **P1/90**
   The final positions are exported to a P1/90 file.
9. **QC End of Line Report**
   A QC report is created, containing the outcome from the main qualifier checks. A statistical report similar to the standard Sprint end of line report is also produced.

8.3 SPRINT

The SPRINT 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.

8.3.1 Data import

Raw data were recorded to tape and disk in P2/94 format. After the end of each 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

8.3.2 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).
Nominal	:	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.

8.3.3 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 co-variances
- 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

8.3.4 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 miss-closure
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

Problem lines were more thoroughly investigated and required different plots for analysis.

8.3.5 Data export, P1/90 output

During the export process the receiver positions were computed and a P1/90-file was generated. The in-line miss-closure 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.

8.4 Data quality control procedures

The first line was sent to the office for quality purposes; both the P1 and P2 headers were checked. The line was processed and the solution was compared with the P190 file from the vessel's NRT and SPRINT systems. This procedure was repeated after a 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 miss-closures were checked.
- Latitude/longitude and grid coordinates were checked against the datum/projection defined in the header.

The final P1/90 files were also checked using Sprint QC tool, p1check and p1List, the two latter tools being PGS internal software. These software tools provided checks on the following:

Sprint QC:
- 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.

p1check:
- 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.

p1list:

- 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 and P1list 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.

8.5 NRT vs Sprint P190 Position Comparisons.

Periodically during the survey NRT P190 positions were checked by comparison with P190 data produced by post processing with Sprint. This was nominally every 10th line. Lines which were reprocessed for problems are also included in the comparison to reflect a value of the differences. The SPRINT solution for sequences 16, 17, 18, 43 and 45 was used for the final data.

Maximum position difference (m)										
Seq	Line name	Vessel		Sources		Tailbuoys		Receivers		Comment
		min	max	min	max	min	max	min	max	
001	1054P1001	-0.4	0.4	-2.5	-0.2	-5.8	4.5	-6.8	5.6	First line QC
002	1306P1002	-0.2	0.1	-2.3	1.9	-3.1	3.2	-8.9	7.2	rGPS data noisy
010	1354P1010	-0.3	0.2	-2.2	1.4	-3.1	2.8	-7.0	7.3	10th line QC
015	1138P1015	-0.2	0.3	-1.7	1.8	-3.3	4.3	-7.8	7.7	25% Comp Rejected
016	1390P1016	-0.4	0.6	-4.2	2.9	-5.3	3.0	-14.1	11.4	Compass noise
017	1402P1017	-0.8	0.5	-1.8	2.2	-4.3	3.4	-12.6	12.1	Compass noise
018	1150P1018	-0.4	0.8	-1.5	2.0	-3.2	1.8	-9.6	7.8	Rot. inconsistency
021	1426P1021	-0.2	0.2	-1.5	1.9	-3.5	2.5	-6.9	6.3	20th line QC
030	1462P1030	-0.2	0.2	-1.8	1.7	-3.7	2.1	-6.5	5.2	30th line QC
033	1234P1033	-0.3	0.4	-2.3	2.0	-1.8	2.5	-8.4	9.0	rGPS drop outs
043	1258P1043	-0.3	0.7	-2.1	2.3	-3.7	2.8	-10.8	12.9	Compass noise
045	1270P1045	-0.2	0.6	-1.9	1.9	-3.7	3.2	-11.5	11.3	Compass noise
048	1282F1048	-0.2	0.2	-1.6	1.7	-3.6	3.8	-8.7	8.6	XP 2-shot drop out

9 Seismic data quality

9.1 Ship & rig noise

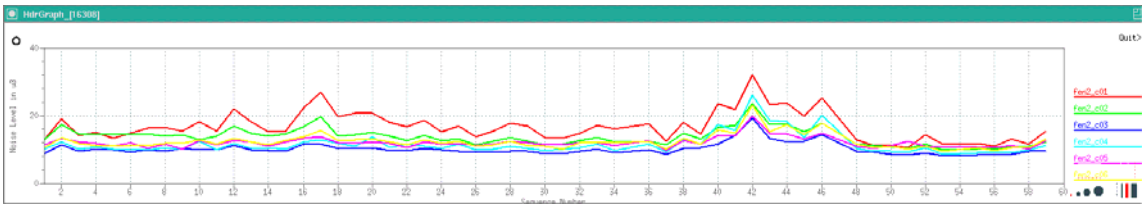
Not an issue for concern on this survey. Hardly any line experienced ship noise/prop noise and never to a level of any great concern.

9.2 Swell noise

We did experience a fair amount of lines with heavy swell on this survey. A few lines were marginally accepted despite heavy swell and strong FEN bursts. Sequences 016, 017, 040, 043-046 had strong to very strong levels of swell. 041 and 042 were scratched /NTBP due to excessive swell. Stacks with both FEN reducing FK (approx 1250m/s fans) and frequency split swell targeting sink were produced when conditions were marginal. FKSINK mostly removed or reduced the level of both FEN and swell significantly to an acceptable level below the target, 1-1.5s. The four worst sequences accepted, Sequences 043-046, were accepted by the onboard client after having evaluated the fk-sink stacks in detail. Some narrow bursts of swell were still present after fk-sink. The target zone 1-1.5s was mostly relieved from noise.

9.3 Strum / Tug noise

Front end strum/tug noise (FEN) was seen on all cables but was particularly strong on streamer 1. The FEN was sensitive to vessel speed so adjustments were made to control the levels. The FEN was worse when the streamer depths were increased during times of marginal weather due to front dilt depth ropes at 8m and cables at 9m.



9.4 Source Separation Errors

Source separations were monitored online and actions taken to correct when needed.

9.5 Telemetry and Parity Errors

Streamer 6 started acting up from sequence 017 and onwards. The level of crossfeed and parity errors forced us to disable streamer 6 channels 445-480. The client was made aware and accepted to shoot with these channels disabled. The shallow target was not affected by dropping these channels. Some attempts were made to fix streamer 6 from the workboat when the weather was agreeable, but the high level of parity errors/spikes/crossfeed returned and forced us to revert streamer 6 to only 444 active channels. Note that the full channel set of 480 channels was always recorded to tape, leaving the last 36 channels, 445-480, as dead.

On some lines the number of streamer 6 edits due to parity went as high as 9%, Sequence 046. Client aware of this and decide to accept the data due to edits only affecting one streamer.

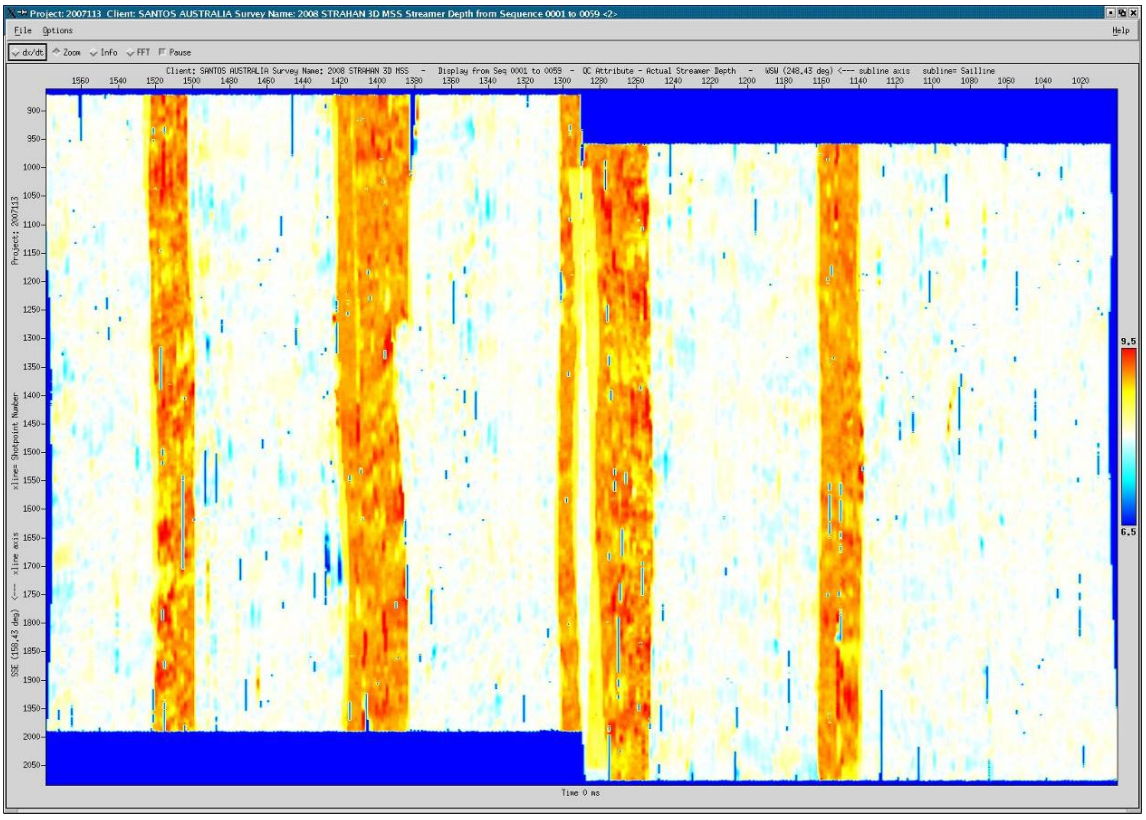
9.6 Streamer Depth Errors

These were generally logged in the Observer logs as QC warnings.

On client request, the target streamer depth would be adjusted, depending on the sea conditions/cable control/swell. No lines were shot at 7m. Roughly ¾ of this survey was acquired with the streamers at 8m, the rest was shot with streamers at 9m. Sequence 016 was started with the streamers at 8m, then about 2/3 into the line the weather had picked up so much that the client requested the streamers dropped to 9m for the last part(*). No other line was recorded using two different depths.

Streamer target depth below followed by areal overview of streamer depth. These depth values are taken from the near mids.

7m	8m	9m
None	001-016*	016*-021
	022-040	041-048
	049-059	



9.7 Bad channels and Recording System Problems

After each sequence, all the recorded traces were checked for excessive RMS noise levels, weak or dead traces and for electrical spikes. This was done both automatically and interactively on-screen. The number of bad channels edited was always in spec.

Spikes
Automated spike detection was running on all the traces, across the entire record length, on the gAS recording system as well as online on the Viper system. The number of spikes was usually small, and the number of bad traces was always well within spec. The spikes can be identified by analysing the observers' logs. They should be removed during processing either automatically using a de-spike algorithm or manually by referencing the observers' logs. The big spikes were flagged as edits.

Cross-feed
We have seen occasional intermittent weak and time variant crossfeed on streamer 2, ie weak but apparent in shot domain but gone in cdp domain.
On most of the sequences 017 – 059, except 027, 028, 031 and 032, streamer 6 was recorded with the last 36 traces, 445-480, inactive to avoid severe crossfeed/spikes if powered up past module 37. Decision was to shoot with 445-480 inactive until weather allowed for work boat operations on the streamer 6 tail. The full streamer 6 channels set, 480, was recorded to tape but the last 36 traces were dead and marked as an edit in the observer log.

Header corruption
Header data transferred from the navigation system to the seismic recording system was occasionally corrupted affecting values stored in the extended header. These events were flagged in the observers' log as "nav header short" which can cause zero values in some of the navigation header fields such as shot point number or source identifier. If needed and if not also a header long is flagged, these errors can be fixed in processing by manipulating the headers to restore the correct values so that these shots can still be used. Using the time stamp in the general header is an option. This time is GPS corrected and relatively accurate (Approx +/- 1s window).

9.8 Skew Correction for NTRS Recording

The NTRS acquisition system used on this survey is a continuous recording system, enabling recording with nearly zero dead time between records. However, as a result of this, time zero does not necessarily fall on a sample time. This automated system sub-sample correction is known as the skew and is defined as the interval between time zero and the next following sample.
Any skew correction factor errors were identified by time-break analysis and the relevant shots were flagged as edits. Most commonly the skew errors were flagged automatically by the recording system.

9.9 Air leaks and Auto-fires

Any auto-fires flagged by gas were checked by QC and removed from the log if proven to be false. The majority of air leaks were spotted immediately online and appropriate action taken.

Summary of causes of scratched and incomplete line sequences

Cause	Scratched	Incomplete or Edit
Air leak	054	033
Source separation errors		
Compressor failure		
Auto-fire, misfire		
Ship noise		
Weather	041, 042	
Depth control errors		
Observing software / hardware		023 hole due to streamer 1 bad sync
Navigation software / hardware		
Strum noise		
Telemetry/parities/module failure		
Navigation Compass Problems		
Other	035 streamer power down online	006 SOL streamer 1 only xfeed due to tailbuoy charging, 038 – small hole due to NTRS set to bypass online.

9.10 RMS and noise analysis

RMS Windows		
RMS Window 1 (Water Column):	100 - 600 ms*	relative to start of record
RMS Window 2 (RMS minimum):	500ms	sliding window
RMS Window 3 (Signal 1):	800 – 1300 ms	relative to start of record
RMS Window 4 (Signal 2):	1300 - 1800 ms	relative to start of record
RMS Window 5 (End of Record):	5500-6000 ms	relative to start of record

* Some of the first lines had the water column RMS window 1 defined as 60-560ms or 60-300ms.

The gAS system produced online RMS values taken from 5 windows calculated on 1ms sample interval data. No instrument delay static was applied prior to analysis but a 5-8-90-120 Hz common band-pass filter was applied to all windows to remove noise occurring outside the bandwidth of the data. These RMS values were passed to the Viper system in real-time when needed to facilitate both online and offline RMS analysis. These values were also used to create areal rms and attribute displays using the PGS 'holoSeis' visualisation software package and Viper BinXYZ areal attribute handling.

1: Water Column noise window
The water column noise window (window 1) displayed the ambient background noise levels, and was also useful for assessing external sources of noise, such as ship noise. Noisy channels are generally much more obvious in this window too. The front traces, and in particular those on the centre streamers nearest the guns, recorded high amplitudes due to first break energy entering the window, and were of little use for QC purposes. To analyse these channels, normally the end of record RMS window was used. On this survey the end of record RMS window had too much residual energy to be useful for this on every line. The start and end of line noise records without the guns firing were analysed to assist in picking bad channels.

2: Minimum RMS
RMS was computed for 250ms about each sample of each trace, i.e. in a sliding 500ms window down each trace. The minimum RMS value for each trace is then stored in a header which can subsequently be plotted. This method ensures that the signal contribution to the RMS value is minimised.

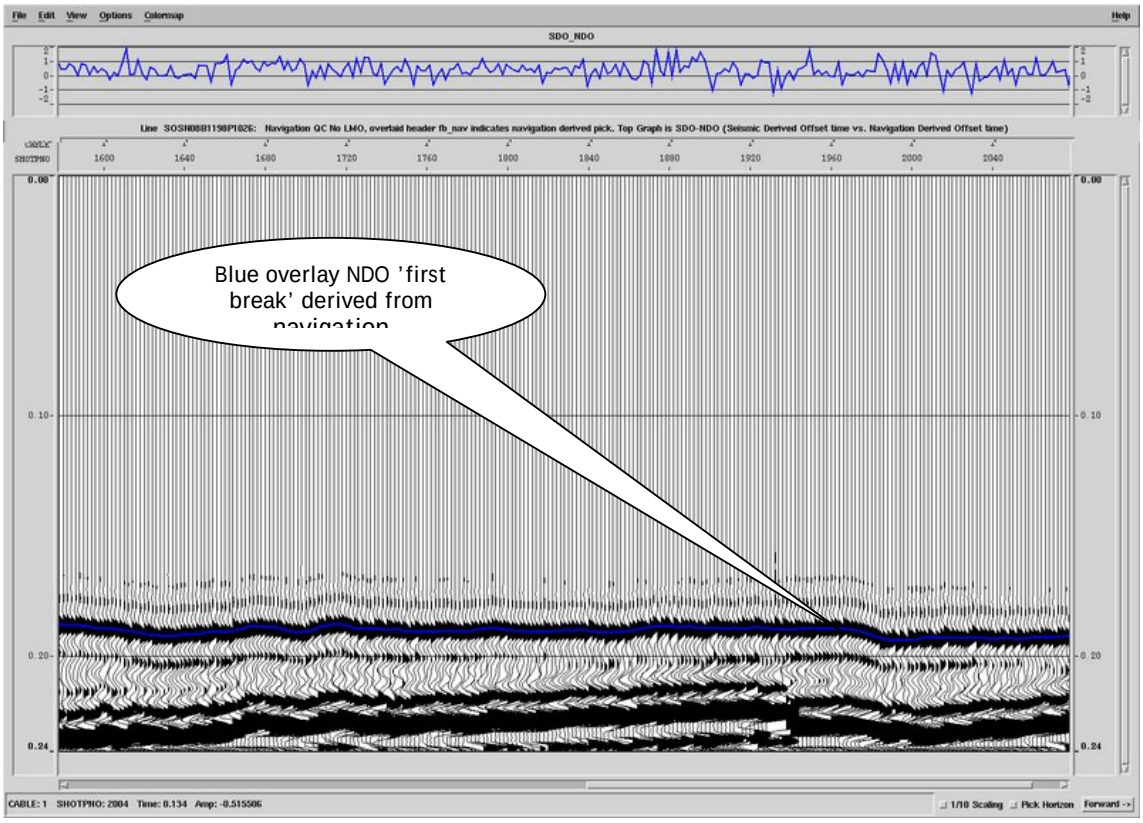
3, 4: Signal Windows
The RMS signal was calculated by the gAS QC system in both windows 3 and 4, as detailed in the table above. Reviewing the amplitudes of individual channels in these RMS windows could highlight weak or dead hydrophones, as the resulting contrast in the recorded amplitudes are greatest here.

5: End-of-record windows
This RMS end of record window (window 5) was used for monitoring ambient noise levels in addition to the water column window. This window was useful at times for examining the ambient RMS levels on the near traces that were affected by first break energy in RMS window 1. On this survey the amount of shot-generated energy recorded in this window was often very much higher here than in window 1, and so external noise sources, for example ship noise, would not necessarily be as easily seen in the end-of-record window. The reverberation/ residual energy made it more difficult to spot bad channels.

9.11 First break / P190 offset check

The nearest traces were merged with the P1/90 navigation data, and the navigation-derived first break was overlaid on the seismic data and checked on screen. In general, there was a good match between the P1/90 and the seismic data. The common offset cube was additionally used to verify navigation quality.

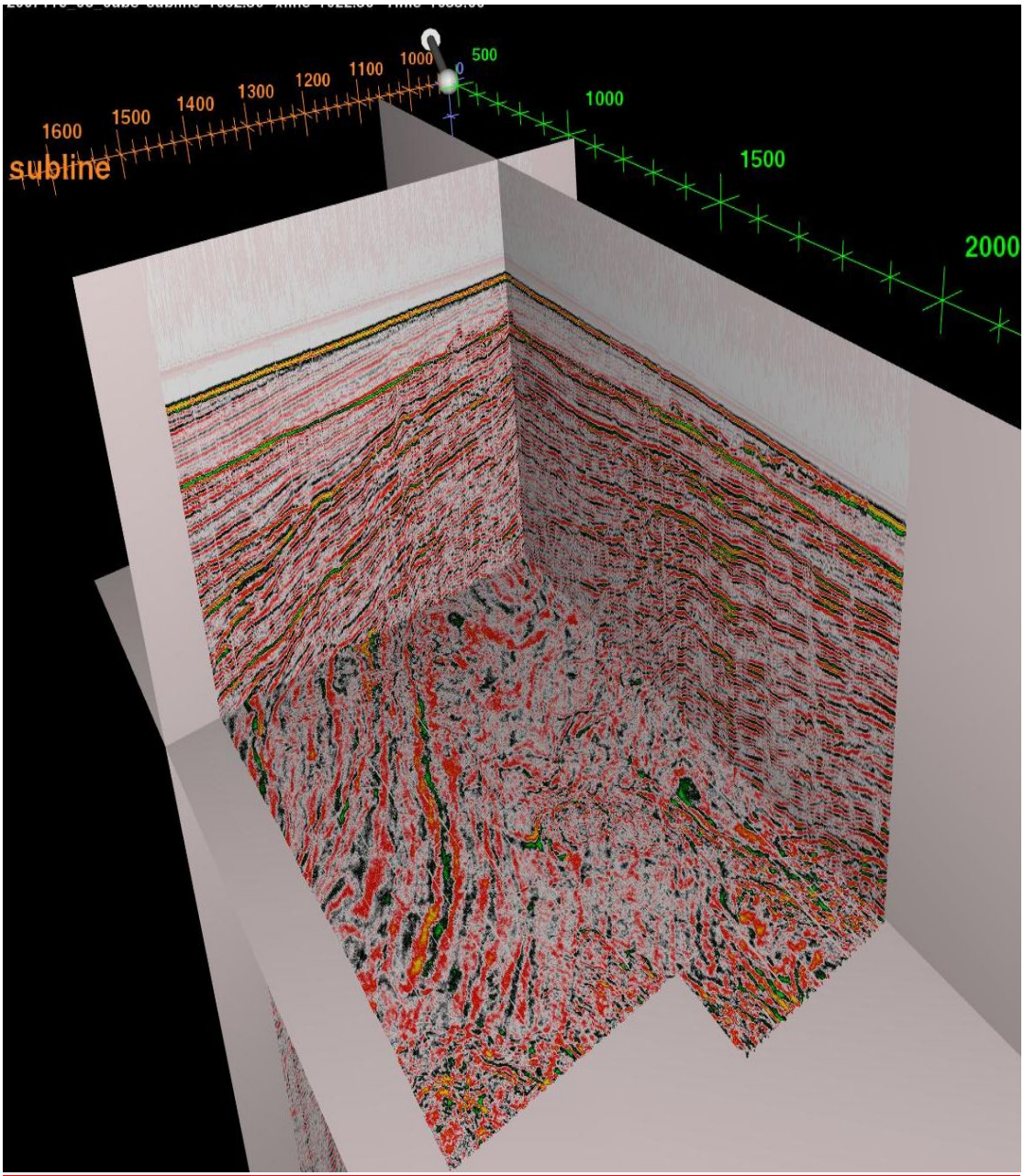
Line SOSN08B1198P1026 Streamer 1 Port Source



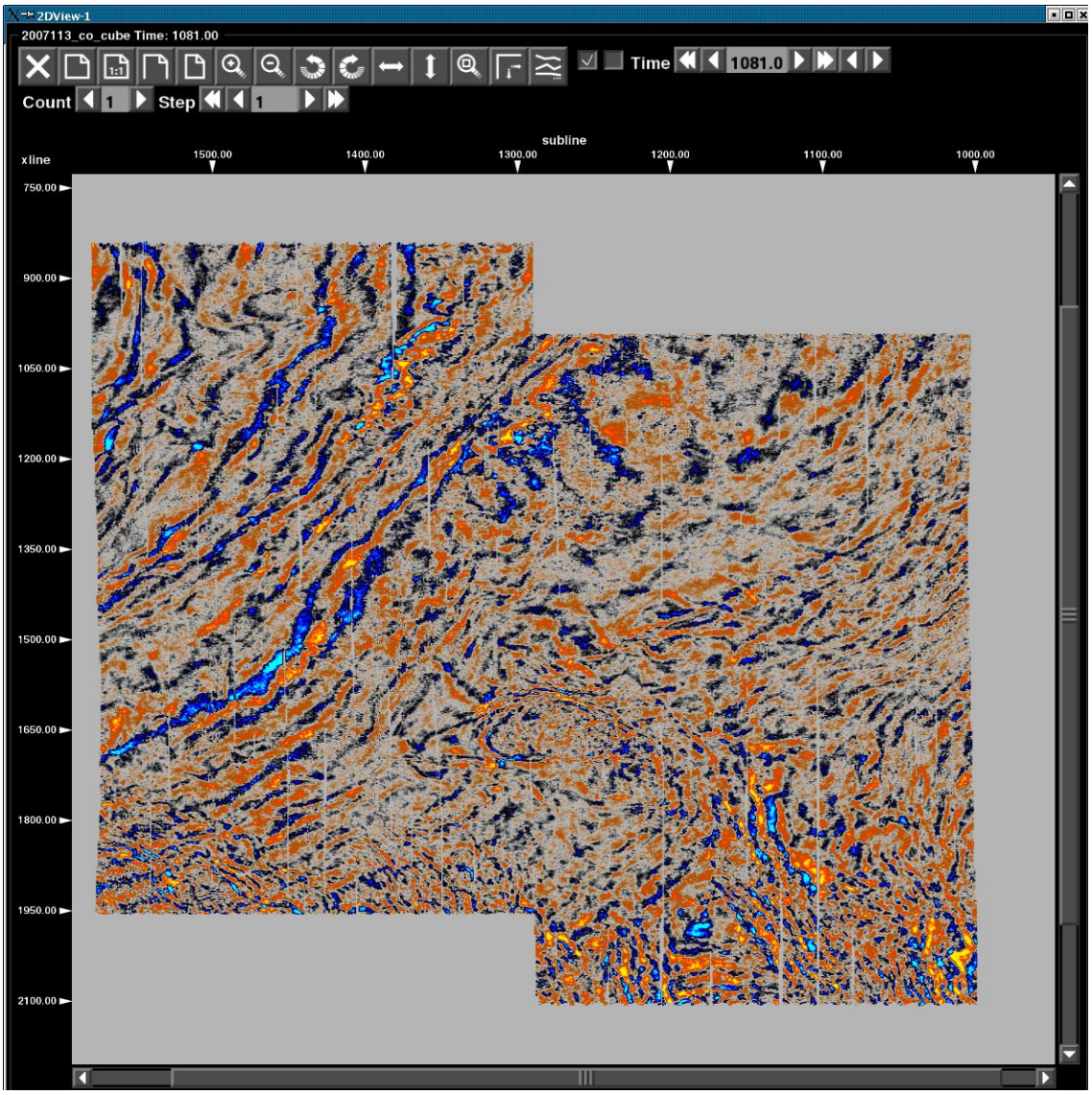
9.12 Common offset cube

The common offset cube was created using PGS' proprietary 'HoloSeis' 3D visualisation program. The main purpose of the cube analysis was to assist with QC of the navigation data after having been merged with seismic. The appearance of miss-ties or busts between lines in the cube could indicate problems with the navigation data.

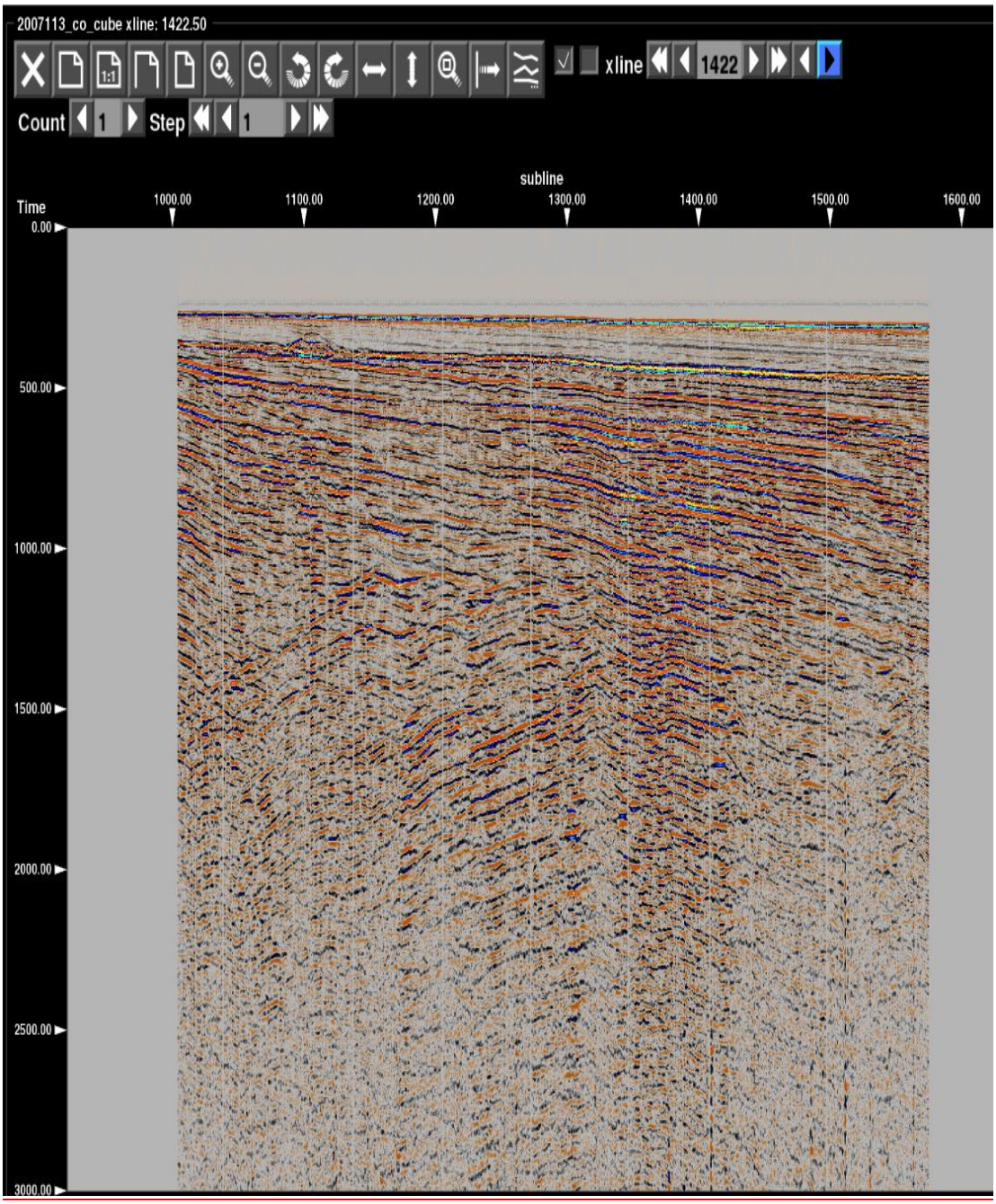
Holoseis plane view



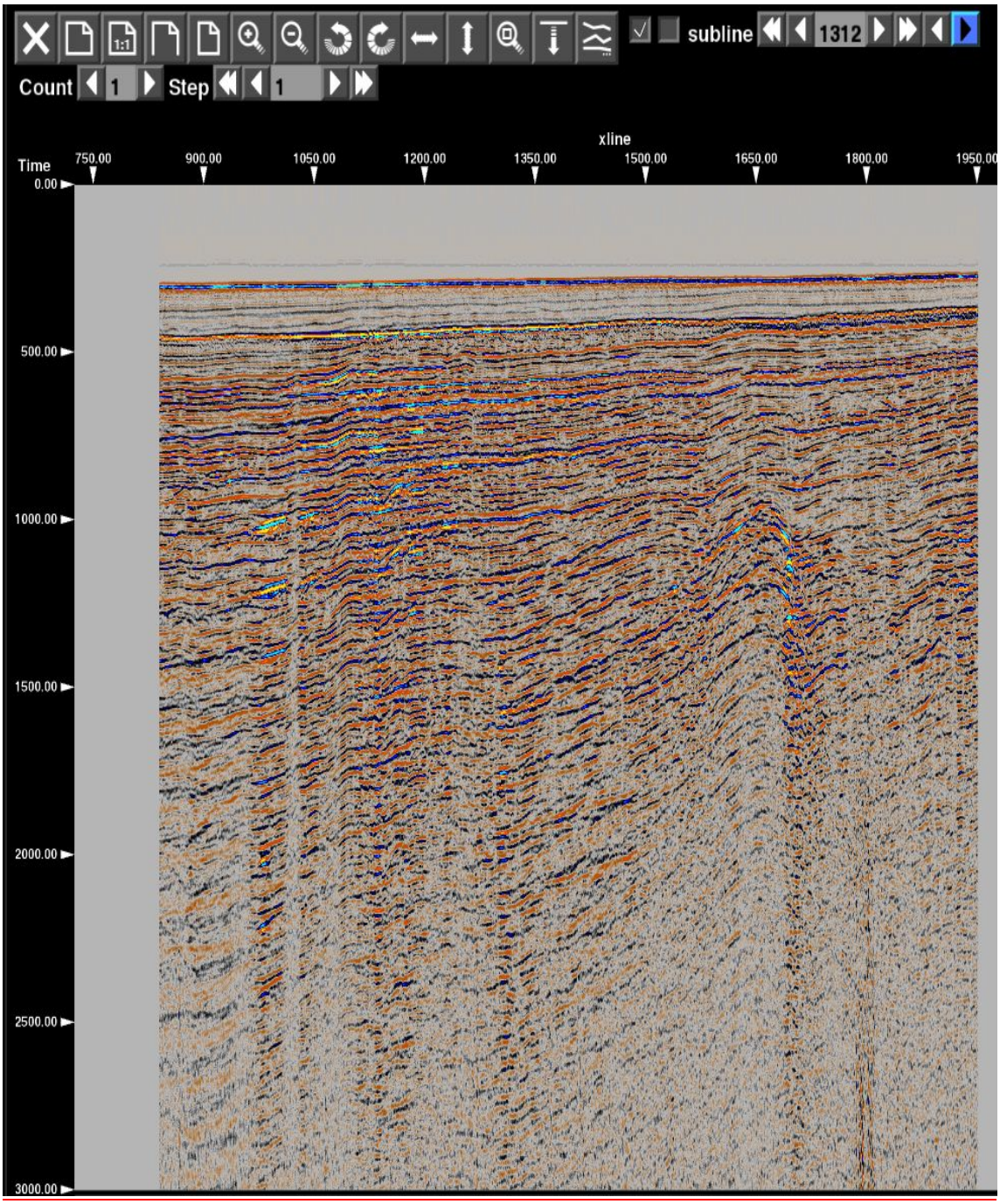
Time-slice at 1081ms



Cross-line at SP 1422



Inline 1312

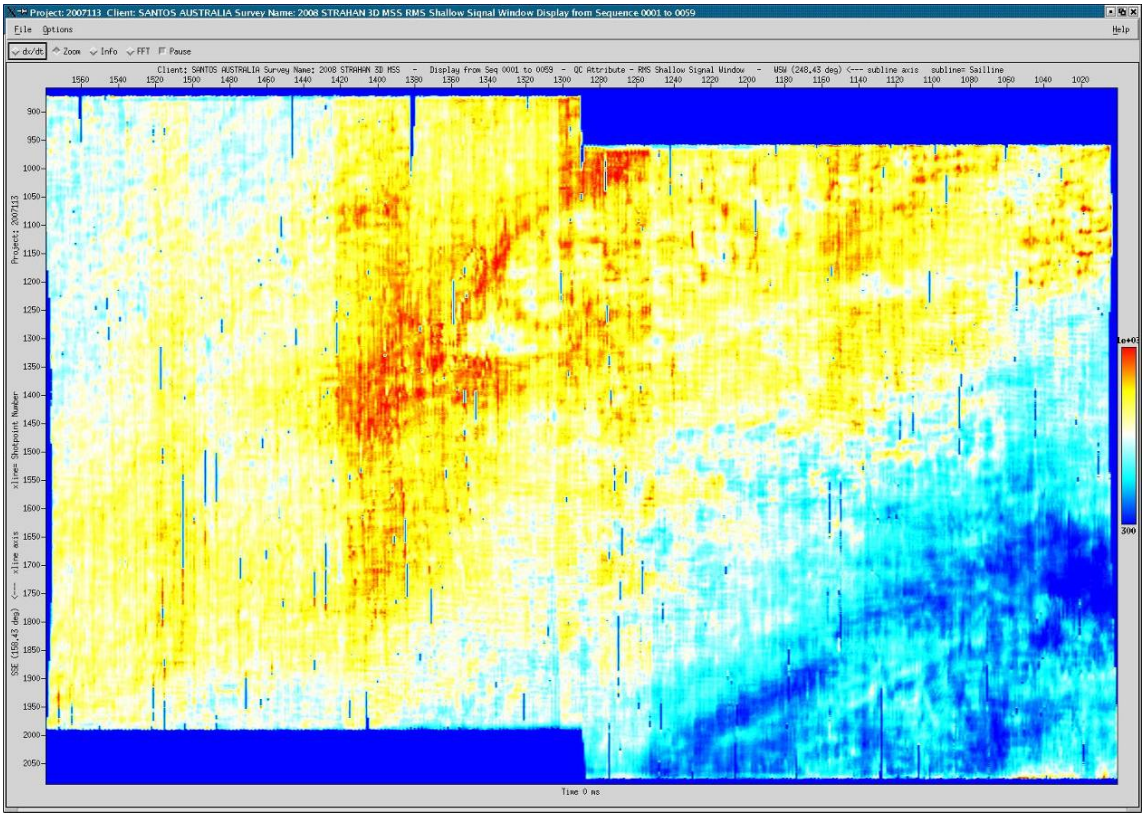

subline
1312
Count
1
Step
1
xline
Time
750.00
900.00
1050.00
1200.00
1350.00
1500.00
1650.00
1800.00
1950.00
0.00
500.00
1000.00
1500.00
2000.00
2500.00
3000.00

9.13 Seismic data attributes

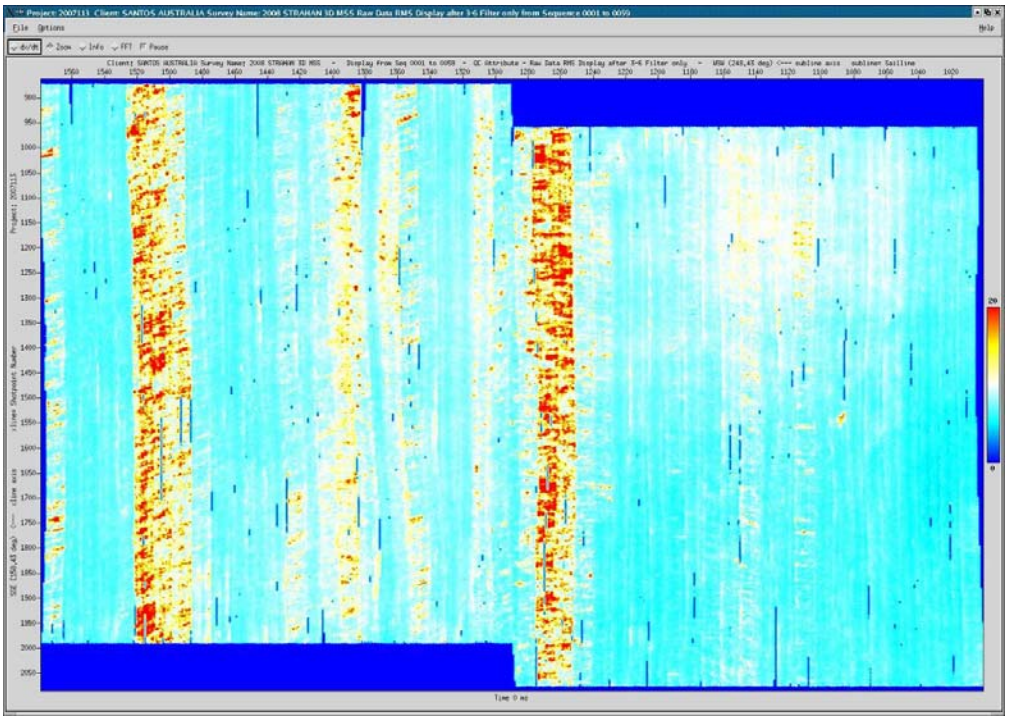
A number of attributes were calculated and binned both using holoseis and viper BinXYZ attribute handling to allow for investigation of streamer to streamer comparison and line to line comparison and matching over the whole survey.

RMS attributes were frequently investigated to quantify marginal lines with other lines previously accepted.

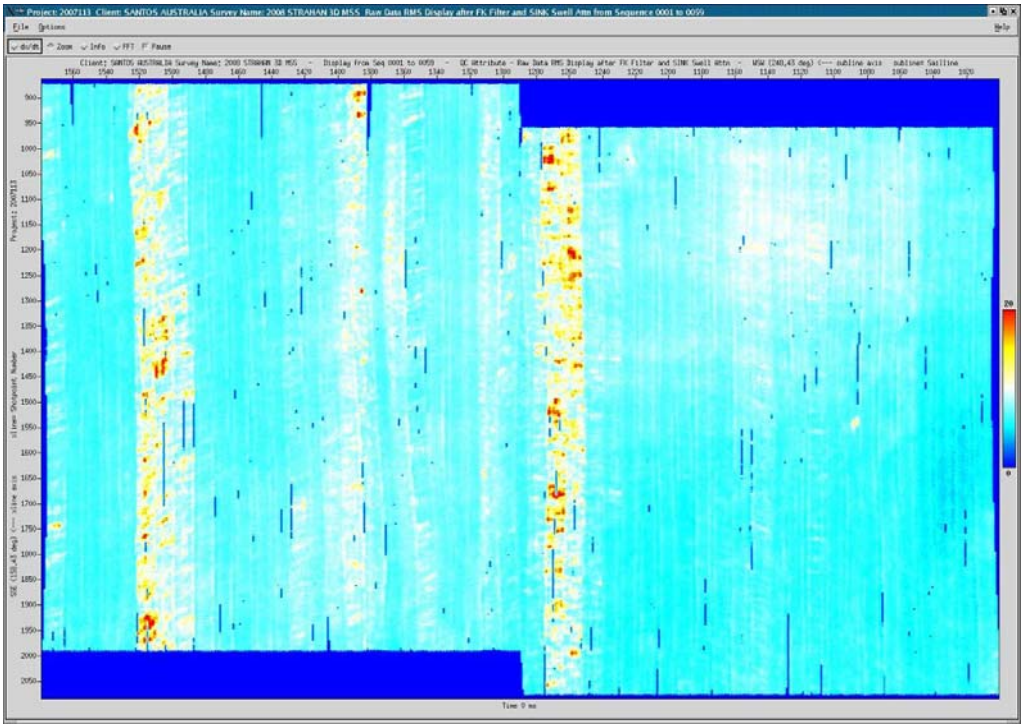
RMS signal window



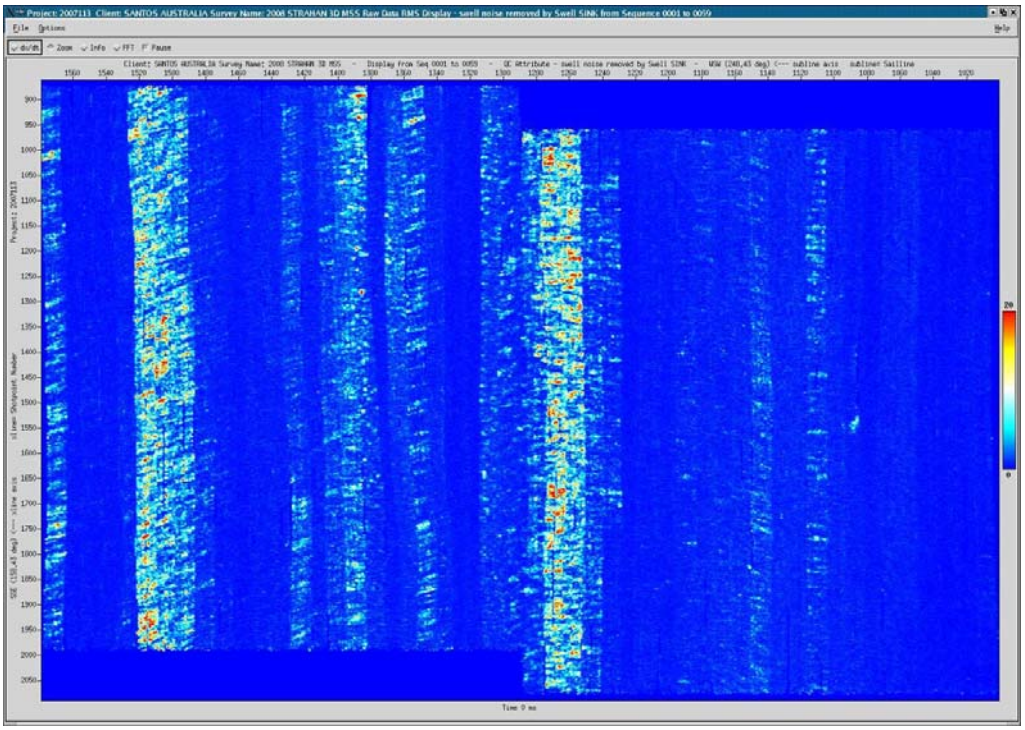
Raw RMS noise



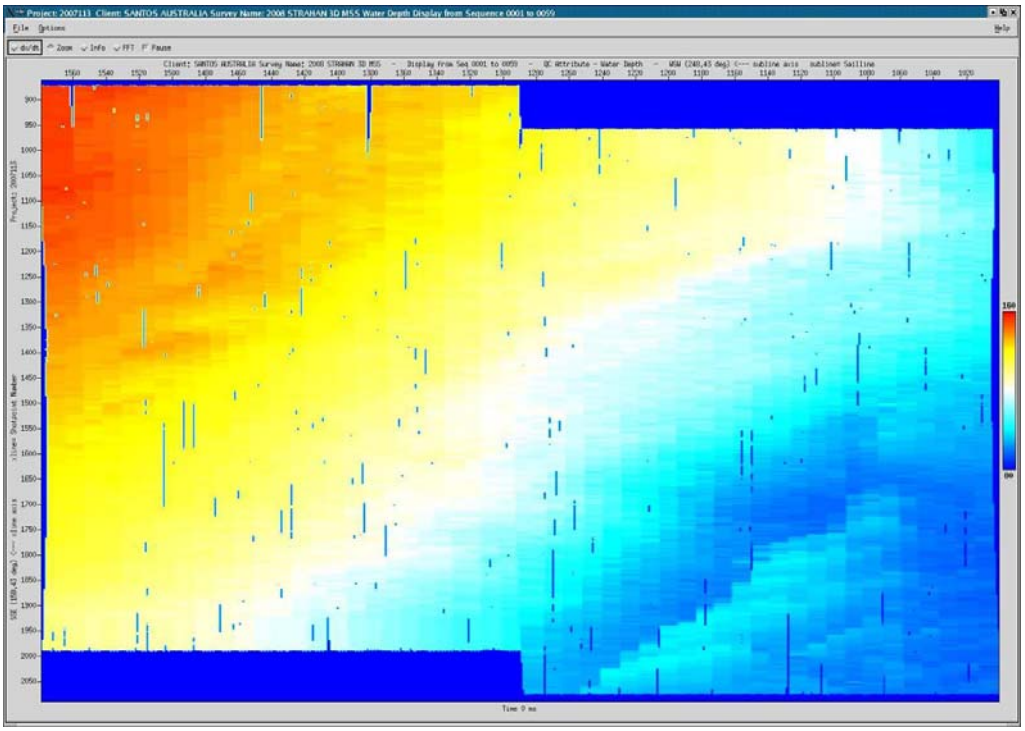
RMS after FK and swell SINK applied



Noise removed by FK and SINK



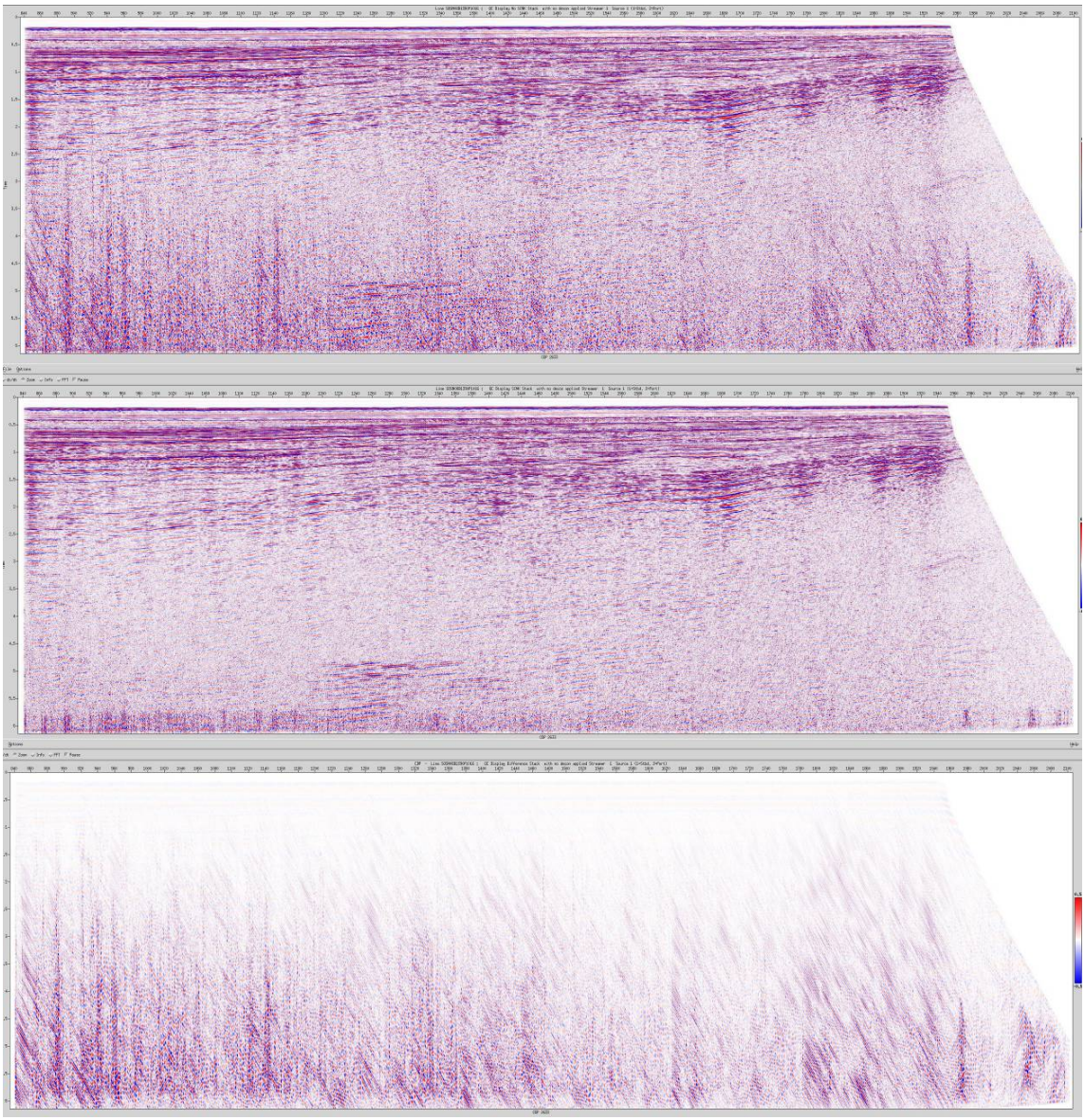
Water depth [m]



9.14 Brute Stack Data

An example brute stack display is shown below.

Screen display stacks SOSN08B1390P1016, streamer 1 starboard source. This was one of the noisier lines. The weather came up towards EOL. Raw no decon brute stack (top), FK SINK stack (middle) and Stack difference (bottom):



10 QC

The gAS acquisition system was used to monitor and record data in real time. The VIPER processing system was then utilised for the subsequent offline QC processing. Problems that occurred during production were investigated using all means available.

10.1 2.0 Online QC

Real-time RMS calculations were performed by the online gAS QC system for all channels of each shot, in five different time windows, as defined and explained in the section "RMS and noise analysis".

The PGS gAS acquisition system was used to provide real-time online QC displays that included:

- 2 x shot gathers, rotating through all streamers for every shot plus a further shot display fixed on one streamer.
- 'End of Record' and 'Water Column' RMS displays indicating the RMS levels of each channel for each shot point, for all 6 streamers. This enabled ambient noise estimates to be made, and external noise, such as ship noise, to be quantified.
- Cable depth variations display.
- Shot-to-shot difference display, for random noise analysis.
- Single near trace display, at full record length.
- Line graph display of gun volume, gun pressure and gun depth.
- Full-length auxiliary trace display from every gun hydrophone for the current shot.
- Stacked auxiliary trace display at full record length for each active shot, used for auto-fire detection.
- 2 x layered hydrophone display (one port array, and one starboard array) of the first 150ms of each auxiliary trace, for monitoring any variation in the gun signature along the line.
- Time break single trace display.

10.2 Offline QC

At the end of each line, as a minimum, the following displays were produced:

- Screen displays of one shot/km rotating through streamers
- RMS noise screen displays for bad channels and other noise analysis
- RMS signal screen displays for traces that might be weak
- Graphical RMS noise display of average channel RMS
- Stacked auxiliary near field phone data on screen for auto-fire analysis
- Layered hydrophone display of top 300ms of auxiliary hydrophone data to monitor variations in gun signature which might indicate an air leak or sub-array separation problem as well as a comparison with recent other line sequences to check for a possible signature change between lines
- Recorded time break screen display
- 'Smash Stack' shot-domain stacked data screen display to highlight any electrical cross-feed in particular.
- 2D Brute Stack paper plot.
- First break display with overlaid navigation offset on screen for comparison.

Further investigations were carried out as needed.

10.2.1 2D QC brute stack

A brute stack was produced for each line sequence in order to assess how noise interference (e.g. ship noise, swell noise, strum noise etc.) was likely to affect the final processed data.

Brute Stack Processing Sequence

Transcription	From SEGD to Viper internal format
Static Correction	Skew correction (< 1ms) for continuous recording system
Geometry Assignment	Nominal 2D geometry (from preplot)
Select	One Source/Streamer combination for stack
Edit (zero)	Bad channels, Bad shots
Static Correction	–58 ms filter delay
High-pass filter	3-6 Hz
SINK	Swell or SI noise attenuation processing (if required)
Amplitude Recovery	T^2 gain (using average velocity)
Mute	First break mute
NMO Correction	Picked velocity function over a 2x2km grid
Mute	Post-NMO mute
Stack	Stack CDP gathers
Static Correction	gun and cable static to mean sea level
Display	Paper plot/screen display (with adjacent trace averaging before plotting)

10.2.2 Navigation / seismic merge QC

A near trace dataset was merged with the final P1/90 files for all streamers. The navigation-derived first break was overlaid on the seismic near trace for each streamer and checked on screen. The measured sound velocity was used to determine the calculated arrival time from the P1/90 offset.

10.2.3 Common offset cube

A second P1/90 QC step was to build a 3-fold common offset (CO) cube to check for anomalies and miss-ties between sail lines on cross-line sections and time-slices.

For each source/streamer combination, one trace was selected by offset (~ 350m) and merged with P1/90 positional data then loaded to the common offset cube. The data was pre-processed and truncated to 3000 ms prior to loading. Once loaded to the cube, inline, cross-line and time-slice displays were viewed to check for potential navigation merge errors.

The cube was viewed using PGS' HoloSeis software package in full 3D. This software makes it possible to view all inline, cross-line and time slices, and permits interactive rotation, translation and stretch of the 3D common offset cube to enable a more detailed analysis of the data.

10.3 Computer systems

The Viper system hardware on the Pacific Explorer is set up as follows…

- 2 x IBM x3650 nodes (2 x dual core processors/node, each node having 4 gb of RAM and 3 x 75gb disk drives) [mamba, python]. There is also 6.5 tb of external RAID disk attached to the mamba node.
- 3 x IBM x335 nodes (dual 2.8 GHz Intel Xeon processors/node, each node having 1.5 Gb of RAM and 2 x 146 GB SCSI disk drives) [Cpu01, Cpu02, Cpu03]
- 2 x Dell Precision 470 node (dual 3.0 Ghz Intel Xeon, with 3.84Gb of RAM and 2 x 360 Gb disks) [Hol01, Hol02]

Viper Node Configuration	
MAMBA:	Data-capture node, with real-time link to gAS recording system Control workstation Data-Processing node
PYTHON:	Data-Processing node and spare mamba replacement
CPU01:	Data-Processing node 3 IBM 3592 tape drive attached 2 IBM 3590 tape drive attached
CPU02:	Data-Processing node 1 IBM 3592 tape drive attached 2 IBM 3590 tape drive attached
CPU03:	Data-Processing node
HOL01:	Data-Processing node HoloSeis 3D viewing node
HOL02:	Data-Processing node HoloSeis 3D viewing node

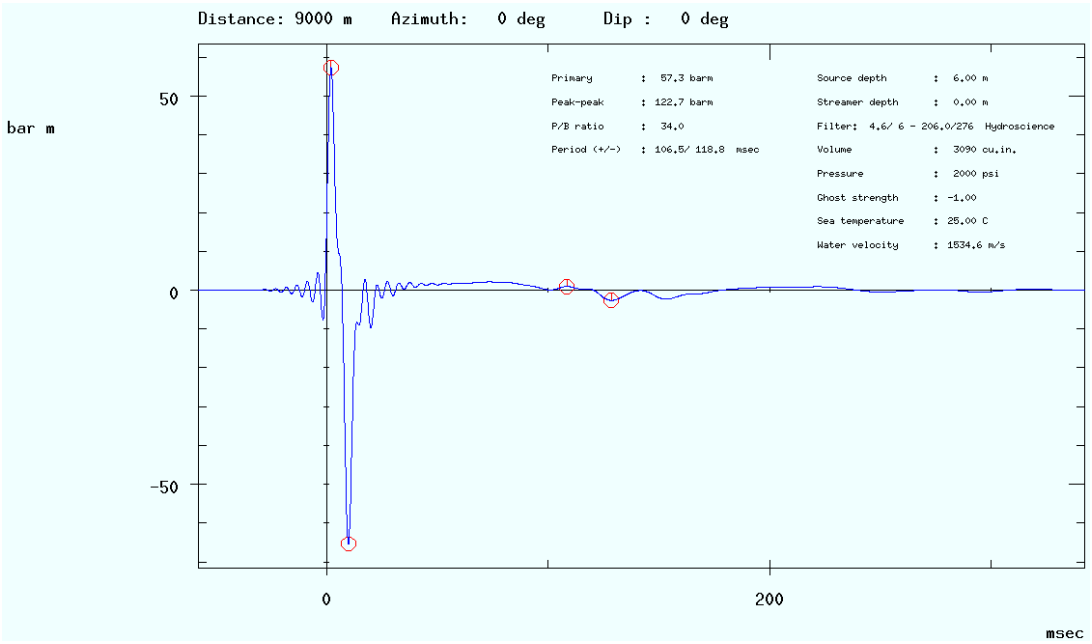
This system runs Viper V4.0.2-3, a data QC and pre-processing suite of software tools on the CentOS v4 Red Hat operating system.

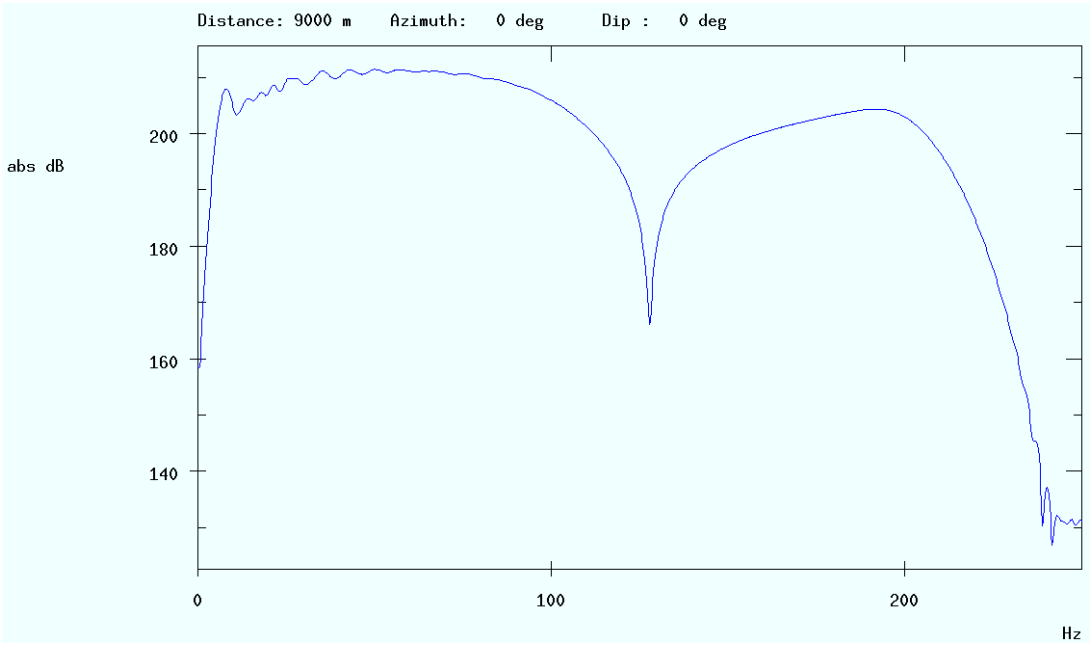
11.0 Appendix

11.1 Data shipments

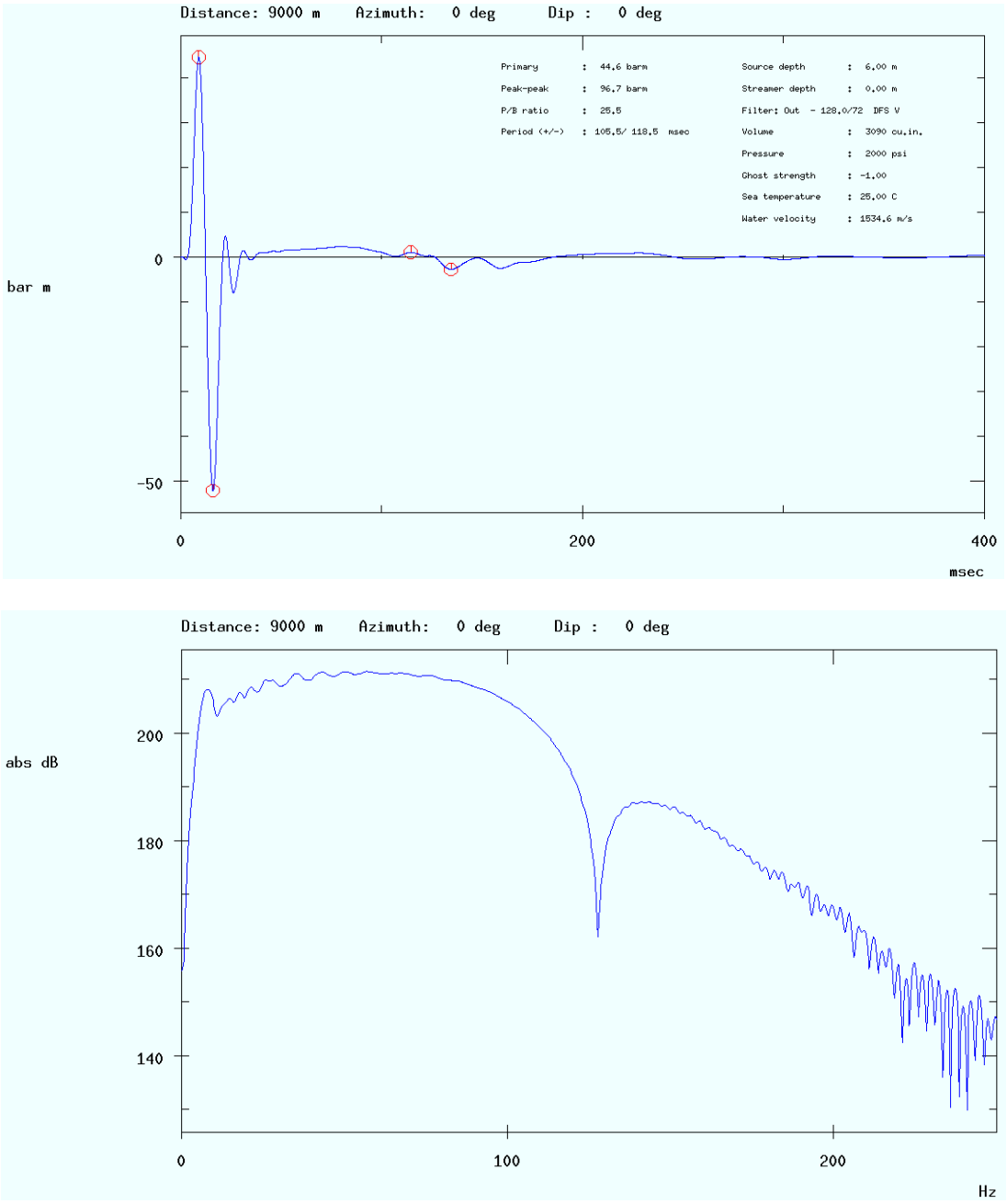
Date	Proforma	Content	Boxes	Wt	Shipping address	Comment
23rd April 08	PAC13003728A	59x 3592 data tapes (data set 1) 2 x P294 tapes 2 x P190 tapes 1 x DVD containing observer logs Project 2007113	4	23 Kg	CGG Veritas 1st Floor, 38 Ord Street, West Perth, WA, 6872 Attn: Tony Weatherall Tel: +62 21 7698038 Fax: +62 21 7698015	Via NT Shipping Agencies PTY Ltd PO BOX 443 0828 Berrimah NT Australia Attn: Robbie Robertson Tel +61 8894 72570 Fax +61 8894 72640
To be shipped Singapore?	PAC13003729A	59x 3592 data tapes (data set 2) 2 x P294 tapes 2 x P190 tapes 1 x DVD containing observer logs Project 2007113	4	23 Kg	Santos Ltd c/o Toll Priority, Basement, 191 Pultney Street, Adelaide S.A. 5000 Attn: Nick Papanicolaou Tel: +61 8 8116 7833 Fax: +61 8 8116 7258	Via NT Shipping Agencies PTY Ltd PO BOX 443 0828 Berrimah NT Australia Attn: Robbie Robertson Tel +61 8894 72570 Fax +61 8894 72640
13.May 2008	NP32/2008	P190 ves file P190 echo file wd corr for draft/ sound/tide(MSL) Vespos plot, paper Contour plot paper Coverage plots Noflex, paper P698 CD with p190files/plotfiles Cgm/pdf	1		Santos Ltd c/o Toll Priority, Basement, 191 Pultney Street, Adelaide S.A. 5000 Attn: Nick Papanicolaou Tel: +61 8 8116 7833 Fax: +61 8 8116 7258	DHL

11.2 Source modelling



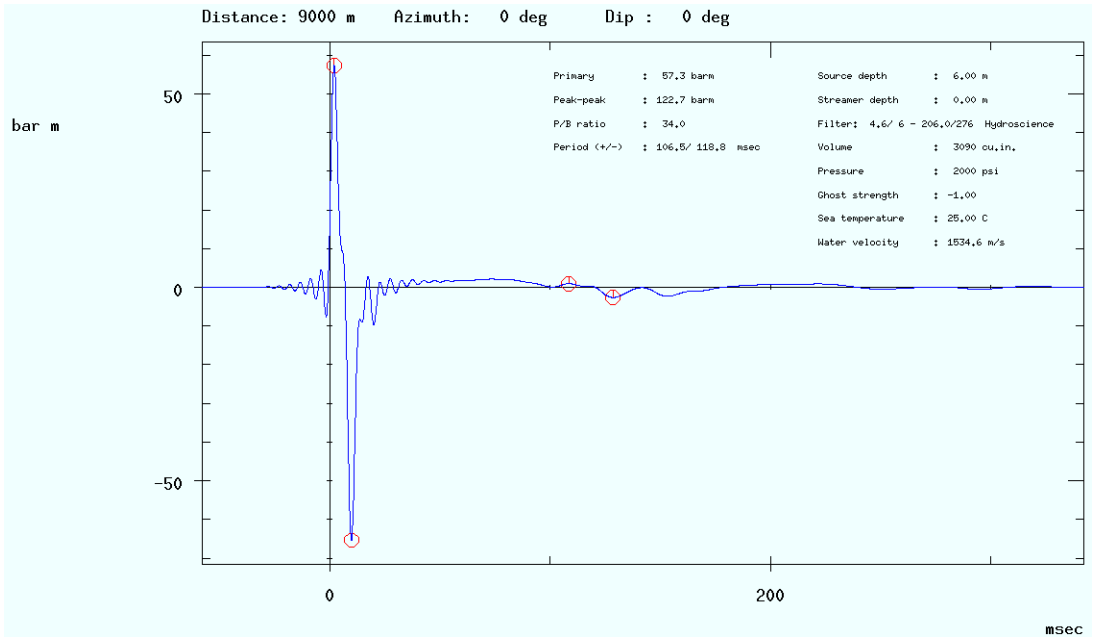


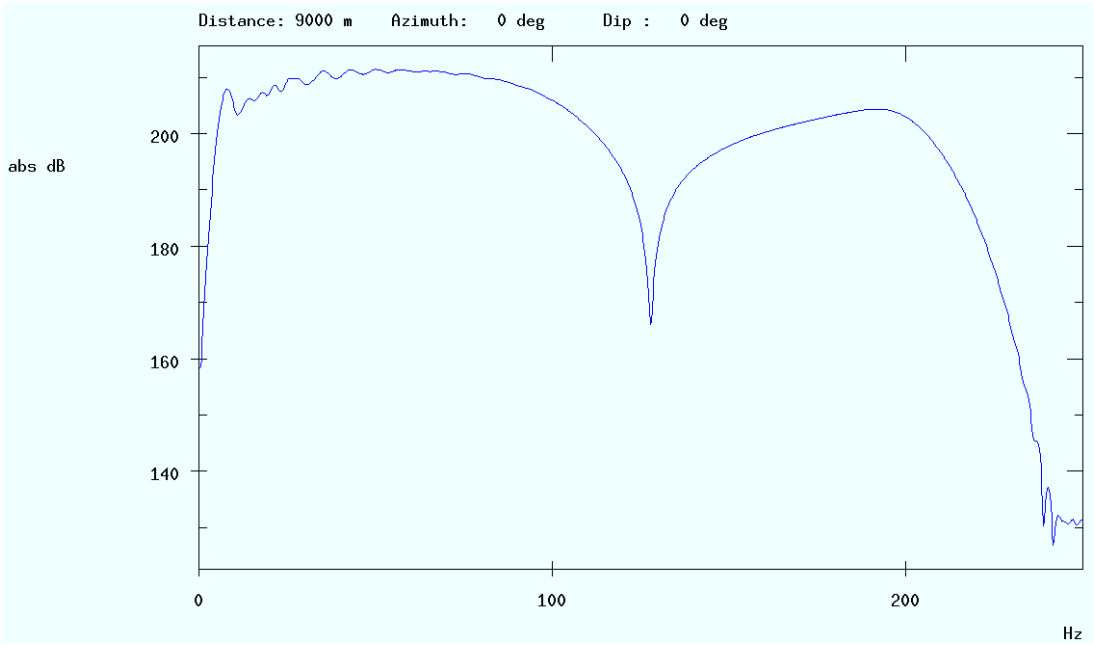
Modeled far-field signature and amplitude spectrum with Hydroscience recording filter (without receiver ghost).



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

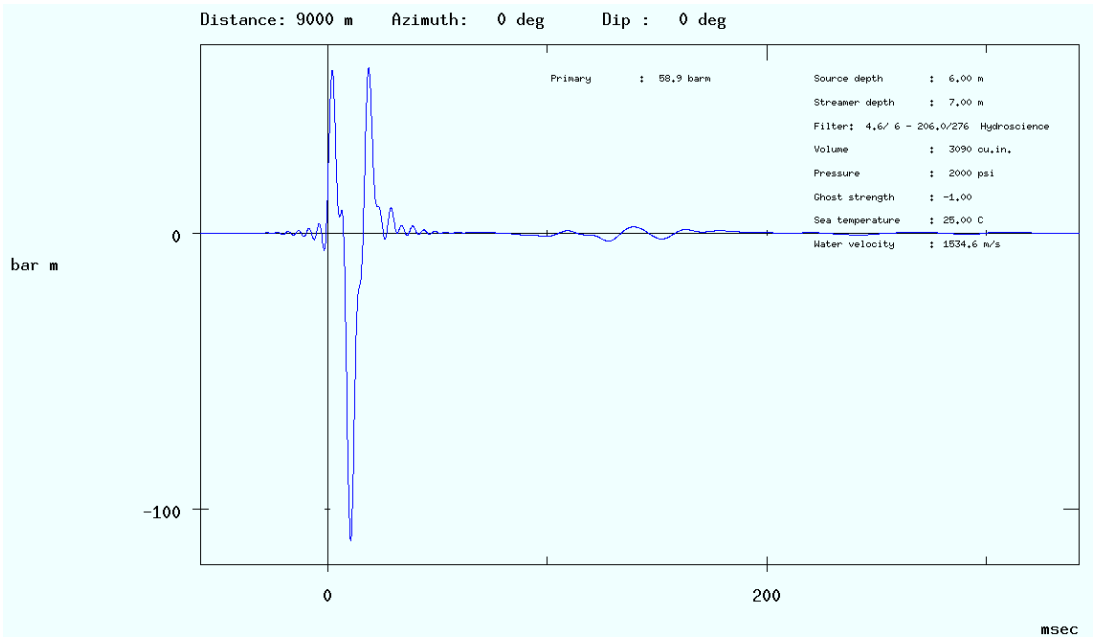
Full system response with source ghost only

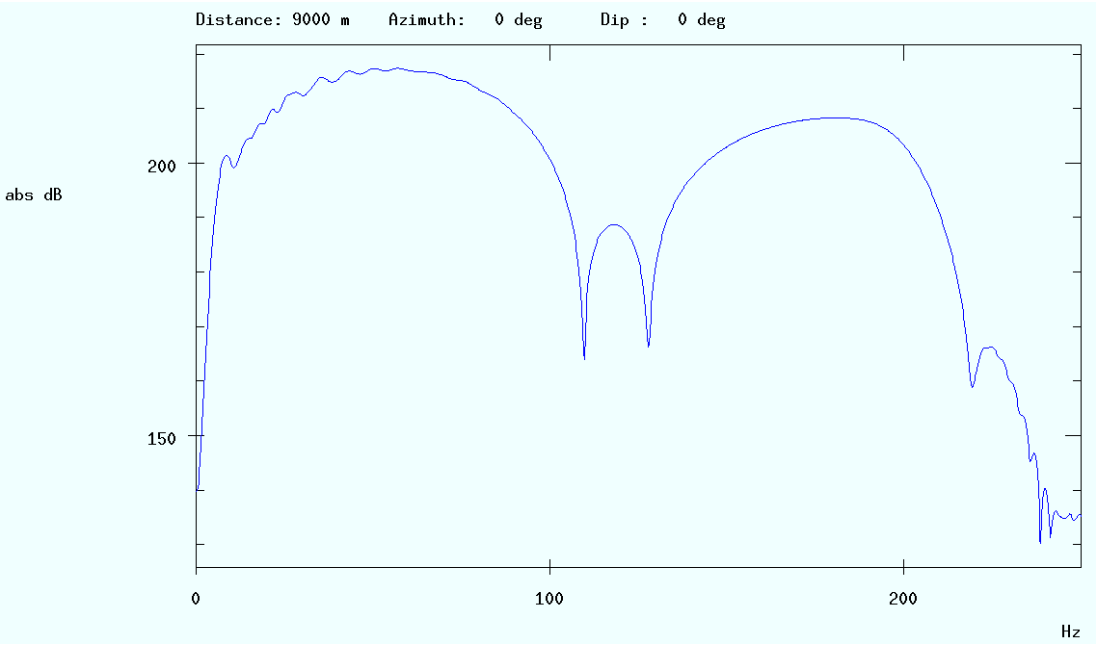




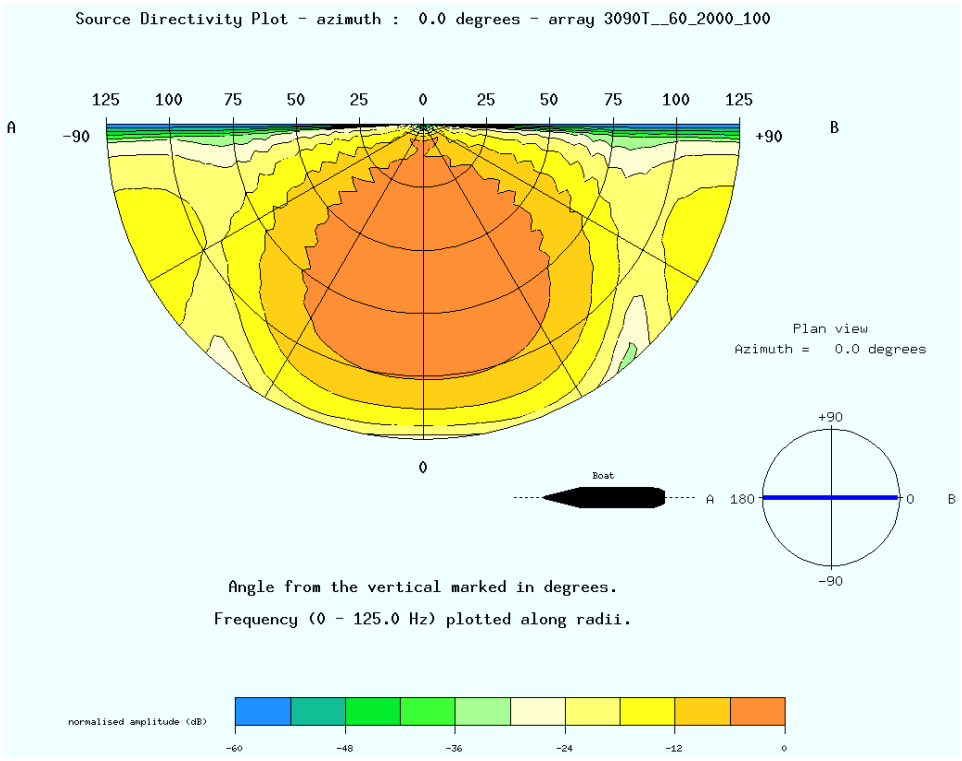
Modeled far-field signature and amplitude spectrum with full system response filter effect applied (without receiver ghost).

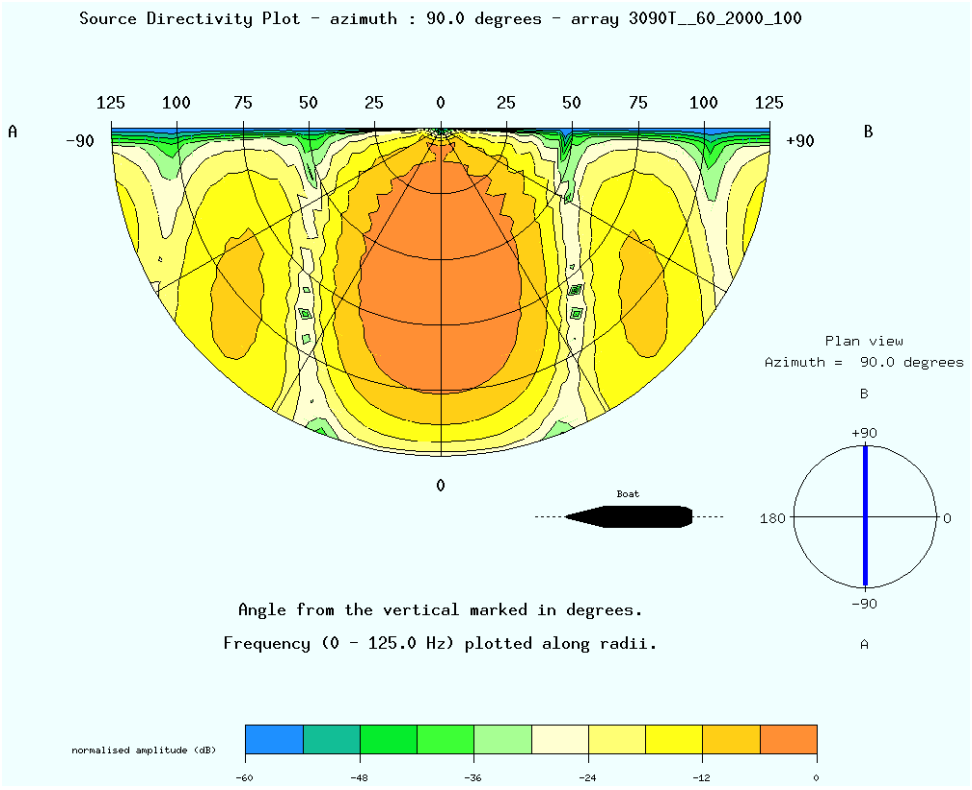
Full system response with source and receiver ghost





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





Directivity plot for constant azimuth of 0° and 90°.

11.3 SEG-D header

GENERAL HEADER #1		Starting byte 0
Bytes	Description	Value
01-02	File Number	399
03-04	SEGD Format	8036
	Bits Per Sample	24
05-10	General Constants	
11	Year	2008
12	Additional Header Blocks	2
12-13	Day	83
14	Hour	8
15	Minute	6
16	Second	42
17	Manufacturer's Code	41
18-19	Manufacturer's Serial Number	14
20-22	Not Used	
23	Base Scan Interval (ms)	2.0
24	Polarity	
25	Scan/Block Exponent	
26	Record Type	Normal Record
27	Record Length (ms)	170496
28	Scan-types / Record	1
29	Channel Sets/Scan Type	7
30	Skew Blocks	0
31	Extended-Header Blocks	0xFF
32	External-Header Blocks	0xFF

GENERAL HEADER #2		Starting byte 32
Bytes	Description	Value
01-03	Expanded File Number	0
04-05	Extended Channel Sets	0
06-07	Extended Header Blocks	890
08-09	External Header Blocks	119
10	Reserved	
11-12	SEG-D Revision Number	Rev. 0.0
13-14	General Trailer	
15-17	Extended Record Length	200
18-19	General Header Block Number	2
20-31	Reserved	
32	Extended Record Length	6

11.4 P1/90 header

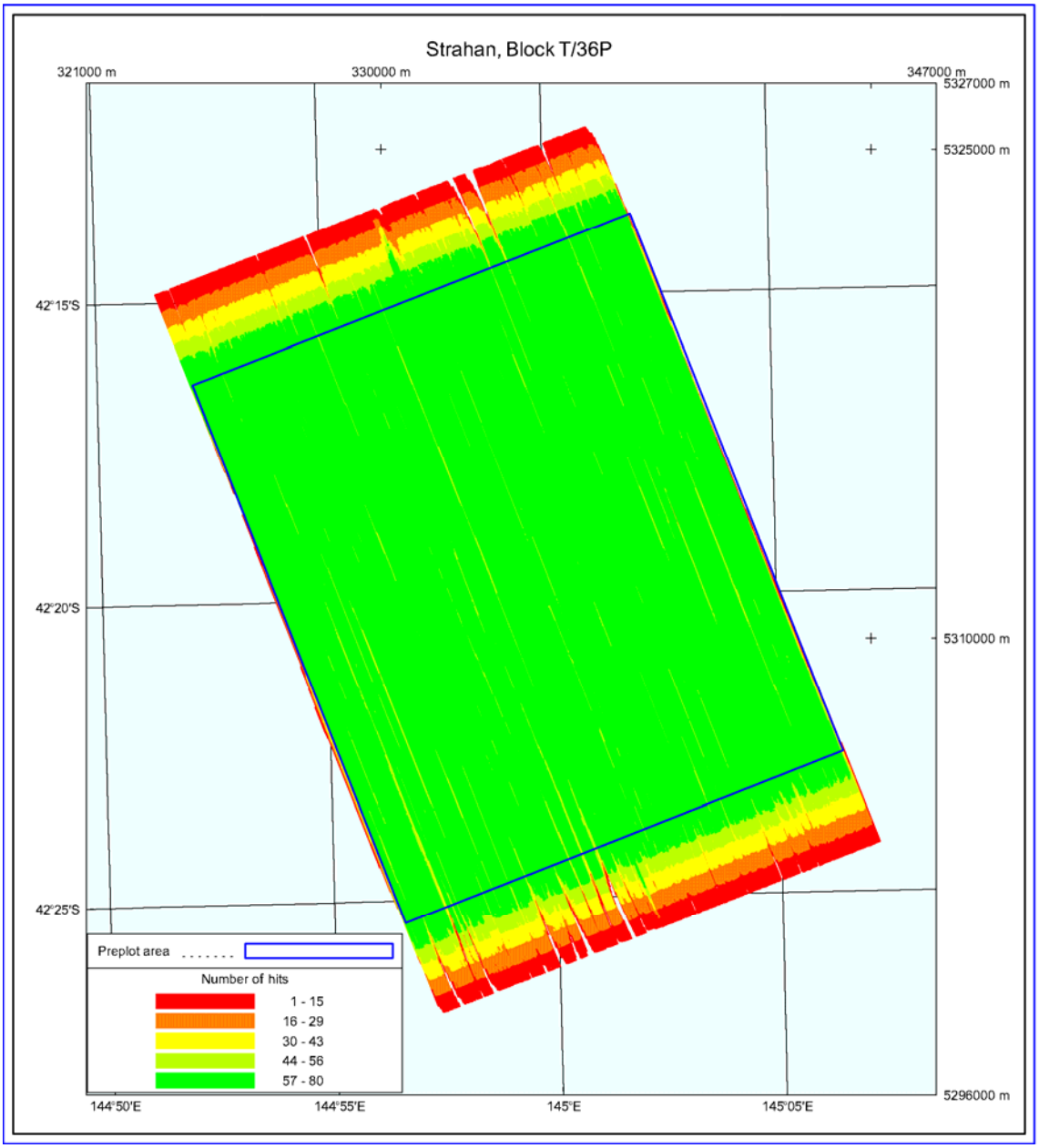
```
H0100 AREA                      BLOCK T/36P - TASMANIA AUSTRALIA
H0101 GENERAL SURVEY DETAILS    3D, SINGLE VESSEL, DUAL SOURCE, SIX STREAMERS
H0102 VESSEL DETAILS            PACIFIC EXPLORER           1
H0103 SOURCE DETAILS            STBD SOURCE                1   1
H0103 SOURCE DETAILS            PORT SOURCE                1   2
H0104 STREAMER DETAILS          STREAMER 1 480CH           1       1   1
H0104 STREAMER DETAILS          STREAMER 2 480CH           1       2   2
H0104 STREAMER DETAILS          STREAMER 3 480CH           1       3   3
H0104 STREAMER DETAILS          STREAMER 4 480CH           1       4   4
H0104 STREAMER DETAILS          STREAMER 5 480CH           1       5   5
H0104 STREAMER DETAILS          STREAMER 6 480CH           1       6   6
H0105 OTHER DETAILS             N/A
H0200 DATE OF SURVEY            29 MAR 2008 - CONTINUING
H0201 DATE OF ISSUE OF TAPE     -- ---- ----
H0202 TAPE VERSION IDENTIFIER   ------------
H0203 LINE PREFIX               SOSN08B
H0300 CLIENT                    SANTOS AUSTRALIA
H0400 GEOPHYSICAL CONTRACTOR    PGS GEOPHYSICAL - MARINE ACQUISITION
H0500 POSITIONING CONTRACTOR    FUGRO SURVEY AS
H0600 POSITIONING PROCESSING    PGS GEOPHYSICAL - MARINE ACQUISITION
H0700 POSITIONING SYSTEM        NAV SYSTEM 1: STARFIX.HP  SPM_4.26
H0700 POSITIONING SYSTEM        NAV SYSTEM 2: SKYFIX.XP   MULTIFIX 4 V2.01 XP
H0700 POSITIONING SYSTEM        INTEGRATED NAV SYSTEM: SPECTRA VERSION 10.9.01
H0800 COORDINATE LOCATION       CENTER OF SOURCE
H0900 OFFSET SYS TO NAV REF PT     1   2    0.00    0.00
H0901 OFFSET SYSTEM TO SOURCE 1    1   2   25.00 -330.00
H0902 OFFSET SYSTEM TO SOURCE 2    1   2  -25.00 -330.00
H0903 OFFSET SYSTEM TO E/S    2    1   2    2.48   31.72
H1000 CLOCK TIME                GMT
H1100 RECEIVER GROUPS PER SHOT  2880
H1400 GEODETIC DATUM AS SURVEY  WGS84       WGS84        6378137.000 298.2572236
H1401 DATUM SHIFT WGS84 TO WGS84   0.0   0.0   0.0 0.000 0.000 0.000 0.0000000
H1500 GEODETIC DATUM POST PROC  WGS84       WGS84        6378137.000 298.2572236
H1501 DATUM SHIFT WGS84 TO 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            ES                      ECHO SOUNDER POSITION
H1800 PROJECTION                002 U.T.M SOUTH
H1900 ZONE                      55
H2000 GRID UNITS                1 INTERNATIONAL METERS    1.000000000000
H2001 HEIGHT UNITS              1 INTERNATIONAL METERS    1.000000000000
H2200 CENTRAL MERIDIAN          147 0 0.000E
H2600*****************************************************************************
H2600 THE Z OFFSET OF THE ECHO SOUNDER TRANSDUCER IS -6.36 METERS FROM THE
H2600 VESSEL REFERENCE POINT AT SEA LEVEL. TRANSDUCER DEPTH CORRECTIONS WERE
H2600 NOT APPLIED TO WATER DEPTHS.
H2600
H2600 THE SOUND VELOCITY SET IN THE ECHO SOUNDER WAS 1500 METERS/SECOND.
H2600 THE WATER DEPTH DATA HAS BEEN DESPIKED.
H2600 THE ECHO SOUNDER DEPTH DATA HAS BEEN CORRECTED FOR HEAVE PRIOR TO BEING
H2600 PASSED TO THE INTEGRATED NAVIGATION SYSTEM.
H2600*****************************************************************************
H2600             FORMAT OF SHOT RECORDS
H2600      COLUMN           DESCRIPTION
H2600           1           'V', 'E', 'Z', 'S', 'T'
H2600                       V= VESSEL REFERENCE POINT
H2600                       E= ECHO SOUNDER
H2600                       Z= INDIVIDUAL SOURCE POSITION
H2600                       S= CENTER OF SOURCE
H2600                       T= TAILBUOY POSITION
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*******************************************************************************
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*******************************************************************************
H2600 STREAMER AND TAILBUOY NUMBERING INCREMENTS FROM STARBOARD TO PORT
H2600
H2600 STREAMER  1: RECEIVERS NUMBERED  480 (FAR) TO    1 (NEAR)
H2600 STREAMER  2: RECEIVERS NUMBERED  960 (FAR) TO  481 (NEAR)
H2600 STREAMER  3: RECEIVERS NUMBERED 1440 (FAR) TO  961 (NEAR)
H2600 STREAMER  4: RECEIVERS NUMBERED 1920 (FAR) TO 1441 (NEAR)
H2600 STREAMER  5: RECEIVERS NUMBERED 2400 (FAR) TO 1921 (NEAR)
H2600 STREAMER  6: RECEIVERS NUMBERED 2880 (FAR) TO 2401 (NEAR)
H2600
H2600 STREAMER ROTATIONS HAVE BEEN APPLIED ON A SHOT BY SHOT BASIS.
H2600
H2600 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*******************************************************************************
H2600 NAVQC
H2600*******************************************************************************
H2600 PGS JOB NUMBER 2007113
H2600
H2600 LINES CONTAINED IN THIS FILE:
H2600
H2600 LINE: --------              SEQUENCE:  ---   FSP:   ----   LSP:   ----
H2600
H2600 FOR SEISMIC DATA EDIT, PLEASE SEE THE OBSERVERS LOG
H2600
```

11.5 P6/98 Full fold coverage perimeter

```
H0100 3D SURVEY NAME            Strahan,Block T/36P Australia
H0200 BIN GRID DESCRIPTOR       PREPLOT
H0300 GEODETIC DATUM NAME       WGS84
H0400 ELLIPSOID-AXIS-INV FLAT   WGS84        6378137.000 298.2572236
H0500 PROJECTION METHOD          002  U.T.M. SOUTH
H0510 PROJECTION ZONE NAME      ZONE 55
H0530 LON OF CM (DMS E/W)        1470000.000E
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)        337627.58E   5323028.35N
H1000 SCALE FACTOR AT (I,J)     1.00000000000      1.0000      1.0000
H1100 NOM BIN WIDTH ON I AXIS    25.0000
H1150 NOM BIN WIDTH ON J AXIS    18.7500
H1200 GRID BEAR J AXIS (DMS)     1582548.000
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   1119.0000    338440.98  5320970.79
H1401 COORDS (LAT,LON) FST NODE   421448.279S  1450230.022E
H1410 COORDS (I,J,E,N) SEC NODE   1001.0000   1474.0000    340888.07  5314780.69
H1420 COORDS (I,J,E,N) GEN PNT    1289.0000   1474.0000    334192.29  5312133.70
H2300 DATA EXTENT BIN GRID        1947.0000   1001.0000   1577.0000   1001.0000
H2400 DATA EXTENT MAP GRID        5323028.35  5301239.04   344148.55   324236.02
H2501 DATA EXTENT GEOG (N/S)      421341.000S   422521.753S
H2502 DATA EXTENT GEOG (E/W)     1450624.940E  1445207.024E
H2700 NUMBER OF PERIMETERS       1
H3101 FULL FOLD COV # OF NODES     3
H3201 FULL FOLD COV (I,J,E,N)     1577.0000   1001.0000    324236.02  5317734.37
H3201 FULL FOLD COV (I,J,E,N)     1001.0000   1001.0000    337627.58  5323028.35
H3201 FULL FOLD COV (I,J,E,N)     1001.0000   1947.0000    344148.55  5306533.02
H3201 FULL FOLD COV (I,J,E,N)     1577.0000   1947.0000    330757.00  5301239.04
H8002 EPSG PROJECTED CS NAME    WGS84  /UTM 55S
H8003 EPSG PROJECTED CS CODE    32755
H8006 EPSG DATABASE VERSION      6.13
```

11.5 Coverage plot ALLS noflex



11.6 Cetacean sightings

PGS Geophysical
M/V PACIFIC EXPLORER
2007113

ACQUISITION REPORT
version 1

Santos Australia Limited
2008 Strahan 3D MSS
Block T36/P
Offshore Tasmania, Australia
28th March to 22nd April 2008

11.6 Cetacean sightings

Australian Government
Department of the Environment and Heritage

Whale and Dolphin Sighting Report Summary
'y marked with the sighting number from the first column.

Please send an electronic copy to:
Cet_sightings@deh.gov.au or Ports and Marine Section, Department of the Environment and Heritage, GPO Box 787, CANBERRA ACT 2601

First name: Observer: F. Macknight
Last name:
Organisation Santos T36/P
ostal addres: -
Telephone:
Email: Contact: Andrew White Andrew.white@santos.com

										Species details						Weather/sea conditions			
Sighting No.	Date	Time (24 hour)	Animal seen from (land/vessel/air/ oil platform)	Location (brief description of where you are at the time of the sightings)	Latitude (deg min sec S)		Longitude (deg min sec E)		Your activity (whale watching, fishing, sailing etc.)	Species - Use the APPEA CD-based identification guide 'Search'	How sure? (very sure - sure -- not sure)	Total no of animals	Description of sighting and animal behaviour (e.g. small pod of animals with calves, breaching, bow riding)	Other animals present (including fish, birds, etc.)	Other notes	Photo/Video taken? (Y/N)	Sea state (see scale on other worksheet)	Cloud cover (oktas)	Overall visibility
1	7-Apr-08	13:51	vessel	West coast Tasmania - offshore Point Hibbs	42	38.74	144	38.74	Seismic Survey	Pygmy right whale	sure	2	slow travel, only 3 sightings	no		no		2|-4 scattered cloud	excellent
2	7-Apr-08	15:10	vessel	West coast Tasmania - offshore Point Hibbs	42	36.16	144	21.2	Seismic Survey	Blue whale	very sure	1	resting/feeding	no	Initially resting then lunge feeding before resuming travel	no		2|-4 scattered cloud	excellent
3	8-Apr-08	8:11	vessel	West coast Tasmania - offshore Point Hibbs	42	13.18	145	0.66	Seismic Survey	Unidentified dolphin	very sure	25	travel/porpoising	no	-	no	2	0 - clear sky	excellent
4	8-Apr-08	15:25	vessel	West coast Tasmania - offshore Point Hibbs	42	23.99	144	52.25	Seismic Survey	Common dolphin	sure	1	not defined	no	sighted by oow	no	3	0 - clear sky	excellent
5	19-Apr-08	8:00	vessel	West coast Tasmania - offshore Point Hibbs	42	23.17	145	1.2	Seismic Survey	Blue whale	very sure	2	milling, 3-5 min down times	no	-	No	2	0 - clear sky	excellent
6	20-Apr-08	PW	vessel	West coast Tasmania - offshore Point Hibbs	42	29.04	144	59.21	Seismic Survey	Long-finned pilot whale	very sure	5	travel			no	3	1-4 scattered cloud	good
7	20-Apr-08	BD	vessel	West coast Tasmania - offshore Point Hibbs	42	29.04	144	59.21	Seismic Survey	Bottlenose dolphin	very sure	50	milling/travel	pilot whales		no	3	1-4 scattered cloud	good
8	20-Apr-08	PW	vessel	West coast Tasmania - offshore Point Hibbs	42	29.04	144	59.21	Seismic Survey	Long-finned pilot whale	very sure	40	social/milling	bottlenose dolphins		no	3	1-4 scattered cloud	good
9	20-Apr-08	PW	vessel	West coast Tasmania - offshore Point Hibbs	42	26.24	144	57.8	Seismic Survey	Long-finned pilot whale	very sure	5	milling/travel	no		no	3	1-4 scattered cloud	good
10	20-Apr-08	PW	vessel	West coast Tasmania - offshore Point Hibbs	42	25.96	144	57.65	Seismic Survey	Long-finned pilot whale	very sure	30	feeding/travel	no		no	3	1-4 scattered cloud	good
11	20-Apr-08	BD	vessel	West coast Tasmania - offshore Point Hibbs	42	25.96	144	57.65	Seismic Survey	Bottlenose dolphin	very sure	25	feeding/travel	no		no	3	1-4 scattered cloud	good
12	20-Apr-08	PW	vessel	West coast Tasmania - offshore Point Hibbs	42	29.23	144	59.87	Seismic Survey	Long-finned pilot whale	very sure	30	social/milling	no		no	3	1-4 scattered cloud	good