FINAL SURVEY REPORT

CGGVeritas

VESSEL: M/V PACIFIC TITAN

- MARINE 2D & HIGH RESOLUTION SEISMIC REFLECTION METHOD ACQUISITION -

LOCATION	:	**AUSTRALIA**
AREA	:	**GIPPSLAND BASIN - AUSTRALIA**
SURVEY	:	**VICP65 – 2D SURVEY**
CLIENT	:	**EAGLE BAY RESOURCES LIMITED**
DURATION	:	**04th June 2008 - 06th June 2008**
C.G.G.V. SURVEY N°	:	**501 11 89 07 06 00 (JOB N°: 6374)**
CONTRACT N°	:	**859832**

Table of Contents

1. Survey Information and Objectives

Eagle Bay agreed to enter into a service contract for the purpose of acquisition of a marine seismic 2D survey with 8 sail lines of approximately 150 total sail kilometres.

The survey area was located south of Gippsland within the block VICP65 in the Bass Strait of Australia.

Water depth in the survey area varied from 792m to around 2006m over the survey.

The seismic acquisition was performed by CGGVeritas using the survey vessel Pacific Titan, owned by Swire Pacific Offshore.

Source volume was 3040 cubic inches at a depth of 6 m.
Streamer length 6000 m, towed at a depth of 8 m.
Recording length was 6 sec.

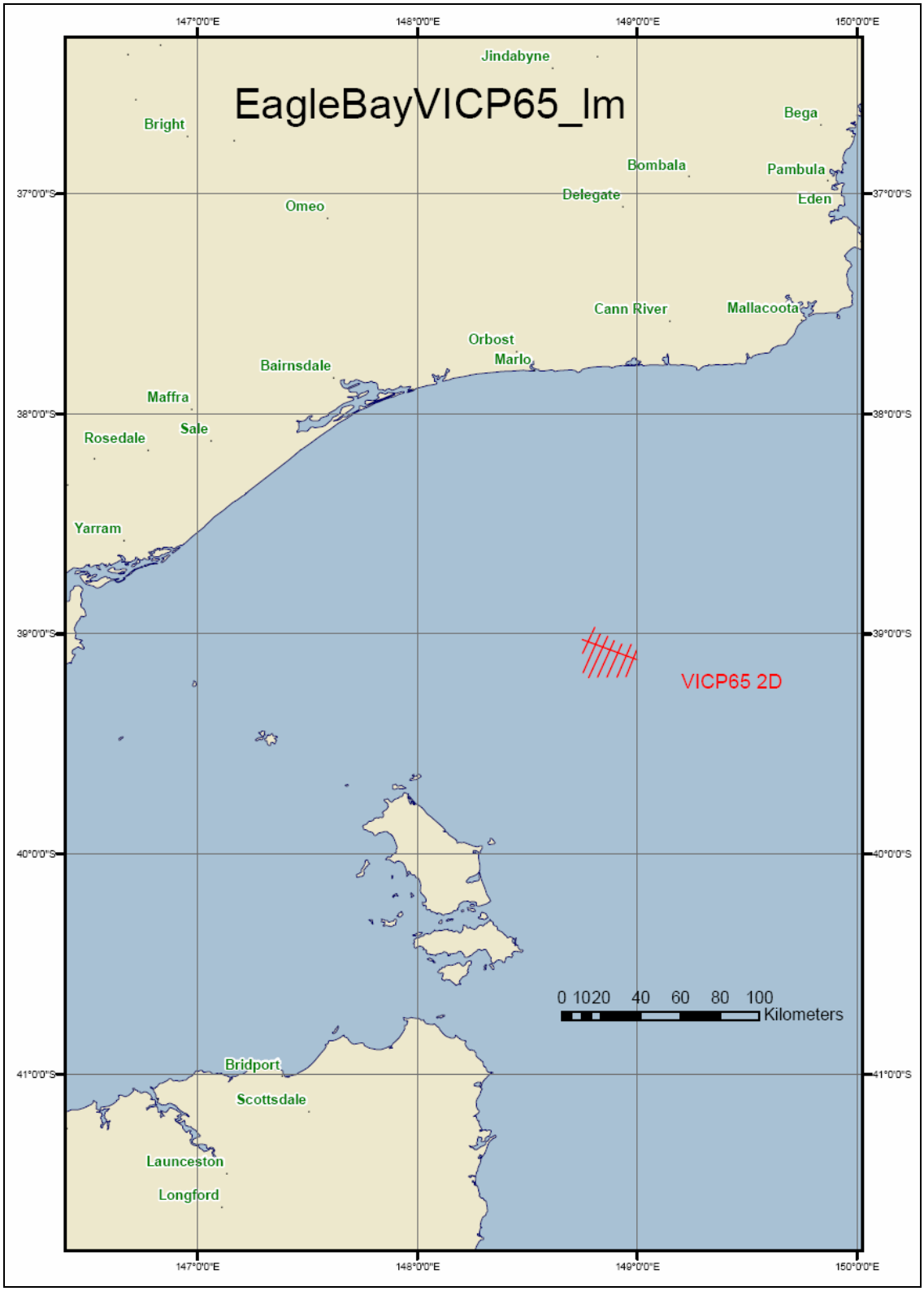
Chargeable production started at 06:56 GMT (16:56 local time) on the 04th June and completed 05th June at 18:40 GMT (06th June at 04:40 local time).

All lines were pre-fixed with EBAY08-. A survey sequence number was used as the last 3 characters in the name, unique for each line in the survey. Sequence number started from 001 and field tapes started at 1.

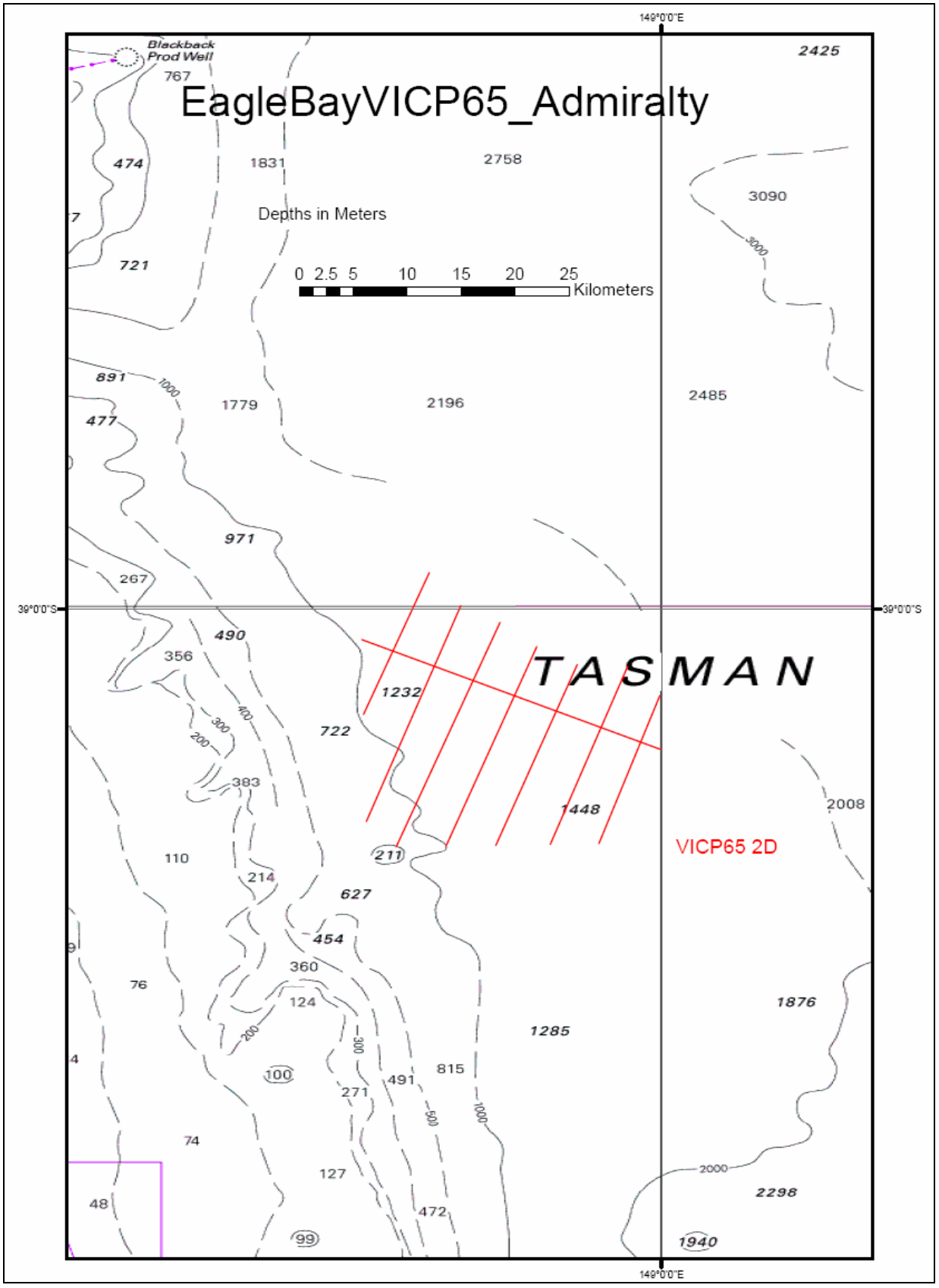
Upon survey completion, Pacific Titan departed the area to transit to Brisbane for crew change.

2. Survey Area

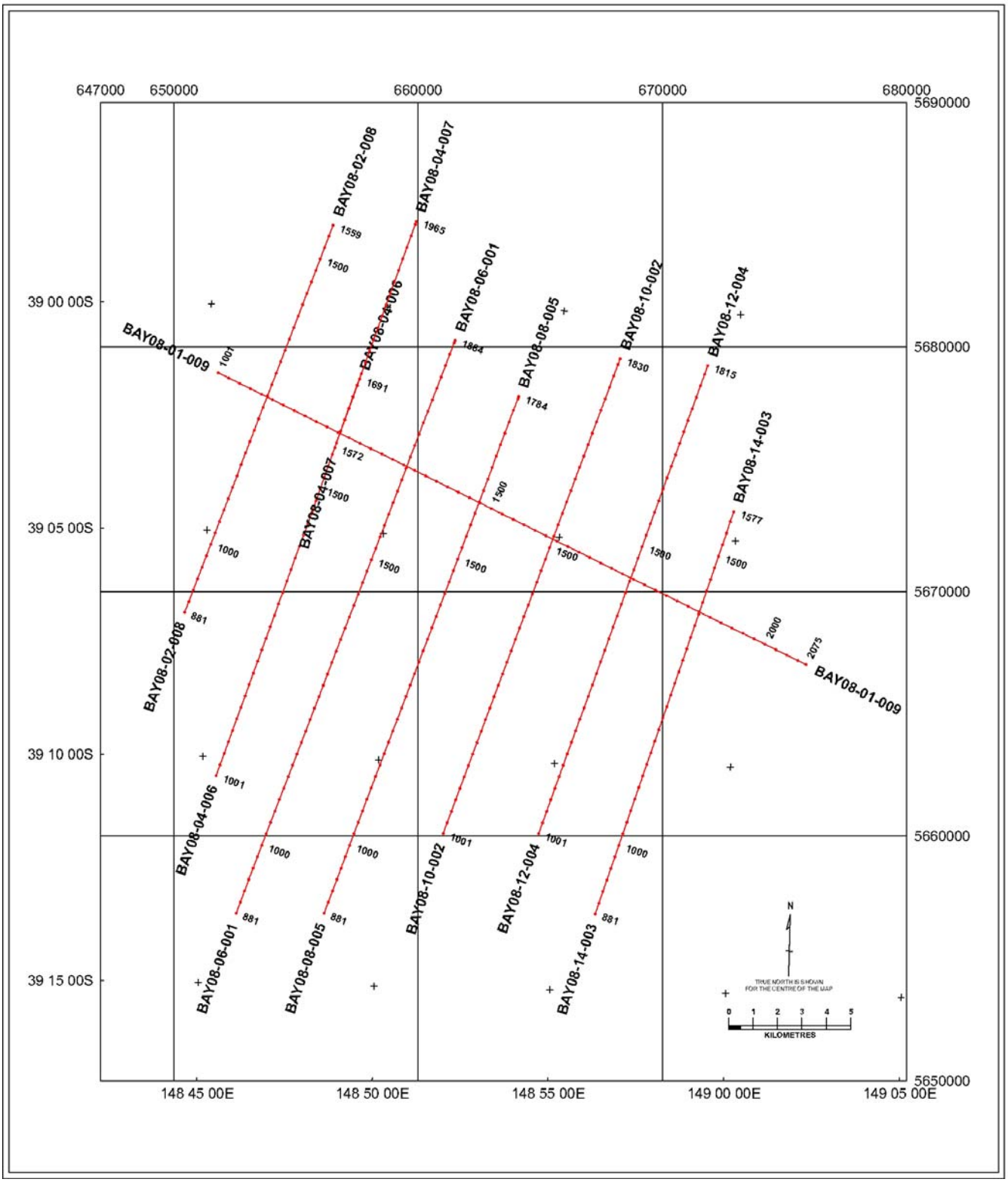
2.1. Survey Map.



2.2. Block VICP65.



2.3. Postplot Map.



3. Contract Work Order

CONTRACT

Client:	Eagle Bay
Vessel(s):	Pacific Titan
Job number:	6734
Bid number:	
Client contract number/ref:	
Name:	
Area:	VICP65 Bass Strait, Australia
Type of survey:	2D Towed streamer
Area or total km's:	150
Line heading:	Variable
Number of lines:	8
Line Length:	Variable
Acquisition method:	2D Single Streamer, Single Source

STREAMER

Type of streamer:	Sercel Seal, digital streamer, Solid Streamer
Number of streamers:	1
Separation:	N/A
Streamer length:	6000 metres.
Number of channels:	480
Group interval:	12.5 metres
Streamer depth and tolerance:	8 metres +/-1 metre
Water depth:	70 to 90 metres

RECORDING

Instrument type:	Sercel SealSercel Seal
Record length:	6 seconds.
Sample rate:	2 milliseconds
Recording filter, Hi-cut:	206Hz @ 276dB/Oct
Recording filter, Low-cut:	Analog (built in) 3Hz @ 6dB/Oct, Digital Low-Cut:IN(effectively4.7Hz)
Filter type:	Butterworth
Pre-amplifier gain:	0dB, (1600mV)
Tape format:	SEGD 8058
Recording media:	IBM 3590
Tape copy:	2 data sets of Field Tapes to be delivered

	SOURCE
Source type:	Bolt Long Life, Tuned array
Source controller:	Seamap Gunlink 2000
Number of sources:	1
Volume per source:	3040 cu in
Source depth and tolerance:	6 metres +/- 1.0 metres
Source pressure and tolerance:	2000 psi +/- 10%
Source length:	15 metres
Number of sub-arrays per source:	3
Sub-array separation:	10 metres
Flip/flop:	N/A
Shot point interval per shot:	25 metres
Shot point location:	
Near fields to be recorded?	Yes
Source firing specifications:	+/- 1.2 milliseconds

4. Vessel Description

4.1. Vessel Specifications – Pacific Titan

M/V Pacific Titan is capable of doing both 2D and 3D seismic data acquisition work. For 2D work the vessel can tow 12 000 meters streamers. For 3D seismic work the vessel can do dual source/dual streamer (2X6000m) operation providing high quality 2D and 3D seismic data for the industry. Features include a SEAL-24 system configurable for multiple streamers. Options include real-time seismic processing, acoustic source positioning, acoustic streamer positioning and onboard navigation. The following are general specifications for the vessel and seismic equipment on board.

Vessel Information

Description:	6,400 BHP Seismic Survey Vessel
Classification:	A1 (E) Seismic Research AMS ACCU
Built:	Japan, 1982, Conversion later in Seattle
Flag:	Singapore
Call Sign:	9V5935
IMO No. :	8208385

Dimensions

Length, overall:	64.5 m
Length BP:	55.2 m
Breadth, moulded:	18.5 m
Depth, moulded:	6.0 m
Summer Draft:	5.18 m
GRT:	3211.0
NRT:	963.0

Machinery

Main engines:	4 x 1,600 BHP, 6Z-ST Total 6,400 BHP Propellers in Kort Nozzles
Bow Thruster:	420 BHP Yanmar 6LAAL-DTN 5 tones thrust, CP propeller
Rudders:	Trailing Flap
Generator:	3 x 280 kW Yanmar 6LAAL-DTN
Speed:	4 x engines, Max: 12.0 kts/14 tons/day Service: 10 kts/10 tons/day 2 x engines: 9.0 kts/9 tons/day

Electronics

Radar:	Furuno FR 1505 Mk III ARPA
Secondary Radar:	Furuno FR 1510 Mk III
GPS:	Furuno GP 30
Echo Sounder:	Simrad ED-162 and Simrad EA 600
Communications:	G.M.D.S.S. Skanti SSB, VHF, Inmarsat C 456304540 / 456304550
Weather Fax:	Furuno 207
Satcom B:	NERA Inmarsat phone/fax Tel (870) 356 304 510
Vsat:	Instrumentroom +47 51 40 76 11 Party Chief +47 51 40 76 12 Chiefs office +47 51 40 76 13 Bridge/Fax +47 51 40 76 14
High Speed data link:	NERA Inmarsat system: Tel (870) 356 304 510

Miscellaneous:

Fire monitoring and detection to all work areas
USCG approved sewage treatment plant.
Incinerator, macerator and compactor.
Six man inflatable Man-overboard boat on quick release davit
LSA equipment for 45 persons excluding survival suits.
Foam deluge system covering streamer winches, streamer storage reels and helideck.
P.A. System
Stainless steel gun deck.
Helideck rated for Bell 212 or equivalent with lights.
FRC: 21 feet Nor Power.

4.2. Seismic Particulars

4.2.1. Streamer and Sensors Details

Item	Description	Type	Amount	Remark
Streamer	24 bit, digital distributed electronic	Sercel solid SEAL	Up to 12 km active	64 mm diameter
Depth Control	Digicourse	5011	22	Located every 300 m along the streamer
Buoyancy		Foam		
Retrievers	Concorde	500	7	1 every 900 meters
Streamer skin	Polyurethane	Solid		3.5 mm thickness
Hydrophones	Sercel Radial	Piezoelectric		Sercel 12-element radial
Section Length	150 m			
Section diameter	64 mm			
Lead-in	Sercel	Armoured	350 m.	
Group Length	12.5 m			
No of hydrophones per group	8	Sercel 12 element radial.		790 nF Group capacitance 21.5 V/Bar sensitivity
Max number of channels	2000			12.5 m @ 2ms
Telemetry data link	Dual twisted quartet	AWG 22		
Aux. Data link	4 twisted pair	AWG 22		
Power lines	Dual	AWG 14		
Connectors	28 points	AWG 16		

4.2.2. Recording System Details

Item	Description	Type	Amount	Remark
Acquisition	SEAL V 5.0	Sercel	1	Max 10 000 channels
Format	SEG D Vs1	De-multiplexed		
Recording	IBM via Argus	IBM computer	4	3590 cartridges
Computer	Sun	Blade 2000	2	
Bird Controller		Digicourse	22	
Graphic user I/F	Unix/Seapro	X11 Ultra 5		Sercel
Terminal	Sun	21”	2	
Sampling				¼,1/2,1,2,4 ms
Aux channels			36	Max 255
Plotter	24”	Veritas	1	On-line
Printer	A4			Label
Printer	A4			Logs, tests etc.
Network	Ethernet	Twisted pair		Category 5 TCP/IP
Argus Raid	Intel Xeon	Raid drive		Data storage/Backup

4.2.3. Seismic QC Details

Item	Description	Type	Amount	Remark
Online Qc	SEAPRO QC Vs 4.0	Sercel	1	Online seismic QC, fully Integrated with recording system.
Offline Qc	ProMAX	Landmark	1	Brute stacks, etc
Plotter	24”	Veritas	1	
Computer	Supermicro	Dual Xeon 3.2Ghz	1	
Terminals		21”	2	
Graphic user interface	Linux	RedHat		
Remote	X terminal			Sat. link
Network	Ethernet	Twisted pair		Category 5 TCP/IP
Product options		High resolution seismic record display. Pre-filtering of seismic data. Attribute calculation First break picking. Signal to noise ratio. Seismic trace energy. Noise level. Seismic trace frequency analysis. Single trace displays. Attribute db generation		

4.2.4. Navigation Details

Item	Description	Type	Amount	Remark
Navigation online	Concept Systems	Spectra		
Navigation offline	FGPS	Seispos		
Work Stations	PC workstations	Shuttle	2	
Network	Ethernet	Twisted pair		Category 5 TCP/IP
PC workstation	Sony	Shuttle		
Printer	HP	Laser		Network to 12”
Compasses	Digicourse	5011	22	Every 300 meter along the streamer + more in the front and tail end.
Streamer positioning	RGPS	Geotrack 220	1	Tracks
Source Positioning	RGPS	Geotrack 320	3	1 on each sub-array.
Acoustics	N/A			
Data logging	UKOOA	P2/94 P1/90		3590, CD-Rom, Online hard disk
Echo Sounder	Simrad	EA600		12 KHz & 200 KHz
Gyro	Simrad HS 50			GPS Gyro
Autopilot	Robertson	AP9 Mk III		
Steering	RobTrack	STS500		
Helmsman Steering display	Spectra	Sony Shuttle	1	Located on the bridge

4.2.5. Source and Mechanical Department Details

Item	Description	Type	Amount	Remark
Acoustic source	Long Life	Bolt		6 acoustic positions per sub-array 8 sources per sub-array
Hanging Plates	Multiwave design	Multiwave		
Chambers	40 – 300 cu. inch.			
Cluster	8-ea clusters	Bolt		3 clusters on the outmost sub-arrays, 2 on the centre sub-array
Near field hydrophones	2540	I/O		3 per sub-array
Depth/pressure Sensors	2527B	I/O		3 per sub-array
Source	Varying configuration	Multiwave / Bolt	Single /dual	Typical: 90-110bar output
Compressors	Frick	TDSB 355	3	Capacity 3 x 2000 cu.ft/min
	Aerial	JGA4	3	
	Caterpillar	Prime mover	3	1 for ea. set of Frick/Aerial
Source controller	Gunlink 2000	Seamap		32 guns, expandable
Solenoid Power Supply	Gunlink 2000	Seamap		25 ms fire pulse width
Deflector	Multiwave	6 foils	2	
Gun Winches	Single	Odim remote ctrl.	5	Slip-ring, Air
Streamer winches	Single	Odim remote ctrl.	4	Each 9000 m (50 mm)
Spooling Device	Marine Project Development	Linear	4	Spooling on each streamer winch individually
Tow Points	Odim	Flexible	4	
Winch Control	Odim		2	

5. List of Key Personnel

5.1. Onboard Personnel

POSITION	Crew 1
Party Chief	Sigurd Østerud
Captain	Theodore Strockyj
Chief Engineer	Carl Sayers
Chief Observer	Allan Beatie
Shift Leader Observer	Jun Lamabas
Chief Navigator	Paul Stafford
Shift Leader Navigation	Christopher Hernandez
Chief Mechanic	Markus Rahm
Shift Leader Mechanic	Ronaldo Morales
QC leader	Steffi Schwarz
Client Representative	Drew Murray

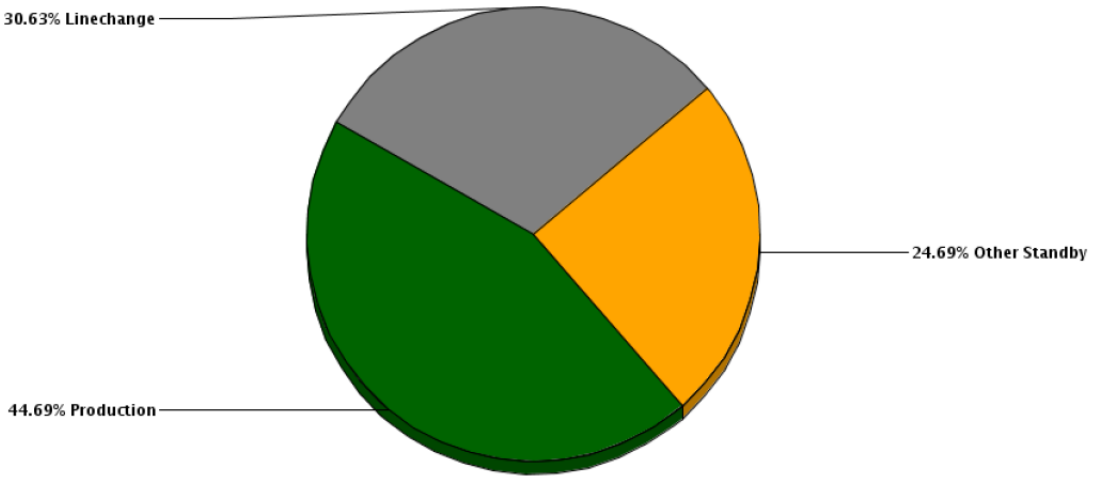
5.2. Office Support Personnel

POSITION	NAME
Vice President Operation	Christian Brige
Operation Manager	Serge Laigre
Instrument Manager	Graham Knight
Navigation Manager	Rafael Bouraly
Mechanic Manager	Mark Plummer
QC support	Fabrice Mandroux

6. Field Information and Observations

6.1. Time Statistics

Time Distribution
M/V Pacific Titan **Client:**(6734) Seboa - Group Shoot - Australia **Survey:** 550 11 89 07 06 00 **Area:** 2D (Project SEBOA)
Date: 4.6.2008 - 5.6.2008



6.2. Production Statistics Eagle Bay VICP65 part of Group Shoot

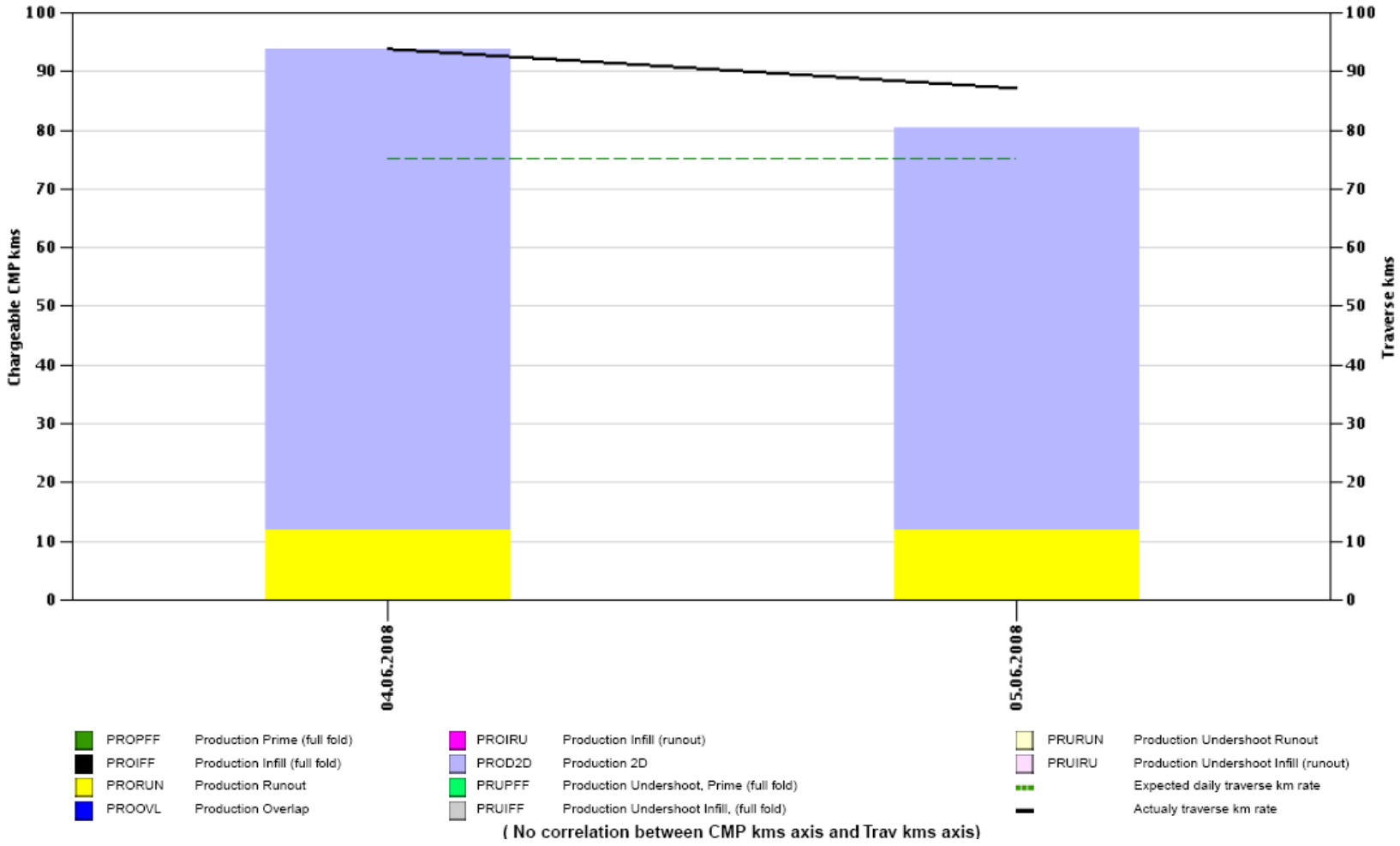
		CHARGE CODES							Hidden downtime	
ACTIVITY		4	6	19	22	29	Total hours	%	RC hrs	RB hrs
Linechange										
LChnom	Linechange, nominal				13.07		13.07	30.62%		
TOTAL					13.07		13.07	30.62%		
Production										
PROD2D	Production 2D Line		1.60	14.83			16.43	38.52%		
PRORUN	Production Runout	0.30		2.33			2.63	6.17%		
TOTAL		0.30	1.60	17.17			19.07	44.69%		
Standby Environment										
ENvoth	Environmental, other					3.60	3.60	8.44%		
TOTAL						3.60	3.60	8.44%		
Standby Other										
STbcli	Standby on clients request					6.93	6.93	16.25%		
TOTAL						6.93	6.93	16.25%		
TOTAL		0.30	1.60	17.17	13.07	10.53	42.67	100.00%		

Charge codes in use

4	Production Runout
6	Production 2D
19	Eagle Bay 2D and runout
22	Chargeable linechange
29	Standby under 12 hrs Eagle Bay

Production Summary

M/V Pacific Titan **Client:**(6734) Seboa - Group Shoot - Australia **Survey:** 550 11 89 07 06 00 **Area:** 2D (Project SEBOA)
Date: 04.06.2008 - 05.06.2008



Chargeable CMP and km² summary

Date	PROPFF	PRORUN	PROIFF	PROIRU	PRUPFF	PRURUN	PRUIFF	PRUIRU	PROOVL	PROD2D	Total CMP kms	Total km²
04.06.2008		12.00000								81.72500	93.72500	
05.06.2008		12.00000								68.50000	80.50000	
Total CMP		24.00000							150.22500		174.22500	
Total Km²												

PROPFF	Production Prime (full fold)	PROIRU	Production Infill (runout)	PRURUN	Production Undershoot Runout
PROIFF	Production Infill (full fold)	PROD2D	Production 2D	PRUIRU	Production Undershoot Infill (runout)
PRORUN	Production Runout	PRUPFF	Production Undershoot, Prime (full fold)		
PROOVL	Production Overlap	PRUIFF	Production Undershoot Infill, (full fold)		

6.3. Daily Summary during survey (Reverse chronological order)

All daily logs are in GMT time.

Thu, 05 Jun 2008, week 23
We started off the day continuing the production for Eagle Bay in very good weather. We had to shut down on line 4 due to a humpback whale within exclusion zone. This was the only delay for this prospect and we finished the Eagle Bay prospect at 18:40 GMT
(04:40 local time).
This concluded the SEBOA group shoot contract.
We then recovered the gear, preformed a TS dip and then began the transit to Brisbane for crew change.
80.5 km production today
Weather; very nice
Midnight fuel balance 616.045 cubic M, Consumed 13.395 cubic M
HSE
Total personnel onboard: 33 (16 Maritime, 15 Seismic, 2 client)
11 x toolbox meetings (8 x Dept. Handovers, 1 x gun recovery, 1 x door recovery, 1 x streamer recovery)
1 x Observation Card
2 x Drill (MOB muster and Pyrotech)

Wed, 04 Jun 2008, week 23
We started of the day with transit from the Bass Strait Vic survey.
We had to slow down while waiting on the Eagle Bay Environmental plan to be approved.
We received this as we were only meters away from the start of first production line.
It was right down to the wire and any further delays would have caused a circle.
94 km production today
We started the Eagle Bay prospect at 06:56 GMT.
Weather; very nice
Midnight fuel balance 629.440 cubic M, Consumed 11.252 cubic M
HSE
Total personnel onboard: 33 (16 Maritime, 15 Seismic, 2 client)
11 x toolbox meetings (8 x Dept. Handovers, 1 x gun deploy, 1 x door deploy, 1 x streamer deployment)

6.4. Field Information and Encountered Problems

6.4.1. Obstructions / Installations in the Field

No obstructions.

6.4.2. Traffic / Shipping Lanes

There was some shipping traffic through the prospect area observed during the duration of the survey. No problems encountered and all ships communicated and cooperated nicely with us.

6.4.3. Fishing Activity

No fishing activity during survey.

6.4.4. Environmental Obstacles

No reportable obstacles during the survey.

6.4.5. Operational Observations

The survey was completed in a little over one day with no problems. We had one aborted line due to a humpback whale sighted within the exclusion zone. The survey was acquired in very good weather conditions, providing excellent data quality.

7. HSE Summary

No environment incidents during the survey.

Prior to all safety critical operations, i.e. deploying and recovery of seismic equipment, a “Toolbox Meeting” was held to verify and eliminate any hazards related to the operation.

Each operation has its own dedicated procedures, laid down in the CGGVeritas QHSE system and these were carefully followed throughout the survey.

We had one HSE incident during this survey.
A hydraulic hose burst on an aux. winch used on the gun deck. Around two litres of oil were contained and problem rectified without any further complications.

HSE summary stats from the 4th – 5th of June 08

QHSE Stats

Personnel Breakdown for the above period (Master Vessel)

		Total man-days for Master Vessel
Marine	32	
CGG	30	66
Sub Contract	0	Total Exposure hrs
Client	4	1584
	0	**Total man-days for chase**
	0	0
	0	0
	0	**Total Chase Exposure hrs**
	0	0
	0	0
Total Exposure hrs All		1584

HSE Breakdown for the period

induction tour seismic	0
induction tour marine	0
HSE Commitee Meeting	0
HSE Crew Meeting	0
Department Meeting	0
PRM	0
OGP_FMM HSE training	0
Small Boat Sortie	0
External Audits	0
Xdepartment Audit	0
New open action	0
Action Closed	0
CSV	0
MSV	0
NC	0
OFI	0
JSA:	0
Observation_cards	0
Tool Box meetings:	22
Drills	2
Incident	0

7.1. Observation Cards during the Survey:

No Observation cards during this survey.

7.2. Production-Log

CGGVERITAS

Production Log: Eagle Bay Resources N.L. - Survey VICP65
M/V Pacific Titan (6734) Seboa - Group Shoot - Australia **Area:** 2D (Project SEBOA)
Date: 04.06.2008 05.06.2008 **Survey:** 550 11 89 07 06 00

Date	Line	Time	Total Time	Dir	FSP	LSP	TOT SPs	Chargeable CMP kms	Primary	Secondary	Comments	Standy per Instance	Date (Local)	Time (Local)	Time (Local)
04-Jun-08		00:00 - 04:44	4.73						Technical D/T	Inter-move	Standby on clients request: Inter program move		04-Jun-08	10:00	14:44
04-Jun-08		04:44 - 06:56	2.20						Technical D/T	Standby	Standby on clients request: Standby for permission to shoot		04-Jun-08	14:44	16:56
04-Jun-08	EBAY08-06-001	06:56 - 09:24	2.47	201	1884	1001	884	22.1	Recording	Production	Production 2D Line:		04-Jun-08	16:56	19:24
04-Jun-08	EBAY08-06-001	09:24 - 09:44	0.33	201	1000	881	120	3	Recording	Production	Production Runout:		04-Jun-08	19:24	19:44
04-Jun-08		09:44 - 11:24	1.67						Line Change	Linechange	Linechange, nominal:		04-Jun-08	19:44	21:24
04-Jun-08	EBAY08-10-002	11:24 - 13:13	1.82	20	1001	1710	710	17.75	Recording	Production	Production 2D Line:		04-Jun-08	21:24	23:13
04-Jun-08	EBAY08-10-002	13:13 - 13:31	0.30	20	1711	1830	120	3	Recording	Production	Production Runout:		04-Jun-08	23:13	23:31
04-Jun-08		13:31 - 15:15	1.73						Line Change	Linechange	Linechange, nominal:		04 & 05-June-08	23:31	01:15
04-Jun-08	EBAY08-14-003	15:15 - 16:53	1.63	199	1577	1001	577	14.425	Recording	Production	Production 2D Line:		05-Jun-08	01:15	02:53
04-Jun-08	EBAY08-14-003	16:53 - 17:14	0.35	199	1000	881	120	3	Recording	Production	Production Runout:		05-Jun-08	02:53	03:14
04-Jun-08		17:14 - 18:58	1.73						Line Change	Linechange	Linechange, nominal:		05-Jun-08	03:14	04:58
04-Jun-08	EBAY08-12-004	18:58 - 20:51	1.88	19	1001	1695	695	17.375	Recording	Production	Production 2D Line:		05-Jun-08	04:58	06:51
04-Jun-08	EBAY08-12-004	20:51 - 21:10	0.32	19	1696	1815	120	3	Recording	Production	Production Runout:		05-Jun-08	06:51	07:10
04-Jun-08		21:10 - 22:52	1.70						Line Change	Linechange	Linechange, nominal:		05-Jun-08	07:10	08:52
04-Jun-08	EBAY08-08-005	22:52 - 00:00	1.13	199	1784	1382	403	10.075	Recording	Production	Production 2D Line:		05-Jun-08	08:52	10:00
05-Jun-08	EBAY08-08-005	00:00 - 01:05	1.08	199	1381	1001	381	9.525	Recording	Production	Production 2D Line:		05-Jun-08	10:00	11:05
05-Jun-08	EBAY08-08-005	01:05 - 01:26	0.35	199	1000	881	120	3	Recording	Production	Production Runout:		05-Jun-08	11:05	11:26
05-Jun-08		01:26 - 03:05	1.65						Line Change	Linechange	Linechange, nominal:		05-Jun-08	11:26	13:05
05-Jun-08	EBAY08-04-006	03:05 - 04:53	1.80	0	1001	1691	691	17.275	Recording	Production	Production 2D Line: Aborted early due to whale in exclusion zone		05-Jun-08	13:05	14:53
05-Jun-08		04:53 - 08:29	3.60						Regional D/T	Standby	Environmental, other: circling due to whale		05-Jun-08	14:53	18:29
05-Jun-08	EBAY08-04-007	08:29 - 08:52	0.38	19	1692	1845	154	3.85	Recording	Production	Production 2D Line:		05-Jun-08	18:29	18:52
05-Jun-08	EBAY08-04-007	08:52 - 09:10	0.30	19	1846	1965	120	3	Recording	Production	Production Runout:		05-Jun-08	18:52	19:10
05-Jun-08		09:10 - 10:58	1.80						Line Change	Linechange	Linechange, nominal:		05-Jun-08	19:10	20:58
05-Jun-08	EBAY08-02-008	10:58 - 12:34	1.60	201	1559	1001	559	13.975	Recording	Production	Production 2D Line:		05-Jun-08	20:58	22:34
05-Jun-08	EBAY08-02-008	12:34 - 12:54	0.33	201	1000	881	120	3	Recording	Production	Production Runout:		05-Jun-08	22:34	22:54
05-Jun-08		12:54 - 15:41	2.78						Line Change	Linechange	Linechange, nominal:		05 & 06-June-08	22:54	01:41
05-Jun-08	EBAY08-01-009	15:41 - 18:19	2.63	116	1001	1955	955	23.875	Recording	Production	Production 2D Line:		06-Jun-08	01:41	04:19
05-Jun-08	EBAY08-01-009	18:19 - 18:40	0.35	116	1956	2075	120	3	Recording	Production	Production Runout:		06-Jun-08	04:19	04:40

Production w/ runouts	19.07 Hours
Linechanges	13.07 Hours
Standby - (All instances)	5.80 Hours
Inter Program moves	4.73 Hours

8. Shipment List

Proforma Nr.		Job #	Description	Receiver
PT-2008-045		6374	Eagle Bay VicP65 Primary (Seq 1-9)	Eagle Bay Resources, West Perth
PT-2008-046		6374	Eagle Bay VicP65 Copy (Seq 1-9)	Bill Lodwick, Kilmore

CGGVERITAS

PT-2008-045

Date: 6-Jun-08

SENDER:

M/V Pacific Titan IN TRANSIT
c/o NT Shipping Agencies
P.O. Box 443
Berrimah
Northern Territory 0828
Australia
Attn: Robbie Robertson
Mob: +61 417 819 593
E-mail: robbie@ntshipping.com.au

Consignee:

Eagle Bay Resources NL
Suite 3 Level 1
610 Murray Street
West Perth WA 6005
Australia

Type of freight:	Comments:
Air	SEBOA Group Shoot, Eagle Bay Resourses, VicP65, Primary Data (Seq 1 - 9)

Box	Item	General description of content	Weight(kg)	Value(USD)
1	1-9	3590 Data tapes containing seismic data (Tapes 1 - 9) (sequence 1 - 9)	2.3	30
	10	3590 Data tape containing Start of Job & End of Job Tests (Tape 10)	0.3	3
		Observers' data		
	11	1 x CD containing Observers/Source/Tape Logs/Timing Diagram, Shipping Proforma	0.1	10
		Nav data		
	12	1 x DVD Navigation Data containing: Final P1/90, RawP294, Production/Processing Log	0.1	10
		QC data		
	13	1 x DVD containing QC Deliverable Data	0.1	10
		Please confirm receipt of goods to chobs.titan@cggveritas.com		
			2.9	

Total boxes 1 Total value: 63

Certified true and correct
CGG Veritas
M/V Pacific Titan

Sign Allan Beattie
Chief Observer

PROFORMA INVOICE AND PACKING LIST

PT-2008-046

Date: 6-Jun-08

SENDER:

M/V Pacific Titan IN TRANSIT
c/o NT Shipping Agencies
P.O. Box 443
Berrimah
Northern Territory 0828
Australia
Attn: Robbie Roberts on
Mob: +61 417 819 593
E-mail: robbie@ntshipping.com.au

Consignee:

Bill Lodwick
Suite 5
11 Sydney Street
Kilmore 3674
Australia

Attn: Bill Lodwick

Type of freight:	Comments:
Air	SEBOA Group Shoot, Eagle Bay Resources, VicP65, Copy Data (Seq 1 - 9)

Box	Item	General description of content	Weight(kg)	Value(USD)
1	1-9	3590 Data tapes containing seismic data (Tapes 1 - 9) (sequence 1 - 9)	2.3	30
	10	3590 Data tape containing Start of Job & End of Job Tests (Tape 10)	0.3	3
		Observers' data		
	11	1 x CD containing Observers/Source/Tape Logs/Timing Diagram, Shipping Proforma	0.1	10
		Nav data		
	12	1 x DVD Navigation Data containing: Final P1/90, RawP294, Production/Processing Log	0.1	10
		QC data		
	13	1 x DVD containing QC Deliverable Data	0.1	10
		Please confirm receipt of goods to chobs.titan@cggveritas.com		
			2.9	

Total boxes 1 Total value: 63

Certified true and correct
CGG Veritas
M/V Pacific Titan

Sign Allan Beattie
Chief Observer

9. Crew Lists

Saturday, June 07, 2008

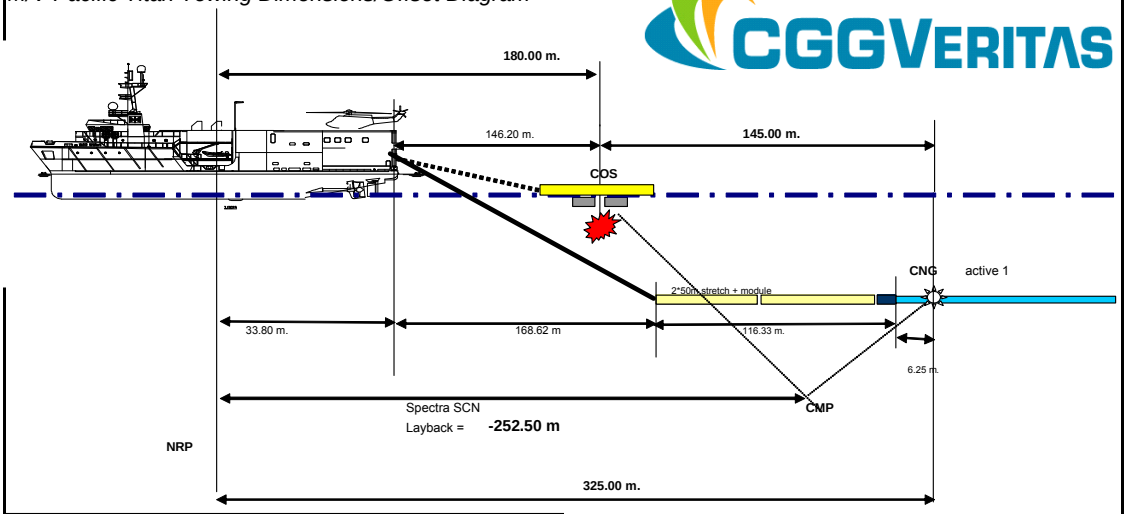
Crew List for M/V Pacific Titan

CGGVERITAS

	Department	Name	Title	Date Of Birth	Nationality	Passport Number	Expiry Date
1	Seismic	Sigurd Osterud	Party Chief	15-Oct-61	Norwegian	20761184	24-Feb-15
2	Seismic	Jun Marcelino Lumabas	S/L Observer	31-Oct-80	Filipino	ZZ229544	29-Jun-12
3	Seismic	Dervin Arenal Victorio	Observer	23-Oct-80	Filipino	QQ0522130	14-Oct-10
4	Seismic	Paul Stafford	Chief Navigator	05-May-70	British	099024130	24-Apr-12
5	Seismic	Markus Rahm	Chief Mechanic	23-Aug-71	Swiss	X2964586	27-Jun-12
6	Seismic	Ronaldo Maravilla Morales	S/L Mechanic	22-Mar-59	Filipino	ZZ145454	18-May-10
7	Seismic	Reynaldo Poud Vega	Mechanic	17-Sep-62	Filipino	UU0385562	19-Dec-11
8	Seismic	Victor Neoda Satago	Mechanic	05-Aug-68	Filipino	LL308971	05-Aug-08
9	Seismic	Jose Naldoza Peralta	Mechanic	01-Jun-50	Filipino	SS0035761	01-Dec-10
10	Seismic	Dennis Paras Aquino	Geophysicist	02-Aug-79	Filipino	NN0348967	14-Jul-09
11	Seismic	Dennis Basallaje Maranon	Observer	22-Sep-77	Filipino	QQ0076201	17-Mar-10
12	Seismic	Christopher Ibasco Hernandez	Navigator	05-Dec-83	Filipino	SS0131590	08-Dec-10
13	Seismic	Roberto Obras Sibayan	Doctor	13-May-65	Filipino	TT0947029	23-Oct-11
14	Seismic	Allan Beattie	Chief Observer	23-Mar-65	British	93105388	03-Dec-13
15	Seismic	Steffi Schwarz	Chief Geophysicist	02-Apr-73	Australian	M2598263	09-Feb-15
16	Client	Carol Dawn Sutherland	MMO	28-Aug-63	New Zealand	AB718594	11-Aug-10
17	Client	DrewDouglas Murray	Client rep	19-Aug-47	Australian	M6406067	02-Mar-17
18	Marine	Theodore Strockyj	Captain	15-Sep-50	Australian	M5129759	05-Sep-16
19	Marine	Carl Sayers	Chief Engineer	24-May-49	New Zealand	AA647005	14-Mar-13
20	Marine	Shan Mudiyanselege	Comp mech	01-May-63	SRI Lankan	M1858320	31-Mar-09
21	Marine	James Riley	Chief Officer	11-Nov-80	Australian	L7347221	26-Apr-09
22	Marine	Hemaka Dissanayake	2nd Mate	26-Feb-72	New Zealander	EA888314	29-Oct-12
23	Marine	Chris Pitman	G.P.	16-Nov-48	New Zealander	AA500827	18-Jun-12
24	Marine	John Mason	G.P.	17-May-47	Australian	E7592880	30-Aug-12
25	Marine	Donald Crawford	Chief Steward	13-Apr-46	Australian	M5345157	21-Jul-16
26	Marine	Christopher Milne	Ch Cook	03-Apr-61	Australian	M5791813	01-Apr-16
27	Marine	Anthony Raines	Cook	07-Mar-54	Australian	M1656991	19-Jul-14
28	Marine	Peter Brown	Comp mech	26-Jun-62	Australian		
29	Marine	Gary Foot	G.P.	15-Dec-64	Australian	L9928520	
30	Marine	Thomas Thompson	Steward	16-Jan-62	New Zealander	EA545053	
31	Marine	Gordon Waller	1st Eng	23-Feb-40	Australian	M5275701	
32	Marine	Phillip Soley	G.P.	08-Jan-61	Australian	L9165361	
33	Marine	J Mitchener	2nd Engineer	01-Dec-63	Australian	L6732931	19-Aug-08

10. Towing Configuration

M/V Pacific Titan Towing Dimensions/Offset Diagram



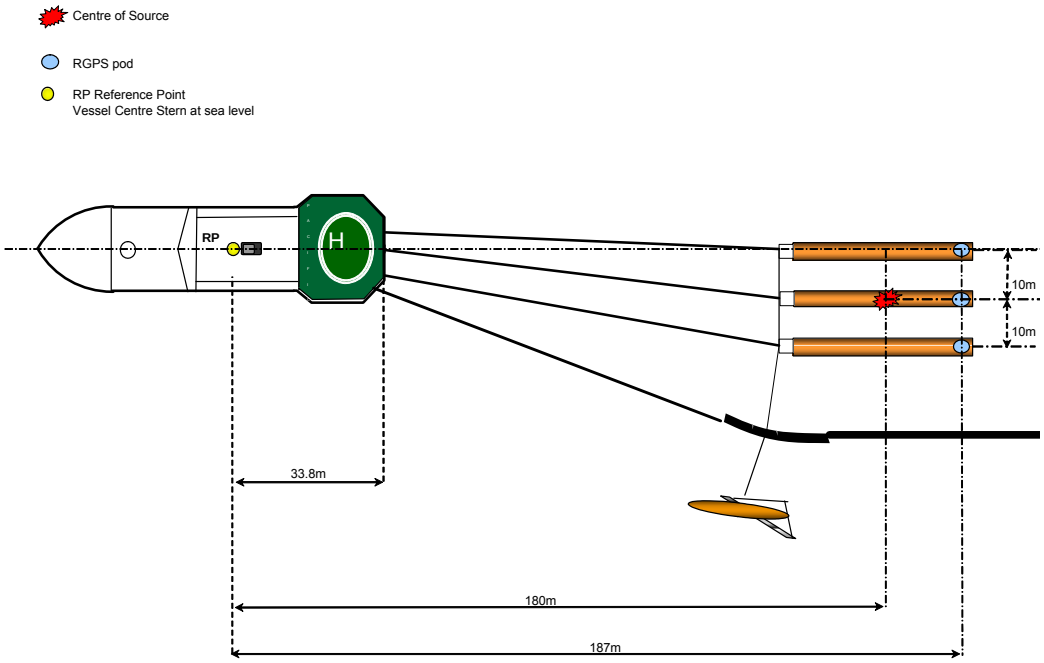
Principal Distances:			Principal Offsets:		Used as:
NRP-Stern	33.80 m.		COS-CNG	145.00 m.	
Stern-COS	146.20 m.		NRP-CMP	-252.50 m	Spectra SCN Layback
Stern-CNG	291.20 m.				
NRP-COS	180.00 m.		NRP-CNG	325.00 m.	Offset from NRP

Centre near group derived from Seal manuals = 6.25m from coupling

Key:	
NRP	Navgation reference point (centre of mast @ sea level)
COS	Centre of source
CNG	**Centre of near group (Trace # 001)**
CDP	Common depth point
NTRP	Near trace reflection point

10.1. Towing Offset Diagram

Pacific Titan
General Towing arrangement



10.2. Streamer System Description

Streamer System Parameters	
Number of Streamers	1
Type of Streamer	Seal Solid
Streamer Length	6000m
Number of channels	480
Groups per Section (150 m)	12
Group Intervals	12.5 m (no overlap)
Active Group Array Length	12.5 m
Outside Diameter	55 mm
Solid Streamer Material	Outer 3.5mm Polypropylene
Normal maximum towing tension	55.6kN Ultimate breaking at 278kN
Connectors (Pins)	28
Channels per Module	60 at 2 ms
Data Transmission Link	Dual twisted Quad AWG 22
Power	+/- 360 V DC
Leakage	30 mA differential circuit breaker
Near Offset (centre source – centre near group)	145m nominal
Streamer Depth	8m +/- 1.0m
Number of Front 50 m Stretch Sections	2 (85 mm diameter)
Number of Tail 50 m Stretch Sections	1 (50 mm diameter)
Number of Compasses per Streamer	23 (within digibirds)
Number of Depth Sensors per Streamer	23 (within digibirds)

Trace allocation	Near	Far	Aux
Streamer 1	1	480	
Auxiliary (in AXCU)			a1 – a30

Hydrophone Parameters	
Hydrophone Specification	Sercel 12 element radial
No of Channels per Section	12
No of Hydrophones per Channel	8 in parallel
Active Length of Channel	12.5m
Channel Centre Spacing	12.5 m under a 1000daN load
Hydrophone Spacing	1.78m
Low Frequency Cut	3 Hz
Nominal Sensitivity, without electronics @ 1 bar @ 20°C	20 V/bar
Nominal Hydrophone Sensitivity	21.5 v/bar
Capacitance per Group	790 nF +/-10% at 22°C
Minimum Leakage Resistor	500 Mohm under 50 V

10.3. Streamer Layout

6000m

Item	Position	S/N	RDU	Bird Collar	SRD Collar	Trace N.O	Weights
DCXU		696502					
Slip ring							
PORT AFT REEL							
Lead-in		n/a					
SHS		1350					
HAU		124					
HESE		1861			13489		10
HESE		1665	1	15797			10
HESA		1332					
SSAS	01	30497	2	34113	12090	1-12	6
SSAS	02	30362	3	29978		13-24	2
SSAS	03	30552	4	30495		25-36	5
SSAS	04	30613				37-48	3
SSAS	05	30352	5	30672	13491	49-60	3
LAUM	01	775					
SSAS	06	30522				61-72	5
SSAS	07	30529	6	27772		73-84	3
SSAS	08	30251				85-96	5
SSAS	09	30531	7	29983		97-108	5
SSAS	10	30515				109-120	2
LAUM	02	513					
SSAS	11	30394	8	40854	12083	121-132	4
SSAS	12	30521				133-144	3
SSAS	13	30136	9	30256		145-156	4
SSAS	14	30578				157-168	7
SSAS	15	30553	10	29096		169-180	4
LAUM	03	515					
SSAS	16	30504				181-192	5
SSAS	17	30447	11	30334	13493	193-204	3
SSAS	18	30160				205-216	4
SSAS	19	30454	12	15076		217-228	4
SSAS	20	30572				229-240	4
LAUM	04	731					
SSAS	21	30508	13	30246		241-252	6
SSAS	22	30495				253-264	3
SSAS	23	30494	14	30137	13490	265-276	7
SSAS	24	30249				277-288	5
SSAS	25	30443	15	31507		289-300	2
LAUM	05	737					
SSAS	26	30152				301-312	2
SSAS	27	30571	16	31053		313-324	5
SSAS	28	30567				325-336	4
SSAS	29	30557	17	22740	13492	337-348	4
SSAS	30	30502				349-360	3
LAUM	06	734					
SSAS	31	30582	18	30329		361-372	4
SSAS	32	30583				373-384	3
SSAS	33	30576	19	30511		385-396	2
SSAS	34	30569				397-408	5
SSAS	35	30574	20	30674	36201	409-420	4
LAUM	07	908					
SSAS	36	30584				421-432	4
SSAS	37	30581	21	31120		433-444	5
SSAS	38	30590				445-456	3
SSAS	39	30580	22	40035	36206	457-468	4
SSAS	40	30588	23	30359		469-480	4
TAPU	01	104					
TES	01	1703					
Tailbuoy	01						

11. Source Configuration

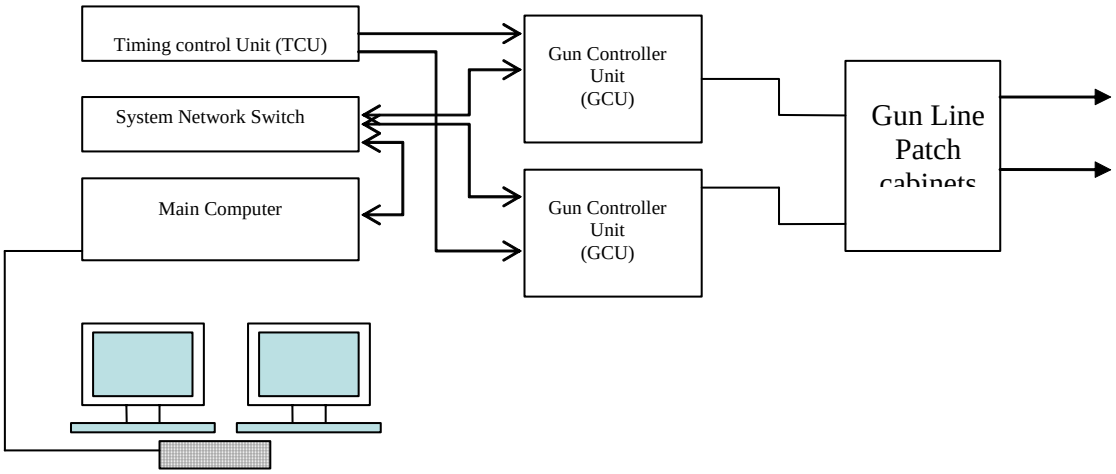
11.1. Source System Description

Source Parameters	
Source Controller	Gunlink 2000
Number of Sources	1
Number of Sub-Arrays (Strings) per Source	3
Array Length	14.7m
Sub-Array Separation	10m
Source Width	20m
Source Separation	n/a
Source Volume	3040 Cubic inches
Number of Hydrophones per String	6
Number of Depth Transducers per String	3
Number of Pressure Transducers per String	1
Number of Guns per String	Strings 1 & 3 = 9 / String 2 = 8
Number of Clusters per String	Strings 1 & 3 = 3 / String 2 = 2
Airgun Type	Bolt, 1500 & 1900 Long Life
Operating Pressure	2000 PSI
Depth of Guns	6.0 m +/- 1.0m
Peak to Peak Amplitude	96.8barm
Primary to Bubble Ratio	22.9

Gun Controller Description

The Gunlink 2000 Seismic Source Control and Acquisition System is the first phase of Seamap's range of new generation seismic gun controller systems.
The system uses the latest high speed micro processors to provide onboard firing control and sensor timing monitoring, continuous monitoring of near field phones and interrogation of depth and pressure sensors.
In addition the system monitors the voltage and current of the firing pulses applied to the gun solenoids allowing the user to monitor variations in the performance of the guns and improve maintenance schedules.

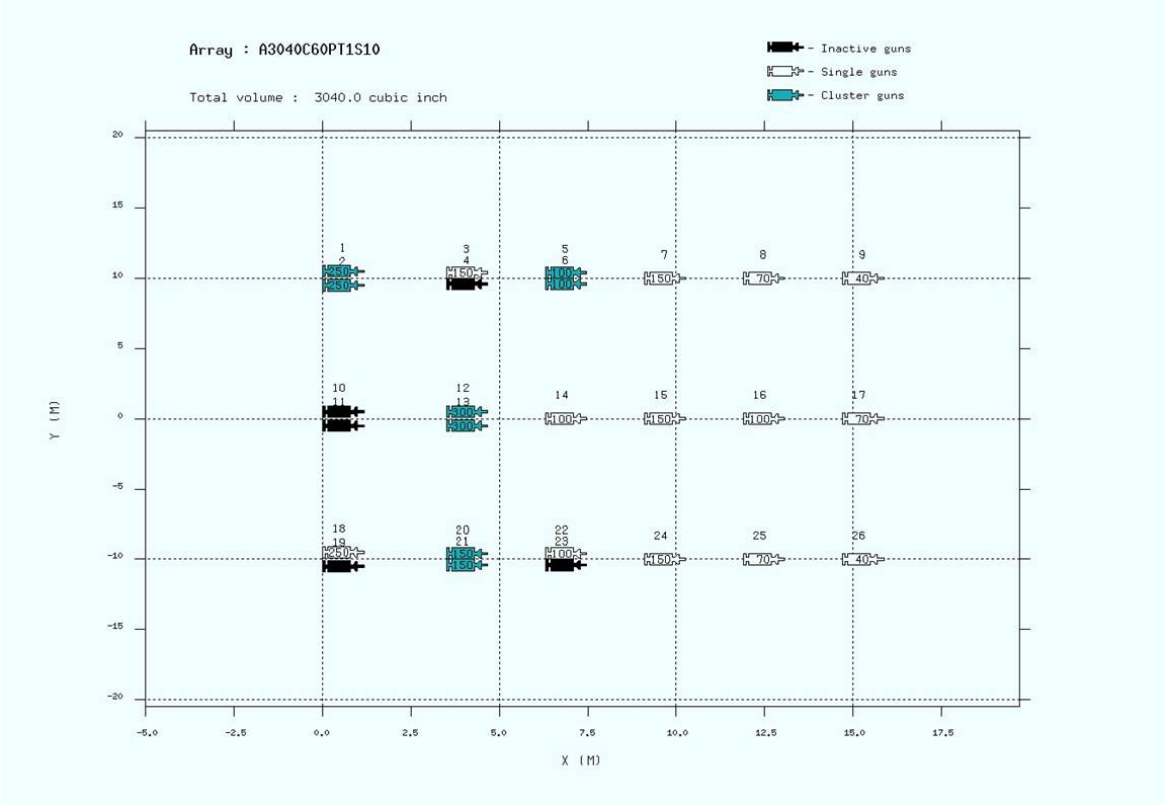
An innovated Graphical User Interface (GUI) makes use of the latest advances in software design to provide the operator with maximum information on the operation and performance of the system without the clutter of text.
An internal database maintains records of all system statistics and the data can be accessed via the in built web server using standard web browser programs.
To further reduce operator fatigue, the system draws the operator's attention to gun misfires, auto-fires and other faults by use of voice alerts issued from the system speakers.



11.1.1. Gun Controller Specifications

Channels available	
Monitored Variables	Gun Fire time Near field Hydrophone Data Depth Sensor value Gun air pressure Value Solenoid coil current
Controlled Variables	Gun Fire time Gun Firing pulse length and Voltage
System Timing	0.01 ms
Fire Detect Window	120 ms
Synchronization Mode	Automatic
Fire Detect Method	Sensor
Fire Time Pick Method	Peak detect
Near Field Hydrophone S.I.	0.1 ms
Near Field Hydrophone Res.	16 Bit
Software	Version 2.5.2

11.1.2. Source Layout



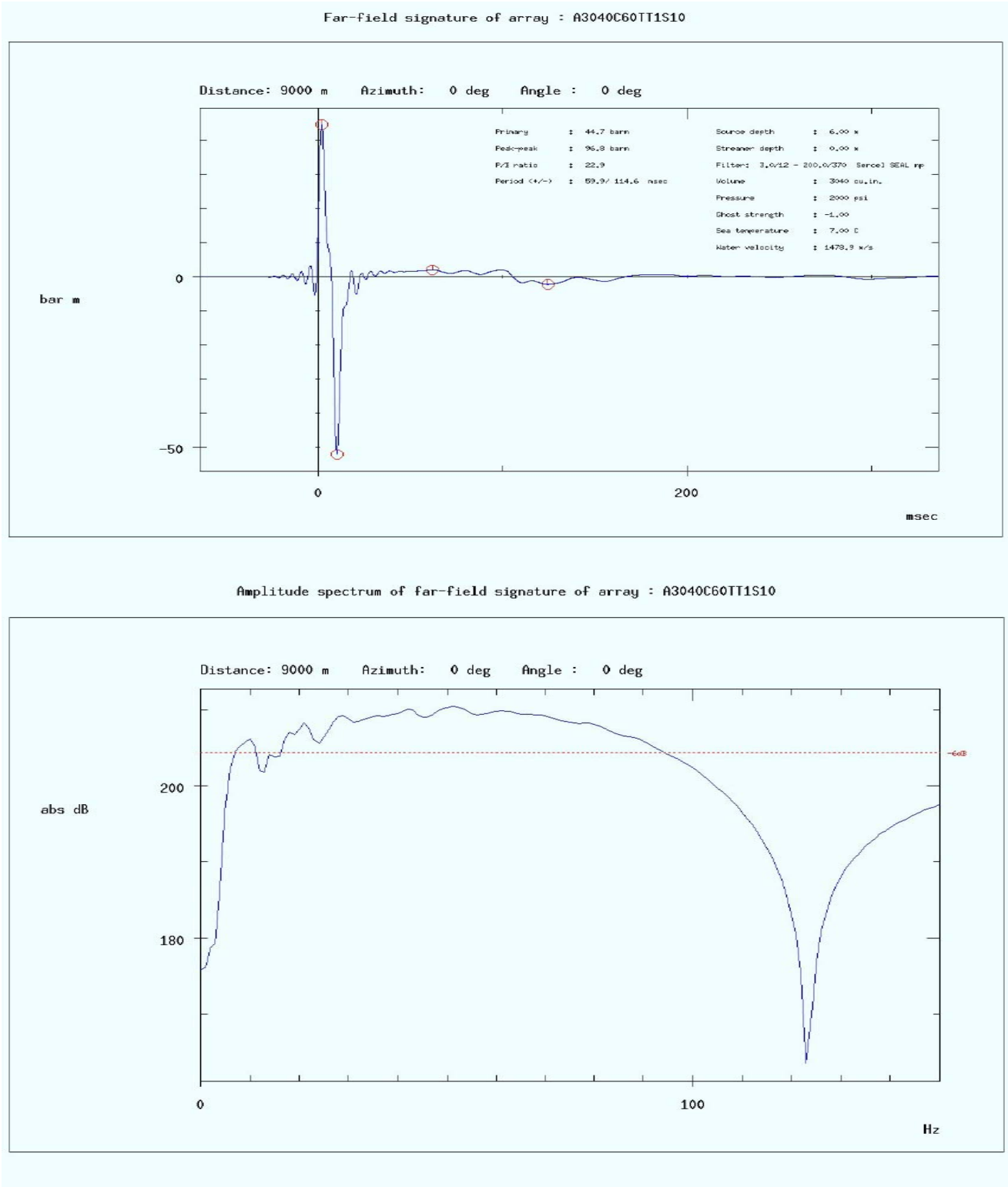
11.1.3. Array Listing

Total active volume: 3040 in^3 Nominal pressure 2000 psi.

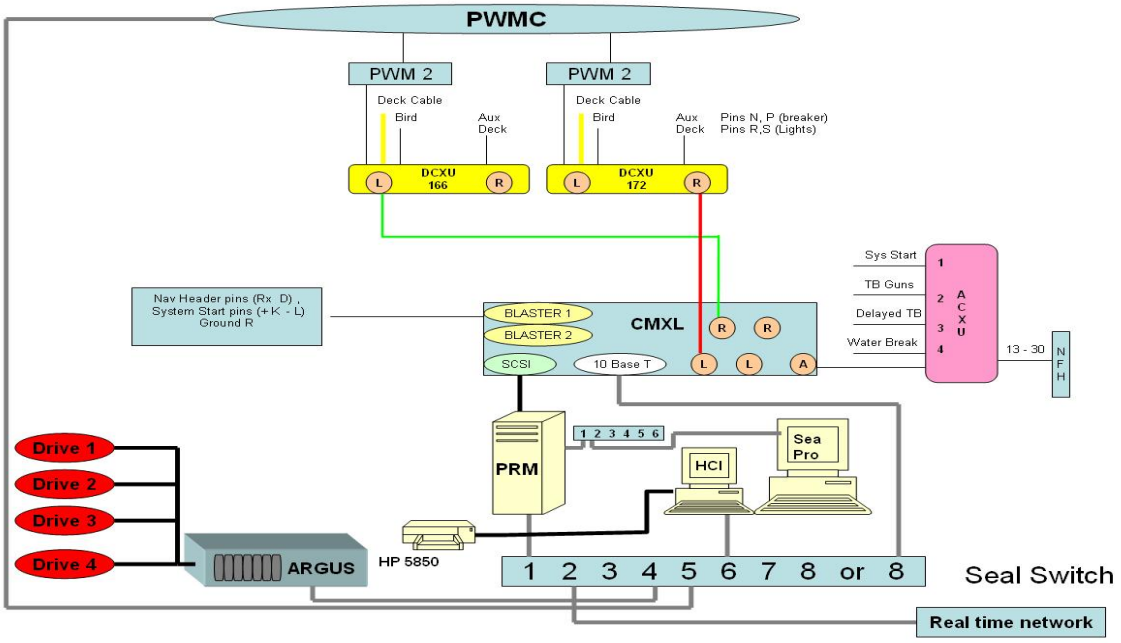
GUN#	GUN TYPE	Dist X (m)	Dist Y (m)	Dist Z (m)	Volume	Active / Spare	Sub-array #
1	1500LL	0	10.5	6	250	Active	1
2	1500LL	0	9.5	6	250	Active	1
3	1900LLX	3.5	10.5	6	150	Active	1
4	1900LLX	3.5	9.5	6	150	Spare	1
5	1900LLX	6.3	10.5	6	100	Active	1
6	1900LLX	6.3	9.5	6	100	Active	1
7	1900LLX	9.1	10	6	150	Active	1
8	1900LLX	11.9	10	6	70	Active	1
9	1900LLX	14.7	10	6	40	Active	1
10	1500LL	0	0.5	6	300	Spare	2
11	1500LL	0	-0.5	6	300	Spare	2
12	1500LL	3.5	0.5	6	300	Active	2
13	1500LL	3.5	-0.5	6	300	Active	2
14	1900LLX	6.3	0	6	100	Active	2
15	1900LLX	9.1	0	6	150	Active	2
16	1900LLX	11.9	0	6	100	Active	2
17	1900LLX	14.7	0	6	70	Active	2
18	1500LL	0	-9.5	6	250	Active	3
19	1500LL	0	-10.5	6	250	Spare	3
20	1900LLX	3.5	-9.5	6	150	Active	3

21	1900LLX	3.5	-10.5	6	150	Active	3
22	1900LLX	6.3	-9.5	6	100	Active	3
23	1900LLX	6.3	-10.5	6	100	Spare	3
24	1900LLX	9.1	-10	6	150	Active	3
25	1900LLX	11.9	-10	6	70	Active	3
26	1900LLX	14.7	-10	6	40	Active	3

11.2. 3040 Cu-Inch Pulse Response and Spectrum at 6m.



12. Instrumentation Room System Diagram



13. Navigation and Positioning System Description

13.1. System Configuration

13.1.1. Navigation Hardware and Software

System	Hardware (Type and Serial No.)	Software version
CONCEPT Spectra	RTNμ (30/207P & 30/208P)	Spectra 10.9.01.10
	IBM E Server Workstations	Red Hat ELWS3.6
External Header	N/A	Labo Header
Acoustic System	N/A	
TS-meter	Saiv AS STD/CTD model SD 204	
Echo sounder	Simrad EA600	

13.1.2. System Timing

Spectra issued closures to the source firing system and recording system 50 milliseconds before the predicted time of peak pressure. Spectra received the time break back from the GunLink source controller and all Spectra system positions are output for this time.

An additional trigger was issued from spectra 450 milliseconds after time zero, this was sent to the recording system as a timing verification. The trigger was 5 milliseconds in duration.

13.2. Survey Positioning Method Used

This survey was carried out using CGGVeritas standard mode of operation for single streamer/single source surveys.

Positioning of the vessel was by 3 Single/Dual frequency differential GPS systems using a delivery of differential correction data in RTCM 104 format and recorded in the P2/94 files.

The sources were positioned relative to the vessel using a network consisting of rGPS units mounted on sub-arrays 1, 2 and 3.

The centre near group of the streamer was positioned by a combination of compass heading units and nominal offsets from the vessel.

The centre last group of the streamer was positioned using a network consisting of a rGPS system unit mounted on the tail buoy, a nominal offset to the tail buoy and a streamer mounted compass heading unit.

The streamer shape was modelled by 23 Digicourse series 5011 combined streamer depth control and magnetic compass units on the streamer.

Least squares condition equations for the streamer assuming circular arcs between compasses and relating the tracking nodes, compasses, tension corrected distances between compasses, rotation bias and scale were used to compute scale, rotation and individual compass corrections. The streamer shape was then computed by the circular arc method.

13.3. Surface Positioning

13.3.1. Vessel Navigation

Summary

The SPM2000 with SPM 5.16 software provides single and dual frequency GPS positioning, using corrections generated by the Fugro Starfix network of reference stations broadcast via geostationary communication satellites.

The standard single frequency service is Starfix and the dual frequency services are Starfix.Plus, Skyfix.XP and Starfix.HP (High Performance).

Both, Starfix and Starfix.Plus are sub-metre level accuracy services. Starfix-Plus is the recommended service for equatorial regions where the standard service cannot achieve metre level accuracy during any peak of the solar cycle.

Starfix.HP is the Fugro positioning service with decimetre level accuracy at distances up to 1000 km from Starfix.HP reference stations making this system ideal for offshore applications requiring very precise horizontal and vertical positioning. The HP engine is now aided with the Starfix.XP engine to provide more robust and accurate position.

Skyfix.XP is Fugro's Positioning service based purely on State Space corrections.

Differential Correction Systems:

Fugro Skyfix via Spot Beam (OCSAT) satellite and Fugro Starfix via Inmarsat (IOR) and NTrip (Corrections received via VSAT)

All systems had the same accuracy and were set to have the same weight in the solution.

Fugro Multifix is a multiple reference station DGPS system tailored for the specific needs of seismic surveying. Algorithms combine reference station data and pseudo range measurements into the best position estimates.

By employing a correlation model for weighting the multiple range corrections in a least squares estimation process, the optimum pseudo-range corrections are obtained. W-testing and F-testing techniques detect and reject correction outliers.

Quality control is based upon UKOOA's recommended DGPS quality indicators - the precision and reliability of the fix are displayed as an Error Ellipse and Marginally Detectable Errors (MDE).

The differential corrections were transmitted to, and received on-board the vessel by three independent means and provided a high degree of redundancy to ensure continuous vessel positioning.

- **Further information is given in Appendix 1.**

Although Selective Availability was turned off in May 2000 differential corrections are still required to provide a high quality continuous vessel position. Less frequent updates are required however.

13.3.2. Float Navigation

Source and Tailbuoy surface navigation was provided by Seatex Seatrack relative GPS. The in-sea units incorporated a GPS receiver and interfacing for direct data transmission of the raw satellite pseudo-range data via UHF link to the vessel.

On board the vessel, the raw pseudo-range data from the float unit was matched with simultaneously received data at the vessel's GPS receiver to compute a vector describing the location of the float unit relative to the vessel from which the float position was derived. Relative positioning CEP was better than 2 m.

13.4. Streamer and Source Positioning

13.4.1. Streamer Compasses

23 series 5011 Digicourse combined magnetic compass and streamer depth controllers were attached to each streamer. All compasses were used for positioning and shaping the streamers.

Compass Sampling Rate = 2 second
Averaging constant = 14 seconds

Compass performance was monitored on a line-to-line basis throughout the acquisition phase of the survey.

13.4.2. Gyro Compass

The gyrocompass used during the survey was:

Gyro 1 - Simrad HS50 GPS

Second gyro was for standby purposes only. This gyro was overhauled prior to the survey and was installed back in place without dual sided calibration.

Gyro 2 - Tokyo Keiki MK.ES

The gyro correction values as computed during the mobilisation calibration were as follows:

Gyro 1 - plus 1.35 degrees
Gyro 2 - plus 2.20 degrees

13.5. Auxilliary Navigation Sensors

13.5.1. Echo Sounder

The echo sounder speed of sound was set to 1500 m/s. A draught correction of zero was entered in the echo sounder. The 12 kHz transducer was set to master transducer due depths of 1500m+ encountered during the survey.

14. Survey Pre-plots

14.1. Geodetics

Satellite/Survey Datum
Datum Name: GDA94
Spheroid Name: GRS80
Semi Major Axis: 6378137.0
Inverse Flattening: 298.2572236

Projection Type: Universal Transverse Mercator 55° S
Origin Longitude: 147.000E
Origin Latitude: 0000.00N
False Easting: 500,000.00E
False Northing: 10,000,000.00N

No transformation from WGS 84 to GDA94

14.2. Preplot

H0100Survey Area VICP65 2D
H0101General Survey Details
H0200Date of Survey N/A
H0201Date of Issue 03 Jun 2008
H0202Tape Version P1/90
H0203Line Prefix
H0300Client Eagle Bay Survey
H0400Geophysical Contractor CGGVeritas
H0500Positioning Contractor
H0600Position Processing
H0800Co-ordinate Location Preplot Sail Line Locations
H1100Receiver Groups per Shot 0
H1400Surveyed Datum WGS84 WGS84 6378137.000 298.2572236
H1401Transformation to WGS84 0.0 0.0 0.0-0.000-0.000-0.000 0.0000000
H1500Post Plot Datum N/A
H1501Transformation to WGS84 N/A
H1600Transformation H14 to H15 N/A
H1700Vertical Datum SL Echo Sounder
H1800Projection Type 2Universal Transverse Mercator
H1900Projection Zone 55S
H2000Grid Units 1Meters 1.000000000000
H2001Height Units 1Meters 1.000000000000
H2002Angular Units 1Degrees
H2200Long of Cent Meridian 1470000.000E
H2301Grid Origin 0000000.000N1470000.000E
H2302Grid Coords at Origin 00500000.00E10000000.00N
H2401Scale Factor 0.9996000000
H2402Lat/Long of Scale Factor 0000000.000N1470000.000E
H2600SHOT POINT INTERVAL 25.00 m
H2600LINE GENERATION MODE Great Circle
H2600NUMBER OF 2D LINES 8
H2600TOTAL 2D LINE LENGTH 150.02 kilometres
H2600AVG. LINE LENGTH 18.75 kilometres
H2600

```
H2600 Line Details
H2600
H2600 Format is:
H2600 LINENAME(A12) SEGMENT(I2) FSP(I6) LSP(I6) AZIMUTH(F7.3) LENGTH(F8.1)
H2600
H2600          1  1   1001   1955 115.300 023850.0
H2600          2  1   1001   1559 019.933 013950.0
H2600          4  1   1001   1845 018.849 021100.0
H2600          6  1   1001   1884 019.858 022075.0
H2600          8  1   1001   1784 019.509 019575.0
H2600         10  1   1001   1710 019.304 017725.0
H2600         12  1   1001   1695 018.694 017350.0
H2600         14  1   1001   1577 017.834 014400.0
H2600
H2600 NOTE: prepared from WGS84 UTM Zone55S client supplied coords 2June08
S1             1001390126.96S1484505.16E 651613.05679083.5
S1             1955390656.51S1490002.71E 672973.55668478.4
S2             1001390510.69S1484510.69E 651613.05672183.7
S2             1559385805.38S1484828.24E 656620.25685202.5
S4             1001391032.67S1484518.67E 651612.85662253.7
S4             1845385945.05S1485001.94E 658813.35682084.7
S6             1001391148.19S1484648.10E 653713.05659883.6
S6             1884390034.81S1485159.77E 661616.45680493.1
S8             1001391145.87S1484918.11E 657313.15659883.6
S8             1784390147.46S1485349.90E 664218.65678198.4
S10            1001391143.50S1485148.11E 660912.95659883.5
S10            1710390240.97S1485551.78E 667114.35676487.0
S12            1001391140.87S1485430.61E 664813.05659883.5
S12            1695390247.87S1485821.86E 670717.75676196.8
S14            1001391138.45S1485656.44E 668313.05659883.6
S14            1577390413.90S1485959.90E 673016.35673493.3
```

15. Navigation Systems Verification and Monitoring

15.1. Gyro Monitoring

Dockside verification was performed in Balikpapan, Indonesia over 07-08th August 2007.
An additional 1 sided calibration took place in Singapore on February 2008

- **The gyro verification results are in Appendix 3**

15.2. GPS Monitoring

Health checks onshore were carried out to verify that the installation was satisfactorily operational (data reception, transmission, processing and Logging were verified) and that operational settings were correct**.** Each system used, including duplicates was verified.

- **The onshore Health Check results are in Appendix 3**

15.3. RGPS Health Checks

The last RGPS verifications were held at Loyang Shipyard Singapore and onboard using a zero base line technique.

Previously verifications took place at Semayang Wharf, Balikpapan, Indonesia over the 07-08th of August 2007.

- **The onshore Health Check results are in Appendix 3**

16. Navigation Processing

16.1. The FGPS Seispos System

SeisPos is an off-line navigation QC and post-processing system for 2D and 3D streamer surveys supplied by Fast Geophysical Processing Services. It runs under various Windows operating systems and has a graphical front end. A relational database management system is used for data storage. SeisPos is capable of automatic filtering and gating of the observations in addition to manual editing, before new adjustments are calculated. There is a comprehensive set of QC tools available such as graphical plots of any node or observation parameters and combinations of these, comparison of online and processed P1/90.

16.2. First Line Test data

A first-break analysis was performed during the first line and to confirm the nominal offsets for the front end of the streamer. An offset shot test line was also performed after any streamer re-deployment.

16.3. Initial QC

Initial QC consisted of on-line monitoring of the systems and of producing an end of line QC report utilising the Spectra QCN (Quality Control Node). The report was generated as a PDF document. If any discrepancies were found, they would be further investigated and any problems were noted in the navigation line-logs.

The report included comparisons between the systems, plots of network reliability, SMA (Semi Major Axis), MDE (Mean Detectable Error) and TS-plots of compasses, depths and source separation.

16.4. Post-processing Flow

The lines were post processed using CGGVeritas standard 3D processing flow consisting of the following stages:

- Import P2/94 to database and check for header changes.
- Check for missing shots and perform shot edits.
- Update a-priori SD's and magnetic declination if required.
- Pre-process data applying standard gating and filtering, hand-edit any remaining observation spikes.
- Compass calibration and bias check.
- Network adjustment
- Processing QC report generation.
- Export final P1/90
- QC of final P1/90
- Comparison of online and final P1/90

16.5. Final QC

Final QC was performed during the post processing and consisted of checking the various reports and plots generated by SeisPos, checking consistency of logs and P1/90 QC and comparison. Any discrepancy was noted in the processing log.

16.6. Water Depth Processing

The recorded water depth data was corrected for vessel draught and speed of sound. All corrections were carried out in post-processing.

17. Observations

17.1. Navigation Summary

All systems performed well throughout the survey. Each systems performance is described in further detail below.

17.1.1. DGPS Systems-

The DGPS systems performed well throughout the survey.

17.1.2. Echo Sounder

The echo sounder performed consistently well throughout the survey.

17.1.3. Gyro

The primary and secondary gyro performed well during the survey.

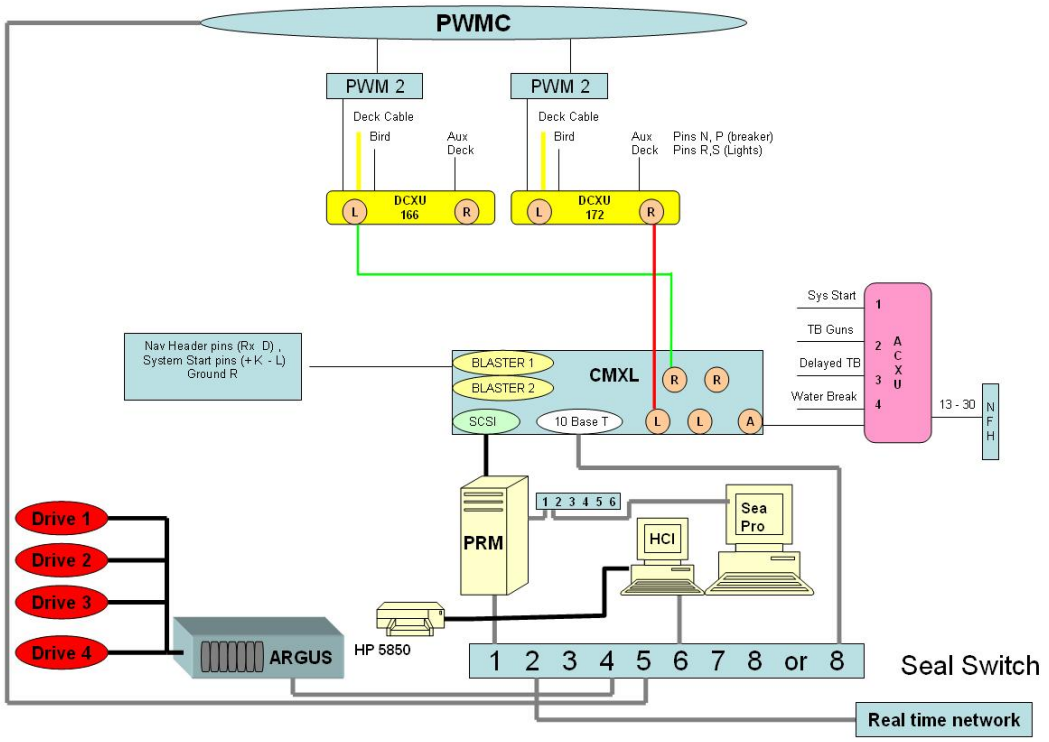
17.1.4. RGPS

RGPS worked well throughout the survey with no significant drop outs.

17.2. Processing and QC Summary

No problems recorded

18. Instrumentation and QC System Description



Unit Type	Manufacturer	Software version
Recording	Sercel Seal	Version 5.1.14
Argus	Profocus: Raid disk and data management	Version 4.0
Tape drives	IBM 3590E	
Plotter	Versatech 24inch	
Onboard QC	Seal Seapro QC and ARGUS QC	Version 4.0
Source Controller	Seamap Gunlink 2000	Version 2.5.2
Auxiliary Systems	48 channel (Sercel AXCU)	
Bird Controller	Digicourse DMU + PC	Sys 3v01
Bird Type	Digicourse 5011E	Sys 3v01

19. Instrumentation and QC tests

19.1. Start-up tests

Before the beginning of the survey started, and after the streamer was deployed, a complete set of instrument/sensors tests were performed.

These tests were as follows:

Instrument tests
1 Harmonic distortion
2 System noise
3 Common mode rejection ratio
4 Gain error/ phase error
5 Cross talk

Sensor tests
6 Hydrophone capacitance
7 LF cut-off
8 Leakage resistance

At the start of the survey a complete set of instrument tests were performed and sent to the processing centre together with the seismic data. The results of the Start of Job Instrument/Sensor tests were:
Channels 91 & 337 failed Capacitance. Channels 51 & 242 failed Leakage.

19.2. Additional client tests

Polarity tests were carried out at the start of contract and verified on Promax. No channels had polarity reversed.

19.3. Daily Instrument and Sensor tests

The daily instrument and sensor tests consisted of the same 8 tests which were used to verify the Seal and Streamers performance at the start and throughout the contract. Results were printed out daily and also recorded to tape at start-up, interim monthly and end of contract. These tests were run daily to confirm that the Seal recording system and streamer performance were in specification.
The series of tests results showed the recording system to be in specification throughout the survey. The overall system performance was stable throughout the survey with test performance repeatable from day to day.

19.3.1. Seal tests performed daily

The following page shows the tests performed daily and their results.

Instrument tests
1 Harmonic distortion
2 System noise
3 Common mode rejection ratio
4 Gain error/ phase error
5 Cross talk
Sensor tests
6 Hydrophone capacitance
7 LF cut-off

8 Leakage resistance

19.3.2. Seal system and streamer test results

Streamer 1

	System tests						Sensor tests			
Date Local	HD	Sys noise	CMRR	Gain err	X talk odd	X talk even	Cap	LF cut-off	Leakage	Remarks
04-Jun-08	OK	OK	OK	OK	OK	OK	2	0	2	Ch. 91, 337 failed capacitance. Ch. 51, 242 failed leackage.
05-Jun-08	OK	OK	OK	OK	OK	OK	2	0	3	Ch. 91, 337 failed capacitance. Ch. 51, 179, 242 failed leakage.

2.3.3. End of job test

At the end of the survey a complete set of instrument tests were performed. These tests were as follows:

Instrument tests
1 Harmonic distortion
2 System noise
3 Common mode rejection ratio
4 Gain error/ phase error
5 Cross talk

Sensor tests
6 Hydrophone capacitance
7 LF cut-off
8 Leakage resistance

The SOJ, Interim Monthly and EOJ tests listed above were recorded to tape, and sent to the processing centre together with the Seismic data.

The result of the End of Job Instrument/Sensor tests were: Channels 91 & 337 failed Capacitance. Channels 51, 179 & 242 failed Leakage.

The overall Seal and Solid streamer system performance was stable and repeatable throughout the survey.

19.3.3. QC Processes

Seismic Observer QC displays

Seal system QC displays showing shot records and rms residual noise were used to monitor seismic data shot by shot. RMS levels were colour scaled to give good visual assessments to the operator of sea swell and ship noise effects on the streamer.

QC products and processing sequence

A Promax system was in use during the survey to further monitor the quality of the Seismic data, and to produce Gathers, Brute and Raw stacks.

19.3.4. Production tape logs

Client	EagleBay
Area	South East Basin, Offshore Australia
Survey	2D, VicP65
Job #	6374

BOX 1

Vessel M/V Pacific Titan

Date	Line Name	Tape	Seq	FF	LF	FSP	LSP	Comments
04 June 2008	EBAY08-06-001	1	1	979	2002	1901	881	SOL/EOL
04 June 2008	EBAY08-10-002	2	2	979	1831	981	1830	SOL/EOL
04 June 2008	EBAY08-14-003	3	3	979	1698	1597	881	SOL/EOL
04 June 2008	EBAY08-12-004	4	4	979	1816	981	1815	SOL/EOL
04 June 2008	EBAY08-08-005	5	5	979	1905	1804	881	SOL/EOL
05 June 2008	EBAY08-04-006	6	6	979	1692	981	1691	Incomplete
05 June 2008	EBAY08-04-007	7	7	1550	1966	1552	1965	SOL/EOL
05 June 2008	EBAY08-02-008	8	8	979	1680	1579	881	SOL/EOL
05 June 2008	EBAY08-01-009	9	9	979	2076	981	2075	SOL/EOL
05 June 2008	SOJ / EOJ Tests	10	NA	1	12	NA	NA	SOJ / EOJ Tests
		End of Survey						

20. Onboard QC Personnel and System

20.1. Onboard QC Processing Geophysicists

4th – 6th June 2008	Steffi Schwarz	CGGVeritas, Chief Field Geophysicist
	Dennis Jerome Aquino	CGGVeritas, Field Geophysicist

20.2. Onshore QC Processing Support

Ronny Tømmerbakke	Support Geophysicist
Cathrine Myrmehl	Support Geophysicist
Christophe Massacand	Chief Operations Geophysicist

20.3. Seismic Processing Hardware Description

Machines	:	1 x Supermicro, built on SC833T-R760 Chassis
		(Dual Core Xenon 2x3.2GHz CPU, 8Gb RAM)
		1 x Win XP SP2 PC
Hard Disk Drive	:	1.6Tb Disk
Monitors	:	4 x 19in LCD Monitors
Tape Drives	:	2 x IBM 3590 tape drives
Plotter	:	1 x Isys V24 24in Thermal Plotter (B&W)

20.4. Seismic Processing Software Description

Processing software	:	ProMAX 2D version 2003.12.1.1
Operating System	:	LINUX Red Hat Enterprise WS 3.0 Update 6
Plotting software	:	ZehPlot Express 4.7.0

21. Acquisition Quality Control

21.1. Introduction

This report provides a summary of the steps taken for the onboard seismic data QC for this survey. Information important for the onshore processing of this data is either contained within this document, or its location is referenced.

The SEBOA survey is comprised of several 2D seismic surveys for the SEBOA consortium (Santos, 3D Oil, Bass Straits Oil Company, Cue Energy Resources, Eagle Bay Resources, Exoil and Tap Oil). The survey sites are located offshore South East Basin and Bass Strait Basin in Australia and cover around 10,900 sq kms.

This report covers the Eagle Bay survey of block VICP65.

Acquisition parameters for the project are the following:

- 1 Streamer x 6000m
- Single source
- 25 m SP interval
- 6 seconds record length

21.2. QC Processing Objectives

The main objective of the onboard QC processing was to identify problems associated with the data acquisition and recording. This included the assessment of noise in the data on a line by line basis in order to give an overall impression of the data quality.

Various QC methods, including RMS noise displays, single and multi-trace displays, gun hydrophone channels and stacks were used to assess compliance with various acceptance criteria and to isolate any other acquisition issues.

The general aim of the QC processing was not to attenuate noise but to show the data as it was recorded, or how it would be presented to the processing centre.

A brute stack was produced for every line with minimal processing to enable a thorough QC of the data onboard. In addition to brute stack processing, gun hydrophone channels were checked to QC the performance of the source. Near trace and Shot vs. Channel RMS displays were generated and examined to identify any noise problems.

21.3. Parameter Testing

Parameter testing consisted of choosing suitable parameters on the first sequence, along with NMO mutes, and post stack scaling for the displays, and checking that these parameters remained appropriate throughout the survey. Testing was kept to a minimum due to the high acquisition rate and resulting workload.

21.4. QC Processing Sequence

Data was recorded by the Observer department in duplicate onto 3590 tape cartridges (10Gb capacity). One 'primary' tape set and one 'copy' tape sets were generated. Upon completion of a line, the ‘original’ (or ‘primary’) tape was read to confirm the integrity of the data on tape. All SEG-D data on the primary tape was extracted and written to the ProMAX system disk. A listing of the field files (FFID), shot point numbers (SP) and number of channels was printed to clearly identify any lost shots or shots with missing navigation headers. Copy tapes were also checked for completeness of data on tape.

The data included 480 seismic channels and 30 auxiliary channels (-1 to -30). Informative auxiliary channels are Aux1 - System Start, Aux2 - Time Break, Aux4 - Waterbreak, Aux13 to Aux30 - Gun Near Field Hydrophones. Also recorded were the start of line (SOL) and end of line (EOL) noise records.

Seismic data, noise records and auxiliary channels were input with a record length of 6000ms, and a 2ms sample interval was used in the acquisition. The cable length was 6000 meters with hydrophone group separation of 12.5 meters, and shotpoints were recorded at 25m intervals.

A bulk shift static correction was applied to the data to correct for the 50ms instrument delay of the recording system.

For QC purposes a nominal 2D geometry was applied to all the seismic trace data. The resulting offset / CDP binning information calculated was then loaded into the seismic trace headers. The data was re-sampled from 2 ms to 4 ms using a minimum phase, high fidelity anti-alias filter applied prior to resample. Further data reduction involved 2-to-1 Marine Trace Decimation after differential NMO, which increased the receiver spacing from 12.5 to 25 meters.

To balance the amplitudes of the shot record, true amplitude recovery using a spherical divergence correction was used and applied to the whole shot record, based on a brute velocity function picked for the area. Band pass filtering (Ormsby 6-8-90-120) was also applied to the data, prior to NMO and stacking.

Water bottom picks were automatically generated and manually QC’ed for the near channel.

Trace editing involved killing any bad traces or shots based on Observer log comments and results of the QC.

21.5. Velocity Analysis

Velocities were picked for every line at a 4 km interval using the ProMAX interactive velocity analysis package. This was comprised of a semblance display with RMS stacking velocity graph and interval velocity graph, CDP super gather panel and function stack panels.

To improve the signal to noise ratio, super gathers were formed by combining 15 adjacent CDP gathers. Stack panels were created from these 15 CDPs using 31 functions varying +/- 35% from the regional velocity function of the first two sequences. Thereafter, the velocity functions of the nearest adjacent line shot in the same direction, were used as a guide.

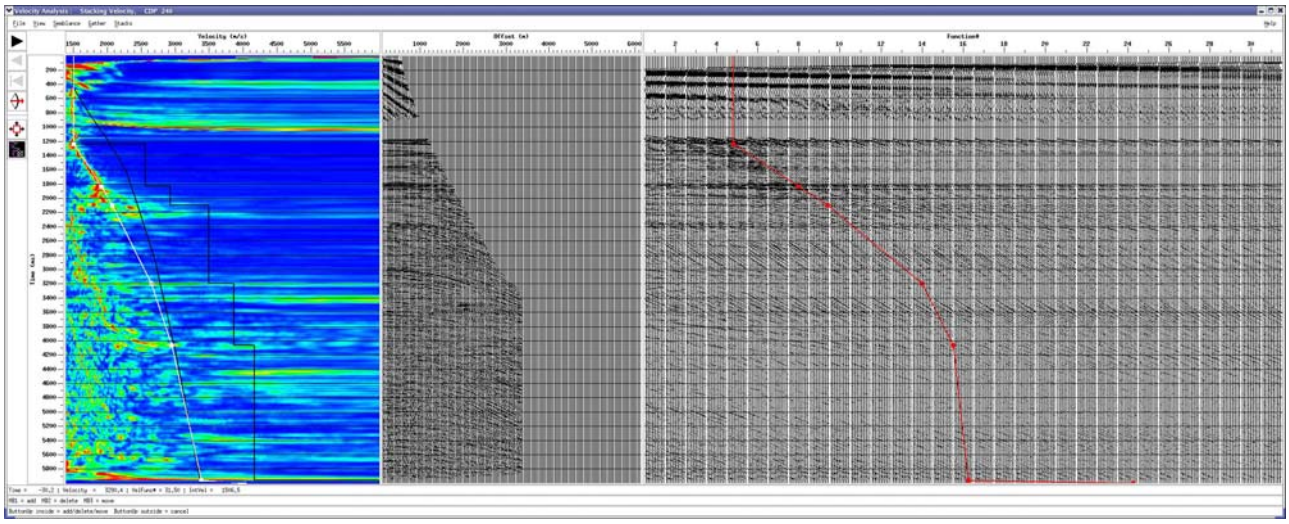


Figure 21-1: Example of velocity analysis for sequence 001. Graphical user interface with semblance, super-CDP gather and function stacks.

To speed up the on-screen velocity picking procedure, the velocity analysis displays were pre-computed. Normal move-out was applied to the gather to check that the events were lining up well. NMO corrected gathers were also displayed onscreen: both, at and between velocity locations, for further verification.

A velocity table for each sequence was exported to ASCII format.

21.6. Brute Stack

Brute stacks were produced as soon as possible after each line and presented to the onboard client to assess the noise impact on the data.
A straight mean vertical stack algorithm was used for CDP stacking, with a root power scalar for normalization of 0.5. A bulk shift static correction was applied post-stack to correct for the gun and cable depths. Filtering was limited to a 6-8-90-120 Hz Ormsby band-pass filter. The raw brute stacks were captured to jpg and plotted to paper.

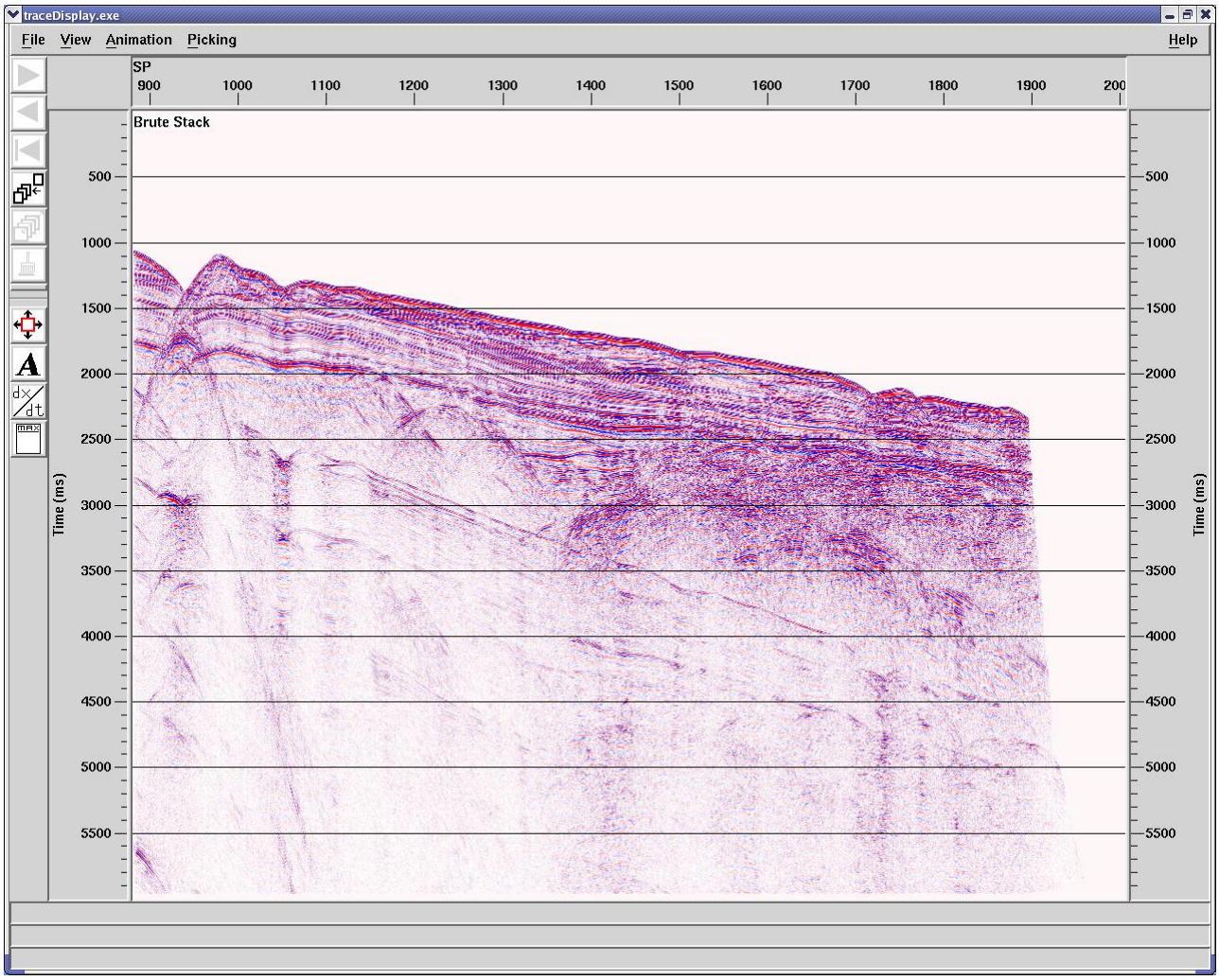


Figure 21-2: Example of brute stack for sequence 001 down to 6 seconds of data.

21.7. QC Workflows

This section describes the quality control steps that were taken. This acquisition QC allows for the onboard processors to find, log and analyse any potential problems with data acquisition. These were done in conjunction with the other onboard departments so as to maintain the highest possible standards of acquisition.

The onboard QC workflows include a full set of quality controls used to detect seismic and positioning problems.

STEP	DETAILS	QC PROCEDURE/PRODUCT
Reformat to ProMAX internal format	Input full length record - 6000ms, 480 channels + 30 auxiliary channels	Check Job Listing for FFID/Shot numbering, Gun Seq, Main headers. Check for missing data
Noise Record	Start And End Of Line. Ambient RMS Calculation	Check screen display and noise level Screen capture SOL & EOL records
Noise History	Append Noise Calculation to History	Screen capture Noise History – single display for entire project
Raw Shots Display	Every 1025m, 480 channels 6000ms	Check Channel Edits Check Data Quality
Auxiliary Channel QC	Create Aux Channel Gathers Vertical Stack Gun Hydrophones for each Gun string	QC of Aux Channels Check for autofires, gun timing, air leaks
Near Trace Display	Select First Channel and Display	Check record length, data quality Screen capture
Shot vs Chan RMS Analysis	• Ormsby, Zero Phase, 4-8-90-120 Hz BPF applied. • 2 Windows: 50-500ms & 5450-5950ms. • Shot by shot Average Noise Calculation.	Check levels against job specs Check for bad channels Screen capture for both displays
RMS History	Calculate Average for Sequence and append to RMS History File	Screen capture RMS History – single display for entire project
Trace Decimation Flow	• Input Raw Shots • Apply Shot and Channel Edits based on Observer Logs and QC • -50ms static shift for Instrument Filter Delay • Ormsby, Minimum Phase, 4-8-90-120 Hz Band Pass Filter • Apply 2D Nominal Marine Geometry	

STEP	DETAILS	QC PROCEDURE/PRODUCT
Decimated shot display	Every 1250 m shot display on screen	Check shots
Velocity Analysis	Every 4 km, Semblance, Gathers, Variable Velocity Percentage Stack Panels	Pick velocities every 4km
Velocity QC	Start ProMAX Interactive Velocity QC and Editing tool.	Check velocity Field for Spikes and Picking errors. Display as Interval Velocities for additional QC
NMO gathers	Every 2km NMO CMP gathers on screen	Check moveout of primaries.
Export Vels	Export Velocity Table to ASCII	Save ASCII Vel file
Stack RMS Flow	Calculate water column RMS value for posting on top of the stack	
Shot Stack Flow	Calculate average RMS level of each shot over entire line, measured within a window. Post in ProMAX database	QC for anomalous values Screen capture
Channel Stack Flow	Calculate average RMS level of each channel over entire line, measured within a window. Post in ProMAX database	QC for anomalous values Screen capture
Stack Flow	• Input Decimated Shots • Sort to CMP order • Moveout with picked Velocity Field • Surgical NMO mute • 1/sqrt(n) fold compensated stack • Apply Gun and Cable Statics • $1/tv^2$ • amplitude recovery • Ormsby, Minimum Phase, 4-8-90-120 Hz Band Pass Filter	Check quality of stack Check completeness of Stack and corresponding SPs, FFIDs and CDPs Screen capture
Stack Plot	Time Variable Amplitude Compensation	QC of stack
SEG-Y stack	Write to SEG-Y & QC	Save deliverable file
Nav Merge QC	Merge lead trace of each cable with P190. Calculate direct arrival time and display over Seismic Near Trace Gather.	Check that predicted Direct Arrival Time closely follows the seismic data. Check that all traces have merged successfully.

STEP	DETAILS	QC PROCEDURE/PRODUCT
		End of Job

21.8. Noise Record and Channel RMS graph

The noise records were recorded at the start and end of every line, and displayed for QC. Channel RMS values were computed for all 480 channels over the entire record for noise analysis, and graphed above the display. For every sequence the noise record at SOL and EOL was displayed on screen and archived to GIF format.

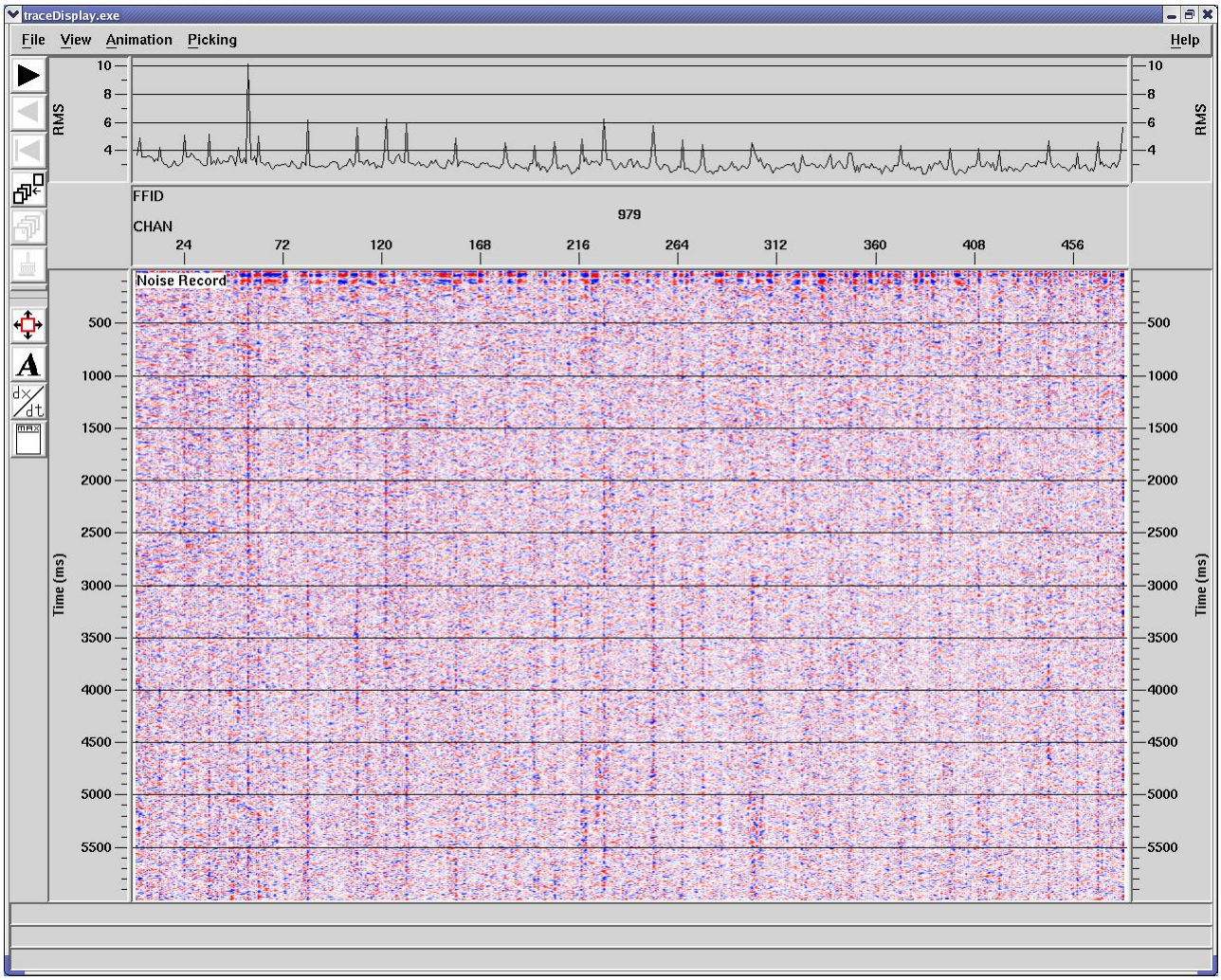


Figure 21-3: Example of noise record with channel RMS levels annotated, sequence 001. Note slightly noisy bird channels, noisy channel number 55.

For each noise record a noise analysis is performed. The average ambient noise encountered in the noise records is recorded in the QC log.

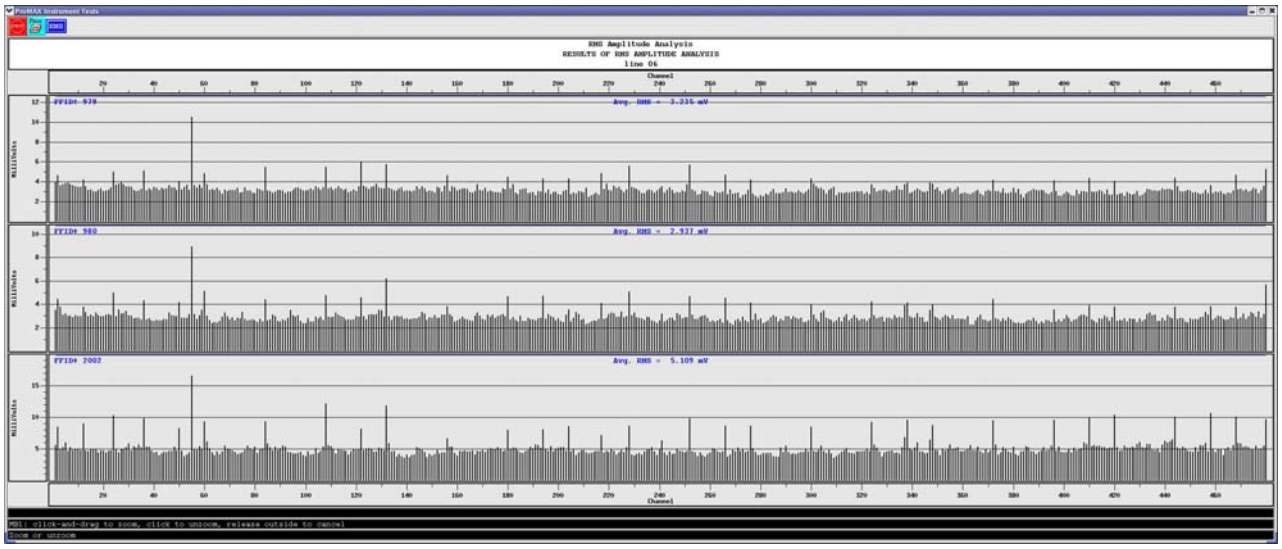


Figure 21-4: Example of analysis of noise records for sequence 001. Note noisy bird channels.

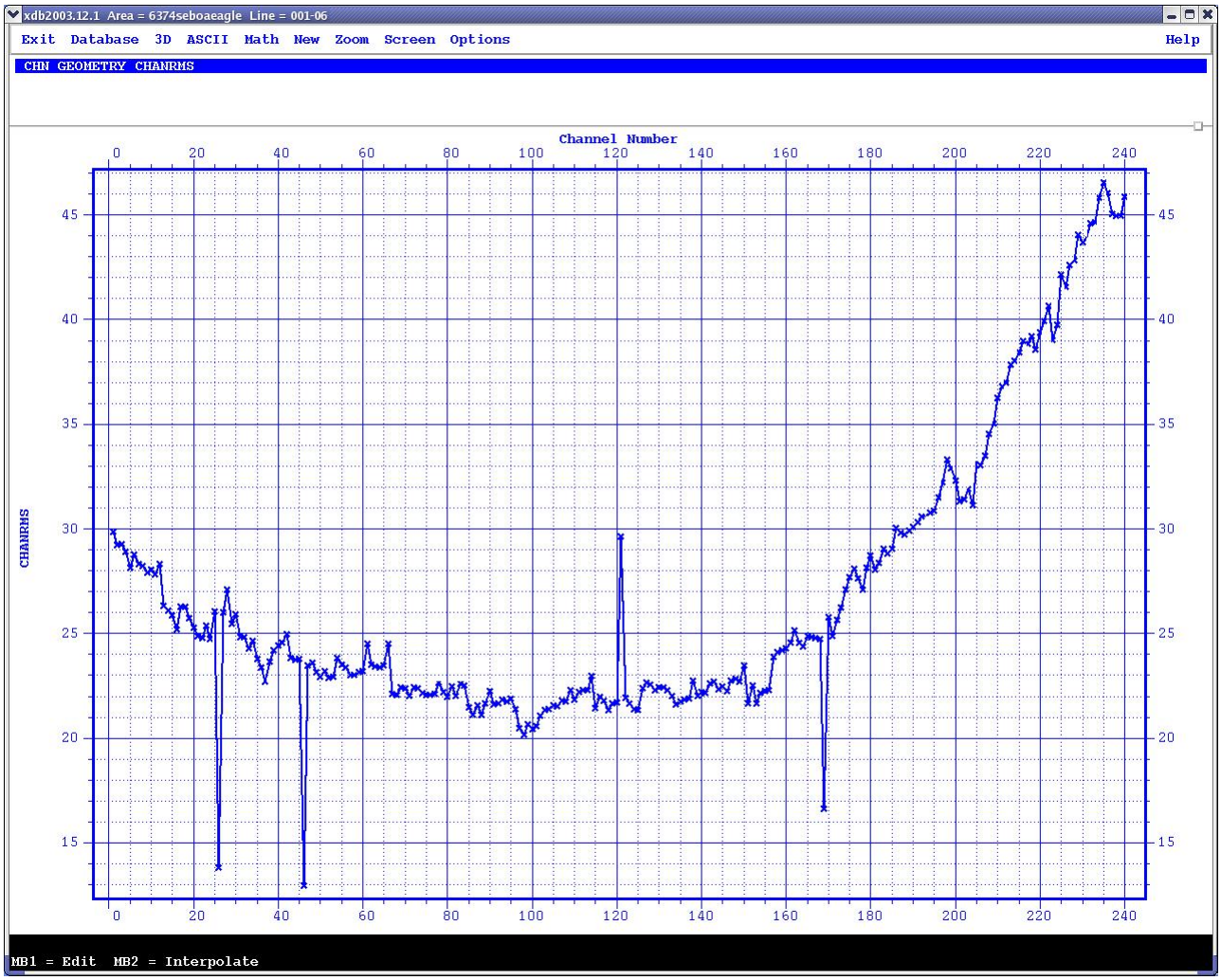


Figure 21-5: Example of channel stack sequence 001. The display computes the average RMS of the last 500ms of each channel and writes it to the database. Note noisy bird channels.

Figure 21-6: Example of shot stack sequence 001. The display computes the average RMS of the last 500ms of each shot and writes it to database.

21.9. Ambient noise - Shot Vs Channel RMS Display

Colour displays of Shot vs. Channel RMS values were produced for the whole cable for every line to assess the ambient noise level and the channel quality. Raw data with a sample rate of 1 ms was used to calculate the RMS values for every channel on every shot.

RMS values were calculated from two windows, a shallow window of 50-500ms at the start of the record, and a deep window of 5450-5950ms at the end of the record. RMS values from all channels were averaged for each shot. They were displayed on the graph.

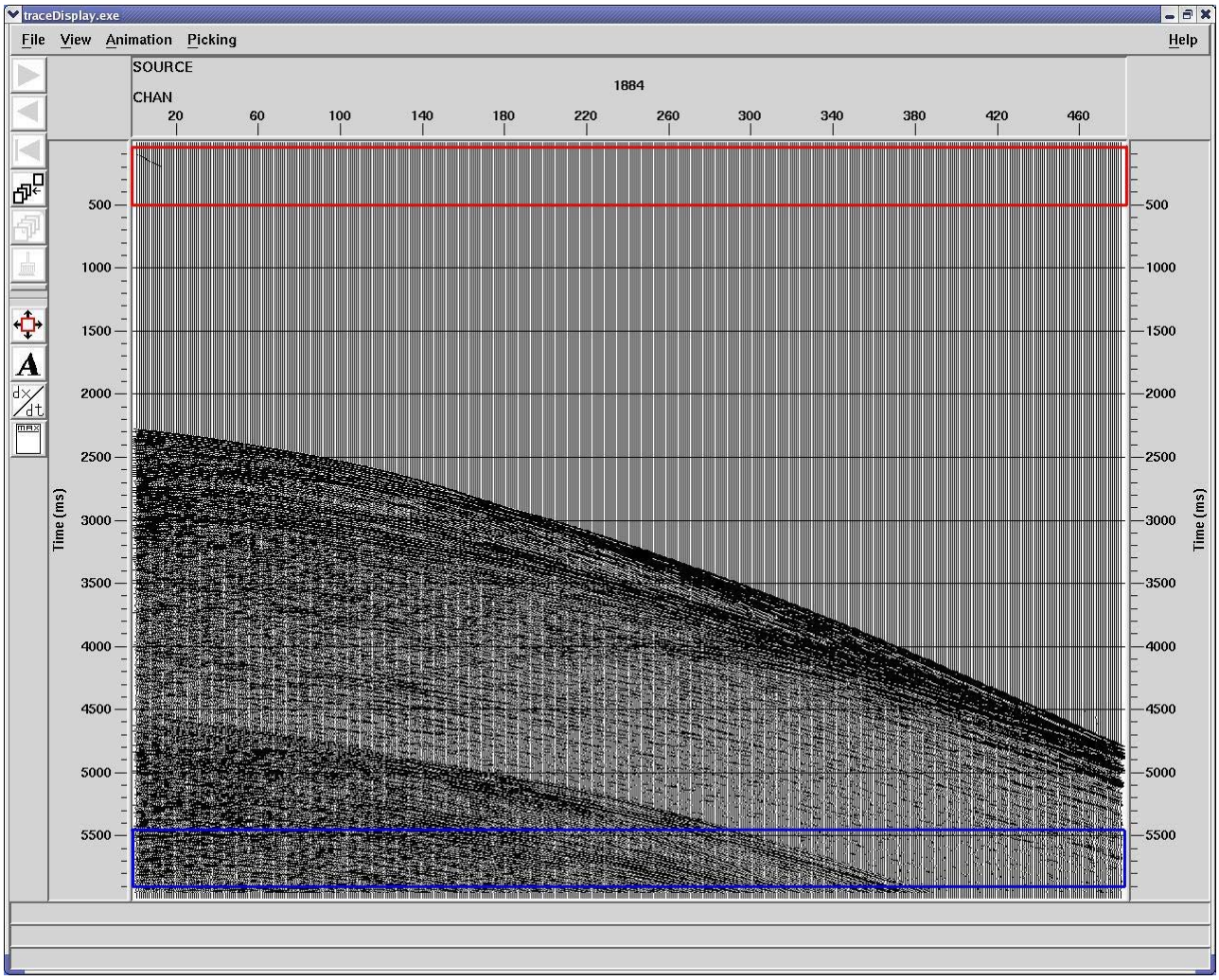


Figure 21-7: Example of shot gather. SP 1884 of sequence 001. Shallow RMS (red rectangle) and deep RMS (blue rectangle) analysis windows annotated.

For all RMS computations a scaling factor of 46.5 was used to convert from millivolts to microbars, the instrument sensitivity being 21.5 Volts/Bar.

The shallow and deep colour RMS displays were viewed on screen, and screen images were then saved as JPG files. The displays were used to show noise trends along the line such as swell noise, noisy/bad channels, bird noise, cable tug, front end noise, cable strikes, auto-fires and misfires, multiple interference, etc. Noisy channels could be clearly identified and deteriorating channels could be spotted using this display. The on screen analysis also allowed the exact shot and channel location of any noise trend to be located and investigated. All suspicious shots were then examined in the raw shot display to find and edit noisy shot records.

The shallow window was overdriven for the first 50 channels, as can be seen on the plot below (red bar at top of display). This is due to the water depth of the survey area, and the impossibility of finding an adequate water column window at the top of the trace, free from the seismic impulse. Therefore, it was impossible to determine average values of ambient noise from the rms displays.

At the end of the survey a composite display was created showing average RMS values per channel on a sequence-by-sequence basis.

ASCII format files of the ambient RMS can be found on the Deliverables CD as well as the QC log

for the survey area (see 24.3).

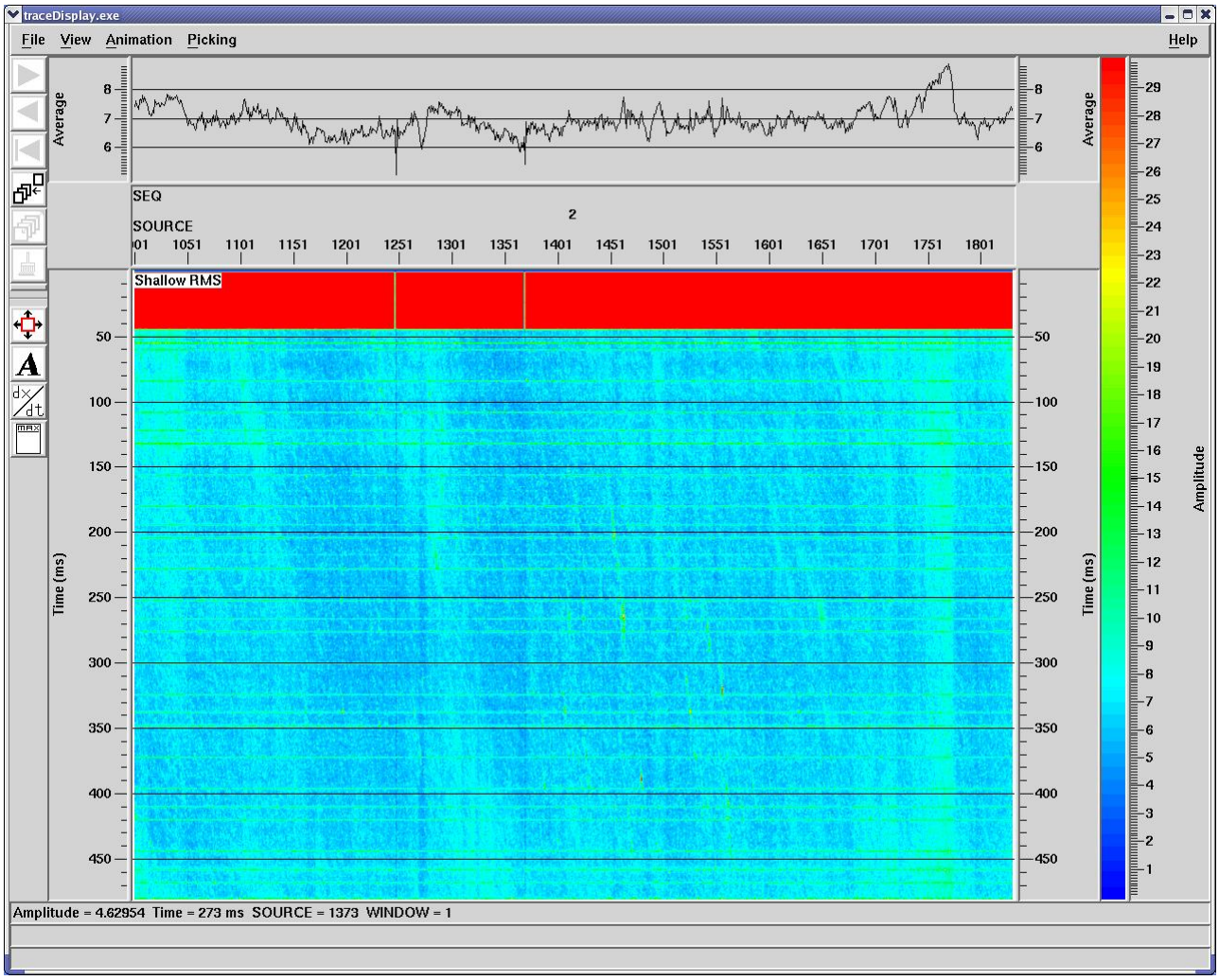


Figure 21-8: Example of shallow RMS window for sequence 001. Note noisy bird channels and noisy channel 55. The first 50 channels are dominated by direct arrival energy.

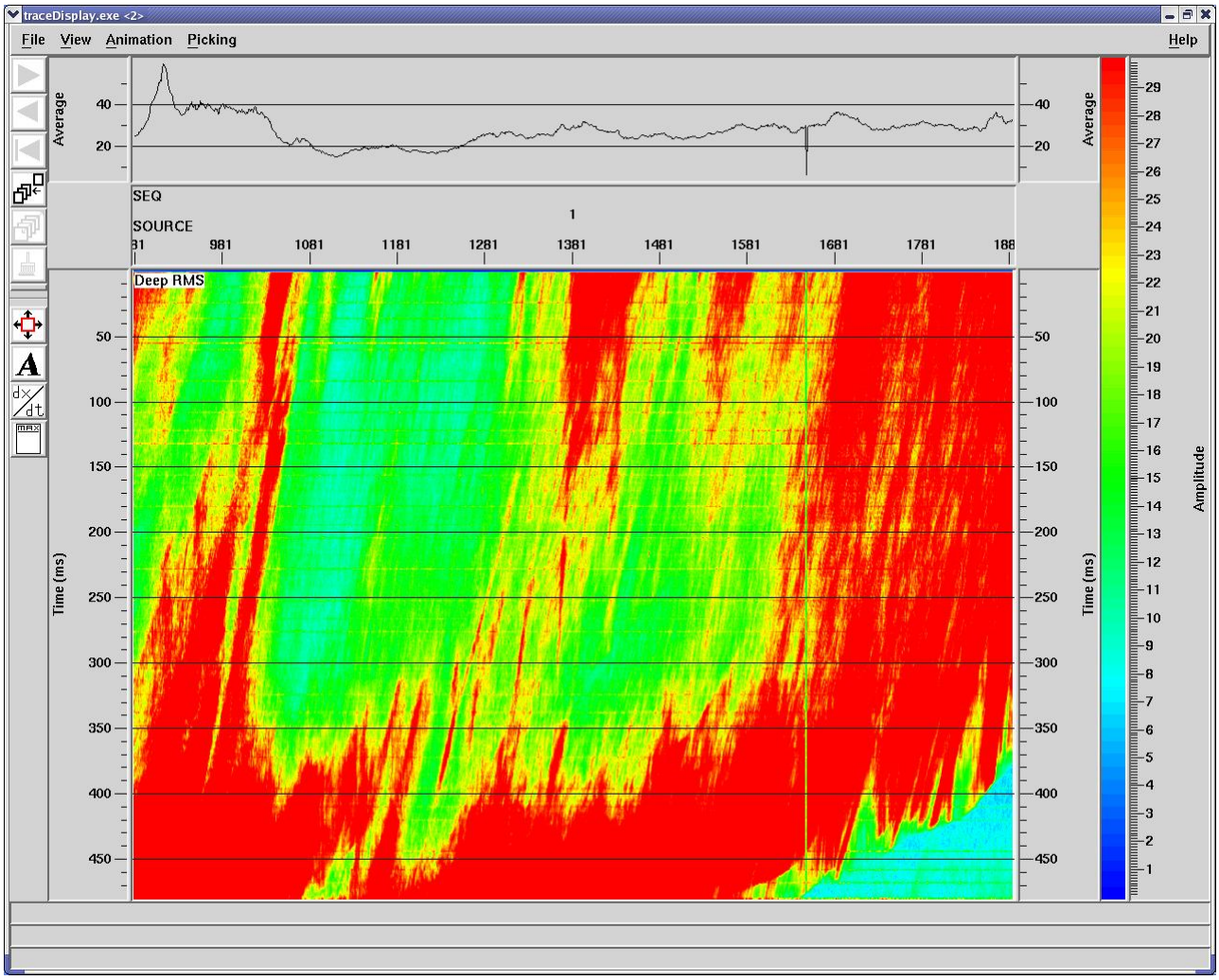


Figure 21-9: Example of deep rms window QC from sequence 001. The RMS is dominated by residual energy.

21.10. Near Trace Display

The near traces were displayed on screen for every line in order to quickly determine any possible errors with acquisition, e.g. gun volume changes, bad records, time-break problems and any auto-fires not reported by the recording system. The near traces also provided a good indication of the geological conditions, including strength of the water bottom multiples, residual seismic multiple energy and swell noise contamination.

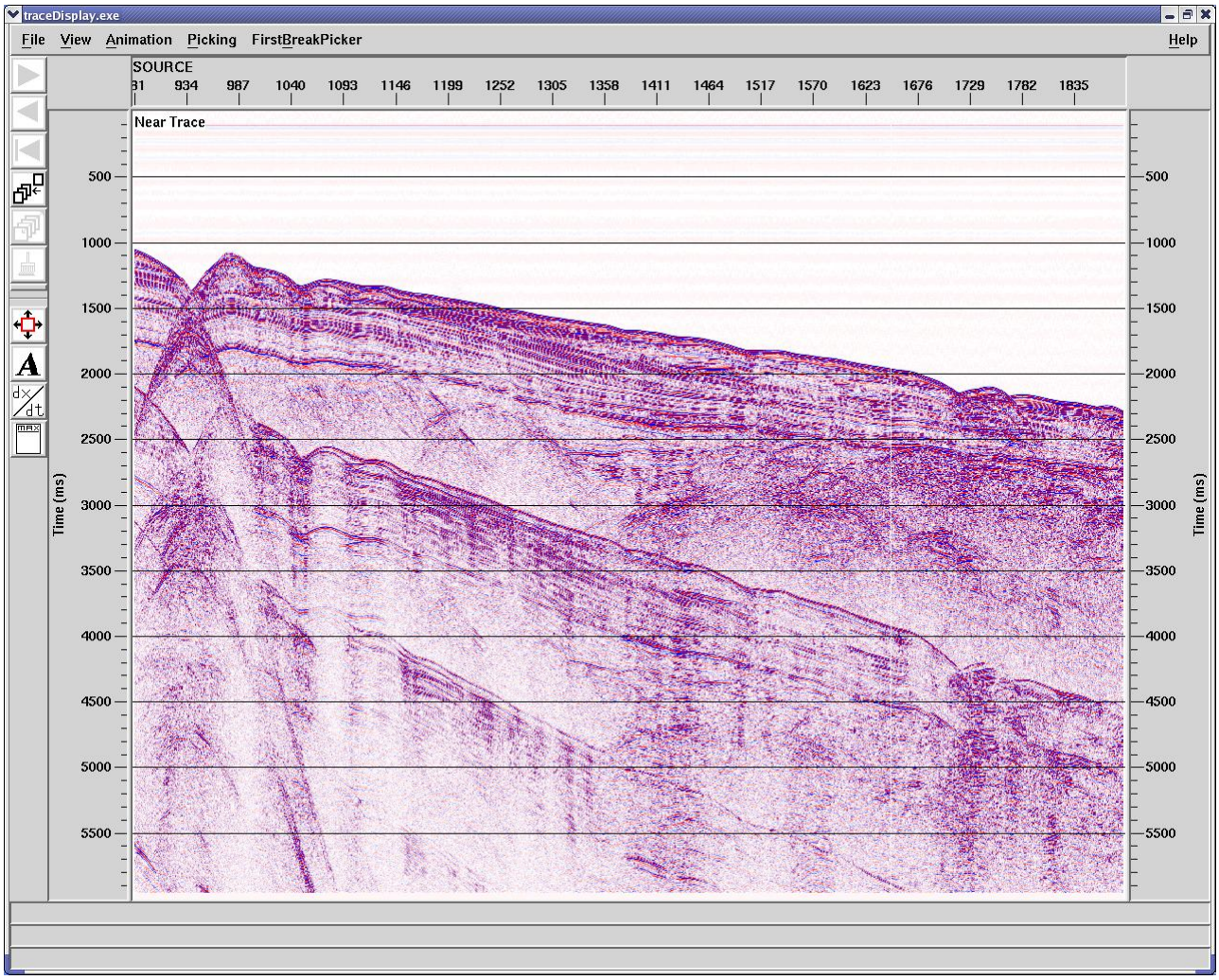


Figure 21-10: Example of near trace display, sequence 001. Note missed SP 1649.

21.11. Auxiliary Channel QC

The 30 auxiliary channels (-1 to -30) loaded during the SEG-D read, were separated from the 480 data channels, stored in a separate data file, and used for on screen analysis. These records consisted of the time break, the water break, and 6 near-field hydrophones for each of the 3 sub-arrays.

Time break and water break channels were displayed as a single trace display on screen. The first 500ms from all 6 hydrophones within each sub-array were stacked vertically and displayed in order to evaluate the performance of the guns. This proved useful in distinguishing genuine gun problems from noise on the trace. The auxiliary channel displays were used to locate air leaks and autofires.

Hydrophone 18 (gun string 1) was dead for all sequences.

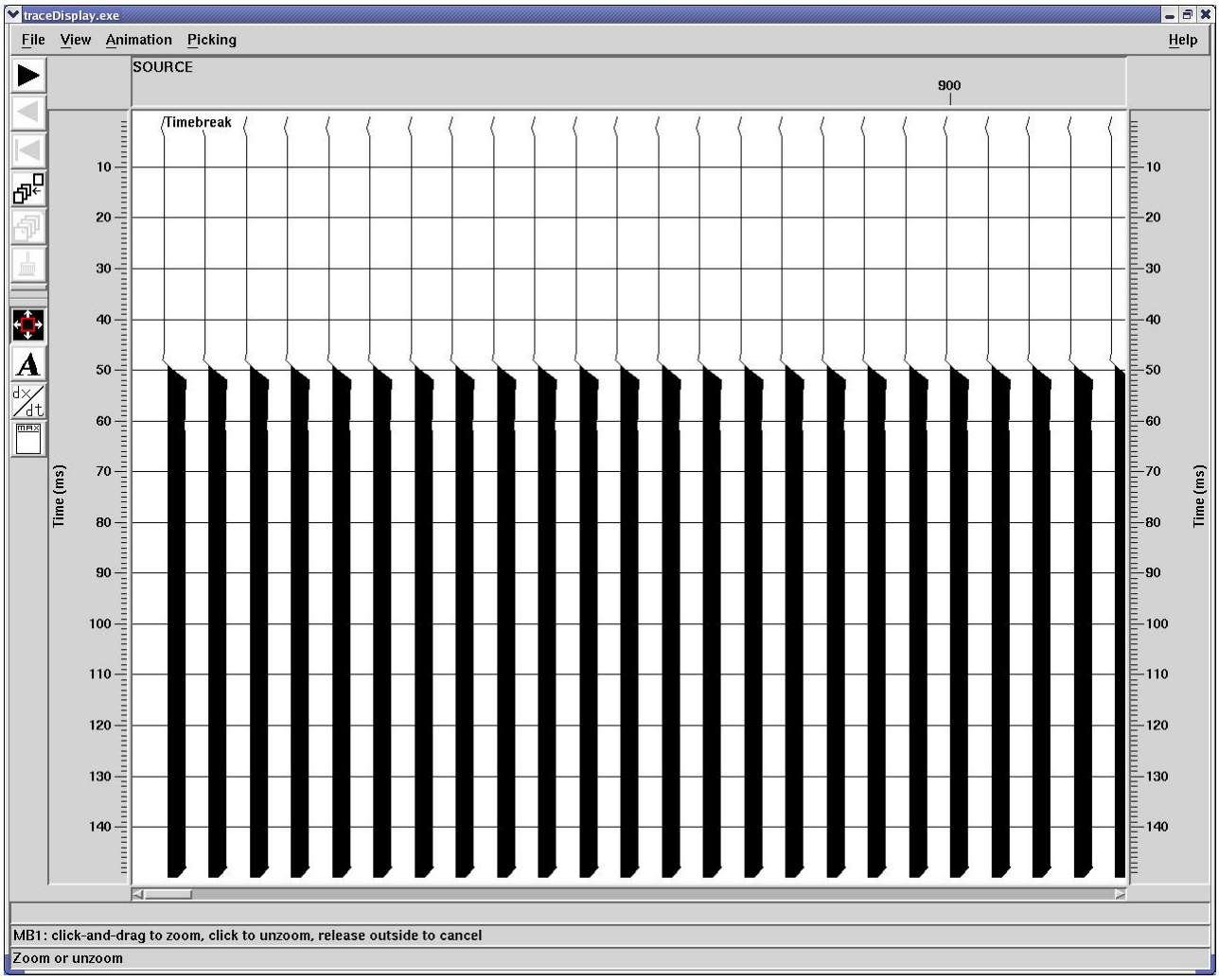


Figure 21-11: Example of Timebreak QC (Auxiliary channel 1) for sequence 001.

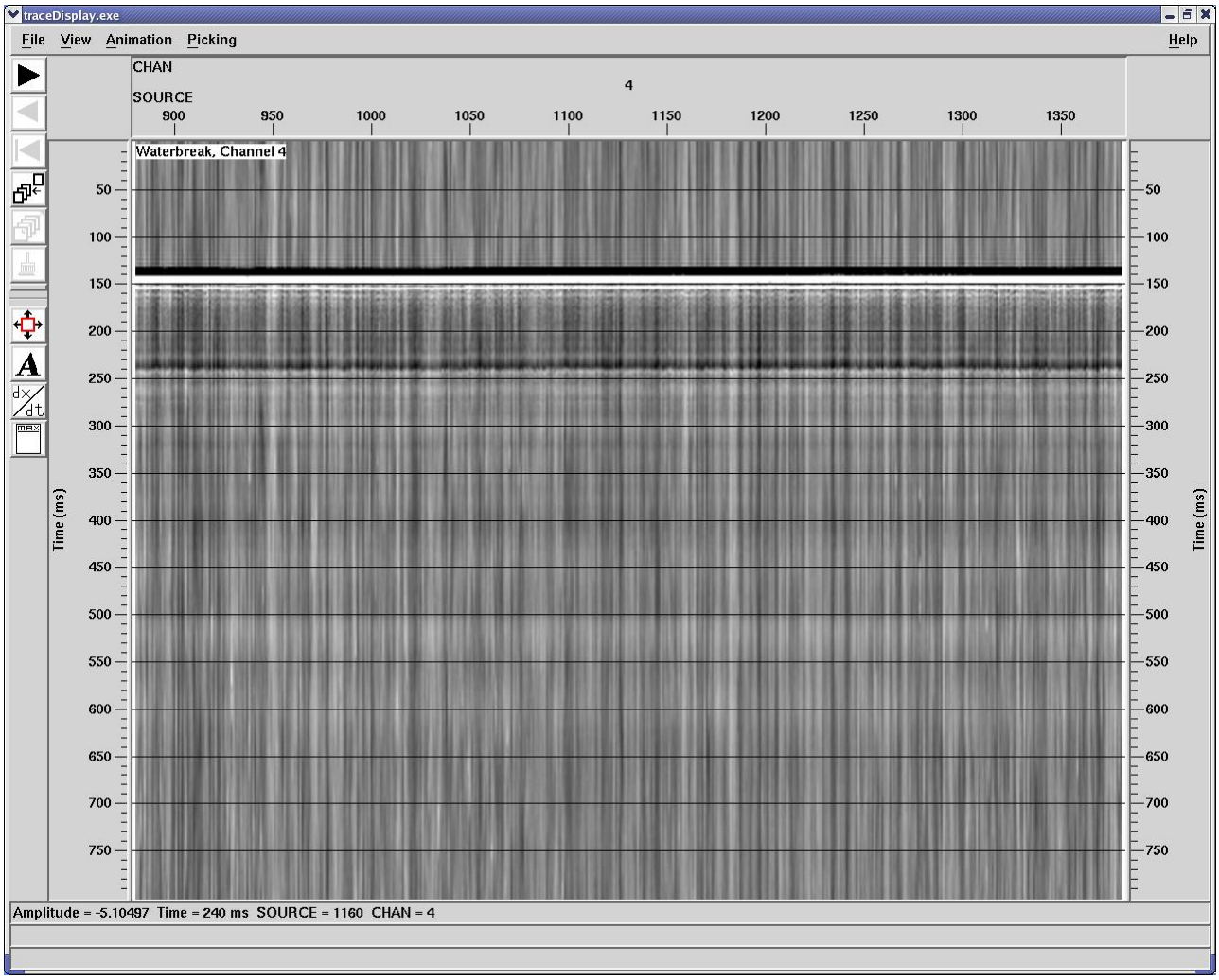


Figure 21-12: Example of waterbreak hydrophone QC (Auxiliary channel 4) for sequence 001.

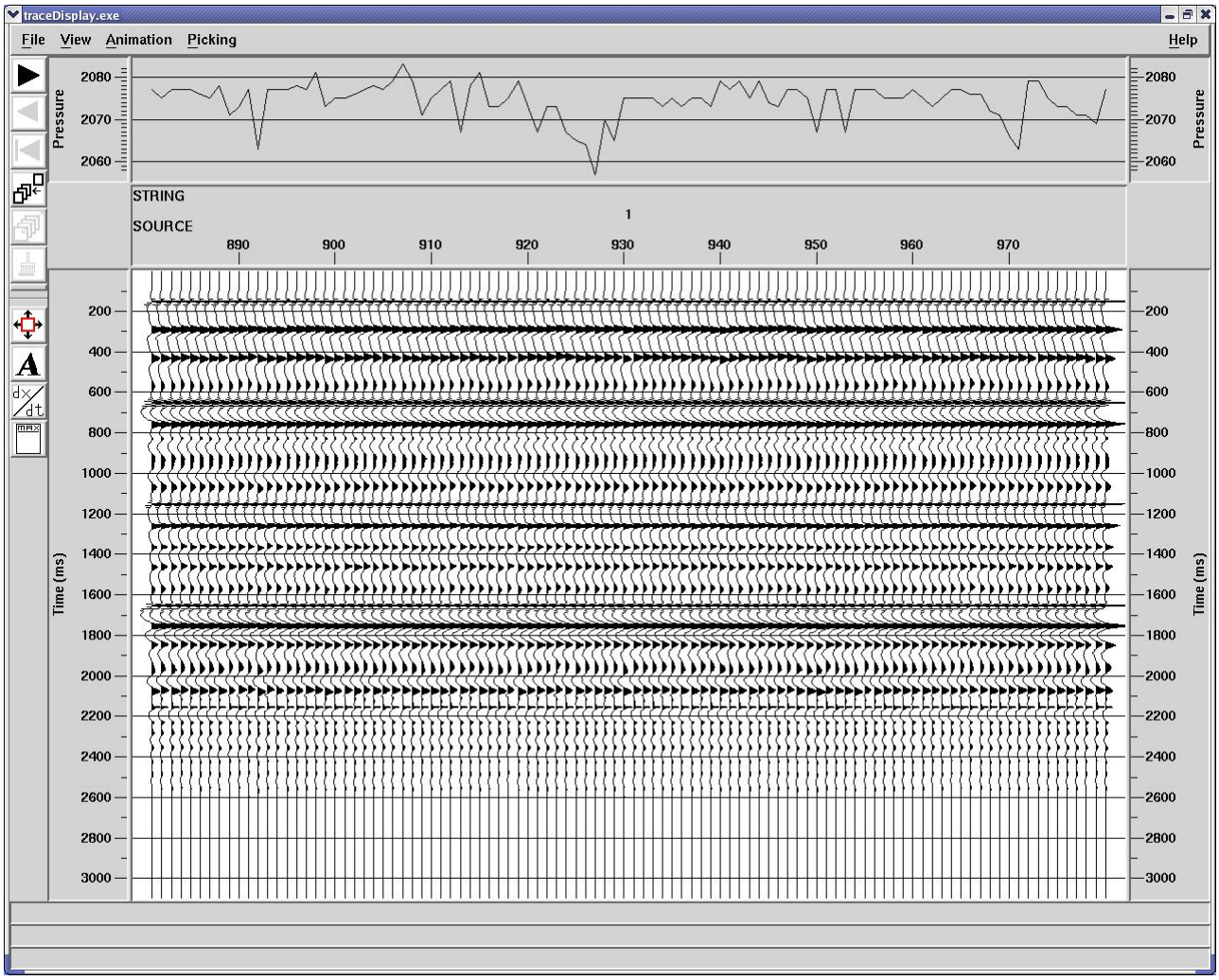


Figure 21-13: Ecample QC of vertically stacked near field hydrophones 1 to 6 on gunstring 1 (Auxiliary channels 13 to 18) of sequence 001. Note annotation of gun pressures and dead auxiliary 18.

21.12. Shot Record Displays

Shot records were band pass filtered (Ormsby 6-8-90-120) and balanced with a true amplitude gain recovery. They were displayed every 500m for each line.

Additional records were also examined on screen if an issue with acquisition was suspected, such as noise, residual seismic energy or auto-fires. The colour RMS displays were frequently used to pinpoint bad/suspicious shots, the shot gathers of which were subsequently investigated onscreen.

Consistently noisy channels were also identified on the raw shot displays, and cross checked against the Observer Logs, which were modified if necessary.

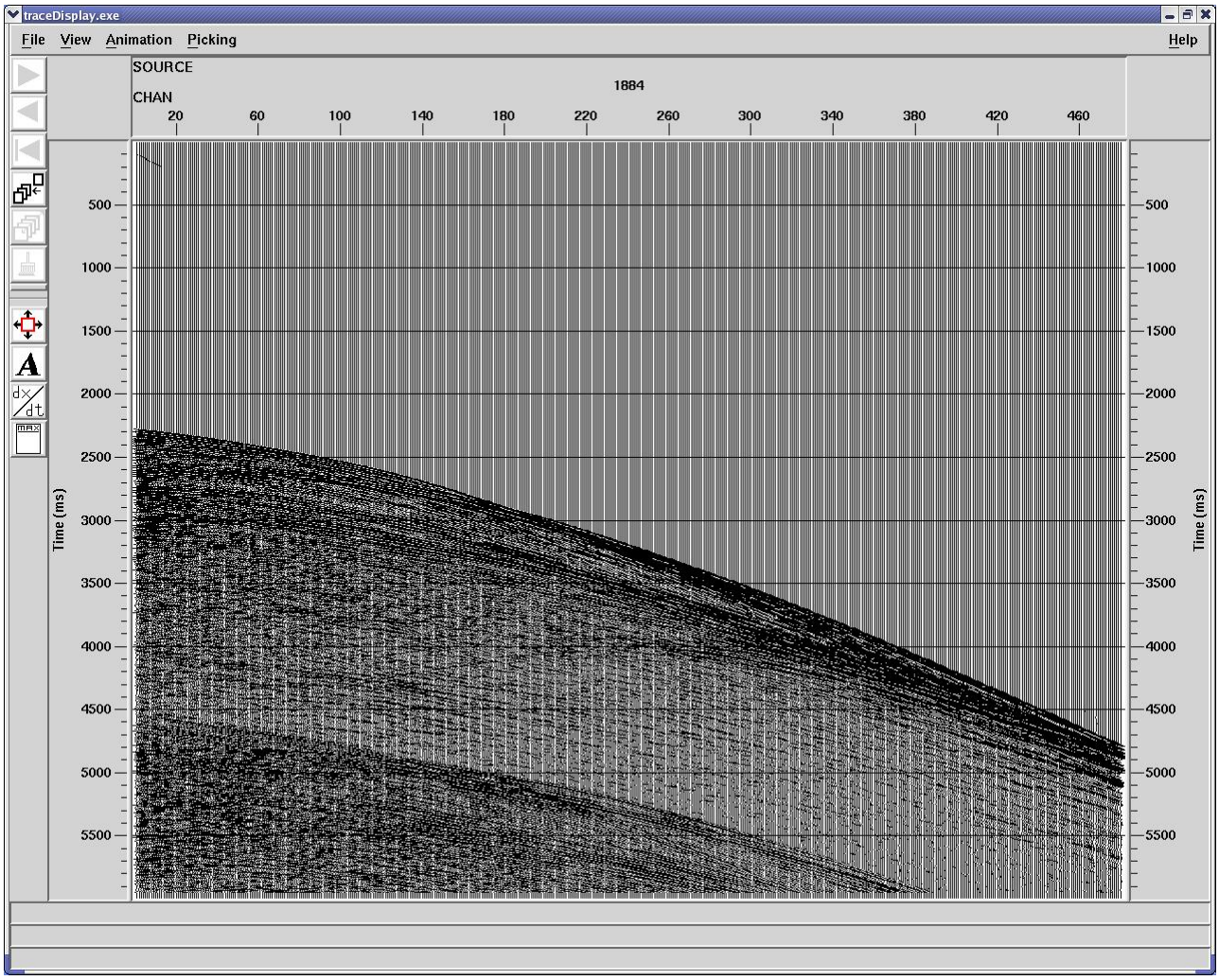


Figure 21-14: Example of raw shots display of SP 1884 of sequence 001.

21.13. Navigation Processing

In order to QC the navigation data, the final processed P190 navigation files were merged with the near traces for each line. The predicted first break time was computed using the water velocity. This was displayed overlaid on the near trace as seen below (in red), to enable QC of the consistency between the predicted and the recorded first breaks.

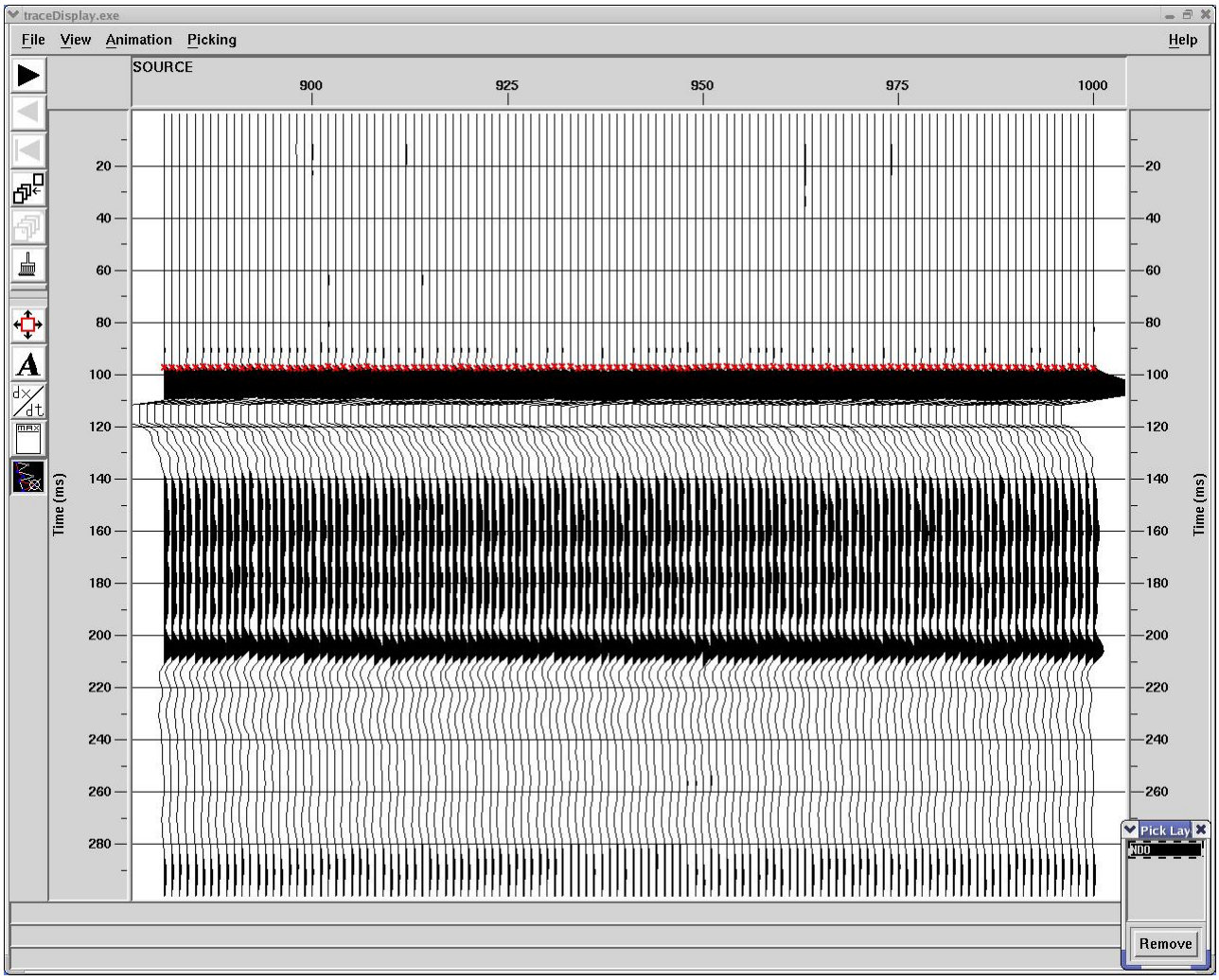


Figure 21-15: Example of navigation QC display for sequence 001.

22. Encountered problems

22.1. Swell noise

Weather conditions over the survey period were good, with swell heights mostly less than 2m. Swell bursts were seen on the raw shot records, typically affecting less than 10% of the traces, usually at a level below 25µb. Because of the high fold of coverage, this noise stacked mostly out, even with no noise attenuation processes applied to the data, and the target area of 2s was largely unaffected.

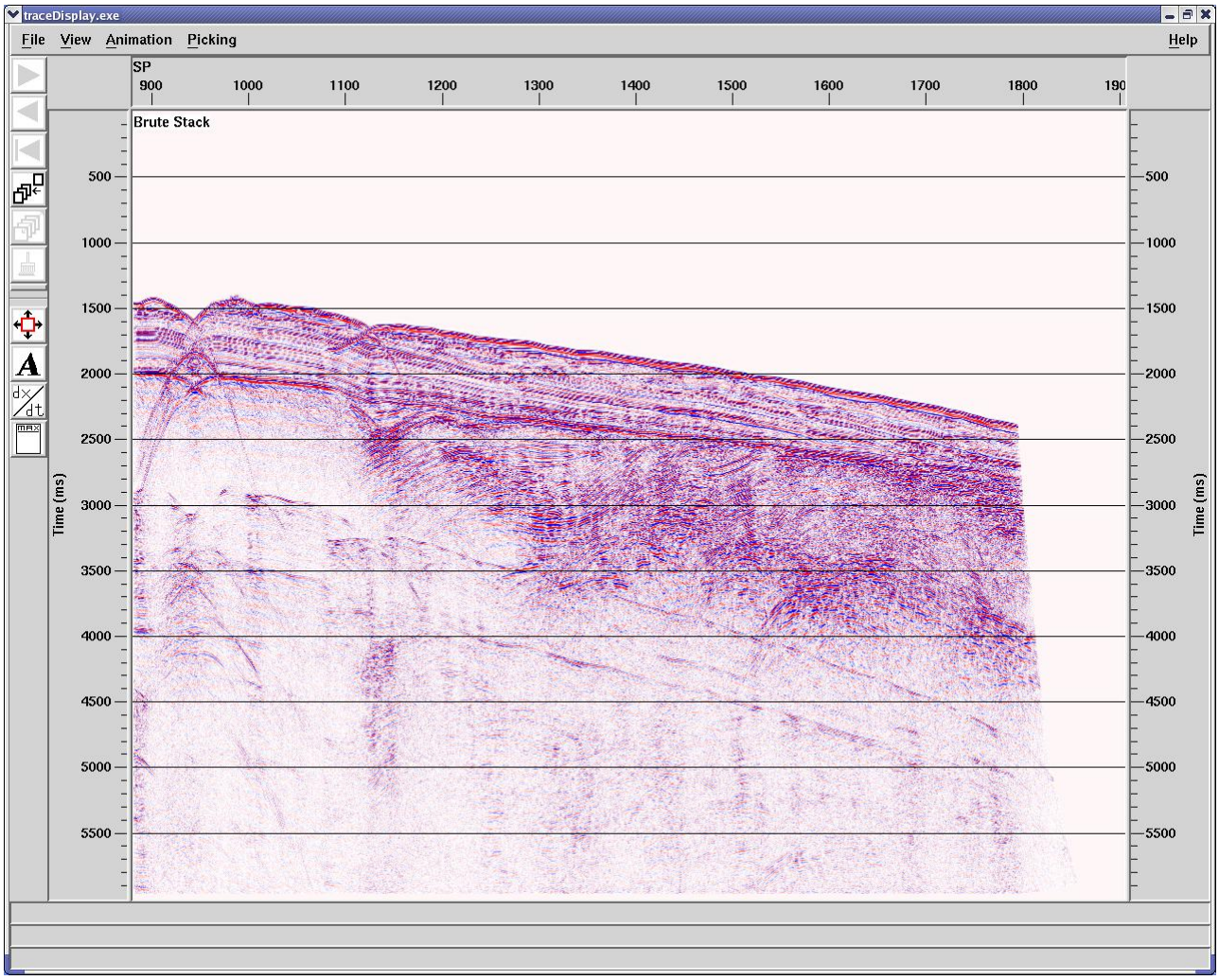


Figure 22-1: Brute stack for sequence 005. Typical brute stack, largely unaffected by swell noise.

22.2. Autofires/Misfires/Airleak

Overall, the guns performed well during the period of acquisition. Processing QC confirmed the guns' performance. Autofires, misfires and air pressures were closely monitored. Occasionally, gunlink flagged shots with incomplete or missing headers as autofires, which was closely investigated to ensure correctness.

The QC procedures in place to check for autofires and other gun problems are described in section 21.11.

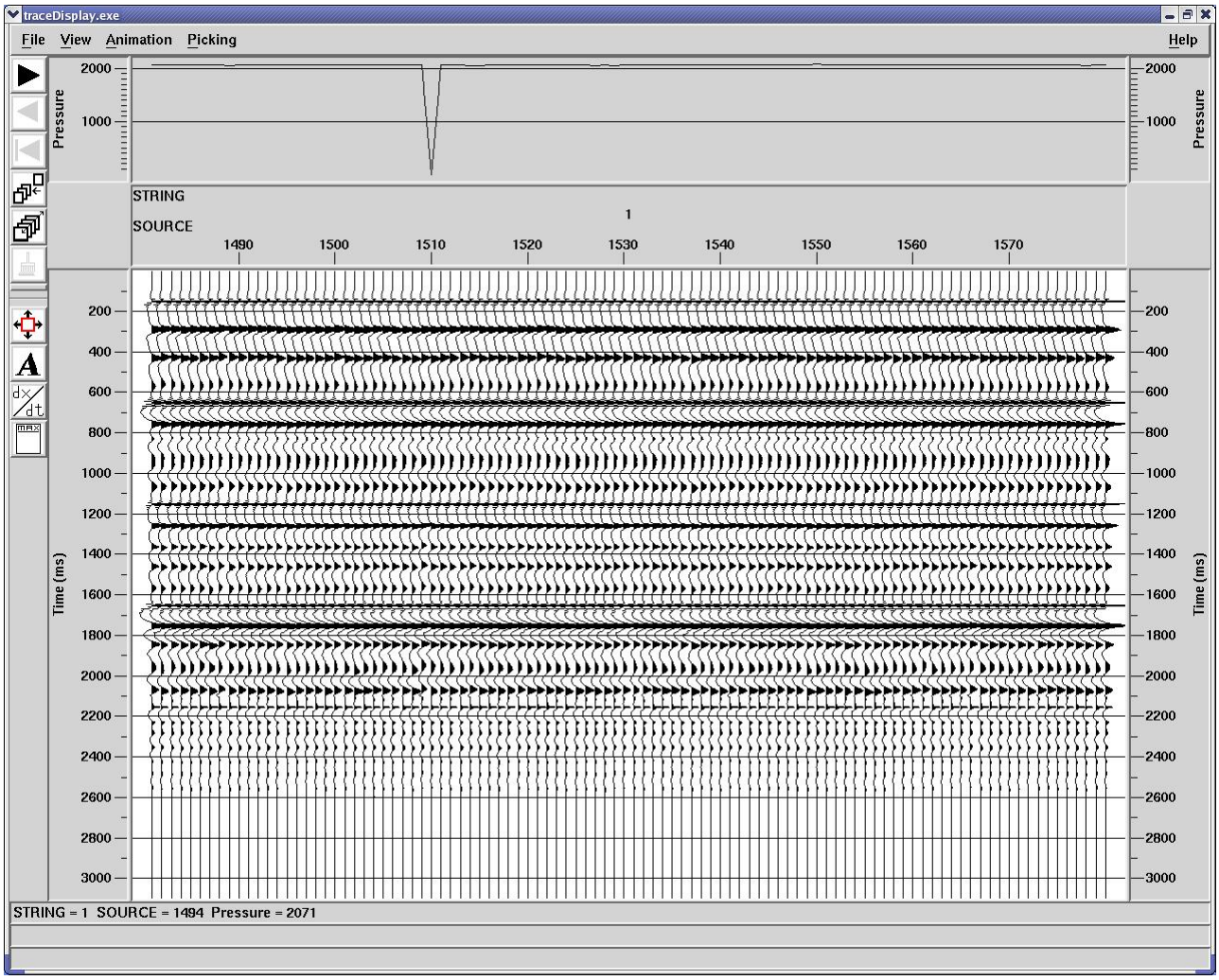


Figure 22-2: QC of vertically stacked near field hydrophones 1 to 6 on gunstring 1 (Auxiliary channels 13 to 18) on sequence 001. Note dead hydrophone 18, and missing gun header on SP 1510 (reported as autofire by gunlink).

22.3. Turn noise

On occasion the streamer was still in turn when the SOL noise files were recorded, due to the line run-in being constrained by safe navigation areas, with associated noise up to 150ub. This did not affect the chargeable SPs, only the noise records.

Notes regarding the sequences affected can be found in the QC logs (see 24.3).

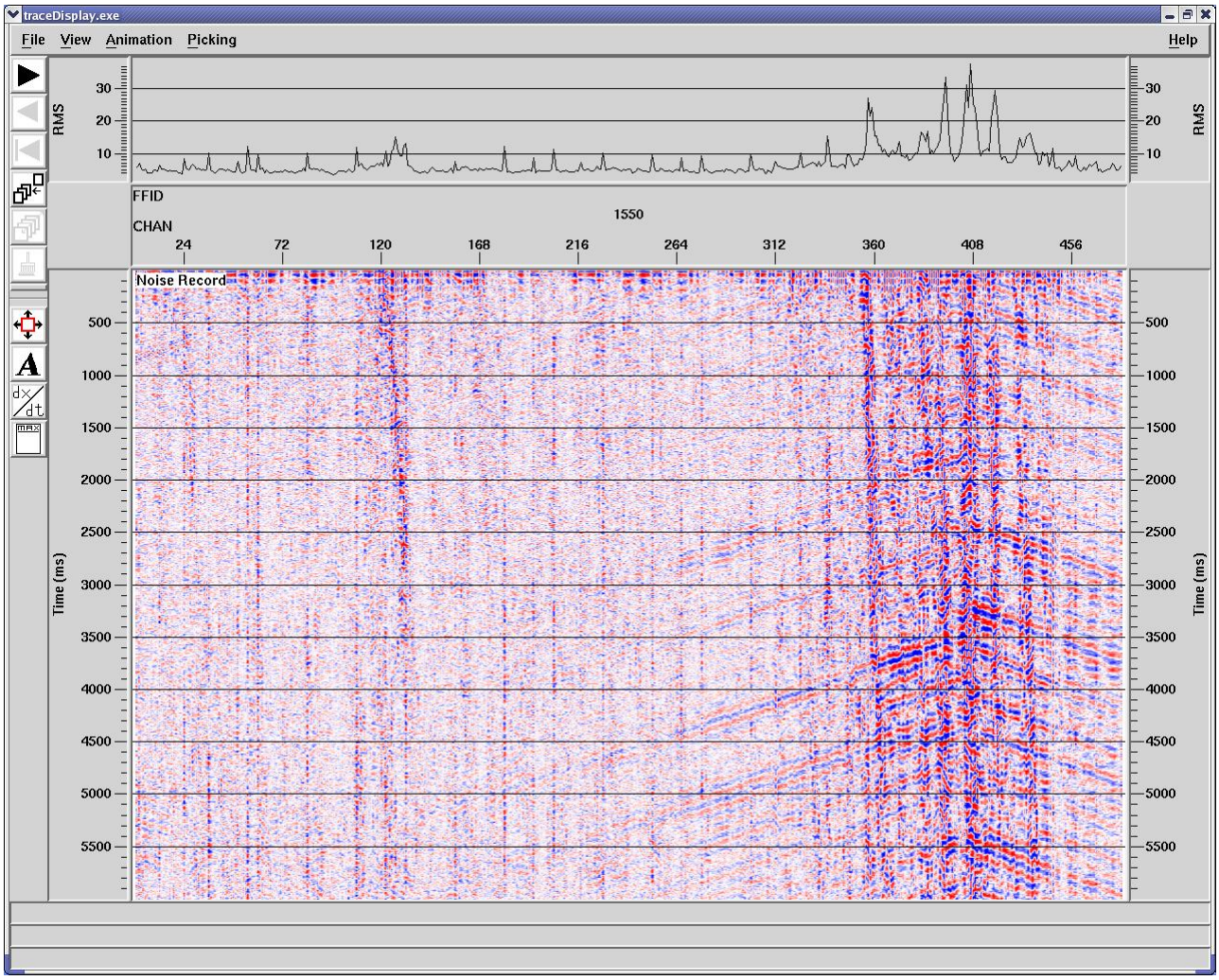


Figure 22-3: SOL noise display of sequence 007. Streamer still in turn while SOL noise records were taken.

22.4. Residual energy

Residual multiple energy was observed in all sequences. This resulted in increased RMS in the deep window display.

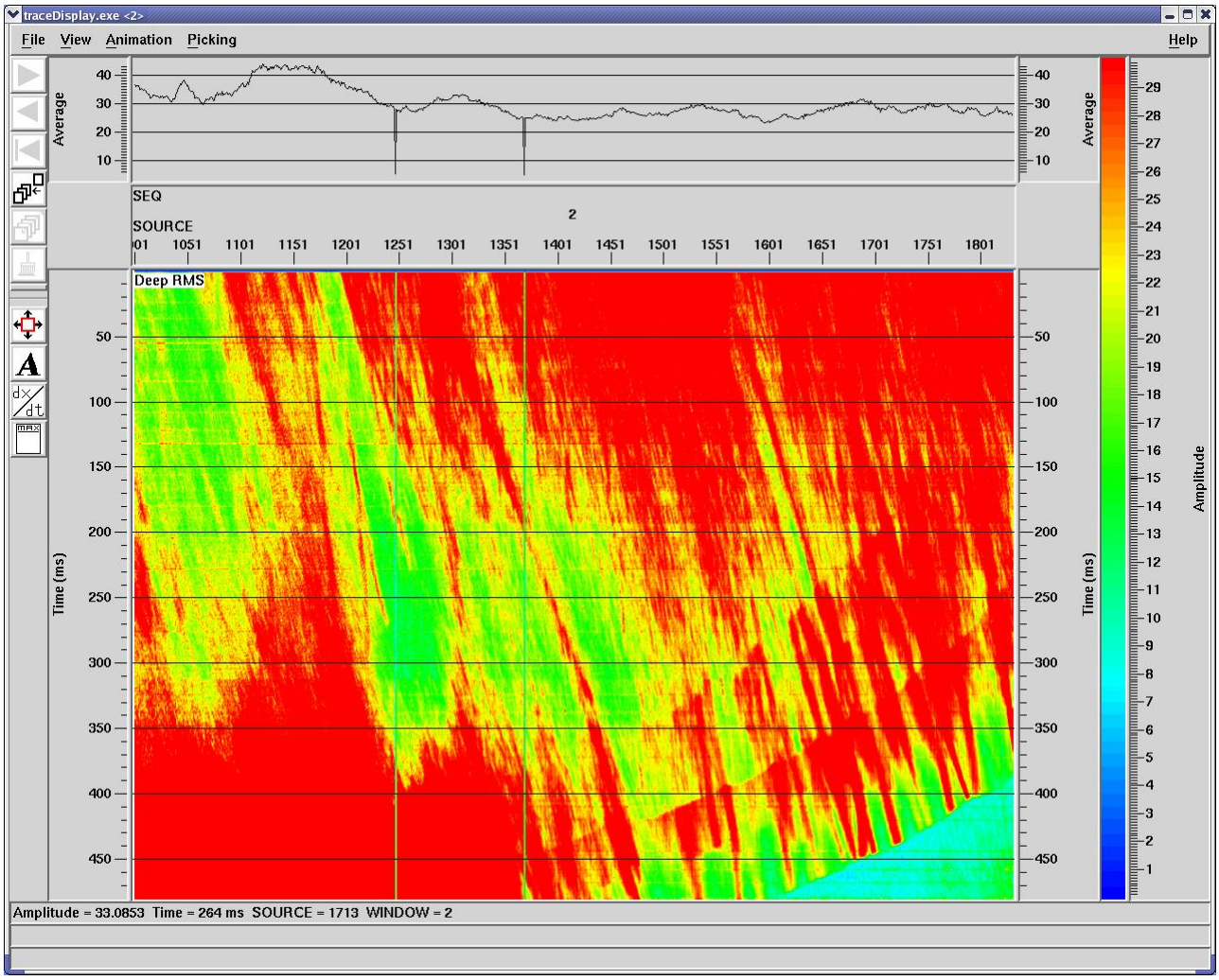


Figure 22-4: Deep RMS window for sequence 002. Multiple energy is prevalent in the whole display. Notice missing SP's 1247 and 1369.

22.5. Spiky Channels

The number of bad channels did not exceed 1.0% for the entire survey. Channel 252 has been noisy for sequence 001. Other channel edits included those which failed the instrument tests based on observer logs. There were no channels with reversed polarity. Further notes regarding the affected channels can be found in the QC logs (see 24.3).

fails instrumentation tests

noisy

for more detailed info, see OBSERVER LINE LOGS

no. Channels
480

seq							Q	%
001	51	91		242	252	337	5	1.0
002	51	91		242		337	4	0.8
003	51	91		242		337	4	0.8
004	51	91		242		337	4	0.8
005	51	91		242		337	4	0.8
006	51	91		242		337	4	0.8
007	51	91		242		337	4	0.8
008	51	91	179	242		337	5	1.0
009	51	91	179	242		337	5	1.0

Figure 22-5: Channel edits.

22.6. Noise history display

The following display shows the noise record history for all sequences, calculated from the SOL and EOL noise files.

All channels for each noise record have been stacked together to a single trace, and these average channel values are annotated above the display.

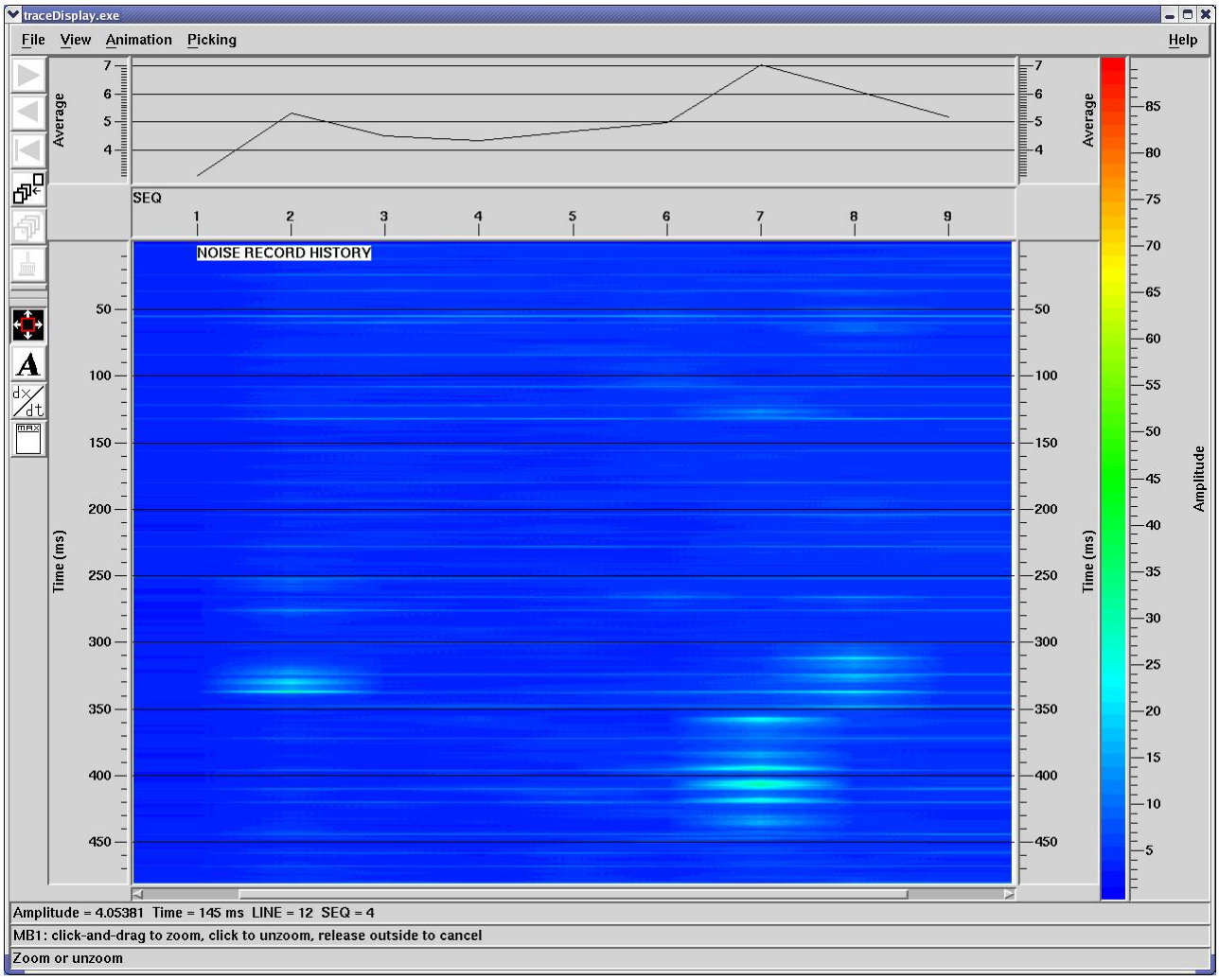


Figure 22-6 : Noise history display for sequences 001 to 009.

22.7. RMS history displays

The following display shows the line average RMS for each individual channel on the streamer for Sequences 001 to 018, calculated from the shallow RMS window at 50 to 500 ms.

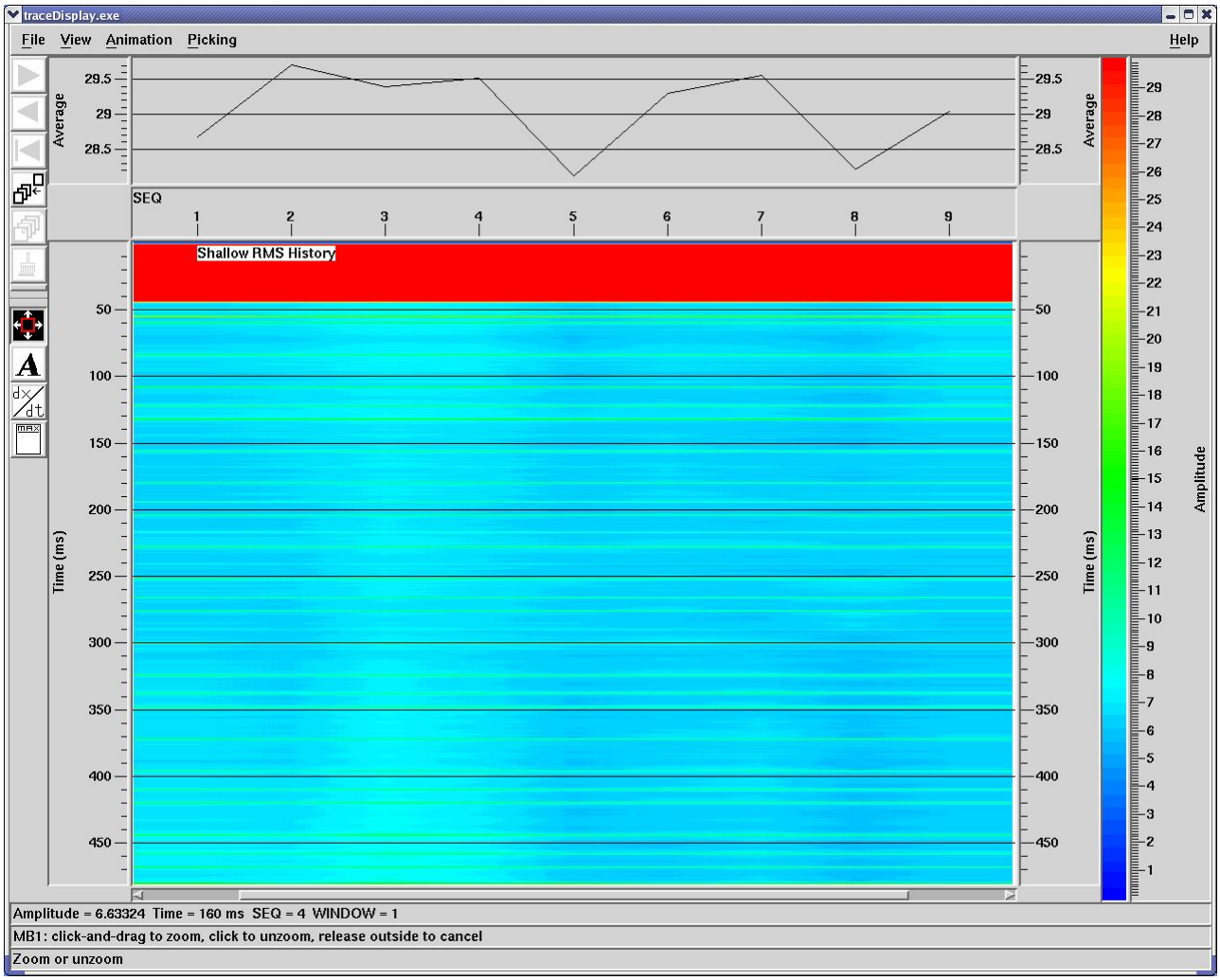


Figure 22-7: Shallow RMS history display for sequences 001 to 009. Notice that the first 50 channels are dominated by direct arrival energy.

The following display shows the line average RMS for each individual channel on the streamer for Sequences 001 to 018, calculated from the deep RMS window at 5450 to 5950 ms

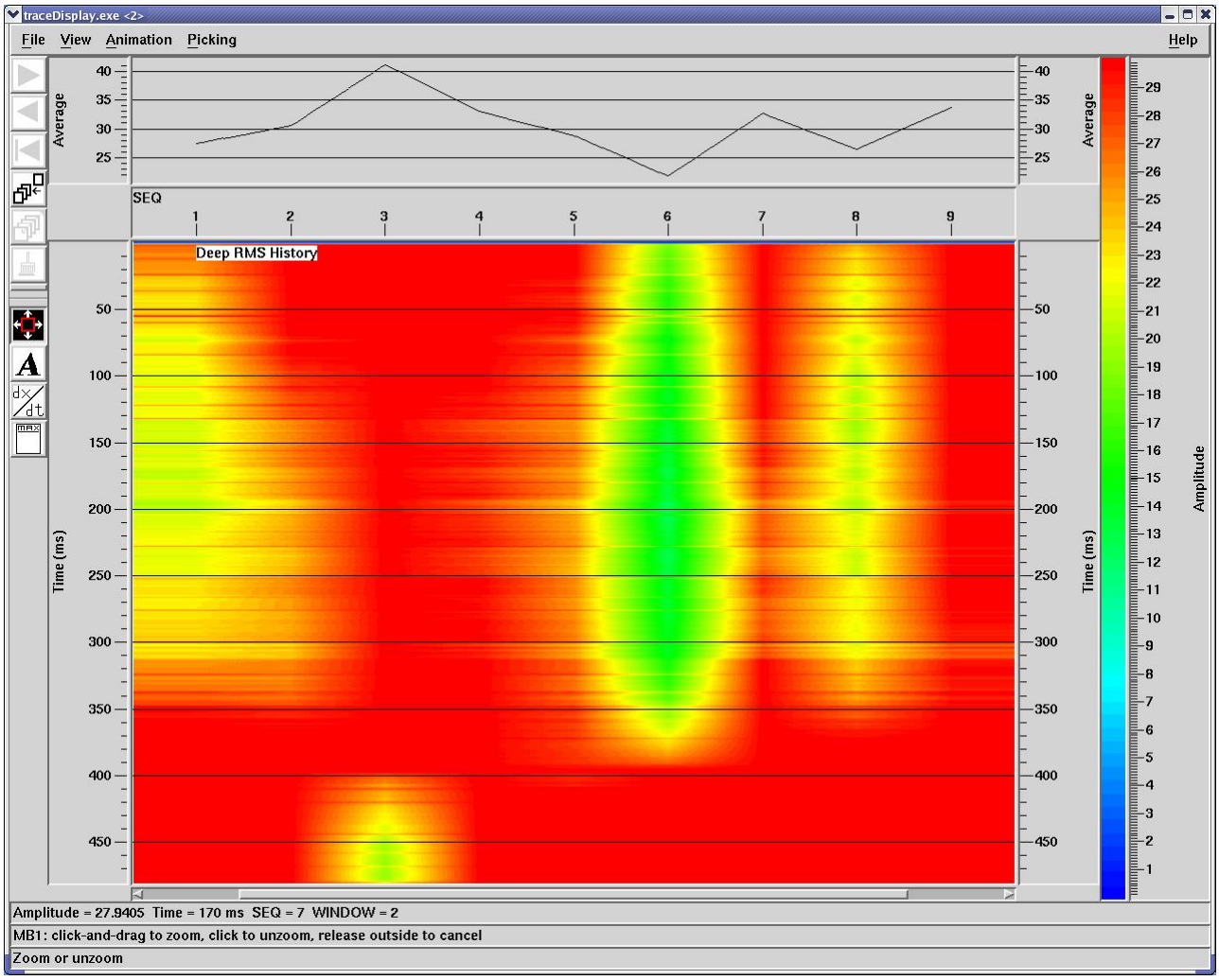


Figure 22-8 Deep RMS history display for sequences 001 to 009. All sequences exhibit strong multiple energy.

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23. Conclusion

Overall the data recorded on this survey was of good quality, helped by good acquisition conditions with low extraneous noise levels.

A total of 9 sequences were shot and of good quality. The number of bad channels did not exceed 1.0% for the entire survey.

Some swell noise was evident, but the brute stacks were largely unaffected. Strong multiple energy was evident.

The brute stacks showed good data quality mostly down to 3.0 seconds and contained dipping surfaces, truncated reflectors, diffractions, and multiples. Good evidence of the captured geology includes unconformities, onlapping features, anticlinal or folded structures, and fault planes.

Signal penetration was good for the top half of the record, but poor beyond this, probably as a result of the high reflectivity of the intermediate layers. Strong multiples were observed.

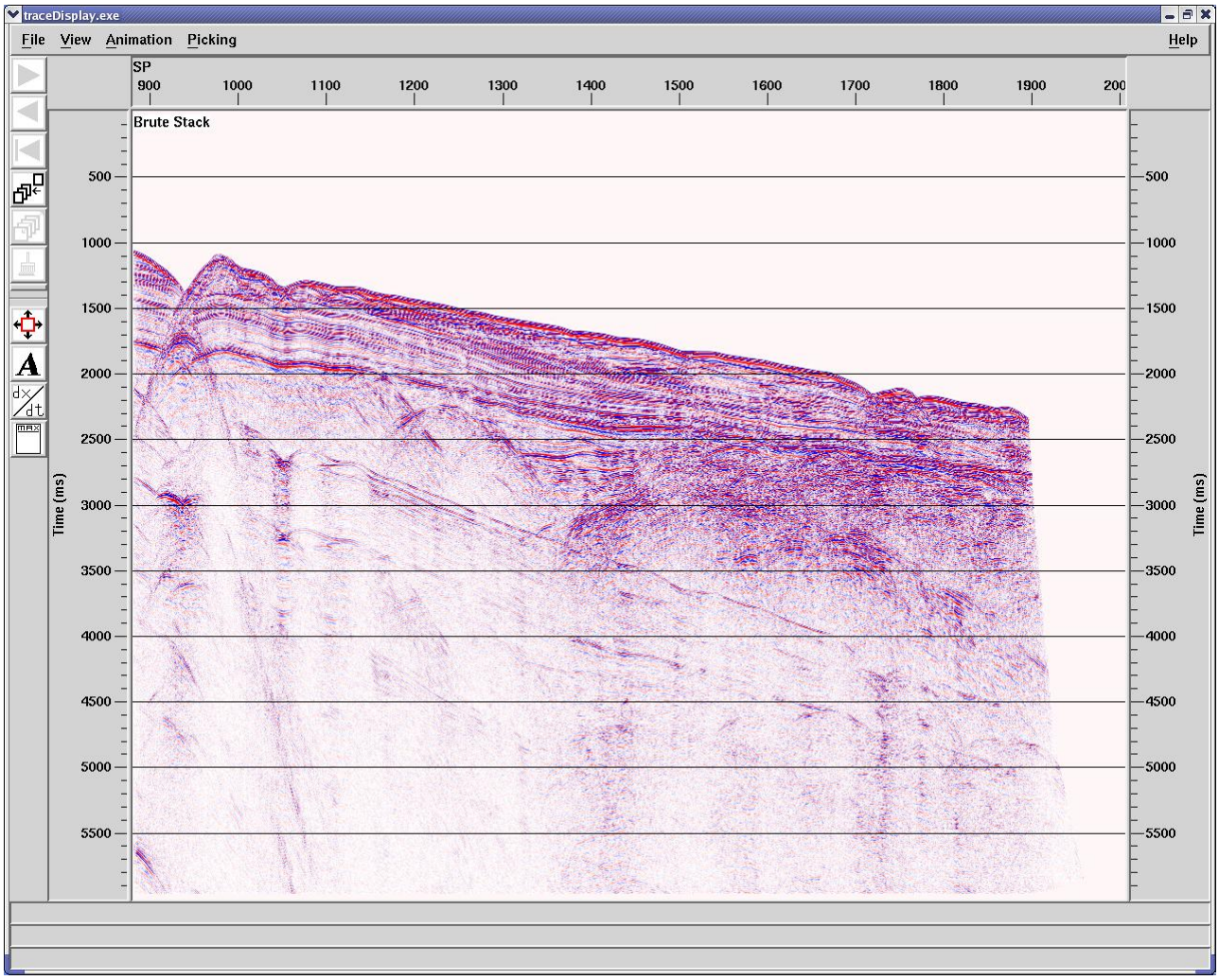


Figure 23-1: Brute stack of sequence 001.

A QC log in Excel format detailing quality control analysis of each line was delivered to the client at the completion of the survey (see 24.3).

24. Appendices

24.1. SEGY Brute Stack Headers

The following SEGY Stacks EBDIC header template was used. Items marked in bold differ from line to line.

C 1 CLIENT: SEBOA CONSORTIUM COMPANY: CGG VERITAS
C 2 SURVEY: GROUP SHOOT 2D AREA: EAST BASIN, OFFSHORE AUSTRALIA
C 3 EBAY08-xx-0xx SP: xxxx-xxxx CDP: 1-xxxx
C 4 DATA TRACES/STREAMER: 480 AUXILIARY TRACES/RECORD: 30
C 5 SAMPLE RATE: 2MS RECORD LENGTH: 6000ms
C 6 RECORDING FORMAT: SEG-D 8058 REV 100 FILTERS: DIGITAL LOW CUT: ON
C 7 ANALOG LOW CUT: 3 HZ 6 DB/OCTAVE HIGH CUT: 200 HZ 370 DB/OCTAVE
C 8 STREAMER: SERCEL SEAL SOLID ACTIVE LENGTH: 6000 M
C 9 GROUP INTERVAL: 12.5 M DEPTH: 8 M
C10 SOURCE TYPE: BOLT AIRGUN VOLUME: 2130 CU IN
C11 NO OF SUB ARRAY/SOURCE: 3 SUB ARRAY SEPARATION: 10 M
C12 ARRAY PRESSURE: 2000 PSI ARRAY DEPTH: 6 M

C13
C14 SEGY HEADER BYTES
C15 Water Depth 185-188
C16 Line Number 189-192
C17 Cable 193-194
C18 Gun Sequence 195-196
C19
C20 SP ANNOTATED AT NEAR TRACE CDP
C21
C22 PROCESSING:
C23
C24 REFORMAT - SEGD TO PROMAX FORMAT
C25 INSTRUMENT DELAY -50ms
C26 SHOT AND CHANNEL EDITS BASED ON OBSERVER LOGS
C27 BANDPASS FILTER, ORMSBY 6-8-90-120 HZ
C28 RESAMPLE 2ms TO 4ms. HIGH FIDELITY ANTIALIAS FILTER
C29 TRACE DECIMATION, 2:1, USING SINGLE NMO FUNCTION
C30 TAR - T**2 CORRECTION
C31 NMO, VELOCITIES PICKED AT 4 KM INTERVALS
C32 CDP STACK, STRAIGHT MEAN SQUARE ROOT NORMALIZATION
C33 GUN & CABLE STATIC 9ms
C34
C35 CDP INTERVAL 12.5 METRES
C36
C37
C38 JUNE 2008

24.2. Shipments

QC deliverables are included in the Primary and Copy Tape Shipments. The following QC products are being shipped to the client:

Shipment No: PT-2008-45 (Primary data)

Date: 5th June 2008

Contents cover Sequences: 1 to 9

1 x DVD containing QC Log File (MS Excel), Stack files (SEGY format), various QC screen displays (JPG format), velocities (ASCII format) and ambient noise (ASCII format) files.

Shipped to:

Eagle Bay Resources NL
Suite 3 Level 1
610 Murray Street
West Perth WA 6005
Australia

Shipment No: PT-2008-046 (Copy Data)

Date: 5th June 2008

Contents cover Sequences: 1 to 9

1 x DVD containing QC Log File (MS Excel), Stack files (SEGY format), various QC screen displays (JPG format), velocities (ASCII format) and ambient noise (ASCII format) files.

Shipped to:

Bill Lodwick
Suite 5
11 Sydney Street
Kilmore 3674
Australia

24.3. QC Line log

A QC log was maintained for the duration of the project to monitor the workflows run, shot edits, problems encountered and any processing comments. This log file has been written to DVD, and u included in the final data shipment to the client.

Seq	Line	Date	Dir	FCSP	LCSP	no. of SPs	no. of CDPs	SEG-D Input	Noise Records	Raw Shot Display	Auxiliary QC	RMS Display Shallow	RMS Display Deep	2D Geometry	Pick WB Times	Database	Near Trace QC	Trace Decimation	Stack RMS	Velocity Analysis	Channel Stack	Shot Stack	NMO QC	Brute Stack	Plot Stack	Archive Stack & Vel	Vels to Ascii	RMS Archive	SEG-Y Stack	FTP P190	P190 merge / QC	FTP JPGs
001	EBAY08-06-001	4-Jun	201°	1884	881	1004	2246	4/6	4/6	4/6	4/6	4/6	4/6	4/6	4/6	4/6	4/6	4/6	4/6	4/6	4/6	4/6	4/6	4/6	4/6	4/6	4/6	4/6	4/6	4/6	4/6	5/6
002	EBAY08-10-002	4-Jun	020°	1001	1830	830	1898	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6
003	EBAY08-14-003	5-Jun	199°	1577	881	697	1632	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6
004	EBAY08-12-004	5-Jun	019°	1001	1815	815	1868	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6
005	EBAY08-08-005	5-Jun	199°	1784	881	904	2046	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6
006	EBAY08-04-006	5-Jun	019°	1001°	1691	691	1620	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6
007	EBAY08-04-007	5-Jun	019°	1692	1965	274	786	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6
008	EBAY08-02-008	5-Jun	201°	1559	881	679	1596	5/6	5/6	5/6	6/6	6/6	6/6	5/6	5/6	5/6	5/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6
009	EBAY08-01-009	6-Jun	116°	1001	2075	1075	2388	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6

Figure 24-1: Onboard QC Workflow Log.

Line	SHOTS	STACK
EBAY08-06-001	Av. Ambient RMS: 3.8 µb., strong residual energy throughout line.	Good stack
EBAY08-10-002	Av. Ambient RMS: 5.0 µb., strong residual energy throughout line.	Good stack
EBAY08-14-003	Av. Ambient RMS: 4.6 µb., strong residual energy throughout line.	Good stack
EBAY08-12-004	Av. Ambient RMS: 4.7 µb., strong residual energy throughout line.	Good stack
EBAY08-08-005	Av. Ambient RMS: 5.1 µb., strong residual energy throughout line.	Good stack
EBAY08-04-006	Av. Ambient RMS: 5.2 µb., strong residual energy throughout line.	Good stack
EBAY08-04-007	Av. Ambient RMS: 6.1 µb., strong residual energy throughout line.	Good stack
EBAY08-02-008	Av. Ambient RMS: 6.1 µb., strong residual energy throughout line.	Good stack
EBAY08-01-009	Av. Ambient RMS: 5.2 µb., strong residual energy throughout line.	Good stack

Figure 24-2: Quality section of QC log.

Seq	Line	Bad Shots: MSP - missed SP (not fired); REC - not recorded SP or bad due to recording system; GAF - gun autofire; GNF - gun no fire; GTE - gun timing error >1.5ms; NGH - hun header missing; NOR - noise on record out of specs; NAV - nav error or missing nav header; SE - spread error	Bad Channels : i=Failes Instrument Tests, n=Noisy, r=Reversed Polarity, s=Spiking, d=Dead for more detailed info, see OBSERVER LINE LOGS
1	EBAY08-06-001	MSP: 1649, NGH: 1510,1038,1275	51i,91i,242i,252n,337i
2	EBAY08-10-002	MSP: 1247,1369 NGH: 1619	51i,91i,242i,337i
3	EBAY08-14-003	NGH: 1458,1109	51i,91i,242i,337i
4	EBAY08-12-004	MSP: 1054 NGH: 1450,1665	51i,91i,242i,337i
5	EBAY08-08-005	NGH: 1113,919	51i,91i,242i,337i
6	EBAY08-04-006	NGH:1231,1486	51i,91i,242i,337i
7	EBAY08-04-007	none	51i,91i,242i,337i
8	EBAY08-02-008	MSP:1133	51i,91i,179i,242i,337i
9	EBAY08-01-009	GAF: 1057 NGH: 1420,2068	51i,91i,179i,242i,337i

Figure 24-3: Shot and Channel Edit Log.

Seq	Linename	Dir	FGSP	LGSP	No. Of CDPs
1	EBAY08-06-001	201	1884	881	2246
2	EBAY08-10-002	20	1001	1830	1898
3	EBAY08-14-003	199	1577	881	1632
4	EBAY08-12-004	19	1001	1815	1868
5	EBAY08-08-005	199	1784	881	2046
6	EBAY08-04-006	19	1001	1691	1620
7	EBAY08-04-007	19	1692	1965	786
8	EBAY08-02-008	201	1559	881	1596
9	EBAY08-01-009	116	1001	2075	1075

Figure 24-4: SEGY Log.

Appendix 1 Navigation Systems & Diagrams

DGPS Reference Stations

WGS84				
Ref. St. Name	**No.**	**Latitude**	**Longitude**	**Height (m)**
Brisbane	275	027° 28’ 38.488’’S	153° 01’ 37.352 ’’E	93.14
Bathurst	336	033° 25’ 46.879’’S	149° 34’ 01.969’’E	756.66
Ceduna	355	032° 07’ 03.049” S	133°41’22.851 “ E	7.27
Corbar	316	031° 29’ 57.430’’S	145° 50’ 20.346 ’’E	270.17
Melbourne	385	037° 47’ 59.264“ S	144° 57’ 39.311” E	67.33

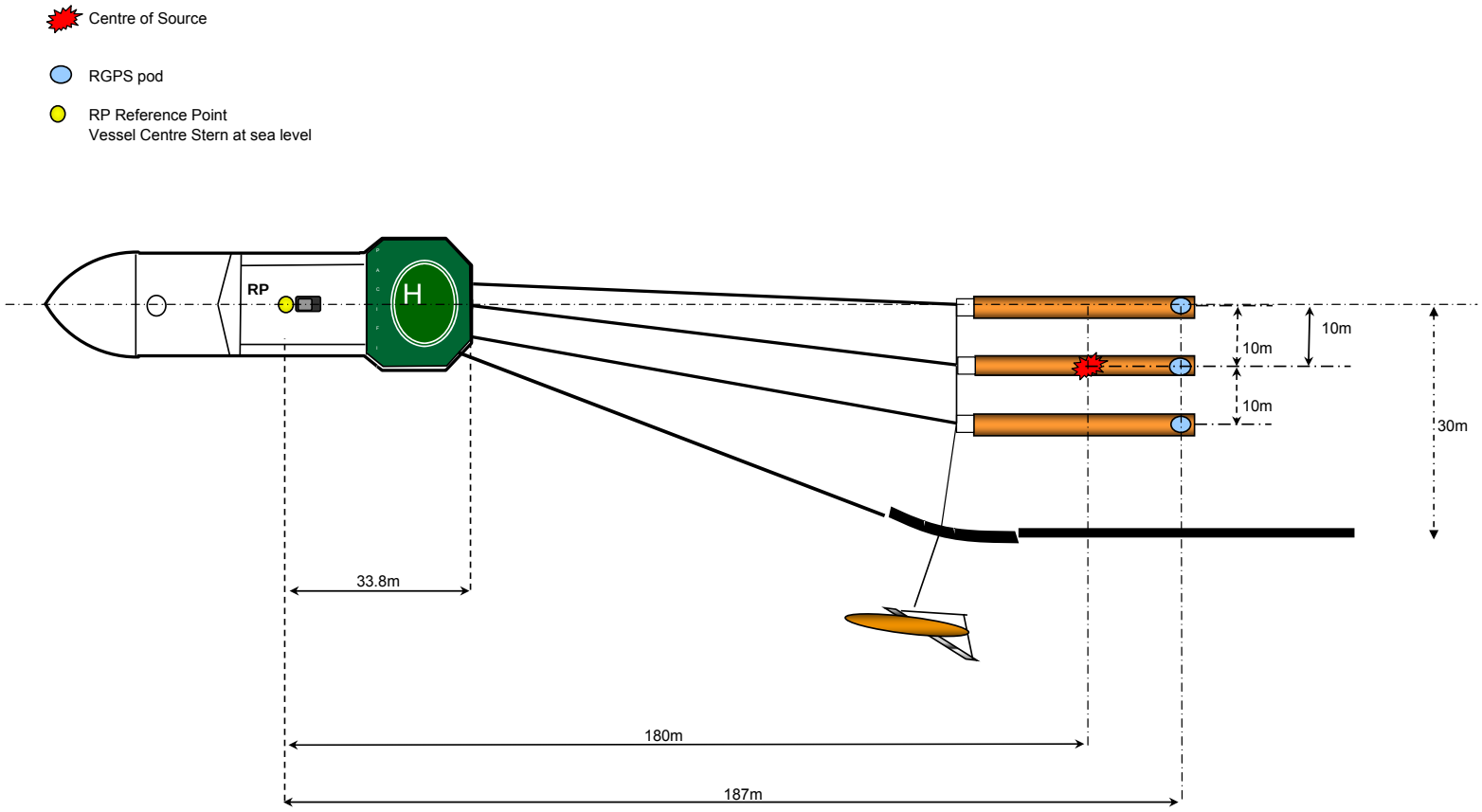
DGPS Reference Guide

Spectra Name	***GPS Feed***	***Position Type***
V1G1	SPM1	SPM 5.16 XP
V1G2	SPM2	SPM 5.16 HP
V1G3	SPM2	Mulifix 5 XP
V1G4	SPM2	SPM 5.16 XP
V1G5	SPM1	SPM 5.16 HP

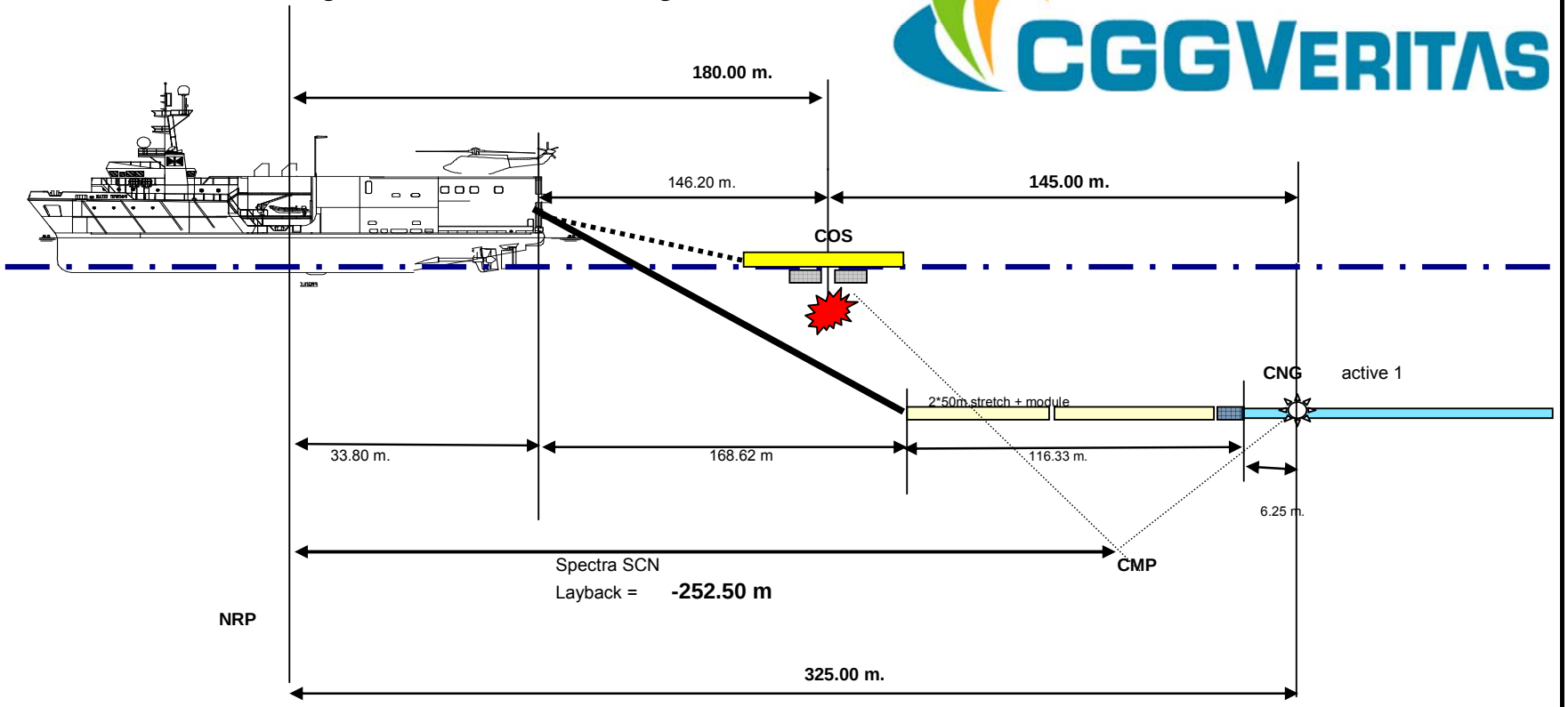
RGPS Reference Guide

RGPS System	***GPS Reference***	***Spectra Node***	***Position***
V1R1 (RGPS1)	SPM1	G1R1	Gun String 1
		G1R3	Gun String 2
		G1R5	Gun String 3
		TB1R1	Tailbuoy
V1R2 (RGPS2)	SPM2	G1R2	Gun String 1
		G1R4	Gun String 2
		G1R6	Gun String 3
		TB1R2	Tailbuoy

Pacific Titan
General Towing arrangement



M/V Pacific Titan Towing Dimensions/Offset Diagram

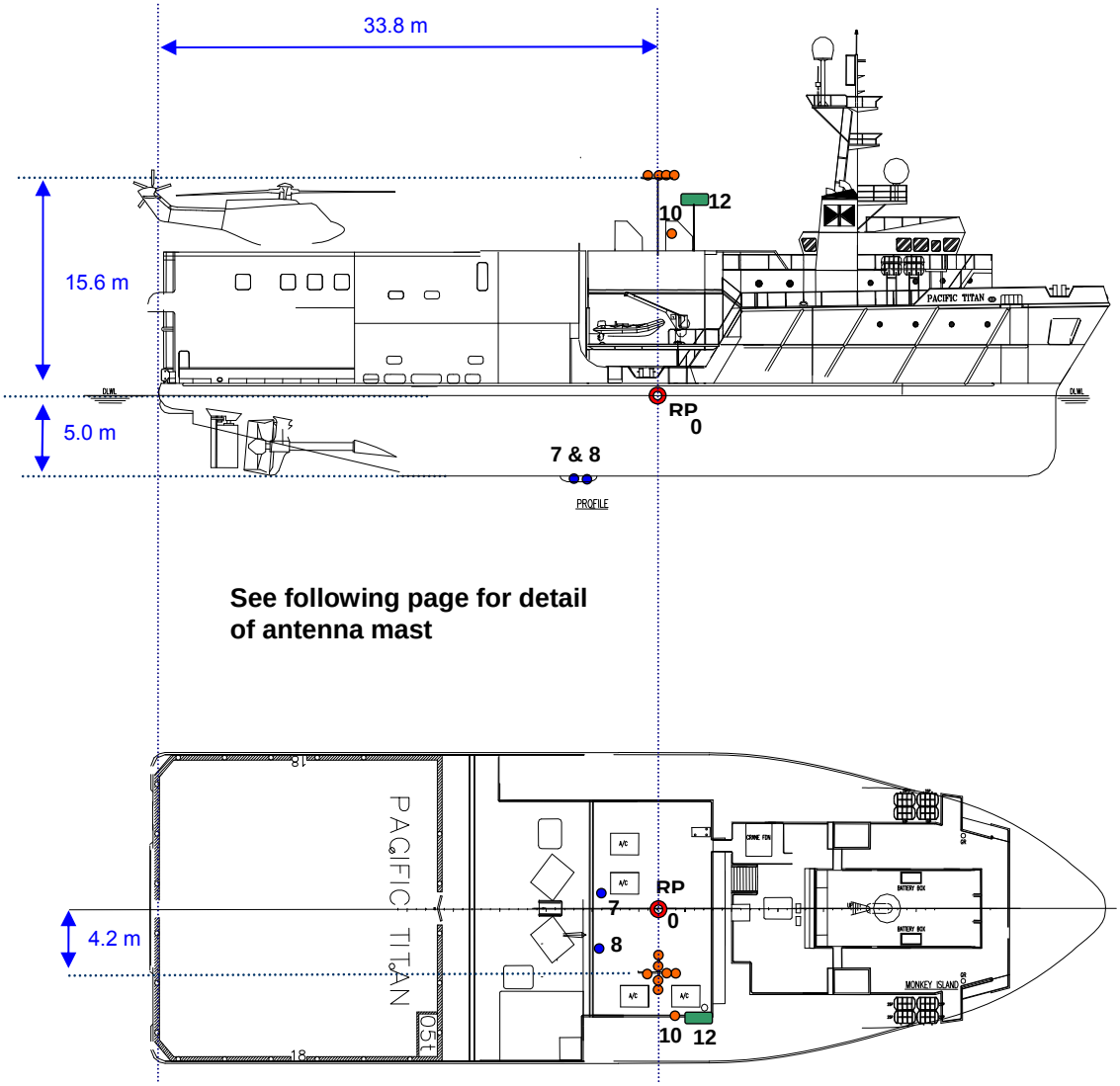


Principal Distances:			Principal Offsets:		Used as:
NRP-Stern	33.80 m.		COS-CNG	145.00 m.	
Stern-COS	146.20 m.		**NRP-CMP**	**-252.50 m**	**Spectra SCN Layback**
Stern-CNG	291.20 m.				
NRP-COS	**180.00 m.**		**NRP-CNG**	**325.00 m.**	**Offset from NRP**

Centre near group derived from Seal manuals = 6.25m from coupling

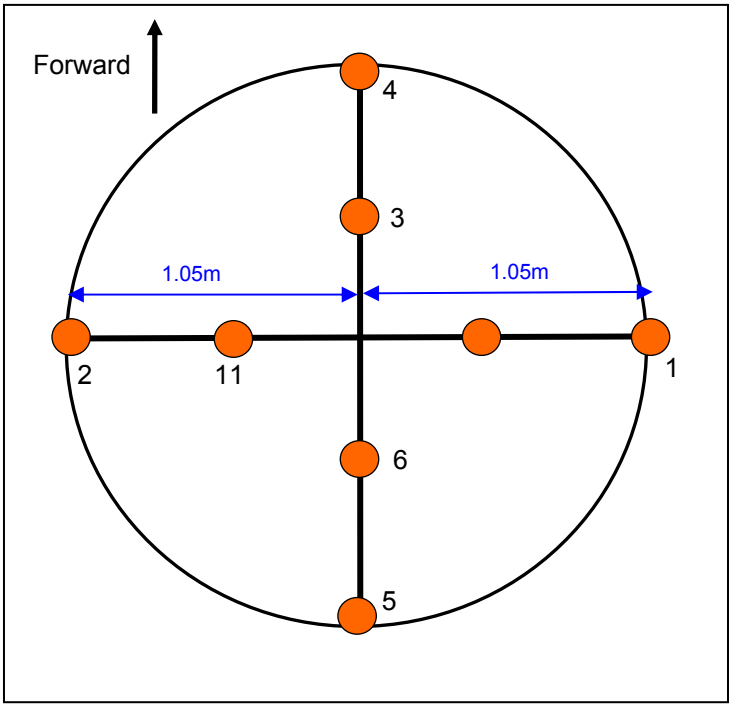
Key:	
NRP	Navgation reference point (centre of mast @ sea level)
COS	Centre of source
CNG	**Centre of near group (Trace # 001)**
CDP	Common depth point
NTRP	Near trace reflection point

Antenna Offsets



No	Spectra ID	X	Y	Z	Description	Cable Id
0	**V1**	0	0	0	Vessel ref point	
		0	-33.8	0	Vessel centre Stern from ref point	
1	**V1G1,V1G5**	5.25	0	15.6	SPM1 XP,HP. Alison 940D	2 Red Rings
2		3.15	0	15.6	Alison 940D	5 Red Rings
3					motorola UHF Radio antenna	
4	**V1G2, V1G3, V1G4**	4.2	**1.05**	15.6	SPM2 XP,HP Multifix. Alison 940D	3 Red Rings
5					Seatex Yagi VCU, UHF antenna	4 Red Rings
6					Seatex Omni VCU, UHF antenna	1 Red Ring
7	**V1E1**	-1.3	-5.8	-5	Simrad EA 600, 200kHz tranceducer	
8	**V1E2**	1.5	-6.1	-5	Simrad EA 600, 12kHz tranceducer	
9	**Speedlan**					
10	**Runt 1**				Trimble Bullet	
11					sailor VHF Antenna	2 Green Rings
12	**V1GY1**				Simrad GPS Gyro	

Detail of Antenna Mast



Appendix 2 Navigation Processing Log

CGGVERITAS

Navigation Processing Log

Client: Eagle Bay
Job: 6374
Area: VicP65

Line Name	Seq	FOSP	FCSP	LSP	LOSP	Line Status	Processing Comments
EBAY08-06-001	1		1884	881		Complete	shot 1649 No E33 record shot 1510 No E33 record shot 1275 No E33 record shot 1083 No E33 record
EBAY08-10-002	2		1001	1830		Complete	shot 1247 No E33 record shot 1369 No E33 record shot 1619 No E33 record
EBAY08-14-003	3		1577	881		Complete	WARNING: shot 1458 No E33 record WARNING: shot 1109 No E33 record
EBAY08-12-003	4		1001	1815		Complete	WARNING: shot 1054 No E33 record WARNING: shot 1450 No E33 record WARNING: shot 1665 No E33 record
EBAY08-08-005	5		1784	881		Complete	WARNING: shot 1113 No E33 record WARNING: shot 919 No E33 record
EBAY08-04-006	6		1001	1691		Incomplete	shot 1231 No E33 record shot 1486 No E33 record
EBAY08-04-007	7	1572	1692	1965		Complete	
EBAY08-02-008	8		1559	881		Complete	shot 1133 No E33 record
EBAY08-01-009	9		1001	2075		Complete	WARNING: shot 1420 No E33 record WARNING: shot 2068 No E33 record

Appendix 3 Calibrations and tests

Summary of Results for the Singapore Calibration Feb 2008-03-08

INTRODUCTION

Subsea 7 (Singapore) Pte Ltd was appointed by CGG Veritas to carry out the following services for their vessel, MV Pacific Titan at Loyang Jetty, Singapore on 6 & 11 February, 2008:

- Gyro Calibration
- DGPS System's Verification
- Tail Buoy System's Verification

The results are summarized as follow:

a) Gyro Calibration – 6 February 2008

Heading @ 134 deg		
System	C-O	Std Dev
Gyro AD 100	0.27 deg	0.05
Gyro HS 50	1.40 deg	0.35

b) DGPS System's verification – 6 February 2008

	Easting		Northing	
System	C-O	Std Dev	C-O	Std Dev
SPM1 XP	-0.57	0.05	-0.16	0.05
SPM2 HP	1.29	0.11	-0.14	0.05

c) DGPS' System's verification (re-carried out) – 11 Feb 2008

	Easting		Northing	
System	C-O	Std Dev	C-O	Std Dev
DG_V_XP_EXP	-0.48	0.03	0.26	0.04
SPM1_XP	-0.31	0.02	-0.06	0.01
SPM1_HP	0.47	0.05	-0.30	0.05
SPM2_XP	-0.50	0.05	0.28	0.05
SPM2_HP	1.26	0.09	-0.23	0.06

d) Tailbuoy System's verification – 6 Feb 2008

	Easting		Northing	
TB SERIAL #	C-O	Std Dev	C-O	Std Dev
1314	-0.70	0.73	-2.70	0.65
1411	-2.72	2.10	-0.27	1.34
2320	-1.67	1.13	-0.67	0.93
0869	-1.04	1.20	-0.17	0.93
1511	-1.23	1.49	-1.04	1.53
1320	-2.61	1.12	1.22	1.08

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Singapore 528883
Tel (Direct): +(65)-6785 4396 (Ext. 101) Tel (Mobile): +(65)-9146 1432 and
+(60) 12 7238452 Fax: +(65)-6260 4465

Project :
Gyro Calibration
DGPS System's Verification
Tail Buoy System's Verification
Vessel : MV Pacific Titan
Location : Laying Jetty, Singapore
Equipment : Nikon DTM-552 Total station
Personnel : Rolando Paguio (Surveyor)
Rostam Rosli
Date : 6 & 11 February 2008

3. SURVEY PROCEDURES

Survey origin at Loyang Jetty, Singapore
Three geodetic control stations were established on 21 December 2006 by Subsea7 (Singapore) Pte Ltd for the purpose of carrying out survey works for the vessel berthed at Loyang Jetty, Singapore .

The stations are:

Station	Easting	Northing	EL	Description
S1	385 112.540	152 940.435	4.694	nail
S2	385 104.607	152 963.277	4.714	nail
S3	385 082.549	153 024.532	4.676	nail

These stations were identified on the ground and their relative bearings and distances were checked prior to usage.

Current Survey

For this calibration, temporary stations TS1 and TS2 were established. TS1 was used as instrument station for carrying out DGPS/Tail Buoy system's verification while TS2 was used as instrument station for Gyro calibration on 6th Feb 2008.
Coordinates of stations TS1 and TS2 are as follow:

Station	Easting	Northing
TS1	385 108.610	152 951.442
TS2	385 105.024	152 959.150

Calibration Preliminaries

Prior to the calibration, the following were carried out:
- All mooring lines were tightened
- There was no heavy loading on the vessel
- The surveyor's time piece was synchronized with the vessel computer time
- All C-O were removed from the vessel's computers (i.e. logged raw data only)
- Advised the navigators to log onto the correct differential stations
- Advised the navigators to monitor the vessel's data when calibration is on-going

3.1 PRISM INSTALLATION

On 6th February 2008, the vessel's heading was 250º. At this direction, Gyro calibration, DGPS/Tail Buoy system's verification were carried out.
For gyro calibration, the bow and stern reflector was set up at the foremost part of the bow and stern of the vessel. Reflectors were also set up at SPM1 XP and SPM2 HP antennas for DGPS system's verification.

3.2 CALIBRATION/VERIFICATION PROCEDURES

Gyro Calibration

For Gyro calibration at 250º heading, total station was set up at temporary station TS2, and S3 was used as reference station. Grid bearings and horizontal distances were observed to the reflectors set up at the bow and stern of the vessel.
Simultaneously, a 3-second interval readings were being logged from the vessel's gyro while observations from total station were being carried out.

DGPS System's Verification

The total station was set up at temporary station TS1, and S3 was used as reference station. Grid bearings and horizontal distances were observed to the prism set up at SPM1 XP and SPM2 HP antennas.
3-second interval readings were then logged from the vessel while observations from total station were being carried out.
On 11th of February 2008, DGPS systems verifications were re-carried out. Same procedure was applied, but observations were done at different instrument station and reference bearing such as S2 and S3. Positions from XP EXP, SPM1 XP, SPM1 HP, SPM2 XP and SPM2 HP were simultaneously logged from the vessel while reflectors set up at DGPS antennas were being observed.

Tailbuoy System's Verification

Tail Buoy system's verification was carried out simultaneously with the DGPS verification. A known position was established using total station and from this position, 6 x rDGPS pods were set up and ranges and bearings relative to SPM1 XP antenna were logged at 3-second interval.

4. GEODETIC PARAMETERS

The survey work was computed based on the following geodetic and projection system.

Geodetic Reference System

Datum	WGS 84
Spheroid	WGS 84
Semi-major axis	6 378 137.0000 metres
Semi-minor axis	6 356 752.3142 metres
Inverse flattening	298.257 223 563 metres
Eccentricity	0.006 694 380

Projection Parameters

Grid	Universal Transverse Mercator (UTM)
Projection type	Transverse Mercator
Central Meridian	105º E
Latitude of origin	0º (Equator)
False Easting	500 000 metres
False Northing	0 metres
Scale factor on CM	0.9996

5. RESULTS

Gyro Calibration

The grid bearings derived from the observation of bow and stern reflectors were converted to true bearings. These were then compared with the ship's print out for AD 100 and HS 50 gyros to obtain the C-O corrections for 250º heading of the vessel.
The convergence at Station TS2 and S3 was computed to be minus 0.03 deg.
True Bearing = Grid Bearing Minus 0.03 º
All observed distances were converted to grid distances. The scale factor used was 0.9998798.

DGPS System's Verification

The observed grid bearings and distances from the reflectors set up at DGPS antennas were converted to easting and northing. These computed coordinates were then compared to the vessel's XP EXP, SPM1 XP, SPM1 HP, SPM2 XP and SPM2 HP easting and northing print outs to derive the C-O corrections.

Tailbuoy System's Verification

The observed ranges and bearings relative to SPM1 XP antenna were converted to easting and northing. The mean coordinates of each rDGPS pod were then compared to known established position to derive the C-O corrections for easting and northing.

Calibration undertaken in Balikpapan, Indonesia

1. ABSTRACT

Fugro Survey Pte Ltd through its subsidiary in Indonesia, PT Fugro Indonesia was contracted by Fugro Survey AS to carry out the following services for their survey vessel MV Pacific Titan at Semayang Wharf, Balikpapan, Indonesia on 07 up to 08th August 2007.

- DGPS System Verification
- Gyro Calibration
- Tail Buoys Verification

All co-ordinates quoted within this report are in metres and referred to WGS 1984 Spheroid and Datum

1.1 Summary of Results

The results are summarized and tabulated as follows:

a) DGPS System Verification

	Easting (m)		Northing (m)	
System	C - O	Std Dev.	C - O	Std Dev.
Port GPS Antenna	-1.4	0.4	1.6	0.2
Stbd GPS Antenna (Primary)	-1.4	0.4	1.6	0.1

b) Gyro Calibration

		Gyro 1 HS 50		Gyro 2 AD 100	
Cal. #	Heading	C - O	Std Dev.	C - O	Std Dev.
August 7	15.3	1.1	0.8	2.2	0.2
August 8	191.9	1.6	0.8	2.2	0.6
Mean		1.35	0.8	2.2	0.4

c) Tail Buoys System Verification

	Degrees °		*Distance (m)*	
System	Mean	Std Dev.	Mean	Std Dev.
Pod1260	3.19	1.76	-0.55	2.10
Pod1314	1.49	1.08	2.05	1.05
Pod1411	1.45	4.32	-1.96	0.98
Pod1503	-3.68	3.34	0.73	1.22
Pod1511	-0.56	4.07	1.91	2.85
Pod1518	0.82	0.33	0.32	0.38
Pod1575	1.33	1.69	1.14	0.71
Pod2041	-0.11	2.28	2.00	1.89

2. PROJECT DETAILS

Client	: Fugro Survey AS
Contractor	: FUGRO SURVEY Pte. Ltd.
Project	: Gyro Calibration, DGPS System and Tail Buoys Verification
Vessel / Barge	: MV Pacific Titan
Location	: Semayang Wharf, Balikpapan, Indonesia
Equipment	: Total Station – Sokkia SET4B
Personnel	: Anto Sinaga (Surveyor) Bambang Setiawan (Surveyor)
Date	: 07th – 08th August 2007

3. SURVEY PROCEDURES

3.1 Survey Stations

There are 2 reference survey station (2 numbers with WGS 1984 coordinates system) at Semayang Wharf Balikpapan, Indonesia. They are FUGRO 3 and FUGRO 4 (Refer to Appendix A). This point must be transferred due to far away from vessel. We make 2 help point near the vessel (P2 and P4) so that we could be shot prism on the vessel easily. P4 was used as instrument set-up location and P2 as the backsight (prism target). Details position of reference point and help point above as follows:

No.	Point_Name	Coordinates			
		Geodetic Coordinates		Grid Coordinates	
		Latitude	Longitude	Easting (m)	Northing (m)
1	FUGRO 3	01°16'14.2952 S	116°48'24.2996 E	478501.312	9859555.337
2	FUGRO 4	01°16'13.6253 S	116°48'24.9706 E	478522.046	9859575.907
3	P2	01°16'21.3263 S	116°48'19.9359 E	478366.480	9859339.450
4	P4	01°16'23.5496 S	116°48'19.7757 E	478361.536	9859271.189

3.2 Position of Target Prism

On board the barge, four prisms were installed with masking tape, one at port GPS Antenna, one at starboard GPS Antenna (DGPS system and tailbuoys verification), and two at along starboard side of the vessel (Gyro calibration). The starboard GPS antenna was used as primary GPS antenna.

3.3 Calibration Procedures

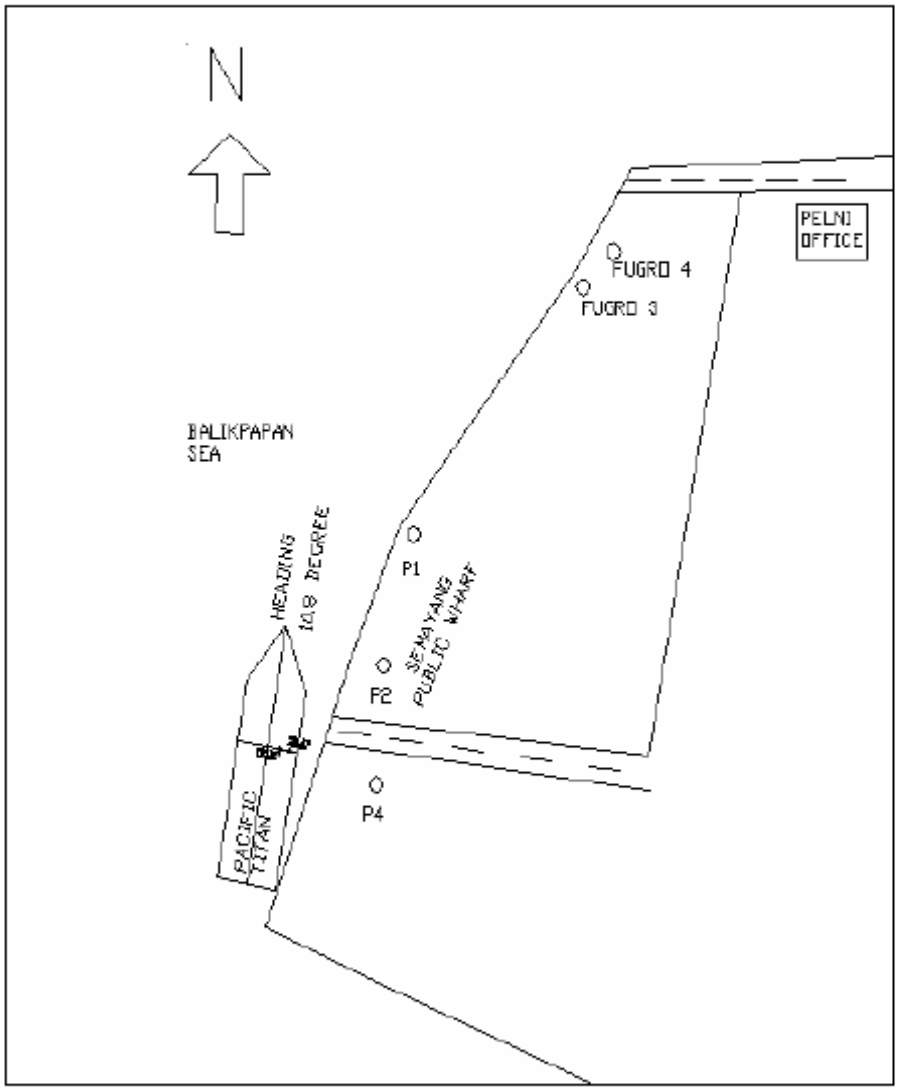
The DGPS verification checks and gyro calibrations were conducted in difference time. The Total Station was set up at P4 and referenced to P2 as backsight (Refer to Appendix C). Range and bearing measurements were observed to the prisms installed on board the barge, same survey procedure was used for both gyro calibration and DGPS verification checks. At the same times, DGPS antenna positions and the gyro readings were logged by vessel chief navigator.

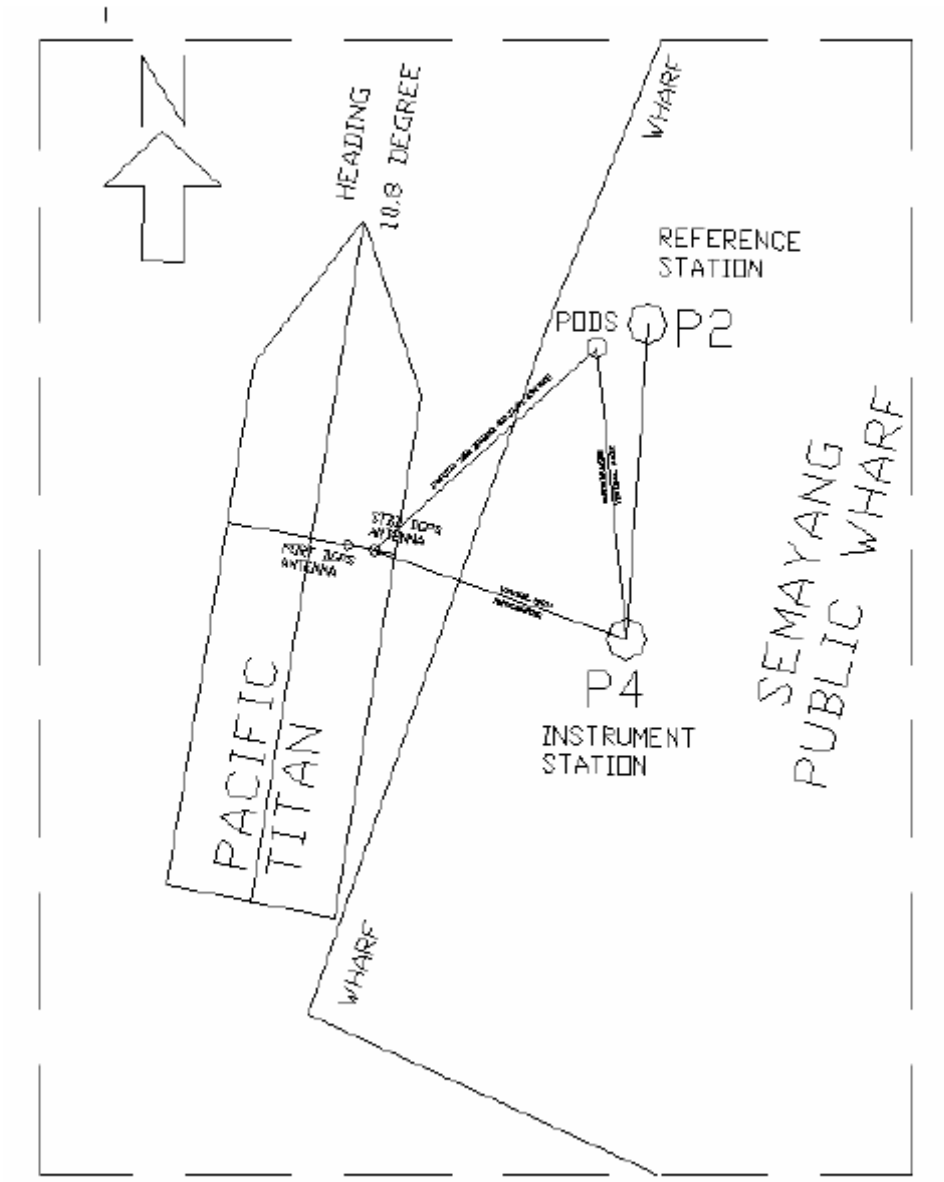
4. GEODETIC PARAMETERS

The survey work was defined and computed in the following Geodetic and Projection system:

Global Positioning System Geodetic Parameters	
Spheroid:	World Geodetic System 1984
Datum:	World Geodetic System 1984
Semi major axis:	a = 6 378 137.000 m
Inverse Flattening:	$1/f$ = 298.257 223 563
Project Projection Parameters	
Grid Projection:	Universal Transverse Mercator
UTM Zone:	50 S
Central Meridian:	117° 00' 00" E
Latitude of Origin:	0° 00' 00" N
False Easting:	500 000 m
False Northing:	0 m
Scale factor on Central Meridian:	0.9996
Units:	metre

C FIELD DIAGRAM



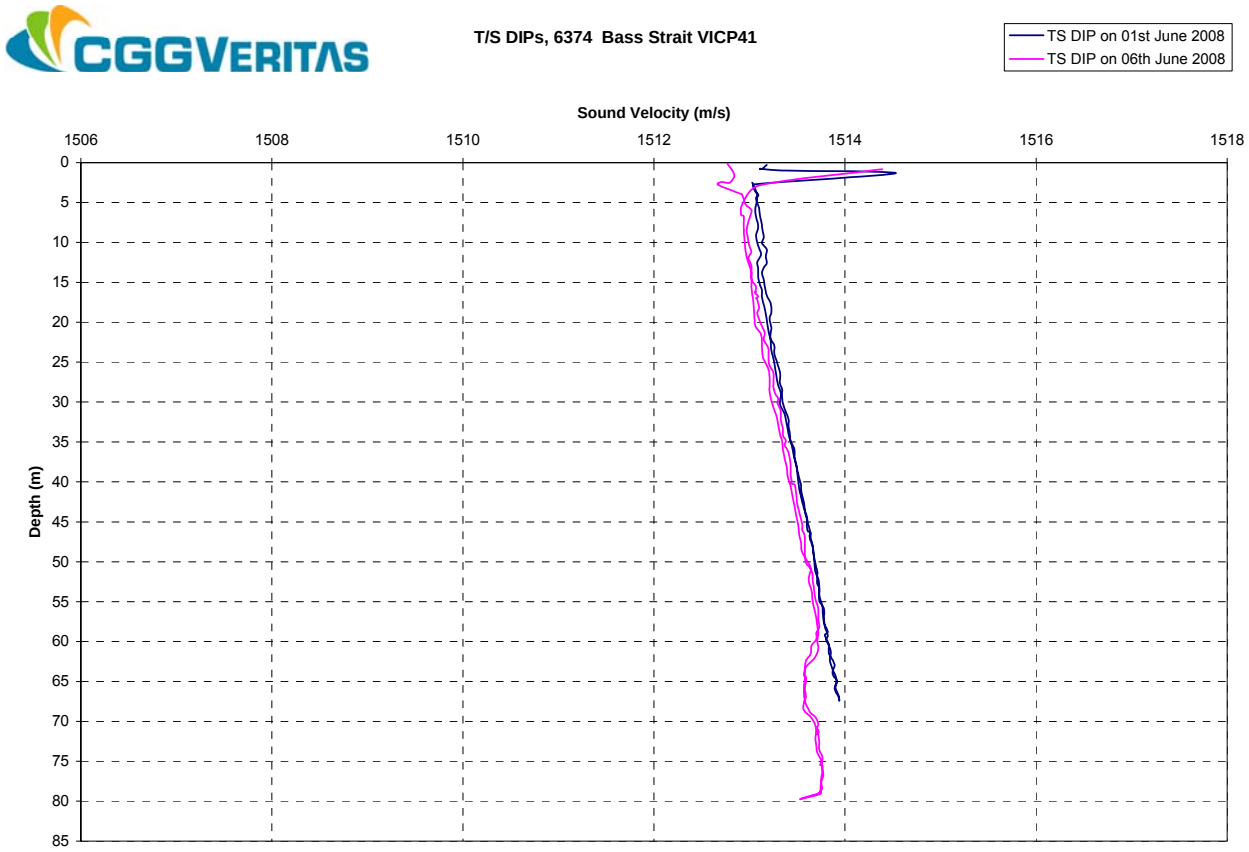

N
HEADING
10.8 DEGREE
WHARF
REFERENCE
STATION
PODS
P2
SEMAYANG
PUBLIC WHARF
P4
INSTRUMENT
STATION
PACIFIC
TITAN
WHARF

Appendix 4 Hydrographical Data Graph

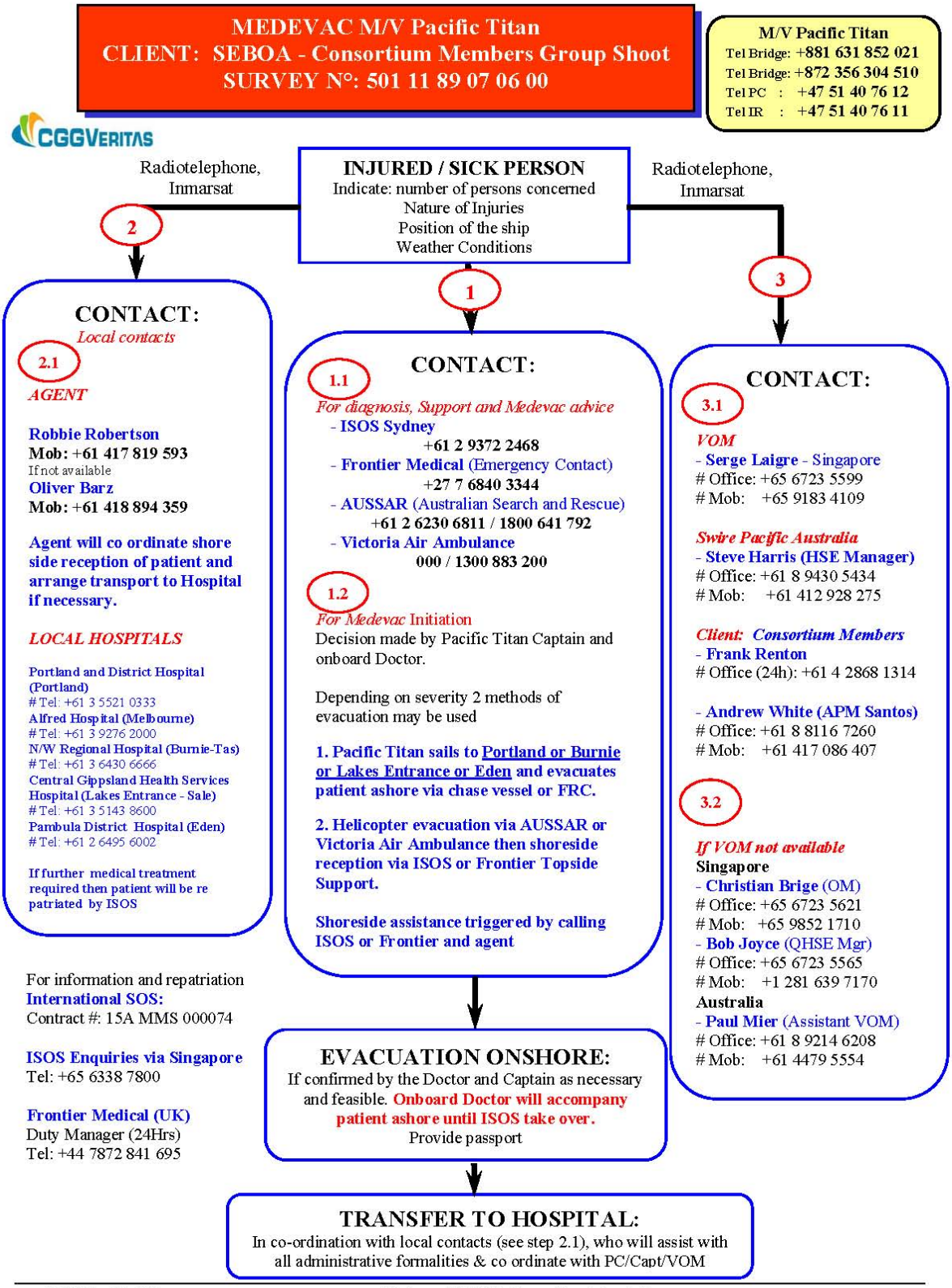
Conductivity, pressure and temperature profiles are gathered using a (TS) Dips. Data and location information are included in the Supporting Documents section of the CDROM.
Data from the Temperature and Salinity (TS) Dips are used to verify the water speed, which is continuously measured while recording data. Two TS Dip measurements were taken during the survey.

Position	
Lat	038° 27' 35" S
Long	149° 05' 07" E
Date:	01 June 2008
Time:	04:40 GMT
	12:40 Local Time
1513.49	Mean Velocity on deploy
1513.43	Mean Velocity on recovery
1513.46	**Mean Velocity**

Position	
Lat	039° 00' 00" S
Long	149° 14' 00" E
Date:	06 June 2008
Time:	23:35 GMT
	09:35 Local Time
1513.47	Mean Velocity on deploy
1513.36	Mean Velocity on recovery
1513.42	**Mean Velocity**



Appendix 5 Medevac Plan



M/V Pacific Titan
Created by: S. Laigre 22nd March 2008 V1.3

Medevac SEBOA-Group Shoot Australia

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March 2008 - July 2008

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		- Aviation Rescue		Phone: 1800 815 257		
		- Maritime Emergency		Phone: 1800 641 792		
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		Dennis Vale	Mob: +61 437 653 905	Phone: +61 8 8116 7651	Fax: +61 8 8116 7113	
Fishing Vessel – SANTOS (M/V Shandara)		Jonathan (Jono) Hammond	Mob: +61 427 366 529	+61 145 115 342	VHF & UHF	
		(Distinguishing mark: RDX2)			(Call sign VNM 4671)	
		John Hammond	Mob: +61 429 130 238		VHF & UHF	
		(Distinguishing mark: UX9)	Mob: +61 428 130 238		(Call sign VJT 3639)	
3D Oil Contact		**Jon Keall**	Mob: +61 439 038 054	Phone: +61 3 9650 9866		E-mail: jkeall@3doil.com.au
				Phone: +61 3 5341 3669		
Bass Straits Oil Company Contact		**Keith Jackson**	Mob: +61 402 109 715	Phone: +61 3 9927 3000		E-mail: keith.jackson@bassoil.com.au
				Phone: +61 3 9439 3552		
Cue Energy Resources Contact		**Desmond Leech**	Mob: +61 422 981 139	Phone: +61 3 96708668		E-mail: des.leech@cuenrg.com.au
				Phone: +61 422 981 139		
Eagle Bay Resources Contact		**Ian R Barr**	Mob: +61 415 271 299	Phone: +61 8 9481 3322		E-mail: ianbarr@eaglebayresources.com.au
				Phone: +61 8 9381 1181		
Exoil Contact		James Willis	Mob: +61 404 078 292	Phone: +61 3 8610 4711		E-mail: james.willis@albersgroup.com
				Phone: +61 3 9699 7439		
Fishing Vessel – Exoil (M/V)						

Tap Oil Contact		Emergency contact number			Phone:	+61 (0)8 9226 7836 (24 Hrs)				
		Blaine Ulmer	Mob:	+61 409 483 932	Phone:	+61 8 9226 7813			E-mail:	blaine.ulmer@tapoil.com.au
					Phone:	+61 8 9271 4046				
		Denise Long	Mob:	+61 409 684 079	Phone:	+61 8 9226 7809			E-mail:	denise.long@tapoil.com.au
					Phone:	+61 8 9367 7583				
		John Thornton	Mob:	+61 404 830 788					E-mail:	john.thornton@tapoil.com.au
Agent & shore support in Australia		Robbie Robertson (Assistant Manager)	Mob:	+61 417 819 593	Phone:	+61 8 8947 2570			E-mail:	robbie@ntshipping.com.au
N.T. Shipping Agencies Pty. Ltd.		Oliver Barz (Alternative Contact)	Mob:	+61 418 894 359						
Melbourne Hospital										
Alfred Hospital					Phone:	+61 3 9276 2000 / +61 03 9840 3500 (Switchboard)	Fax:	+61 3 9276 2255 / +61 3 9840 3547		
Commercial Road, Prahran, Melbourne, Australia										
Austin & Repatriation Medical Center					Phone:	+61 3 9276 2000 / +61 3 9840 3500	Fax:	+61 3 9276 2255		
Studley Road, Heidelberg, Melbourne, Australia 3084										
Burnie (Tasmania) Hospital										
North West Regional Hospital					Phone:	+61 3 6430 6666 / +61 3 6430 6524				
Brickport Road, Burnie, TAS 7320, Australia										
Portland Hospital										
Portland and District Hospital					Phone:	+61 3 5521 0333	Fax:	+61 3 55 210 358		
Bentinck Street, PORTLAND, Victoria 3305										
Lakes Entrance – Sale Hospital										
Central Gippsland Health Services Hospital					Phone:	+61 3 5143 9600		+61 3 5143 9633		
Guthridge Parade, Sale 3850										
Eden Hospital										
Pambula District hospital					Phone:	+61 2 6495 6002				
Merimbula rd, Pambula NSW 2549										
Australian Federal Authorities										
NOPSA					Phone:	+61 3 8866 5700				
24 hr Incident Notification										
Department of Agriculture, Fisheries & Forestry (Switchboard)					Phone:	+61 2 6272 3933				
Department of Industry, Tourism & Resources (Switchboard)					Phone:	+61 2 6213 6000				
Victoria Police Centre					Phone:	+61 3 9247 6666				
Victoria Police Centre, 37 Flinders Street, Melbourne, VIC, 3005										
Air Wing (Victoria Police)					Phone:	+61 3 9374 1311	Fax:	+61 3 9374 1929		
Victoria Police										
Hanger 104, Essendon Airport, VIC, 3041										
Burnie Police Headquarters					Phone:	+61 3 6434 5211				
88 Wilson Street, Burnie TAS 7320					Phone:	+61 3 6230 2700				
Onshore										
Police		Police Emergency			Phone:	0				
		Police Non urgent			Phone:	131 444				
Ambulance		Ambulance Emergency			Phone:	0				
		Air Ambulance (Victoria)			Phone:	+61 3 9845 9911				
Hospitals – Public Victoria		Royal Melbourne Hospital			Phone:	03 9342 7000 (Ph)				
Hospitals – Public Tasmania		Royal Hobart Hospital (Public)			Phone:	03 6222 8308 (Ph)				
		Launceston General Hospital			Phone:	03 6348 7111 (Ph)				
		North West Regional Hospital (Burnie)			Phone:	03 6430 6666 (Ph)				
Medical Advice		International SOS Medical Support Singapore			Phone:	+65 6338 7800 (24 hrs)				
Airport		Melbourne			Phone:	03 9297 1600 (Ph - Administration)				
		Hobart			Phone:	03 6212 1600 (Ph - Administration)				
		Launceston			Phone:	03 6391 6222 (Ph - Administration)				
Australian Search and Rescue (ASAR)					Phone:	1800 641 792 (Ph within Australia)				
					Phone:	+61 2 6230 6811 (Ph Outside Aust.)				
					Phone:	+61 2 6279 5719 (Ph Outside Aust.)				
					Phone:	+61 2 6279 5717 (Ph Outside Aust.)				
					Phone:	08 9478 3388 (Ph)				
Australian Maritime Safety Organization					Phone:	08 9430 2121 (Fax)				
Minerals Resources Tasmania Petroleum Emergency Contact		Hobart			Phone:	Carol Bacon				
					Phone:	03 6233 8326 (Ph Bus Hrs)				
					Phone:	03 6239 1409 (Ph after hours)				
					Phone:	Chris Boron				
					Phone:	03 6233 8362 (Ph Bus Hrs)				
					Phone:	03 6272 4862 (Ph after hours)				
Maritime Rescue Coordination Centre					Phone:	02 6230 6811 (Ph)				
					Phone:	02 6230 6868 (Fax)				
Yolla A Platform		Mark Sanford			Phone:	+65 3 5654 9124			Email:	Mark.Sanford@originenergy.com.au
Origin Energy BassGas Operations										