FINAL SURVEY REPORT

CGGVeritas

VESSEL: M/V PACIFIC TITAN

- Marine 2D & High Resolution SEISMIC REFLECTION METHOD ACQUISITION -

LOCATION	:	AUSTRALIA
AREA	:	BASS BASIN - AUSTRALIA
SURVEY	:	T41P
CLIENT	:	3D OIL LIMITED
DURATION	:	18th April 2008 - 04th May 2008
C.G.G.V. SURVEY N°	:	501 11 89 07 06 00 (JOB N°: 6374)
CONTRACT N°	:	859832

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1. Survey Information and Objectives

3D Oil agreed to enter into a service contract for the purpose of acquisition of a marine seismic 2D survey of approximately 2200 sail kilometres.

The survey area was located approximately 100 kilometres North of Tasmania within the block T41P in the Bass Strait of Australia.

Water depth in the survey area was relative flat. Water depth is around 80m over the survey area.

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 6 sec.

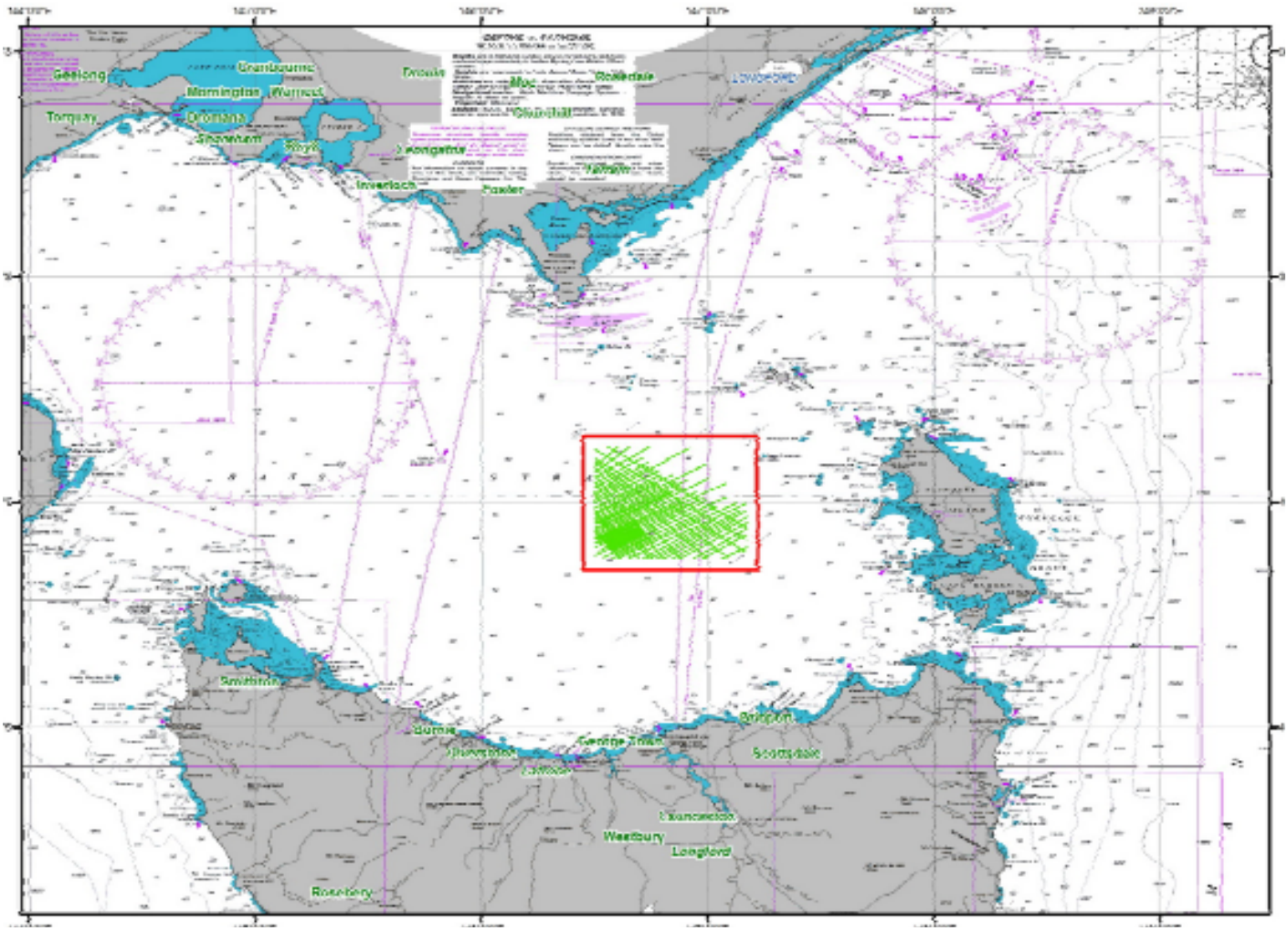
Chargeable production started on the 18th April at 07:45 GMT) or 17:45 (Local Time) and completed 04th May at 07:10 (GMT) or 17:10 (Local Time).

All lines were pre-fixed with TBOB08. 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.

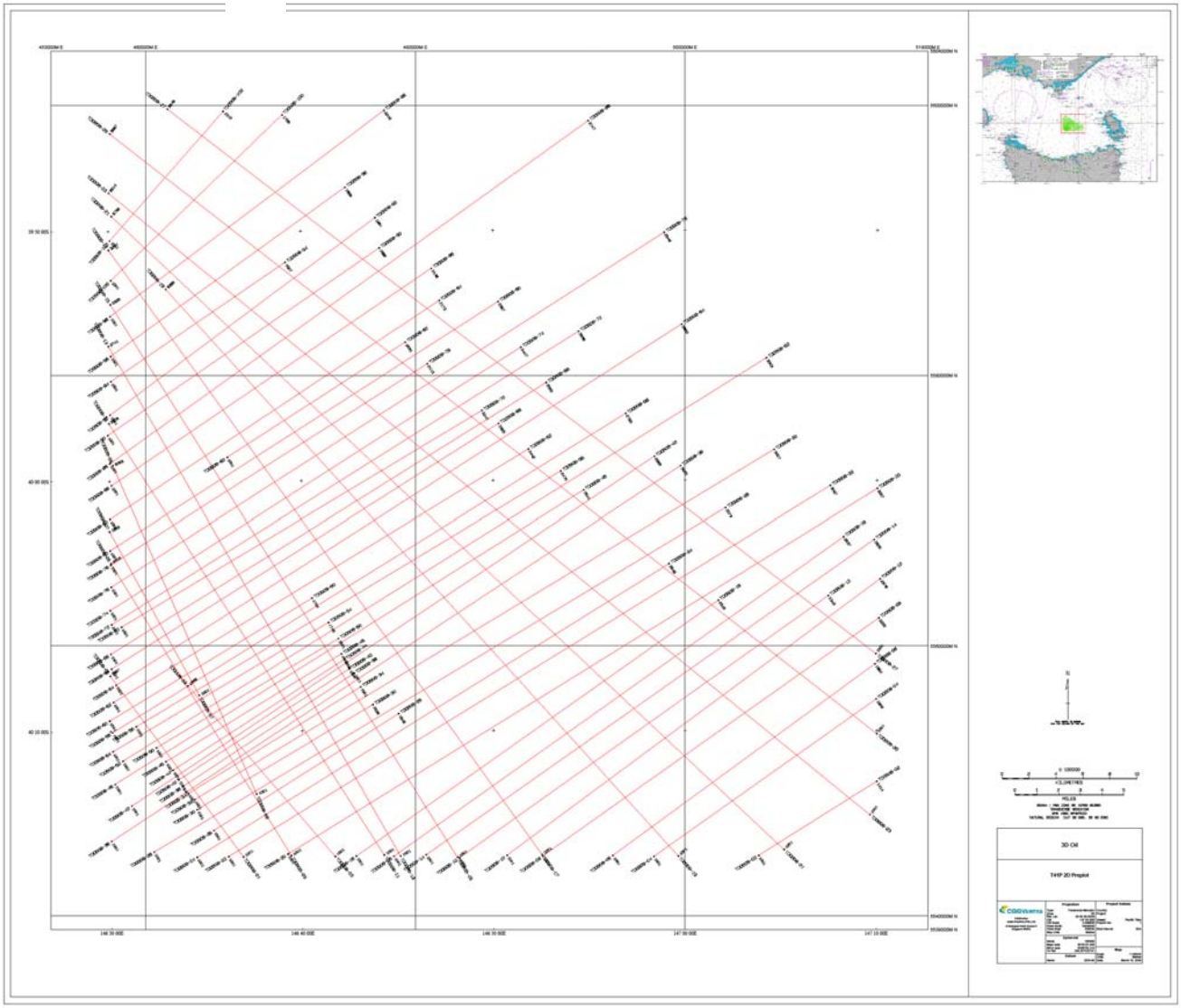
Upon survey completion, Pacific Titan departed the area to transit to the Bass Strait survey.

2. Survey Area

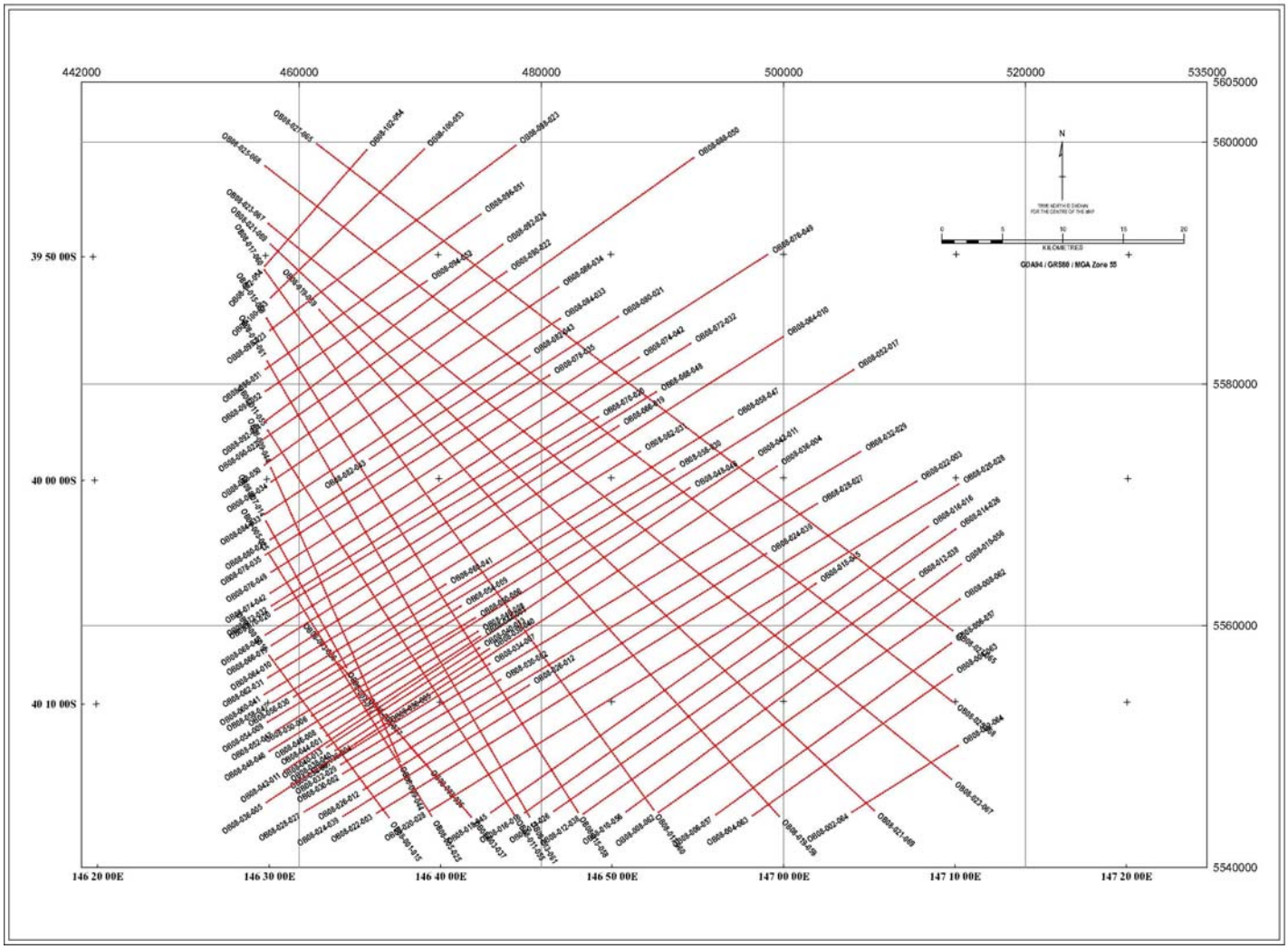
2.1. T41P Survey Location



2.2. Survey Preplot Map.



2.3. Survey Postplot Map.



3. Contract Work Order

CONTRACT

Client:	3D Oil
Vessel(s):	Pacific Titan
Job number:	6734
Bid number:	
Client contract number/ref:	
Name:	
Area:	T41P Bass Strait, -Australia
Type of survey:	2D Towed streamer
Area or total km's:	2203
Line heading:	Variable
Number of lines:	65
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

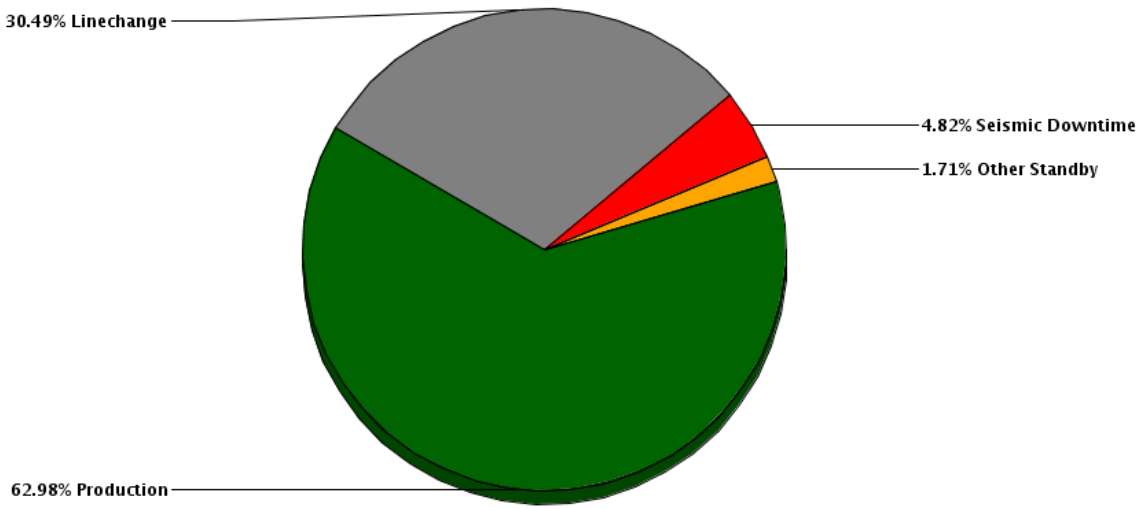
POSITION	Crew 2
Party Chief	Haydn Brook
Captain	Bruce Wallis
Chief Engineer	Thomas Broughton
Chief Observer	Tyrone Hackett
Shift Leader Observer	Slawomir Korybalski
Chief Navigator	Steven Ryan
Shift Leader Navigation	Donald Hutchings
Chief Mechanic	Ralph Bennett
Shift Leader Mechanic	Regis Derrien
Client Representative	William Lloyd

5.2. Office Support Personnel

POSITION	NAME
Vice President Operation	Christian Brige
Operation Manager	Serge Laigre
Instrument Manager	Joar Vestrheim
Navigation Manager	Rafael Bouraly
Mechanic Manager	Steinar Hovland
QC support	Christophe Massacand

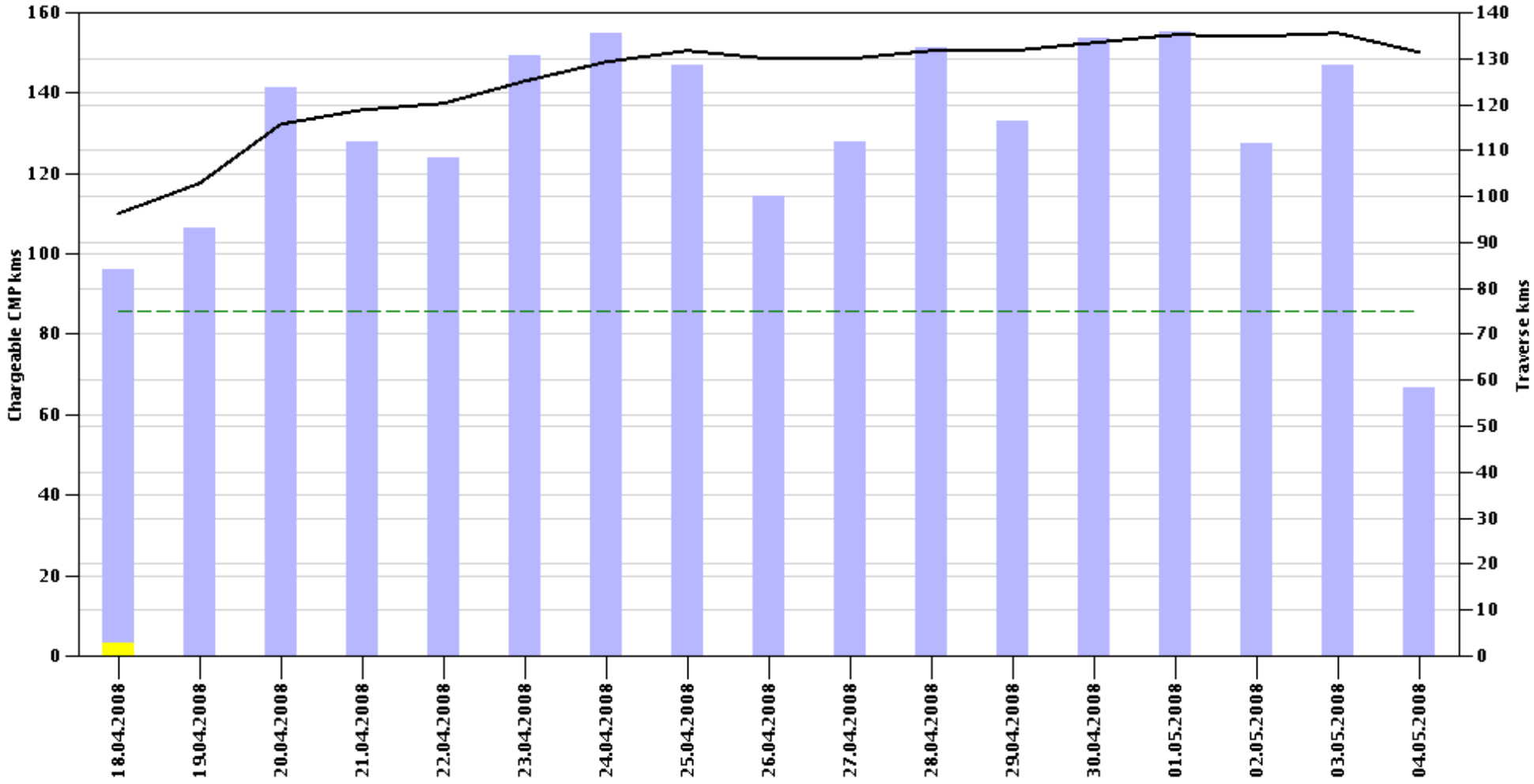
6. Field Information and Observations

6.1. Time Statistics



		CHARGE CODES								Hidden downtime	
ACTIVITY		15	17	22	25	27	Tc corr	Total hours	%	RC hrs	RB hrs
Linechange											
LChnom	Linechange, nominal			119.72				119.72	30.49%		
TOTAL				119.72				119.72	30.49%		
Production											
PROD2D	Production 2D Line	2.22	244.77					246.98	62.90%		
PRORUN	Production Runout	0.33						0.33	0.08%		
TOTAL		2.55	244.77					247.32	62.98%		
Standby Environment											
ENvcur	Environmental, sea currents										
TOTAL											
Standby Other											
STbcli	Standby on clients request				2.45	4.25		6.70	1.71%		
TOTAL					2.45	4.25		6.70	1.71%		
TD MEC Source											
MEsgun	Mechanical, source, gun						8.30	8.30	2.11%		
MEshar	Mechanical, source, array hardware						0.37	0.37	0.09%		
TOTAL							8.67	8.67	2.21%		
TD MEC Wide tow											
MEwflo	Mechanical, wide tow, flotation						3.03	3.03	0.77%		
TOTAL							3.03	3.03	0.77%		
TD REC Onboard system											
REoacq	Recording, onboard, recording/acquisition systems						7.23	7.23	1.84%		
TOTAL							7.23	7.23	1.84%		
TOTAL		2.55	244.77	119.72	2.45	4.25	18.93	392.67	100.00%		

6.2. Production Statistics 3D Oil part of Group Shoot



Chargeable CMP and km² summary

Date	PROPFF	PRORUN	PROIFF	PROIRU	PRUPFF	PRURUN	PRUIFF	PRUIRU	PROOVL	PROD2D	Total CMP kms	Total km²
18.04.2008		3.00000								93.22500	96.22500	
19.04.2008										106.27500	106.27500	
20.04.2008										141.35000	141.35000	
21.04.2008										127.75000	127.75000	
22.04.2008										123.82500	123.82500	
23.04.2008										149.22500	149.22500	
24.04.2008										154.65000	154.65000	
25.04.2008										147.07500	147.07500	
26.04.2008										114.40000	114.40000	
27.04.2008										127.82500	127.82500	
28.04.2008										151.25000	151.25000	
29.04.2008										133.15000	133.15000	
30.04.2008										153.57500	153.57500	
01.05.2008										155.25000	155.25000	
02.05.2008										127.35000	127.35000	
03.05.2008										146.85000	146.85000	
04.05.2008										66.65000	66.65000	
Total CMP		3.00000							2219.67500		2222.67500	
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

All daily logs are in GMT time.

Sun, 04 May 2008, week 19
146.85 km acquired today.
3D Oil survey completed today. On completion of 3D Oil the vessel then proceeded to Bass Strait prospect.
Along the way gun string 3 recovered for maintenance.
Bass Strait survey commenced with no problems.

No Tailbuoy GPS through the day.
Midnight fuel balance 515.512 cubic M, Consumed 15.1 cubic M
HSE
Total personnel onboard: 34 (16 Maritime, 16 Seismic, 2 client)
14 x toolbox meetings (8 x Dept. Handovers, 3 x gun deployment, 3 x gun recovery)
0 x Observation card

Sat, 03 May 2008, week 18
146.85 km acquired today.
Day commenced with the vessel circling due a airleak on gun string 2 (fractured top housing liner).
Sea conditions reduced the speed slightly on Seq 068. Streamer set back to nominal 8m depth on Seq 068
Gun string 3 recovered on two occasions today due to electrical problems with Gun 7.
Vessel currently on last line for 3D Oil.
No tailbuoy GPS through the day.
Midnight fuel balance 515.512 cubic M, Consumed 15.1 cubic M
HSE
Total personnel onboard: 34 (16 Maritime, 16 Seismic, 2 client)
14 x toolbox meetings (8 x Dept. Handovers, 3 x gun deployment, 3 x gun recovery)
1 x Observation card

Fri, 02 May 2008, week 18
127.35 km acquired today.
Sea conditions ordinary throughout the day with a large swell from the West. Forecast shows no improvement in weather conditions for the remainder of 3D Oil.
Streamer set to 9m from Seq 63 onwards. Throughout the day swell noise evident on the streamer but is within acceptable limits.
Vessel speed reduced slightly through the day to keep streamer control
One extended line change today for repairs to gun string 1 (fractured top housing liner).
Vessel circled late in the day due to an air-leak on gun string 2 (fractured top housing liner).
No tailbuoy GPS through the day.
Midnight fuel balance 530.612 cubic M, Consumed 15.5 cubic M
HSE
Total personnel onboard: 34 (16 Maritime, 16 Seismic, 2 client)
10 x toolbox meetings (8 x Dept. Handovers, 1 x gun deployment, 1 x gun recovery)
1 x Observation card

Thu, 01 May 2008, week 18
155.25 km acquired today.
Sea conditions increased through the day, streamer put to 9m at Seq 60. Vessel speed had to be reduced at Seq 60 to keep the front end of the streamer in Spec.
Seq 60 onwards, occasional random swell noise evident on the streamer affecting approximately 5% of the traces.
No tailbuoy GPS through the day.
Midnight fuel balance 546.112 cubic M, Consumed 14.0 cubic M
HSE
Total personnel onboard: 34 (16 Maritime, 16 Seismic, 2 client)
8 x toolbox meetings (8 x Dept. Handovers)
1 x Observation cards
1 x MOB drill (talk)

Wed, 30 Apr 2008, week 18
153.575 km acquired today.
Steady production throughout the day. Sea conditions remain favorable and forecast looks good for the remainder of 3D Oil.
No tailbuoy GPS through the day.
Midnight fuel balance 560.112 cubic M, Consumed 14.0 cubic M
HSE
Total personnel onboard: 34 (16 Maritime, 16 Seismic, 2 client)
8 x toolbox meetings (8 x Dept. Handovers)
1 x Observation cards
2 x CSV
1 x Action point closed

Tue, 29 Apr 2008, week 18
151.25 km acquired today.
Production good today, sea conditions have eased off slightly over the last 24 hours.
During Seq 052 vessel had to slow down due a small vessel crossing ahead.
No tailbuoy GPS through the day.
Midnight fuel balance 574.112 cubic M, Consumed 14.3 cubic M
HSE
Total personnel onboard: 34 (16 Maritime, 16 Seismic, 2 client)
8 x toolbox meetings (8 x Dept. Handovers)
1 x Observation cards

Mon, 28 Apr 2008, week 18
151.25 km acquired today.
Production good today, sea conditions remain moderate.
Ships noise on streamer during Seq 46, at an acceptable limit.
No tailbuoy GPS through the day.
Midnight fuel balance 588.412 cubic M, Consumed 14.9 cubic M
HSE
Total personnel onboard: 34 (16 Maritime, 16 Seismic, 2 client)
8 x toolbox meetings (8 x Dept. Handovers)
6 x Observation cards
1 x MSV

Sun, 27 Apr 2008, week 18
127.825 km acquired today. Steady day production, sea conditions remain favourable.
Seq 43, speed reduced to keep the front end of the streamer in Spec (going shallow)
No tailbuoy GPS through the day.
Midnight fuel balance 603.312 cubic M, Consumed 14.5 cubic M
HSE
Total personnel onboard: 34 (16 Maritime, 16 Seismic, 2 client)
8 x toolbox meetings (8 x Dept. Handovers)
1 x Observation card

Sat, 26 Apr 2008, week 17
114.4 km acquired today.
One circle today, due to array 2 gun 3 auto-firing (broken top housing liner).
For approximately 5km of Seq 36, had low number of satellites which caused loss of RGPS data to string 1.
Seq 38 and 39, the streamer was put down to 9m due to sea conditions increasing Around 3 to 3.5m swell with 20 to 25 knots of wind.
Through Seq 39, a slight drop in air pressure due to an air leak on compressor No.1. Compressor No.3 put online to increase pressure.
No tailbuoy GPS through the day.
Midnight fuel balance 617.812 cubic M, Consumed 14.8 cubic M
HSE
Total personnel onboard: 34 (16 Maritime, 16 Seismic, 2 client)
12 x toolbox meetings (8 x Dept. Handovers, 2 x gun deployment, 2 x gun recovery)
1 x Observation card

Fri, 25 Apr 2008, week 17
147.075 km acquired today. Weather remains good, steady production throughout the day.
Gun arrays recovered on two occasions today for general maintenance.
One Extended line change due to extra time required for gun maintenance. Spreader Bar required changing.
No tailbuoy GPS through the day.
Seq 33 ship noise evident on the streamer for approximately 7km
Midnight fuel balance 632.612 cubic M, Consumed 14 cubic M
HSE
Total personnel onboard: 34 (16 Maritime, 16 Seismic, 2 client)
12 x toolbox meetings (8 x Dept. Handovers, 2 x gun deployment, 21 x gun recovery)
1 x Observation cards
1 x CSV

Thu, 24 Apr 2008, week 17
154.65 km acquired today. Weather remains good, steady production throughout the day.
V1G3 (Multifix) not available Seq 27 and 28.
No tailbuoy GPS through the day.
During Seq 27, Robtrack wondered off course: approximately 35m offline. Bridge brought back online.
Midnight fuel balance 646.612 cubic M, Consumed 13.8 cubic M
HSE
Total personnel onboard: 34 (16 Maritime, 16 Seismic, 2 client)
10 x toolbox meetings (8 x Dept. Handovers, 1 x gun deployment, 1 x gun recovery)
1 x Observation cards
1 x muster drill, 1 x SOPEP Drill
1 x MSV

Wed, 23 Apr 2008, week 17
149.225 km acquired today. Weather remains good, steady production throughout the day
V1G3 (Multifix) not available Seq 24 to 27.
No tailbuoy GPS through the day.
Midnight fuel balance 660.412 cubic M, Consumed 14.0 cubic M
HSE
Total personnel onboard: 34 (16 Maritime, 16 Seismic, 2 client)
8 x toolbox meetings (8 x Dept. Handovers)
1 x Observation cards

Tue, 22 Apr 2008, week 17
123.825 km acquired today.
1 circle today due to the seal system freezing up early into Seq 018(appears to be a memory issue).
Seq 018 is NTBP.
No tailbuoy GPS through the day.
Midnight fuel balance 674.412 cubic M, Consumed 14.2 cubic M
HSE
Total personnel onboard: 34 (16 Maritime, 16 Seismic, 2 client)
8 x toolbox meetings (8 x Dept. Handovers)
0 x Observation cards
1 x JSA

Mon, 21 Apr 2008, week 17
127.75 km acquired today.
Steady days production, weather remains very good.
No Tailbuoy GPS throughout the day.
Echo sounder crashed during Seq 17 for approximately 1km (time took to reboot system).
Midnight fuel balance 688.612 cubic M, Consumed 13.7 cubic M
HSE
Total personnel onboard: 34 (16 Maritime, 16 Seismic, 2 client)
8 x toolbox meetings (8 x Dept. Handovers)
6 x Observation cards
1 x OFI (change from Paravane to Barovane)

Sun, 20 Apr 2008, week 17

141.35 km acquired today.
Steady days production, weather remains favorable.
No Tailbuoy GPS throughout the day.
Midnight fuel balance 702.312 cubic M, Consumed 13.9 cubic M
HSE
Total personnel onboard: 34 (16 Maritime, 16 Seismic, 2 client)
8 x toolbox meetings (8 x Dept. Handovers)
1 x Observation cards
1 x general safety meeting

Sat, 19 Apr 2008, week 16
106.25 km acquired today.
One circle today due to the seal system freezing. After a reboot the system returned to normal.
During the circle Pacific Titan could not make contact with a fishing vessel approaching from the SW. Streamer was dived to 15m as a precaution until communication
is made. Fishing vessel altered course when communication is established and then the streamer put back to 8m depth
No Tailbuoy GPS throughout the day.
Midnight fuel balance 716.212 cubic M, Consumed 13.4 cubic M
HSE
Total personnel onboard: 34 (16 Maritime, 16 Seismic, 2 client)
8 x toolbox meetings (8 x Dept. Handovers)
3 x Observation cards

Fri, 18 Apr 2008, week 16
96.225 km total km acquired today.
23.075 km acquired for CUE Energy
73.15 km acquired for 3D Oil
Cue Energy survey completed today. On completion of Cue Energy the vessel then proceeded to 3D Oil prospect. Along the way all gun arrays recovered for
maintenance on the HP air system. The paravane was brought to the stern of the vessel to check to check for any twists in the chain. Paravane looked fine.
First line for 3D Oil completed successfully but the paravane float was not visible. Separations etc fine, on completion of the first sequence array 3 recovered followed by
recovering the leadin to investigate why the paravane would not stay on the surface. It was discovered that the chain from the float to the door had parted and was hanging from the
safety line. Once this was repaired all equipment redeployed and the vessel proceeded to line TDOB08-030-002.
No tailbuoy GPS position part way through Seq 003 due to GPS not charging.
Extended line change after sequence 001 due to repairs on the door.
Midnight fuel balance 729.612 cubic M, Consumed 13.1 cubic M
HSE
Total personnel onboard: 34 (16 Maritime, 16 Seismic, 2 client)
17 x toolbox meetings (8 x Dept. Handovers, 2 x gun deployment, 2 x gun recovery, 2 x door retrieval, 2 x door deployment, 1 x HP manifold fittings requiring tighting)
3 x Observation cards
1 x Fire drill
2 x MSV (PC-HP manifold tighting - Bringing in para vane to check for twists in chain)
1 x JSA for working on HP air manifold
Version 2: Seq 003, charge code incorrect (6), changed to charge code 17.

6.4. Field Information and Encountered Problems

6.4.1. Obstructions / Installations in the Field

No obstructions on Survey location

6.4.2. Traffic / Shipping Lanes

There was daily commercial 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 noticed throughout the survey.

6.4.4. Seismic Interference and Time Share

No seismic interference was observed during the survey.

6.4.5. Environmental Obstacles

Sea conditions for the area considered good over the survey duration. Streamer put to 9 meters of a few lines due to limiting the impact of swell noise on the streamer and also to maintain streamer ballast control.

6.4.6. Operational Observations

No weather downtime, little technical downtime seen a “Clean survey”.

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 no incidents during the survey.

HSE summary stats from 18th April to 04th May 08

		Total man-days for Master Vessel
Marine	**272**	
CGG	**272**	**578**
Sub Contract	**0**	Total Exposure hrs
Client	**34**	**13872**
	0	**Total man-days for chase**
	0	**0**
	0	**0**
	0	**Total Chase Exposure hrs**
	0	**0**
	0	**0**
Total Exposure hrs All		**13872**

induction tour seismic	**0**
induction tour marine	**0**
HSE Committee Meeting	**0**
HSE Crew Meeting	**1**
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	**1**
CSV	**3**
MSV	**4**
NC	**0**
OFI	**1**
JSA:	**2**
Observation_cards	**29**
Tool Box meetings:	**169**
Drills	**4**
Incident	**0**

Fuel Figures Breakdown

Vessels	**End of Month R.O.B.**	**Fuel used**	**Fuel bunkered**
Pacific Titan	**500.312**	**242.4**	**0**
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	total ROB	**total used**	**total bunkered**
Chase totals	**0**	**0**	**0**
Totals for all vessels		**242.4**	**0**

7.1. Observation Cards during the Survey:

Safety Observation Card Register
M/V Pacific Titan

Last update: 4-May-08

Card #	Date	Short Description	Deficient PPE	Negative attitude towards HSE rule	Deficient maintenance	Sharp parts / cutting tools	Deficient equipment	Poorly designed equipment	Deficient means of communication	Training deficiency	Deficient information	Working at height / aloft	Slippery surfaces / tripping hazards	Lifting / Handling	Small boat sorties	Deficient housekeeping	Misc. Transport	Hygiene	Other	Action Taken or Recommendation	Action By	APL	O: Open / X: Closed
1	18-Apr-08	AMSA warning cancelled by someone off vessel						x												PC to speak with VOM.	Party Chief		x
2	18-Apr-08	Nav on shift forgot to tell bridge that lead in was coming onboard to check door. Need to lift communication around vessel						x												PC informed bridge and then reminded Nav on shift about communication.	Party Chief		x
3	18-Apr-08	Muster list has S/L nav listed to do dutiies that would be more suitable for the medic (prepare for burnt victims etc) Problably a mistake when making list																	x	Inform the captain and PC to put in correct duties on list	Party Chief		x
4	19-Apr-08	Spillage of green liquid (unknown origin) in walkway streamer deck, causing slippery walkways										x								Cleaned up when spotted			x
5	19-Apr-08	Curtains in showers are starting to get mold on them.																x		Informed Jimmy (CH steward)	Captain		x
6	19-Apr-08	Well done, several cards coming in already closed due to crew taking immediate action to fix HSE issues and not leave it for someone else.																		well done	Party Chief		x
7	21-Apr-08	Not even 24hrs after Safety Meeting and a lot of paper (news papers and A4 docs) has been found in NON-BURNABLE trash bin in the Galley.													x					Moved most of these papers to the right bin. Segregating trash should be raised again on Safety Meeting and meybe it needs to be revised.	Captain		x
8	22-Apr-08	Inadequate lighting on port/stbd side to work on the paravane at night				x														getting a portable flood light or something similar. Ordered a halogen flood light. On Order	Source		x
9	22-Apr-08	Look at putting a door on streamer deck to walkway outside by the paravane to improve visibiltywhen launching/recovering paravane.											x							Mechs to put in a improvement report or will a baravone solve the issue? OFI on hold	Source		o
10	22-Apr-08	Paravane float chain parted, and was hanging from safety line.		x																Repaired. OFI has been put in to change to Barovanes	Source		x
11	22-Apr-08	Save all around fisher v/v out let full													x					Emptied by mechs. Who is responsible?			x
12	22-Apr-08	Oil breather pipe from compressors oil on deck													x					Oil absorbent put down and catch containers emptied by mechs who is responsible			x
13	22-Apr-08	Deck air compressor reciver drained of moisture		x																Who is responsible mechs drained			x
14	24-Apr-08	Coffee machine continually get filled with water from water bottles instead of water from the pruifer. This is enviormental (Plastic bottles) issue.						x												Place sign to infor crew to use purifier water	Party Chief		x
15	25-Apr-08	Oil spil on the upper deck Oil drum had fallen over and punctured																	x	Oil absorbent put down and ab to m/t the drum into an m/t one	Ch/Officer		x
16	25-Apr-08	Deck air compressor belt drive not gaurded at the bottom(the unit is the wrong way round)			x															Turn unit 180°	Source		x

17	26-Apr-08	Some of the LP air hose is perished					x													This was renewed (do not think that it is low pressure it is not dangerous IT IS)	Source		x
18	26-Apr-08	The opening above the LP air compressor had perspex fitted but was still allowing water on the LP air compressor electrics																	x	Silicon around perspex	Source		x
19	27-Apr-08	Lights not workin in the gym					x													Gym closed and notice put up to Inform users not to use untill the lights are repaired	Hsea		x
20	29-Apr-08	Provided dishes for night shift were found incomplete, People seems to compose their meals by taking bits of food from few dishes.																x		components on separate dishes to be able to compose your own meal. **This wont happen has the catering staff feel this idea will only**	Captain		x
21	29-Apr-08	Some butter and bread pieces were found in confiture / jam jars.																x		People should use clean knife or spoon for that. Put a sign on the white board in the galley.			x
22	29-Apr-08	No lifting belt available in the gym												x						Kidney belt ordered	Party Chief		x
23	29-Apr-08	No information available in the gym towards correct lifting technics												x						Order pictures. Found website, asked Purchasing if OK to go through. **Agent is chasing up.**	Party Chief		o
24	29-Apr-08	Meals left out at night not in fridge due to lack of available space																x		Look at ordering bigger fridge (needs to fit through doors) or find a suitable solution.	Party Chief		o
25	30-Apr-08	Almost out of band aids in First Aid station in Instrument room.																	x	Talk to Doc and get him to restock the First Aid station.	Medic		x
26	30-Apr-08	Gun float on the array on deck in the way when crossing deck																	x	lifted float so as not need ing to bend to cross under the float	Source		x
27	1-May-08	No MSDS sheet for Hunters Sodium Hypochlorite in folder for the Chemical Storage area and no file found in the QHSE folder under the MSDS folder									x									Chemical Storage Folder and a PDF copy in the QHSE folder. **One did arrive at CC, must have went missing.**	Recording		x
28	2-May-08	Smell of fumes in lower seismic accomadation																	x	**exhasts is engine room, all crew in lower accomodation asked to open up A/C vents. Both only short term measures until CC where**	Hsea		x
29	4-May-08	Cardboard roll from empty roll of toilet paper found floating in toilet bowl.														x				Picked up and threw in the bin. Remind the crew (again) at next safety meeting not to put foreign objects in the toilet.			o

7.2. Production-Log

CGGVERITAS

Production Log:		3D Oil Limited - Survey T41P														
M/V Pacific Titan		(6734) Seboa - Group Shoot - Australia							Area:	2D (Project SEBOA)						
Date:	18.04.2008	30.04.2008		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)
18-Apr-08		05:00 - 07:45	2.75						Technical D/T	Inter-move	Standby on clients request : Interprogram move: 3D OIL		18-Apr-08	15:00	17:45
18-Apr-08	TDOB08-044-001	07:45 - 09:35	1.83	57	1001	1606	606	15.15	Recording	Production	Production 2D Line		18-Apr-08	17:45	19:35
18-Apr-08		09:35 - 11:50	2.25						Line Change	Linechange	Linechange, nominal		18-Apr-08	19:35	21:50
18-Apr-08		11:50 - 14:52	3.03						Technical D/T	MEC	Mechanical, wide tow, flotation: chain parted and hanging by safety line		18 & 19-Apr-08	21:50	00:52
18-Apr-08	TDOB08-030-002	14:52 - 16:39	1.78	239	1608	1001	608	15.2	Recording	Production	Production 2D Line		19-Apr-08	00:52	02:39
18-Apr-08		16:39 - 18:45	2.10						Line Change	Linechange	Linechange, nominal		19-Apr-08	02:39	04:45
18-Apr-08	TDOB08-022-003	18:45 - 00:00	5.25	57	1001	2712	1712	42.8	Recording	Production	Production 2D Line		19-Apr-08	04:45	10:00
19-Apr-08	TDOB08-022-003	00:00 - 01:06	1.10	58	2713	3097	385	9.625	Recording	Production	Production 2D Line		19-Apr-08	10:00	11:06
19-Apr-08		01:06 - 03:00	1.90						Line Change	Linechange	Linechange, nominal		19-Apr-08	11:06	13:00
19-Apr-08	TDOB08-036-004	03:00 - 07:38	4.63	236	3022	1354	1669	41.725	Recording	Production	Production 2D Line		19-Apr-08	13:00	17:38
19-Apr-08	TDOB08-036-005	07:38 - 11:04	3.43	236	1473	1354	120		Technical D/T	REC	Recording, onboard, recording/acquisition systems		19-Apr-08	17:38	21:04
19-Apr-08		11:04 - 11:23	0.32						Technical D/T	REC	Overlap due to: Recording, onboard, recording/acquisition systems:		19-Apr-08	21:04	21:23
19-Apr-08	TDOB08-036-005	11:23 - 12:19	0.93	236	1353	1001	353	8.825	Recording	Production	Production 2D Line		19-Apr-08	21:23	22:19
19-Apr-08		12:19 - 13:50	1.52						Line Change	Linechange	Linechange, nominal		19-Apr-08	22:19	23:50
19-Apr-08	TDOB08-050-006	13:50 - 15:33	1.72	59	1001	1631	631	15.775	Recording	Production	Production 2D Line		19 & 20-Apr-08	23:50	01:33
19-Apr-08		15:33 - 17:29	1.93						Line Change	Linechange	Linechange, nominal		20-Apr-08	01:33	03:29
19-Apr-08	TDOB08-034-007	17:29 - 19:08	1.65	238	1601	1001	601	15.025	Recording	Production	Production 2D Line		20-Apr-08	03:29	05:08
19-Apr-08		19:08 - 21:17	2.15						Line Change	Linechange	Linechange, nominal		20-Apr-08	05:08	07:17
19-Apr-08	TDOB08-046-008	21:17 - 23:07	1.83	58	1001	1612	612	15.3	Recording	Production	Production 2D Line		20-Apr-08	07:17	09:07
19-Apr-08		23:07 - 00:00	0.88						Line Change	Linechange	Linechange, nominal		20-Apr-08	09:07	10:00
20-Apr-08		00:00 - 01:13	1.22						Line Change	Linechange	Linechange, nominal		20-Apr-08	10:00	11:13
20-Apr-08	TDOB08-054-009	01:13 - 03:12	1.98	239	1746	1001	746	18.65	Recording	Production	Production 2D Line		20-Apr-08	11:13	13:12
20-Apr-08		03:12 - 04:53	1.68						Line Change	Linechange	Linechange, nominal		20-Apr-08	13:12	14:53
20-Apr-08	TDOB08-064-010	04:53 - 10:11	5.30	57	1001	2990	1990	49.75	Recording	Production	Production 2D Line		20-Apr-08	14:53	20:11
20-Apr-08		10:11 - 11:51	1.67						Line Change	Linechange	Linechange, nominal		20-Apr-08	20:11	21:51
20-Apr-08	TDOB08-042-011	11:51 - 16:51	5.00	236	2665	1001	1665	41.625	Recording	Production	Production 2D Line		20 & 21-Apr-08	21:51	02:51
20-Apr-08		16:51 - 18:25	1.57						Line Change	Linechange	Linechange, nominal		21-Apr-08	02:51	04:25
20-Apr-08	TDOB08-026-012	18:25 - 20:12	1.78	57	1001	1649	649	16.225	Recording	Production	Production 2D Line		21-Apr-08	04:25	06:12
20-Apr-08		20:12 - 22:03	1.85						Line Change	Linechange	Linechange, nominal		21-Apr-08	06:12	08:03
20-Apr-08	TDOB08-040-013	22:03 - 23:40	1.62	237	1604	1001	604	15.1	Recording	Production	Production 2D Line		21-Apr-08	08:03	09:40
20-Apr-08		23:40 - 00:00	0.33						Line Change	Linechange	Linechange, nominal		21-Apr-08	09:40	10:00
21-Apr-08		00:00 - 01:42	1.70						Line Change	Linechange	Linechange, nominal		21-Apr-08	10:00	11:42
21-Apr-08	TDOB08-007-014	01:42 - 03:11	1.48	331	1001	1553	553	13.825	Recording	Production	Production 2D Line		21-Apr-08	11:42	13:11
21-Apr-08		03:11 - 05:05	1.90						Line Change	Linechange	Linechange, nominal		21-Apr-08	13:11	15:05
21-Apr-08	TDOB08-001-015	05:05 - 07:00	1.92	143	1667	1001	667	16.675	Recording	Production	Production 2D Line		21-Apr-08	15:05	17:00
21-Apr-08		07:00 - 08:29	1.48						Line Change	Linechange	Linechange, nominal		21-Apr-08	17:00	18:29
21-Apr-08	TDOB08-016-016	08:29 - 13:10	4.68	54	1001	2637	1637	40.925	Recording	Production	Production 2D Line		21-Apr-08	18:29	23:10
21-Apr-08		13:10 - 16:07	2.95						Line Change	Linechange	Linechange, nominal		21 & 22-Apr-08	23:10	02:07
21-Apr-08	TDOB08-052-017	16:07 - 22:26	6.32	237	3253	1001	2253	56.325	Recording	Production	Production 2D Line		22-Apr-08	02:07	08:26
21-Apr-08		22:26 - 00:00	1.57						Line Change	Linechange	Linechange, nominal		22-Apr-08	08:26	10:00
22-Apr-08		00:00 - 00:17	0.28						Line Change	Linechange	Linechange, nominal		22-Apr-08	10:00	10:17
22-Apr-08	TDOB08-066-018	00:17 - 00:38	0.35	58	1001	1121	121		Technical D/T	REC	NTBP due to: Recording, onboard, recording/acquisition systems:		22-Apr-08	10:17	10:38
22-Apr-08		00:38 - 03:46	3.13						Technical D/T	REC	Recording, onboard, recording/acquisition systems		22-Apr-08	10:38	13:46
22-Apr-08	TDOB08-066-019	03:46 - 07:22	3.60	58	1001	2359	1359	33.975	Recording	Production	Production 2D Line		22-Apr-08	13:46	17:22
22-Apr-08		07:22 - 09:23	2.02						Line Change	Linechange	Linechange, nominal		22-Apr-08	17:22	19:23
22-Apr-08	TDOB08-070-020	09:23 - 12:46	3.38	239	2247	1001	1247	31.175	Recording	Production	Production 2D Line		22-Apr-08	19:23	22:46
22-Apr-08		12:46 - 14:35	1.82						Line Change	Linechange	Linechange, nominal		22 & 23-Apr-08	22:46	00:35
22-Apr-08	TDOB08-080-021	14:35 - 18:16	3.68	57	1001	2367	1367	34.175	Recording	Production	Production 2D Line		23-Apr-08	00:35	04:16
22-Apr-08		18:16 - 20:10	1.90						Line Change	Linechange	Linechange, nominal		23-Apr-08	04:16	06:10
22-Apr-08	TDOB08-090-022	20:10 - 22:55	2.75	235	1980	1001	980	24.5	Recording	Production	Production 2D Line		23-Apr-08	06:10	08:55
22-Apr-08		22:55 - 00:00	1.08						Line Change	Linechange	Linechange, nominal		23-Apr-08	08:55	10:00
23-Apr-08		00:00 - 00:40	0.67						Line Change	Linechange	Linechange, nominal		23-Apr-08	10:00	10:40
23-Apr-08	TDOB08-098-023	00:40 - 03:38	2.97	53	1001	2018	1018	25.45	Recording	Production	Production 2D Line		23-Apr-08	10:40	13:38
23-Apr-08		03:38 - 05:15	1.62						Line Change	Linechange	Linechange, nominal		23-Apr-08	13:38	15:15
23-Apr-08	TDOB08-092-024	05:15 - 08:04	2.82	233	1981	1001	981	24.525	Recording	Production	Production 2D Line		23-Apr-08	15:15	18:04
23-Apr-08		08:04 - 09:33	1.48						Line Change	Linechange	Linechange, nominal		23-Apr-08	18:04	19:33
23-Apr-08	TDOB08-005-025	09:33 - 12:22	2.82	148	2018	1001	1018	25.45	Recording	Production	Production 2D Line		23-Apr-08	19:33	22:22
23-Apr-08		12:22 - 13:51	1.48						Line Change	Linechange	Linechange, nominal		23-Apr-08	22:22	23:51
23-Apr-08	TDOB08-014-026	13:51 - 18:27	4.60	55	1001	2625	1625	40.625	Recording	Production	Production 2D Line		23 & 24-Apr-08	23:51	04:27
23-Apr-08		18:27 - 20:22	1.92						Line Change	Linechange	Linechange, nominal		24-Apr-08	04:27	06:22
23-Apr-08	TDOB08-028-027	20:22 - 00:00	3.63	239	2979	1653	1327	33.175	Recording	Production	Production 2D Line		24-Apr-08	06:22	10:00
24-Apr-08	TDOB08-028-027	00:00 - 01:42	1.70	239	1652	1001	652	16.3	Recording	Production	Production 2D Line		24-Apr-08	10:00	11:42
24-Apr-08		01:42 - 03:27	1.75						Line Change	Linechange	Linechange, nominal		24-Apr-08	11:42	13:27
24-Apr-08	TDOB08-020-028	03:27 - 08:57	5.50	58	1001	3057	2057	51.425	Recording	Production	Production 2D Line		24-Apr-08	13:27	18:57
24-Apr-08		08:57 - 10:42	1.75						Line Change	Linechange	Linechange, nominal		24-Apr-08	18:57	20:42
24-Apr-08	TDOB08-032-029	10:42 - 15:59	5.28	238	3007	1001	2007	50.175	Recording	Production	Production 2D Line		24 & 25-Apr-08	20:42	01:59
24-Apr-08		15:59 - 18:13	2.23						Line Change	Linechange	Linechange, nominal		25-Apr-08	01:59	04:13
24-Apr-08	TDOB08-056-030	18:13 - 22:08	3.92	59	1001	2470	1470	36.75	Recording	Production	Production 2D Line		25-Apr-08	04:13	08:08
24-Apr-08		22:08 - 00:00	1.87						Line Change	Linechange	Linechange, nominal		25-Apr-08	08:08	10:00
25-Apr-08		00:00 - 00:06	0.10						Line Change	Linechange	Linechange, nominal		25-Apr-08	10:00	10:06
25-Apr-08	TDOB08-062-031	00:06 - 04:01	3.92	238	2442	1001	1442	36.05	Recording	Production	Production 2D Line		25-Apr-08	10:06	14:01
25-Apr-08		04:01 - 06:01	2.00						Line Change	Linechange	Linechange, nominal		25-Apr-08	14:01	16:01
25-Apr-08		06:01 - 06:23	0.37						Technical D/T	MEC	Mechanical, source, array hardware		25-Apr-08	16:01	16:23
25-Apr-08	TDOB08-072-032	06:23 - 10:35	4.20	58	1001	2636	1636	40.9	Recording	Production	Production 2D Line		25-Apr-08	16:23	20:35
25-Apr-08		10:35 - 12:29	1.90						Line Change	Linechange	Linechange, nominal		25-Apr-08	20:35	22:29
25-Apr-08	TDOB08-084-033	12:29 - 15:36	3.12	236	2173	1001	1173	29.325	Recording	Production	Production 2D Line		25 & 26-Apr-08	22:29	01:36
25-Apr-08		15:36 - 17:32	1.93						Line Change	Linechange	Linechange, nominal		26-Apr-08	01:36	03:32
25-Apr-08	TDOB08-086-034	17:32 - 20:37	3.08	55	1001	2148	1148	28.7	Recording	Production	Production 2D Line		26-Apr-08	03:32	06:37
25-Apr-08		20:37 - 22:37	2.00						Line Change	Linechange	Linechange, nominal		26-Apr-08	06:37	08:37
25-Apr-08	TDOB08-078-035	22:37 - 00:00	1.38	237	2113	1630	484	12.1	Recording	Production	Production 2D Line		26-Apr-08	08:37	10:00
26-Apr-08	TDOB08-078-035	00:00 - 01:45	1.75	237	1629	1001	629	15.725	Recording	Production	Production 2D Line		26-Apr-08	10:00	11:45
26-Apr-08		01:45 - 03:36	1.85						Line Change	Linechange	Linechange, nominal		26-Apr-08	11:45	13:36
26-Apr-08	TDOB08-003-036	03:36 - 04:48	1.20	139	1669	1220	450	11.25	Recording	Production	Production 2D Line		26-Apr-08	13:36	14:48
26-Apr-08	TDOB08-003-037	04:48 - 08:19	3.52	139	1339	1220	120		Technical D/T	MEC	Mechanical, source, gun		26-Apr-08	14:48	18:19
26-Apr-08		08:19 - 08:38	0.32						Technical D/T	MEC	Overlap due to: Mechanical, source, gun:		26-Apr-08	18:19	18:38
26-Apr-08	TDOB08-003-037	08:38 - 09:14	0.60	139	1219	1001	219	5.475	Recording	Production	Production 2D Line		26-Apr-08	18:38	19:14
26-Apr-08		09:14 - 10:40	1.43						Line Change	Linechange	Linechange, nominal		26-Apr-08	19:14	20:40
26-Apr-08	TDOB08-012-038	10:40 - 14:28	3.80	54	1001	2343	1343	33.575	Recording	Production	Production 2D Line		26 & 27-Apr-08	20:40	00:28

26-Apr-08		14:28 - 16:33	2.08						Line Change	Linechange	Linechange, nominal		27-Apr-08	00:28	02:33
26-Apr-08	TDOB08-024-039	16:33 - 21:25	4.87	238	2649	1001	1649	41.225	Recording	Production	Production 2D Line		27-Apr-08	02:33	07:25
26-Apr-08		21:25 - 23:13	1.80						Line Change	Linechange	Linechange, nominal		27-Apr-08	07:25	09:13
26-Apr-08	TDOB08-038-040	23:13 - 00:00	0.78	56	1001	1286	286	7.15	Recording	Production	Production 2D Line		27-Apr-08	09:13	10:00
27-Apr-08	TDOB08-038-040	00:00 - 00:52	0.87	56	1287	1611	325	8.125	Recording	Production	Production 2D Line		27-Apr-08	10:00	10:52
27-Apr-08		00:52 - 03:00	2.13						Line Change	Linechange	Linechange, nominal		27-Apr-08	10:52	13:00
27-Apr-08	TDOB08-060-041	03:00 - 04:57	1.95	238	1704	1001	704	17.6	Recording	Production	Production 2D Line		27-Apr-08	13:00	14:57
27-Apr-08		04:57 - 06:41	1.73						Line Change	Linechange	Linechange, nominal		27-Apr-08	14:57	16:41
27-Apr-08	TDOB08-074-042	06:41 - 10:28	3.78	57	1001	2447	1447	36.175	Recording	Production	Production 2D Line		27-Apr-08	16:41	20:28
27-Apr-08		10:28 - 12:08	1.67						Line Change	Linechange	Linechange, nominal		27-Apr-08	20:28	22:08
27-Apr-08	TDOB08-082-043	12:08 - 14:05	1.95	237	1630	1001	630	15.75	Recording	Production	Production 2D Line		27 & 28-Apr-08	22:08	00:05
27-Apr-08		14:05 - 16:44	2.65						Line Change	Linechange	Linechange, nominal		28-Apr-08	00:05	02:44
27-Apr-08	TDOB08-009-044	16:44 - 19:39	2.92	156	2063	1001	1063	26.575	Recording	Production	Production 2D Line		28-Apr-08	02:44	05:39
27-Apr-08		19:39 - 21:28	1.82						Line Change	Linechange	Linechange, nominal		28-Apr-08	05:39	07:28
27-Apr-08	TDOB08-018-045	21:28 - 00:00	2.53	54	1001	1944	944	23.6	Recording	Production	Production 2D Line		28-Apr-08	07:28	10:00
28-Apr-08	TDOB08-018-045	00:00 - 01:00	1.00	54	1945	2316	372	9.3	Recording	Production	Production 2D Line		28-Apr-08	10:00	11:00
28-Apr-08		01:00 - 03:18	2.30						Line Change	Linechange	Linechange, nominal		28-Apr-08	11:00	13:18
28-Apr-08	TDOB08-048-046	03:18 - 07:59	4.68	238	2641	1001	1641	41.025	Recording	Production	Production 2D Line		28-Apr-08	13:18	17:59
28-Apr-08		07:59 - 09:44	1.75						Line Change	Linechange	Linechange, nominal		28-Apr-08	17:59	19:44
28-Apr-08	TDOB08-058-047	09:44 - 14:29	4.75	58	1001	2792	1792	44.8	Recording	Production	Production 2D Line		28 & 29-Apr-08	19:44	00:29
28-Apr-08		14:29 - 16:10	1.68						Line Change	Linechange	Linechange, nominal		29-Apr-08	00:29	02:10
28-Apr-08	TDOB08-068-048	16:10 - 20:19	4.15	238	2522	1001	1522	38.05	Recording	Production	Production 2D Line		29-Apr-08	02:10	06:19
28-Apr-08		20:19 - 22:01	1.70						Line Change	Linechange	Linechange, nominal		29-Apr-08	06:19	08:01
28-Apr-08	TDOB08-076-049	22:01 - 00:00	1.98	57	1001	1723	723	18.075	Recording	Production	Production 2D Line		29-Apr-08	08:01	10:00
29-Apr-08	TDOB08-076-049	00:00 - 03:22	3.37	57	1724	2949	1226	30.65	Recording	Production	Production 2D Line		29-Apr-08	10:00	13:22
29-Apr-08		03:22 - 05:50	2.47						Line Change	Linechange	Linechange, nominal		29-Apr-08	13:22	15:50
29-Apr-08	TDOB08-088-050	05:50 - 10:39	4.82	234	2747	1001	1747	43.675	Recording	Production	Production 2D Line		29-Apr-08	15:50	20:39
29-Apr-08		10:39 - 12:16	1.62						Line Change	Linechange	Linechange, nominal		29-Apr-08	20:39	22:16
29-Apr-08	TDOB08-096-051	12:16 - 14:31	2.25	54	1001	1858	858	21.45	Recording	Production	Production 2D Line		29 & 30-Apr-08	22:16	00:31
29-Apr-08		14:31 - 16:31	2.00						Line Change	Linechange	Linechange, nominal		30-Apr-08	00:31	02:31
29-Apr-08	TDOB08-094-052	16:31 - 18:17	1.77	235	1627	1001	627	15.675	Recording	Production	Production 2D Line		30-Apr-08	02:31	04:17
29-Apr-08		18:17 - 19:50	1.55						Line Change	Linechange	Linechange, nominal		30-Apr-08	04:17	05:50
29-Apr-08	TDOB08-100-053	19:50 - 21:46	1.93	46	1001	1708	708	17.7	Recording	Production	Production 2D Line		30-Apr-08	05:50	07:46
29-Apr-08		21:46 - 23:32	1.77						Line Change	Linechange	Linechange, nominal		30-Apr-08	07:46	09:32
29-Apr-08	TDOB08-102-054	23:32 - 00:00	0.47	221	1512	1353	160	4	Recording	Production	Production 2D Line		30-Apr-08	09:32	10:00
30-Apr-08	TDOB08-102-054	00:00 - 01:00	1.00	221	1352	1001	352	8.8	Recording	Production	Production 2D Line		30-Apr-08	10:00	11:00
30-Apr-08		01:00 - 02:44	1.73						Line Change	Linechange	Linechange, nominal		30-Apr-08	11:00	12:44
30-Apr-08	TDOB08-011-055	02:44 - 06:41	3.95	147	2516	1001	1516	37.9	Recording	Production	Production 2D Line		30-Apr-08	12:44	16:41
30-Apr-08		06:41 - 08:06	1.42						Line Change	Linechange	Linechange, nominal		30-Apr-08	16:41	18:06
30-Apr-08	TDOB08-010-056	08:06 - 11:51	3.75	53	1001	2378	1378	34.45	Recording	Production	Production 2D Line		30-Apr-08	18:06	21:51
30-Apr-08		11:51 - 13:29	1.63						Line Change	Linechange	Linechange, nominal		30-Apr-08	21:51	23:29
30-Apr-08	TDOB08-006-057	13:29 - 16:09	2.67	233	1964	1001	964	24.1	Recording	Production	Production 2D Line		30-Apr & 01-May-08	23:29	02:09
30-Apr-08		16:09 - 18:03	1.90						Line Change	Linechange	Linechange, nominal		01-May-08	02:09	04:03
30-Apr-08	TDOB08-015-058	18:03 - 23:34	5.52	327	1001	2933	1933	48.325	Recording	Production	Production 2D Line		01-May-08	04:03	09:34
30-Apr-08		23:34 - 00:00	0.43						Line Change	Linechange	Linechange, nominal		01-May-08	09:34	10:00

Production w/ runouts	188.22 Hours
Linechanges	101.57 Hours
Standby - (All instances)	0.00 Hours
Inter Program moves	2.75 Hours

CGGVERITAS

Production Log:	3D Oil Limited - Survey T41P				
M/V Pacific Titan	(6734) Seboa - Group Shoot - Australia			Area:	2D (Project SEBOA)
Date:	01.05.2008	04.05.2008	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)
01-May-08		00:00 - 01:19	1.32						Line Change	Linechange	Linechange, nominal		01-May-08	10:00	11:19
01-May-08	TDOB08-019-059	01:19 - 07:20	6.02	138	3265	1001	2265	56.625	Recording	Production	Production 2D Line		01-May-08	11:19	17:20
01-May-08		07:20 - 09:25	2.08						Line Change	Linechange	Linechange, nominal		01-May-08	17:20	19:25
01-May-08	TDOB08-017-060	09:25 - 16:20	6.92	324	1001	3204	2204	55.1	Recording	Production	Production 2D Line		01 & 02-May-08	19:25	02:20
01-May-08		16:20 - 18:07	1.78						Line Change	Linechange	Linechange, nominal		02-May-08	02:20	04:07
01-May-08	TDOB08-013-061	18:07 - 22:58	4.85	150	2741	1001	1741	43.525	Recording	Production	Production 2D Line		02-May-08	04:07	08:58
01-May-08		22:58 - 00:00	1.03						Line Change	Linechange	Linechange, nominal		02-May-08	08:58	10:00
02-May-08		00:00 - 00:29	0.48						Line Change	Linechange	Linechange, nominal		02-May-08	10:00	10:29
02-May-08	TDOB08-008-062	00:29 - 03:54	3.42	54	1001	2222	1222	30.55	Recording	Production	Production 2D Line		02-May-08	10:29	13:54
02-May-08		03:54 - 05:49	1.92						Line Change	Linechange	Linechange, nominal		02-May-08	13:54	15:49
02-May-08		05:49 - 06:22	0.55						Technical D/T	MEC	Mechanical, source, gun		02-May-08	15:49	16:22
02-May-08	TDOB08-004-063	06:22 - 08:47	2.42	234	1809	1001	809	20.225	Recording	Production	Production 2D Line		02-May-08	16:22	18:47
02-May-08		08:47 - 10:15	1.47						Line Change	Linechange	Linechange, nominal		02-May-08	18:47	20:15
02-May-08	TDOB08-002-064	10:15 - 11:29	1.23	57	1001	1414	414	10.35	Recording	Production	Production 2D Line		02-May-08	20:15	21:29
02-May-08		11:29 - 13:20	1.85						Line Change	Linechange	Linechange, nominal		02-May-08	21:29	23:20
02-May-08	TDOB08-027-065	13:20 - 21:28	8.13	307	1001	3649	2649	66.225	Recording	Production	Production 2D Line		02 & 03-May-08	23:20	07:28
02-May-08		21:28 - 23:34	2.10						Line Change	Linechange	Linechange, nominal		03-May-08	07:28	09:34
02-May-08	TDOB08-023-066	23:34 - 00:00	0.43	129	3914	3784	131		Technical D/T	MEC	NTBP due to: Mechanical, source, gun:		03-May-08	09:34	10:00
03-May-08		00:00 - 03:29	3.48						Technical D/T	MEC	Mechanical, source, gun		03-May-08	10:00	13:29
03-May-08	TDOB08-023-067	03:29 - 11:23	7.90	129	3914	1001	2914	72.85	Recording	Production	Production 2D Line		03-May-08	13:29	21:23
03-May-08		11:23 - 13:48	2.42						Line Change	Linechange	Linechange, nominal		03-May-08	21:23	23:48
03-May-08	TDOB08-025-068	13:48 - 22:06	8.30	307	1001	3887	2887	72.175	Recording	Production	Production 2D Line		03 & 04-May-08	23:48	08:06
03-May-08		22:06 - 23:48	1.70						Line Change	Linechange	Linechange, nominal		04-May-08	08:06	09:48
03-May-08	TDOB08-021-069	23:48 - 00:00	0.20	132	3739	3667	73	1.825	Recording	Production	Production 2D Line		04-May-08	09:48	10:00
04-May-08	TDOB08-021-069	00:00 - 07:10	7.17	133	3666	1001	2666	66.65	Recording	Production	Production 2D Line		04-May-08	10:00	17:10
04-May-08		07:10 - 08:40	1.50						Technical D/T	Oper DT	Standby on clients request : Interprogram move: 3D OIL		04-May-08	17:10	18:40

Production w/ runouts	56.55 Hours
Linechanges	18.15 Hours
Standby - (All instances)	0.00 Hours
Inter Program moves	1.50 Hours

8. Shipment List

Proforma invoice nr.	Description	Receiver	Destination
PT-2008-031	3D Oil T41P Primary (1 - 69)	3D Oil Ltd. Melbourne	Australia
PT-2008-032	3D Oil T41P Copy (1 - 69)	Fugro Seismic Imaging, Perth	Australia

PT-2008-032

Date: 7-May-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:

Fugro Seismic Imaging Pty Ltd
69 Outram Street
West Perth, WA, 6005
Australia

Attn: Simon Stewart

Type of freight:	Comments:
Air	**SEBOA Group Shoot, Bass Strait, 3D Oil T41P Copy Data (Seq 1 - 69)**

Box	Item	General description of content	Weight(kg)	Value(USD)
1	1-30	3590 Data tapes containing seismic data (Tapes 1 - 30) (Sequence 1 - 24)	7	100
2	1-30	3590 Data tapes containing seismic data (Tapes 31 - 60) (Sequence 25 - 47)	7	100
3	1-30	3590 Data tapes containing seismic data (Tapes 61 - 90) (Sequence 47 - 68)	7	100
4	1-3	3590 Data tapes containing seismic data (Tapes 91 - 93) (Sequence 68 - 69)	0.7	10
	4	1 x 3590 Tape containing Start of Job and End of Job Tests (Tape 94)	0.2	3
		Observers' data		
	5	1 x CD containing Observers/Source/Tape Logs/Timing Diagram, Shipping Proforma	0.1	10
		Nav data		
	6	1 x DVD Navigation Data containing: Final P1/90, Raw P294, Production/Processing Log	0.1	10
		QC data		
	7	1 x DVD containing QC Deliverable Data	0.1	10
		Please confirm receipt of goods to chobs.titan@cggveritas.com		
			22.2	

Total boxes: **4**

Total value: **343**

Certified true and correct
CGG Veritas
M/V Pacific Titan

Sign

Tyrone Hackett
Chief Observer

PT-2008-031

Date: 7-May-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:

3D Oil Limited
164 Flinders Lane
Melbourne VIC 3000
Australia

Attn: Jon Keall
Tel +61 3 9650 9866
Fax + 61 3 9639 1960
www.3doil.com.au

Type of freight:	Comments:
Air	**SEBOA Group Shoot, Bass Strait, 3D Oil T41P Primary Data (Seq 1 - 69)**

Box	Item	General description of content	Weight(kg)	Value(USD)
1	1-30	3590 Data tapes containing seismic data (Tapes 1 - 30) (Sequence 1 - 24)	7	100
2	1-30	3590 Data tapes containing seismic data (Tapes 31 - 60) (Sequence 25 - 47)	7	100
3	1-30	3590 Data tapes containing seismic data (Tapes 61 - 90) (Sequence 47 - 68)	7	100
4	1-3	3590 Data tapes containing seismic data (Tapes 91 - 93) (Sequence 68 - 69)	0.7	10
	4	1 x 3590 Tape containing Start of Job and End of Job Tests (Tape 94)	0.2	3
		Observers' data		
	5	1 x CD containing Observers/Source/Tape Logs/Timing Diagram, Shipping Proforma	0.1	10
		Nav data		
	6	1 x DVD Navigation Data containing: Final P1/90, Raw P294, Production/Processing Log	0.1	10
		QC data		
	7	1 x DVD containing QC Deliverable Data	0.1	10
		Please confirm receipt of goods to chobs.titan@cggveritas.com		
			22.2	

Total boxes: **4**

Total value: **343**

Certified true and correct
CGG Veritas
M/V Pacific Titan

Sign

Tyrone Hackett
Chief Observer

9. Crew Lists

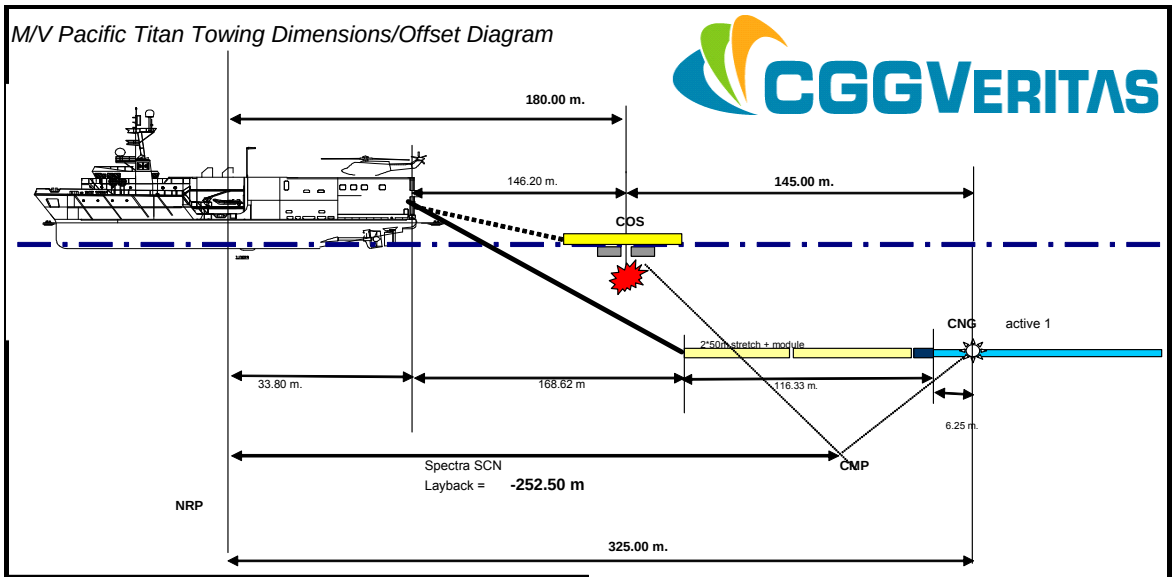
Swire Pacific Offshore

CGGVERITAS

Pacific Titan Crew List **Date:** **2nd. April** **2008**

No	Name	Rank	D.O.B.	Citizen	Passport no.	Exp.date
1	Bruce Wallis	Captain	24.08.53	Australian	**L8924123**	25.01.11
2	Raymond Smith	Chief Officer	23.04.61	Australian	**M6763702**	17.04.17
3	William Shelley	2nd Mate	26.02.72	Australian	**E3022159**	
4	Tommy Boughton	Chief Engineer	30.03.55	Australian	**M7065567**	01.06.17
5	Peter Caple	1st Engineer	02.05.65	Australian	**E3052135**	16.10.17
6	P.Golatkar	2nd Engineer	25.06.59	Indian	**B5713039**	02.08.11
7	C.Herangi	G.P.	04.08.56	New Zealander	**AA390623**	28.05.12
8	K.Robertson	G.P.	10.06.48	Australian	**M6535274**	15.11.16
9	BjornThomasson	G.P.	11.10.52	New Zealander	**AA528860**	
10	Lionel Hall	G.P.	03.01.58	Australian	**M5337014**	22.05.16
11	Jamie Dent	Chief Stwd	21.09.61	Australian	**L89494325**	22.05.10
12	Bruce Maher	Stwd	05.03.53	Australian	**L3042947**	29.11.11
13	David Ferrier	Chief Cook	12.03.58	Australian	**M5091479**	11.04.16
14	Nathan Bartlett	2nd. Cook	01.05.80	Australian	**M1664811**	28.10.14
15	Kenneth Stephens	Comp. Mech	17.09.51	Australian	**M1851206**	27.09.14
16	David Billington	Comp. Mech	09.11.49	Australian	**M2858580**	30.06.15
CGG VERITAS GEOPHYSICAL						
17	Haydn Brook	Party Chief	10.07.73	Australian	E1024451	10.03.15
18	Tyrone Hackett	Chief Observer	19.12.71	Canadian	BD106336	16.06.10
19	John Shannon Gracey	Observer	18.07.59	British	039872219	27.10.10
20	Steven Ryan	Ch Nav	10.08.81	Australian	M5358989	04.01.12
21	Ralph Bennett	Chief Mechanic	26.03.58	British	102069928	18.12.10
22	Regis Derrien	SL Mechanic	15.02.69	French	02YD55942	06.08.12
23	William Agcaoili	SL Mechanic	18.11.51	Filipino	ZZ206521	29.11.11
24	Paulo Goncalves	Mechanic	07.09.71	French	05AT81090	14.02.16
25	Ivar Almhjell	Mechanic	24.01.75	Norweign	26128623	06.08.17
26	Aleil Aliman	Medic	08.03.75	Filipino	SS0907185	06.04.11
27	Ingvild Bostad	Observer	04.02.79	Norwegian	20874534	09.05.15
28	Tommy Timenes	Chief Field-Geo	02.09.73	Norwegian	26335444	23.08.08
29	Isabelle Nicolas	Field Geo.	16.05.79	Filipino	ZZ213750	22.01.12
30	Jared Smith	Navigator	03.03.78	New Zealander	F017116	16.05.10
31	Donald Hutchings	SL Navigator	16.03.59	Canadian	BD106848	18.08.12
32	Slavomir Korybalski	SL Observer	01.03.75	Polish	AT8339985	30.08.17
33	William Lloyd	Client Rep	21.10.48	Australian	E1022292	14.03.15
34	Debbie Glasgow	MMO	25.11.57	New Zealand	N466526	01.12.08

10. Towing Configuration

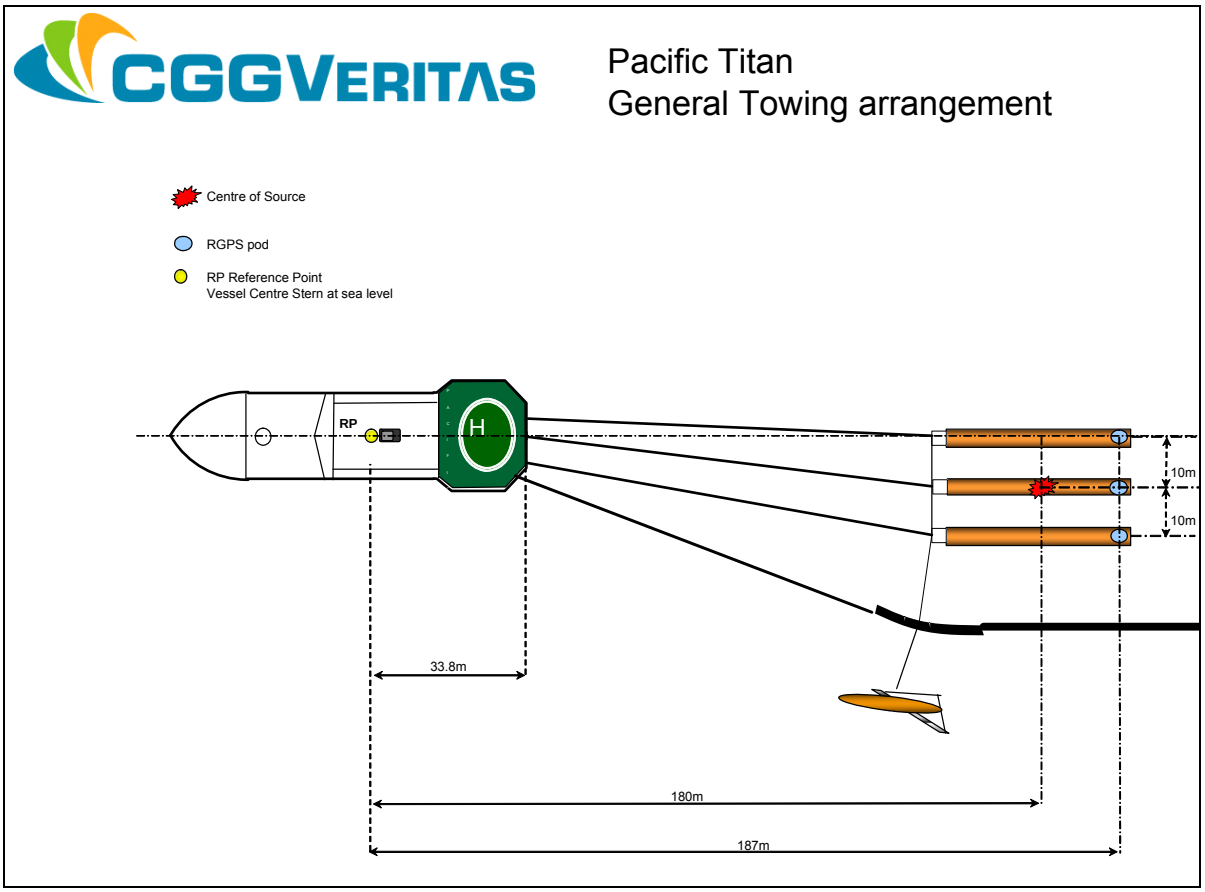


Principal Distances:			Principal Offsets:		Used as:
NRP-Stern	33.80 m.		COS-CNG	145.00 m.	
Stern-COS	146.20 m.		**NRP-CMP**	**-252.50 m**	**Spectra SCN Layback**
Stern-CNG	291.20 m.				
NRP-COS	**180.00 m.**		**NRP-CNG**	**325.00 m.**	**Offset from NRP**

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



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						

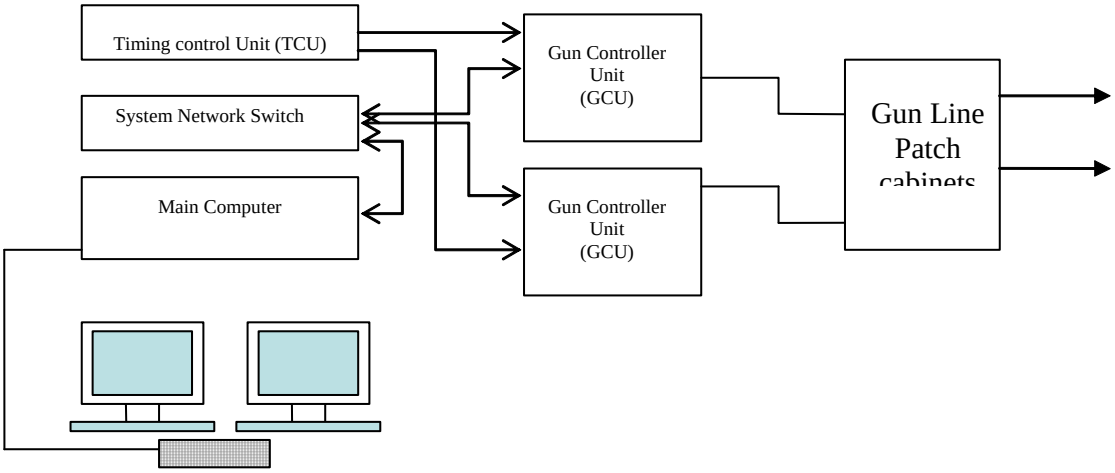
11. Source Configuration

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.

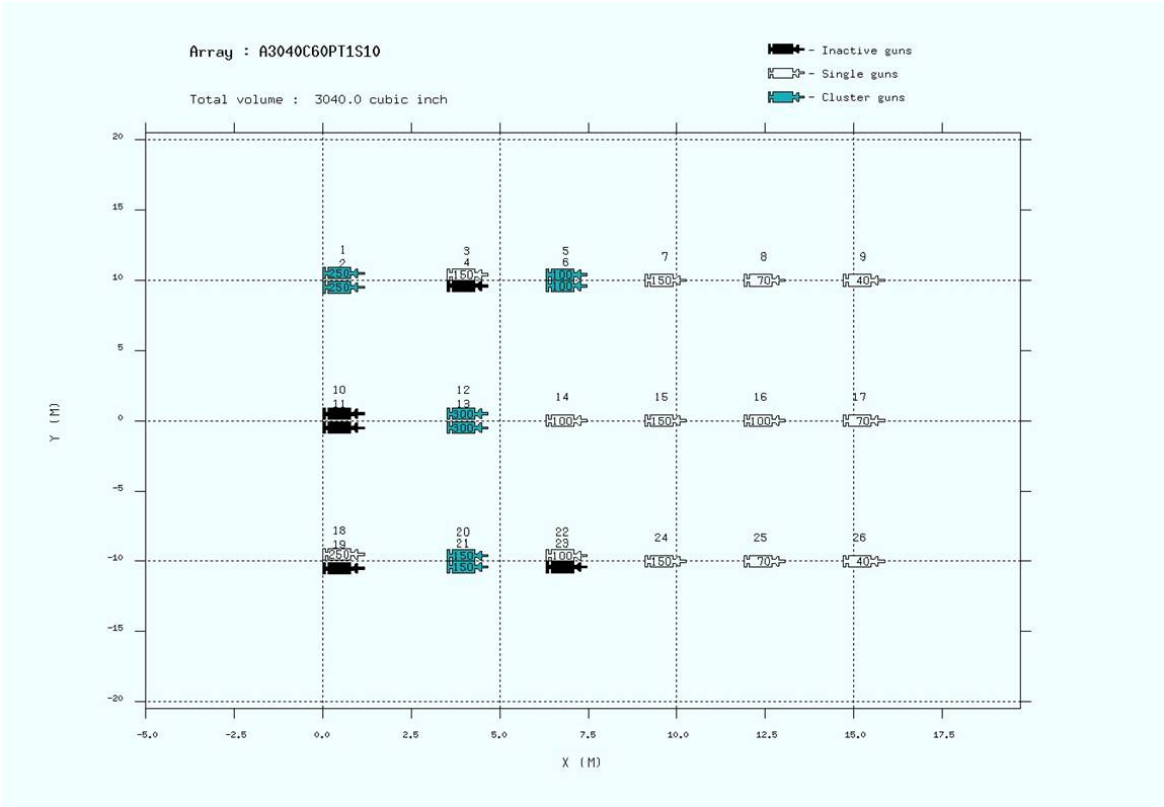
An innovated Graphical User Interface (GUI) makes use of the latest advances in software design to provide the operator with maximum information on the operation and performance of the system without the clutter of text.
An internal database maintains records of all system statistics and the data can 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



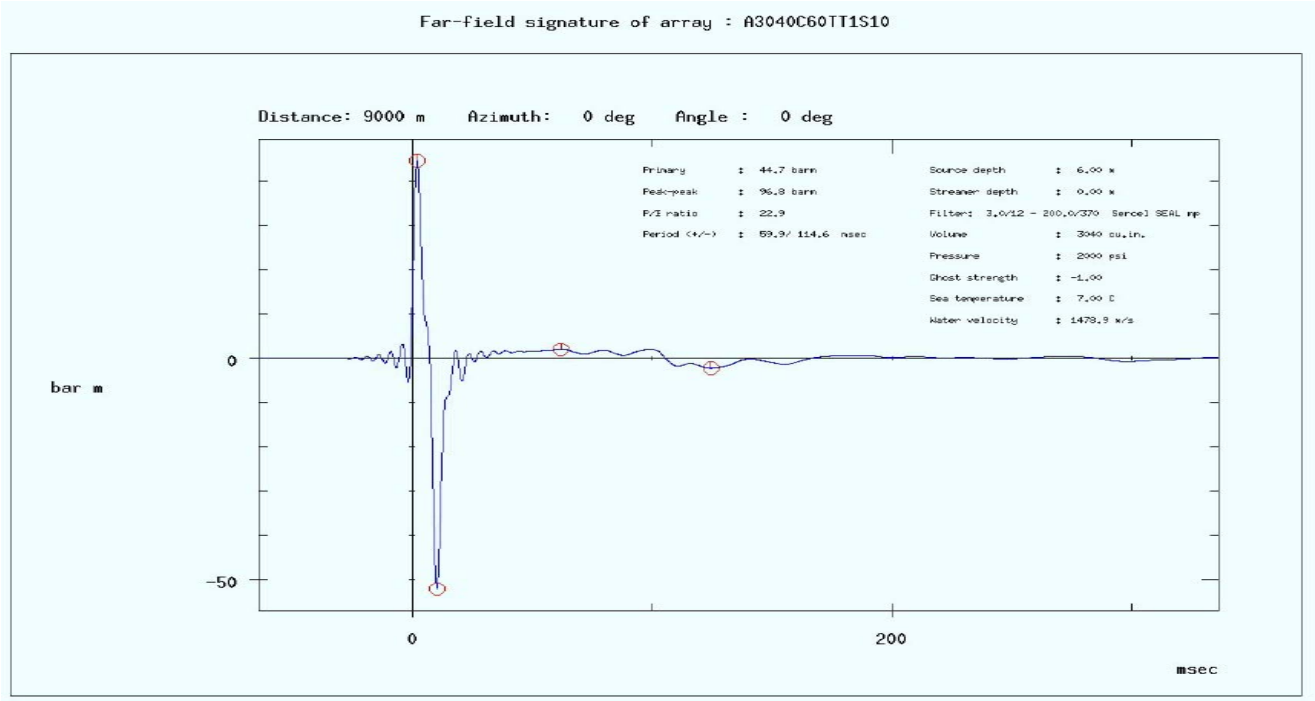
11.1.3. Array Listing

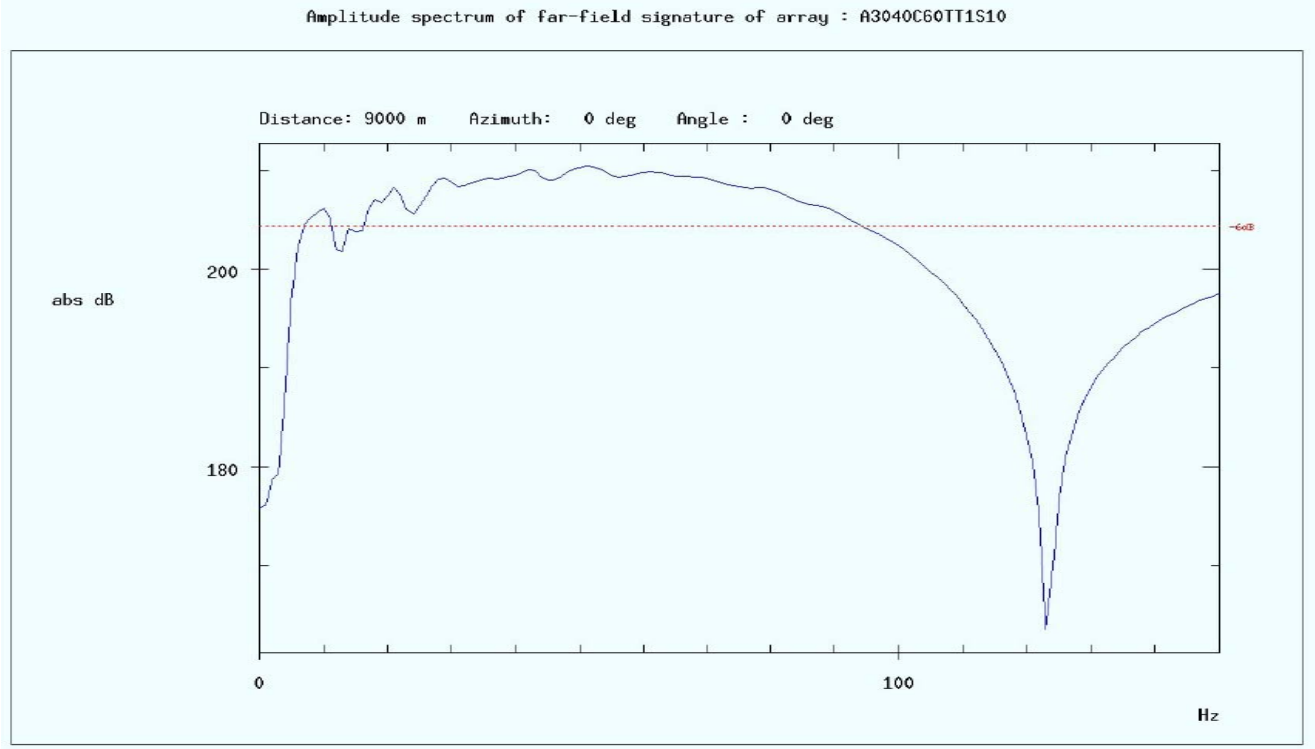
Total active volume: 3040 in^3 Nominal pressure 2000 psi.

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

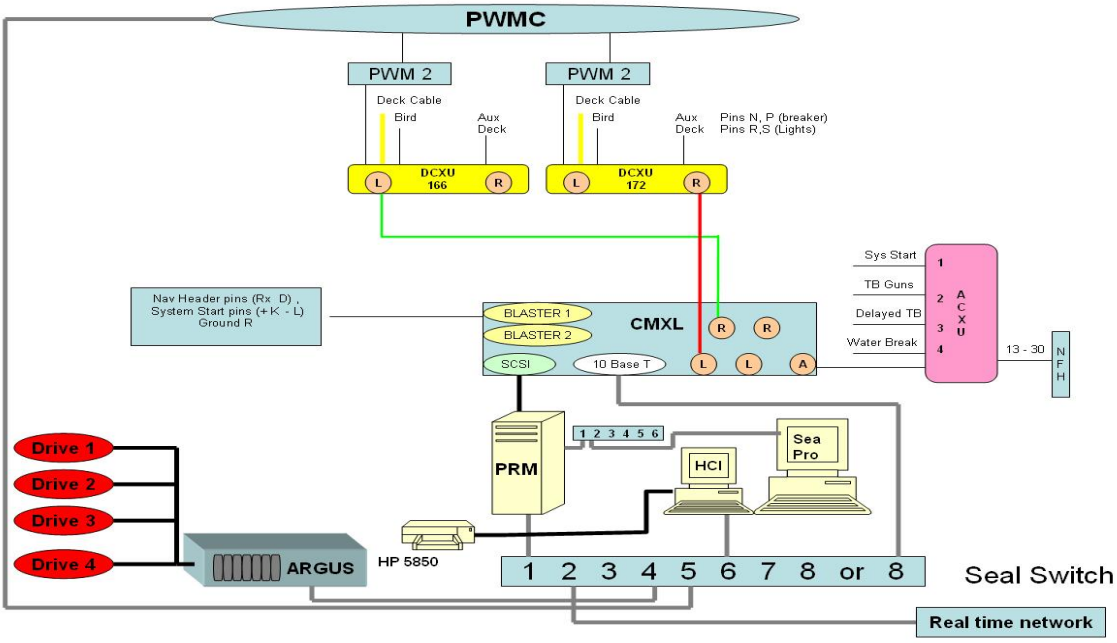
23	1900LLX	6.3	-10.5	6	100	Spare	3
24	1900LLX	9.1	-10	6	150	Active	3
25	1900LLX	11.9	-10	6	70	Active	3
26	1900LLX	14.7	-10	6	40	Active	3

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 200khz transducer was set to master transducer due to the shallow range of depths 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              T41P 2D
H0101General Survey Details
H0200Date of Survey           N/A
H0201Date of Issue            17 Mar 2008
H0202Tape Version             P1/90
H0203Line Prefix
H0300Client                   3D Oil
H0400Geophysical Contractor   CGGVeritas
H0500Positioning Contractor
H0600Position Processing
H0800Co-ordinate Location     Preplot Sail Line Locations
H1100Receiver Groups per Shot 0
H1400Surveyed Datum           GDA94     GRS80     6378137.000 298.2572221
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       65
H2600TOTAL 2D LINE LENGTH     2202.97 kilometres
H2600AVG. LINE LENGTH         33.89 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    TDOB08-01  1   1001   1667 323.821 016650.0
H2600    TDOB08-02  1   1001   1414 057.865 010325.0
H2600    TDOB08-03  1   1001   1669 319.311 016700.0
H2600    TDOB08-04  1   1001   1809 054.706 020200.0
H2600    TDOB08-05  1   1001   2018 328.481 025425.0
H2600    TDOB08-06  1   1001   1964 053.879 024075.0
H2600    TDOB08-07  1   1001   1553 331.455 013800.0
H2600    TDOB08-08  1   1001   2222 054.774 030525.0
H2600    TDOB08-09  1   1001   2063 336.537 026550.0
H2600    TDOB08-10  1   1001   2378 053.595 034425.0
H2600   TDOB08-100  1   1001   1708 046.232 017675.0
H2600   TDOB08-102  1   1001   1512 041.526 012775.0
H2600    TDOB08-11  1   1001   2516 327.522 037875.0
H2600    TDOB08-12  1   1001   2343 054.732 033550.0
H2600    TDOB08-13  1   1001   2741 330.264 043500.0
H2600    TDOB08-14  1   1001   2625 055.029 040600.0
H2600    TDOB08-15  1   1001   2933 327.927 048300.0
H2600    TDOB08-16  1   1001   2637 054.804 040900.0
H2600    TDOB08-17  1   1001   3204 324.351 055075.0
H2600    TDOB08-18  1   1001   2316 054.946 032875.0
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H2600    TDOB08-20  1   1001   3057 058.464 051400.0
H2600    TDOB08-21  1   1001   3739 313.140 068450.0
H2600    TDOB08-22  1   1001   3097 058.636 052400.0
H2600    TDOB08-23  1   1001   3914 309.059 072825.0
H2600    TDOB08-24  1   1001   2649 058.405 041200.0
H2600    TDOB08-25  1   1001   3887 307.850 072150.0
H2600    TDOB08-26  1   1001   1649 057.962 016200.0
H2600    TDOB08-27  1   1001   3649 307.368 066200.0
H2600    TDOB08-28  1   1001   2979 059.261 049450.0
H2600    TDOB08-30  1   1001   1608 059.440 015175.0
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H2600    TDOB08-34  1   1001   1601 058.546 015000.0
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H2600    TDOB08-38  1   1001   1611 056.772 015250.0
H2600    TDOB08-40  1   1001   1604 057.213 015075.0
H2600    TDOB08-42  1   1001   2865 056.568 046600.0
H2600    TDOB08-44  1   1001   1606 057.374 015125.0
H2600    TDOB08-46  1   1001   1612 058.697 015275.0
H2600    TDOB08-48  1   1001   2641 058.223 041000.0
H2600    TDOB08-50  1   1001   1631 059.300 015750.0
H2600    TDOB08-52  1   1001   3253 058.278 056300.0
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H2600    TDOB08-78  1   1001   2113 057.931 027800.0
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H2600    TDOB08-82  1   1001   1630 057.369 015725.0
H2600    TDOB08-84  1   1001   2173 056.728 029300.0
H2600    TDOB08-86  1   1001   2148 056.114 028675.0
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H2600    TDOB08-90  1   1001   1980 055.680 024475.0
H2600    TDOB08-92  1   1001   1981 053.603 024500.0
H2600    TDOB08-94  1   1001   1627 055.913 015650.0
H2600    TDOB08-96  1   1001   1858 054.501 021425.0
H2600    TDOB08-98  1   1001   2018 053.336 025425.0
H2600
H2600 Note: Coordinates are SURFACE KILOMETRES
H2600          and no run outs should be acquired
H2600
STDOB08-01          1001401501.90S1463654.89E 467278.05544365.0
STDOB08-01          1667400745.97S1462959.75E 457394.95557756.6
STDOB08-02          1001401500.12S1470351.29E 505464.05544489.0
STDOB08-02          1414401201.90S1471000.96E 514207.75549972.5
STDOB08-03          1001401501.07S1464142.61E 474075.05544417.0
STDOB08-03          1669400810.27S1463402.70E 463148.25557037.6
STDOB08-04          1001401502.99S1465822.22E 497690.05544402.0
STDOB08-04          1809400844.02S1470958.76E 514167.05556073.5
STDOB08-05          1001401458.77S1463924.67E 470816.05544476.0
STDOB08-05          2018400315.69S1463003.88E 457445.75566090.1
STDOB08-06          1001401500.57S1465613.45E 494648.05544475.0
STDOB08-06          1964400719.64S1470954.76E 514077.25558675.3
STDOB08-07          1001400832.90S1463438.34E 463995.05556344.0
STDOB08-07          1553400159.77S1463000.21E 457345.85568430.5
STDOB08-08          1001401501.47S1465234.02E 489464.05544442.0
STDOB08-08          2222400529.29S1471006.63E 514364.75562076.8
STDOB08-09          1001401231.35S1463736.82E 468249.05549011.0
STDOB08-09          2063395921.49S1463011.25E 457580.25573312.0
STDOB08-10          1001401459.58S1465041.47E 486805.05544496.0
STDOB08-10          2378400355.55S1471010.64E 514465.05564966.9
STDOB08-100          1001395157.92S1463007.88E 457424.05586987.0
STDOB08-100          1708394521.15S1463904.08E 470114.95599279.5
STDOB08-102          1001395022.51S1463004.91E 457337.05589928.0
STDOB08-102          1512394512.26S1463600.68E 465749.75599535.5
STDOB08-11          1001401458.24S1464416.53E 477711.05544516.0
STDOB08-11          2516395741.44S1462959.62E 457287.15576395.0
STDOB08-12          1001401505.68S1464811.86E 483271.05544301.0
STDOB08-12          2343400436.01S1470727.95E 510609.45563725.7
STDOB08-13          1001401501.08S1464507.78E 478922.05544432.0
STDOB08-13          2741395435.45S1462959.37E 457248.95582129.0
STDOB08-14          1001401458.00S1464628.30E 480824.05544532.0
STDOB08-14          2625400221.17S1470951.66E 514020.85567877.6
STDOB08-15          1001401503.66S1464805.73E 483126.05544363.0
STDOB08-15          2933395255.29S1463006.35E 457397.65585218.0
STDOB08-16          1001401501.39S1464446.19E 478412.05544421.0
STDOB08-16          2637400214.69S1470815.98E 511753.95568081.0
STDOB08-17          1001401457.74S1465231.36E 489401.05544557.0
STDOB08-17          3204395044.52S1463001.19E 457252.55589248.9
STDOB08-18          1001401500.88S1464248.48E 475631.05544428.0
STDOB08-18          2316400447.16S1470144.33E 502471.05563389.1
STDOB08-19          1001401501.48S1465938.79E 499499.05544449.0
STDOB08-19          3265395218.84S1463259.15E 461496.35586363.5
STDOB08-20          1001401455.37S1463914.23E 470569.05544580.0
STDOB08-20          3057400019.63S1471001.25E 514255.15571624.1
STDOB08-21          1001401446.06S1470510.85E 507344.05544921.0
STDOB08-21          3739394923.23S1463010.61E 457462.45591756.3
STDOB08-22          1001401500.87S1463608.21E 466175.05544392.0
STDOB08-22          3097400012.35S1470734.57E 510777.85571854.3
STDOB08-23          1001401322.09S1470940.02E 513708.05547501.0
STDOB08-23          3914394827.47S1463002.74E 457265.75593474.5
STDOB08-24          1001401502.04S1463429.41E 463841.05544345.0
STDOB08-24          2649400319.58S1465910.04E 498816.35566089.6
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STDOB08-25	1001401007.29S1471000.74E	514209.05553506.0
STDOB08-25	3887394605.01S1463007.07E	457344.15597867.1
STDOB08-26	1001401357.88S1463522.32E	465082.05546329.0
STDOB08-26	1649400918.85S1464502.57E	478769.45554982.9
STDOB08-27	1001400654.80S1470957.69E	514148.05559441.0
STDOB08-27	3649394506.20S1463307.66E	461631.65599702.7
STDOB08-28	1001401449.17S1463214.46E	460651.05544726.0
STDOB08-28	2979400105.84S1470206.75E	503004.65570212.2
STDOB08-30	1001401307.52S1463429.66E	463830.05547876.0
STDOB08-30	1608400857.01S1464341.74E	476855.05555650.9
STDOB08-32	1001401243.30S1463422.74E	463663.05548622.0
STDOB08-32	3007395846.30S1470437.85E	506590.05574512.2
STDOB08-34	1001401228.37S1463403.38E	463203.05549080.0
STDOB08-34	1601400814.25S1464303.90E	475955.65556966.5
STDOB08-36	1001401423.12S1463001.54E	457506.05545512.0
STDOB08-36	3022395925.28S1465946.11E	499670.75573313.3
STDOB08-38	1001401212.51S1463344.99E	462766.05549567.0
STDOB08-38	1611400741.22S1464243.79E	475476.35557983.1
STDOB08-40	1001401156.08S1463333.00E	462480.05550072.0
STDOB08-40	1604400731.07S1464228.26E	475107.85558295.0
STDOB08-42	1001401258.48S1463104.94E	458990.05548130.0
STDOB08-42	2865395902.85S1465824.06E	497724.65574004.4
STDOB08-44	1001401133.05S1463314.67E	462043.05550780.0
STDOB08-44	1606400708.31S1464212.62E	474735.35558995.4
STDOB08-46	1001401112.47S1463252.94E	461526.05551412.0
STDOB08-46	1612400654.79S1464204.08E	474531.85559411.6
STDOB08-48	1001401206.10S1463012.99E	457753.05549738.0
STDOB08-48	2641400023.49S1465442.50E	492472.65571515.0
STDOB08-50	1001401039.04S1463222.89E	460810.05552439.0
STDOB08-50	1631400617.94S1464154.69E	474305.65560546.9
STDOB08-52	1001401110.81S1463037.71E	458328.05551446.0
STDOB08-52	3253395506.16S1470414.22E	506035.15581299.5
STDOB08-54	1001401047.78S1463007.35E	457606.05552152.0
STDOB08-54	1746400539.38S1464123.75E	473569.15561733.4
STDOB08-56	1001400947.93S1463120.12E	459317.05554007.0
STDOB08-56	2470395937.95S1465331.30E	490782.65572917.0
STDOB08-58	1001401002.21S1463006.49E	457578.05553557.0
STDOB08-58	2792395719.90S1465654.35E	495595.25577177.4
STDOB08-60	1001400934.31S1462957.02E	457349.05554416.0
STDOB08-60	1704400440.49S1464032.94E	472359.35563544.7
STDOB08-62	1001400849.28S1463009.56E	457638.05555806.0
STDOB08-62	2442395845.07S1465150.49E	488389.85574544.1
STDOB08-64	1001400807.93S1463017.77E	457825.05557082.0
STDOB08-64	2990395345.36S1465949.20E	499743.55583792.9
STDOB08-66	1001400729.27S1463003.72E	457486.05558272.0
STDOB08-66	2359395743.98S1465016.64E	486160.35576423.9
STDOB08-68	1001400653.85S1463002.00E	457439.05559364.0
STDOB08-68	2522395605.66S1465246.10E	489702.05579460.5
STDOB08-70	1001400548.41S1463035.88E	458230.05561386.0
STDOB08-70	2247395712.50S1464925.24E	484939.15577392.0
STDOB08-72	1001400542.76S1463004.80E	457493.05561556.0
STDOB08-72	2636395402.39S1465427.66E	492108.45583264.0
STDOB08-74	1001400508.92S1463000.86E	457394.05562599.0
STDOB08-74	2447395440.47S1465127.24E	487826.35582084.4
STDOB08-76	1001400412.59S1463004.36E	457467.05564336.0
STDOB08-76	2949395004.74S1465855.15E	498458.75590594.6
STDOB08-78	1001400319.62S1463003.18E	457430.05565969.0
STDOB08-78	2113395519.88S1464635.21E	480895.95580854.9
STDOB08-80	1001400245.30S1463001.74E	457390.05567027.0
STDOB08-80	2367395251.08S1465015.89E	486126.05585454.0
STDOB08-82	1001395903.21S1463608.72E	466055.05573918.0
STDOB08-82	1630395427.92S1464526.26E	479254.95582452.9

STDOB08-84	1001400130.60S1463001.53E	457372.05569330.0
STDOB08-84	2173395248.14S1464712.46E	481769.05585535.3
STDOB08-86	1001400010.38S1463006.59E	457478.05571804.0
STDOB08-86	2148395130.82S1464648.06E	481183.75587917.9
STDOB08-88	1001395917.65S1463001.70E	457353.05573429.0
STDOB08-88	2747394536.76S1465457.97E	492813.65598853.0
STDOB08-90	1001395809.70S1462955.57E	457196.05575523.0
STDOB08-90	1980395041.42S1464405.82E	477324.35589430.3
STDOB08-92	1001395721.02S1463003.35E	457372.05577025.0
STDOB08-92	1981394928.84S1464352.61E	477003.65591666.9
STDOB08-94	1001395600.14S1463006.59E	457435.05579519.0
STDOB08-94	1627395115.40S1463911.84E	470342.05588358.9
STDOB08-96	1001395459.55S1463005.98E	457410.05581387.0
STDOB08-96	1858394815.52S1464219.23E	474776.45593920.4
STDOB08-98	1001395324.28S1463004.94E	457369.05584324.0
STDOB08-98	2018394511.15S1464421.65E	477670.95599613.4

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, speed of sound and finally the data was tidally corrected using a tide file supplied from the client. All three corrections were carried out in post-processing. A set of tidally corrected P1's is delivered along with a set of uncorrected P1's.

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-

Daily drop outs of positions generated by SPM 2. SPM 1 remained stable throughout the survey and thus always provided 2 solutions. In the attempt at further troubleshooting problems with SPM2 the raw GPS feed into Multifix position (V1G3) was changed from SPM2 to SPM1 before commencing seq #025. Required offsets were changed in online navigation system to reflect use of different antenna.

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.

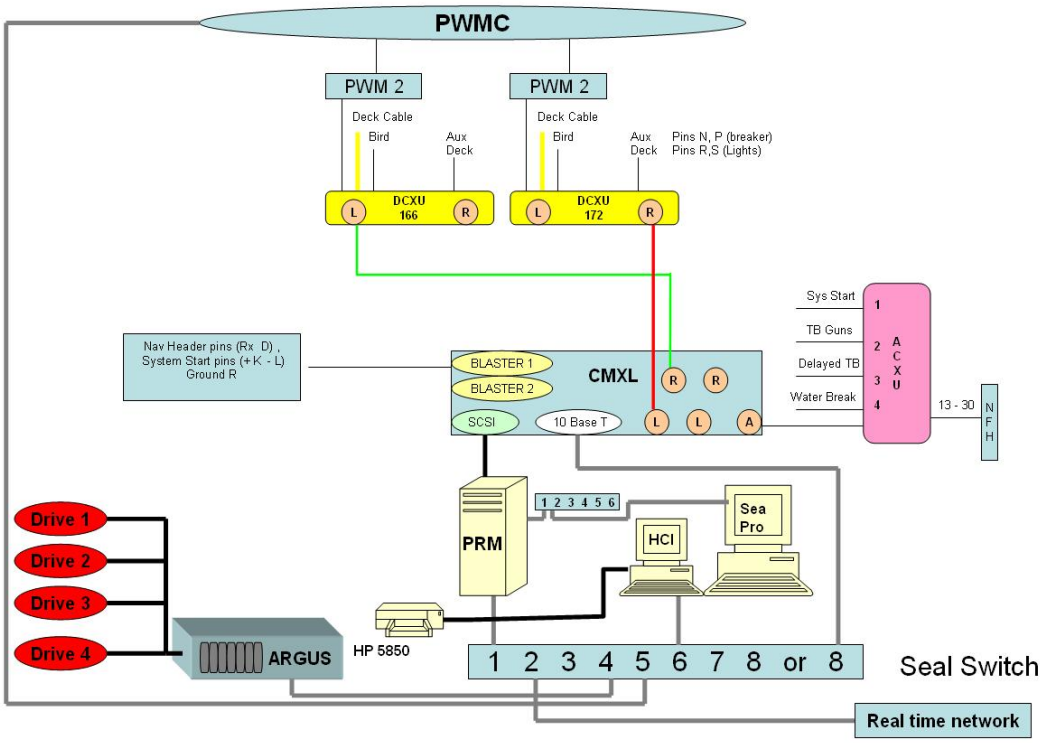
17.1.4. RGPS

Small periods of poor satellite constellations and low satellite numbers were observed throughout the acquisition of the survey. These events did significantly affect the quality of the RGPS data. Any occurrences were noted in the navigation line-log.
Communication was lost with RGPS1 machine on a couple of occasions this normally meant that the V1R1 RGPS network was rejected in offline processing. Any occurrences were noted in the processing comments. Having a redundant RGPS2 machine transmitting V1R2 RGPS network to online navigation system meant that positioning to in-sea equipment was at no stage lost.

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, 132 & 337 failing Capacitance, Channels 452 failing Cutoff and Channels 242, 252 & 452 failing Hydrophone Leakage.

19.2. Additional client tests

Polarity tests were carried out at the start of contract and verified on Promax. Channel 59 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
18-Apr-08	ok	ok	ok	ok	ok	ok	3	1	3	SOJ Test Chs. 91, 132 & 337 failed Capacitance. Ch. 452 failed Cutoff, Ch. 242, 252 & 452 failed Leakage.
19-Apr-08	ok	ok	ok	ok	ok	ok	2	1	3	Chs. 91, 337 failed Capacitance. Ch. 452 failed Cutoff, Ch. 242, 252 & 452 failed Leakage.
20-Apr-08	ok	ok	ok	ok	ok	ok	2	1	2	Chs. 91, 337 failed Capacitance. Ch. 452 failed Cutoff, Ch. 242 & 452 failed Leakage.
21-Apr-08	ok	ok	ok	ok	ok	ok	3	1	2	Chs. 91, 132, 337 failed Capacitance. Ch. 452 failed Cutoff, Ch. 242 & 452 failed Leakage.
22-Apr-08	ok	ok	ok	ok	ok	ok	3	1	2	Chs. 91, 132, 337 failed Capacitance. Ch. 452 failed Cutoff, Ch. 242 & 452 failed Leakage.
23-Apr-08	ok	ok	ok	ok	ok	ok	2	1	2	Chs. 91, 337 failed Capacitance. Ch. 452 failed Cutoff, Ch. 242 & 452 failed Leakage.
24-Apr-08	ok	ok	ok	ok	ok	ok	2	1	2	Chs. 91, 337 failed Capacitance. Ch. 452 failed Cutoff, Ch. 242 & 452 failed Leakage.
25-Apr-08	ok	ok	ok	ok	ok	ok	2	1	2	Chs. 91, 337 failed Capacitance. Ch. 452 failed Cutoff, Ch. 242 & 452 failed Leakage.
26-Apr-08	ok	ok	ok	ok	ok	ok	2	1	2	Chs. 91, 337 failed Capacitance. Ch. 452 failed Cutoff, Ch. 242 & 452 failed Leakage.
27-Apr-08	ok	ok	ok	ok	ok	ok	1	1	2	Chs. 337 failed Capacitance. Ch. 452 failed Cutoff, Ch. 242 & 452 failed Leakage.
28-Apr-08	ok	ok	ok	ok	ok	ok	1	1	2	Chs. 337 failed Capacitance. Ch. 452 failed Cutoff, Ch. 242 & 452 failed Leakage.
29-Apr-08	ok	ok	ok	ok	ok	ok	1	1	2	Chs. 337 failed Capacitance. Ch. 452 failed Cutoff, Ch. 242 & 452 failed Leakage.
30-Apr-08	ok	ok	ok	ok	ok	ok	1	1	3	Chs. 337 failed Capacitance. Ch. 452 failed Cutoff, Ch. 179, 242 & 452 failed Leakage.
01-May-08	ok	ok	ok	ok	ok	ok	2	1	2	Chs. 85, 337 failed Capacitance. Ch. 452 failed Cutoff, Ch. 242 & 452 failed Leakage.
02-May-08	ok	ok	ok	ok	ok	ok	2	1	2	Chs. 85, 337 failed Capacitance. Ch. 452 failed Cutoff, Ch. 242 & 452 failed Leakage.
03-May-08	ok	ok	ok	ok	ok	ok	1	1	2	Chs. 337 failed Capacitance. Ch. 452 failed Cutoff, Ch. 242 & 452 failed Leakage.
04-May-08	ok	ok	ok	ok	ok	ok	2	1	2	Chs. 85, 337 failed Capacitance. Ch. 452 failed Cutoff, Ch. 242 & 452 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: Chs 85 and 337 failing Capacitance, Ch 452 failing Cutoff and Chs 242 and 452 failing 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	3D Oil	CGGVERITAS					BOX	1
Area	South East Basin, Offshore Australia							
Survey	2D, T41P						Vessel	M/V Pacific Titan
Job #	6374							
Date	Line Name	Tape	Seq	FF	LF	FSP	LSP	Comments
18 April 2008	TDOB08-044-001	1	1	979	1607	981	1606	SOL/EOL
18 April 2008	TDOB08-030-002	2	2	979	1609	1628	1001	SOL/EOL
18 April 2008	TDOB08-022-003	3	3	979	2526	982	2526	SOL
18 April 2008	TDOB08-022-003	4	3	2527	3098	2527	3097	EOL
19 April 2008	TDOB08-036-004	5	4	979	2526	3042	1497	SOL
19 April 2008	TDOB08-036-004	6	4	2527	2669	1496	1354	EOL/Incomplete
19 April 2008	TDOB08-036-005	7	5	979	1474	1493	1001	SOL/EOL
19 April 2008	TDOB08-050-006	8	6	979	1632	981	1631	SOL/EOL
19 April 2008	TDOB08-034-007	9	7	979	1602	1621	1001	SOL/EOL
19 April 2008	TDOB08-046-008	10	8	979	1613	981	1612	SOL/EOL
20 April 2008	TDOB08-054-009	11	9	979	1747	1766	1001	SOL/EOL
20 April 2008	TDOB08-064-010	12	10	979	2526	981	2526	SOL
20 April 2008	TDOB08-064-010	13	10	2527	2991	2527	2990	EOL
20 April 2008	TDOB08-042-011	14	11	979	2526	2885	1340	SOL
20 April 2008	TDOB08-042-011	15	11	2527	2866	1339	1001	EOL
20 April 2008	TDOB08-026-012	16	12	979	1650	981	1649	SOL/EOL
20 April 2008	TDOB08-040-013	17	13	979	1605	1624	1001	SOL/EOL
21 April 2008	TDOB08-007-014	18	14	979	1554	981	1553	SOL/EOL
21 April 2008	TDOB08-001-015	19	15	979	1668	1687	1001	SOL/EOL
21 April 2008	TDOB08-016-016	20	16	979	2526	981	2526	SOL
21 April 2008	TDOB08-016-016	21	16	2527	2638	2527	2637	EOL
21 April 2008	TDOB08-052-017	22	17	979	2526	3273	1728	SOL
21 April 2008	TDOB08-052-017	23	17	2527	3254	1727	1001	EOL
22 April 2008	TDOB08-066-018	24	18	979	1123	981	1123	NTBP
22 April 2008	TDOB08-066-019	25	19	979	2360	981	2359	SOL/EOL
22 April 2008	TDOB08-070-020	26	20	979	2248	2267	1001	SOL/EOL
22 April 2008	TDOB08-080-021	27	21	979	2368	981	2367	SOL/EOL
22 April 2008	TDOB08-090-022	28	22	979	1981	2000	1001	SOL/EOL
23 April 2008	TDOB08-098-023	29	23	979	2019	981	2018	SOL/EOL
23 April 2008	TDOB08-092-024	30	24	979	1982	2001	1001	SOL/EOL

Client	3D Oil	CGGVERITAS	BOX	2
Area	South East Basin, Offshore Australia			
Survey	2D, T41P		Vessel	M/V Pacific Titan
Job #	6374			

Date	Line Name	Tape	Seq	FF	LF	FSP	LSP	Comments
23 April 2008	TDOB08-005-025	31	25	979	2019	2038	1001	SOL/EOL
23 April 2008	TDOB08-014-026	32	26	979	2526	981	2526	SOL
23 April 2008	TDOB08-014-026	33	26	2527	2626	2527	2625	EOL
23 April 2008	TDOB08-028-027	34	27	979	2526	2999	1454	SOL
24 April 2008	TDOB08-028-027	35	27	2527	2980	1453	1001	EOL
24 April 2008	TDOB08-020-028	36	28	979	2526	981	2526	SOL
24 April 2008	TDOB08-020-028	37	28	2527	3058	2527	3057	EOL
24 April 2008	TDOB08-032-029	38	29	979	2526	3027	1482	SOL
24 April 2008	TDOB08-032-029	39	29	2527	3008	1481	1001	EOL
24 April 2008	TDOB08-056-030	40	30	979	2471	981	2470	SOL/EOL
25 April 2008	TDOB08-062-031	41	31	979	2443	2462	1001	SOL/EOL
25 April 2008	TDOB08-072-032	42	32	979	2526	981	2526	SOL
25 April 2008	TDOB08-072-032	43	32	2527	2637	2527	2636	EOL
25 April 2008	TDOB08-084-033	44	33	979	2174	2193	1001	SOL/EOL
25 April 2008	TDOB08-086-034	45	34	979	2149	981	2148	SOL/EOL
25 April 2008	TDOB08-078-035	46	35	979	2114	2133	1001	SOL/EOL
26 April 2008	TDOB08-003-036	47	36	979	1456	1689	1214	SOL/Incomplete
26 April 2008	TDOB08-003-037	48	37	979	1340	1359	1001	SOL/EOL
26 April 2008	TDOB08-012-038	49	38	979	2344	981	2343	SOL/EOL
26 April 2008	TDOB08-024-039	50	39	979	2526	2669	1124	SOL
26 April 2008	TDOB08-024-039	51	39	2527	2650	1123	1001	EOL
26 April 2008	TDOB08-038-040	52	40	979	1612	981	1611	SOL/EOL
27 April 2008	TDOB08-060-041	53	41	979	1705	1724	1001	SOL/EOL
27 April 2008	TDOB08-074-042	54	42	979	2448	981	2447	SOL/EOL
27 April 2008	TDOB08-082-043	55	43	979	1631	1650	1001	SOL/EOL
27 April 2008	TDOB08-009-044	56	44	979	2064	2083	1001	SOL/EOL
27 April 2008	TDOB08-018-045	57	45	979	2317	981	2316	SOL/EOL
28 April 2008	TDOB08-048-046	58	46	979	2526	2661	1116	SOL
28 April 2008	TDOB08-048-046	59	46	2527	2642	1115	1001	EOL
28 April 2008	TDOB08-058-047	60	47	979	2526	981	2526	SOL

Client	3D Oil	CGGVERITAS	BOX	3
Area	South East Basin, Offshore Australia			
Survey	2D, T41P		Vessel	M/V Pacific Titan
Job #	6374			

Date	Line Name	Tape	Seq	FF	LF	FSP	LSP	Comments
28 April 2008	TDOB08-058-047	61	47	2527	2793	2527	2792	EOL
28 April 2008	TDOB08-068-048	62	48	979	2523	2542	1001	SOL/EOL
28 April 2008	TDOB08-076-049	63	49	979	2526	981	2526	SOL
29 April 2008	TDOB08-076-049	64	49	2527	2950	2527	2949	EOL
29 April 2008	TDOB08-088-050	65	50	979	2526	2767	1222	SOL
29 April 2008	TDOB08-088-050	66	50	2527	2748	1221	1001	EOL
29 April 2008	TDOB08-096-051	67	51	979	1859	981	1858	SOL/EOL
29 April 2008	TDOB08-094-052	68	52	979	1628	1647	1001	SOL/EOL
29 April 2008	TDOB08-100-053	69	53	979	1709	981	1708	SOL/EOL
29 April 2008	TDOB08-102-054	70	54	979	1513	1532	1001	SOL/EOL
30 April 2008	TDOB08-011-055	71	55	979	2517	2536	1001	SOL/EOL
30 April 2008	TDOB08-010-056	72	56	979	2379	981	2378	SOL/EOL
30 April 2008	TDOB08-006-057	73	57	979	1965	1984	1001	SOL/EOL
30 April 2008	TDOB08-015-058	74	58	979	2526	981	2526	SOL
30 April 2008	TDOB08-015-058	75	58	2527	2934	2527	2933	EOL
01 May 2008	TDOB08-019-059	76	59	979	2526	3285	1739	SOL
01 May 2008	TDOB08-019-059	77	59	2527	3265	1738	1001	EOL
01 May 2008	TDOB08-017-060	78	60	979	2526	981	2526	SOL
01 May 2008	TDOB08-017-060	79	60	2527	3205	2527	3204	EOL
01 May 2008	TDOB08-013-061	80	61	979	2526	2761	1217	SOL
01 May 2008	TDOB08-013-061	81	61	2527	2743	1216	1001	EOL
02 May 2008	TDOB08-008-062	82	62	979	2223	981	2222	SOL/EOL
02 May 2008	TDOB08-004-063	83	63	979	1810	1829	1001	SOL/EOL
02 May 2008	TDOB08-002-064	84	64	979	1415	981	1414	SOL/EOL
02 May 2008	TDOB08-027-065	85	65	979	2526	981	2526	SOL
02 May 2008	TDOB08-027-065	86	65	2527	3650	2527	3649	EOL
02 May 2008	TDOB08-023-066	87	66	979	1168	3934	3748	NTBP
03 May 2008	TDOB08-023-067	88	67	979	2526	3934	2389	SOL
03 May 2008	TDOB08-023-067	89	67	2527	3915	2388	1001	EOL
03 May 2008	TDOB08-025-068	90	68	979	2526	981	2526	SOL

Client	3D Oil	CGGVERITAS	BOX	4
Area	South East Basin, Offshore Australia			
Survey	2D, T41P		Vessel	M/V Pacific Titan
Job #	6374			

Date	Line Name	Tape	Seq	FF	LF	FSP	LSP	Comments
03 May 2008	TDOB08-025-068	91	68	2527	3888	2527	3887	EOL
03 May 2008	TDOB08-021-069	92	69	979	2526	3758	2214	SOL
04 May 2008	TDOB08-021-069	93	69	2527	3740	2213	1001	EOL
04 May 2008	SOJ-EOJ-TEST	94		1	12			Test passed
			END OF JOB					

20. Onboard QC Personnel and System

20.1. Onboard QC Processing Geophysicists

18th April to 04th May 2008	Tommy Timenes	CGGVeritas, Chief Field Geophysicist
	Isabel Adjani Nicolas	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 3D OIL 2D survey of block T41P.

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.

After intial cable deployment and after each subsequent redeployment, a near-offset test was performed using the gun closest to the centre of the source to ascertain the actual distance from the source to the centre of the first receiver group.

21.4. QC Processing Sequence

Data was recorded by the Observer department in duplicate onto 3590 tape cartridges with a 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 - Water break, 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 shot points 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 ProMAX interactive velocity analysis package. This 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.

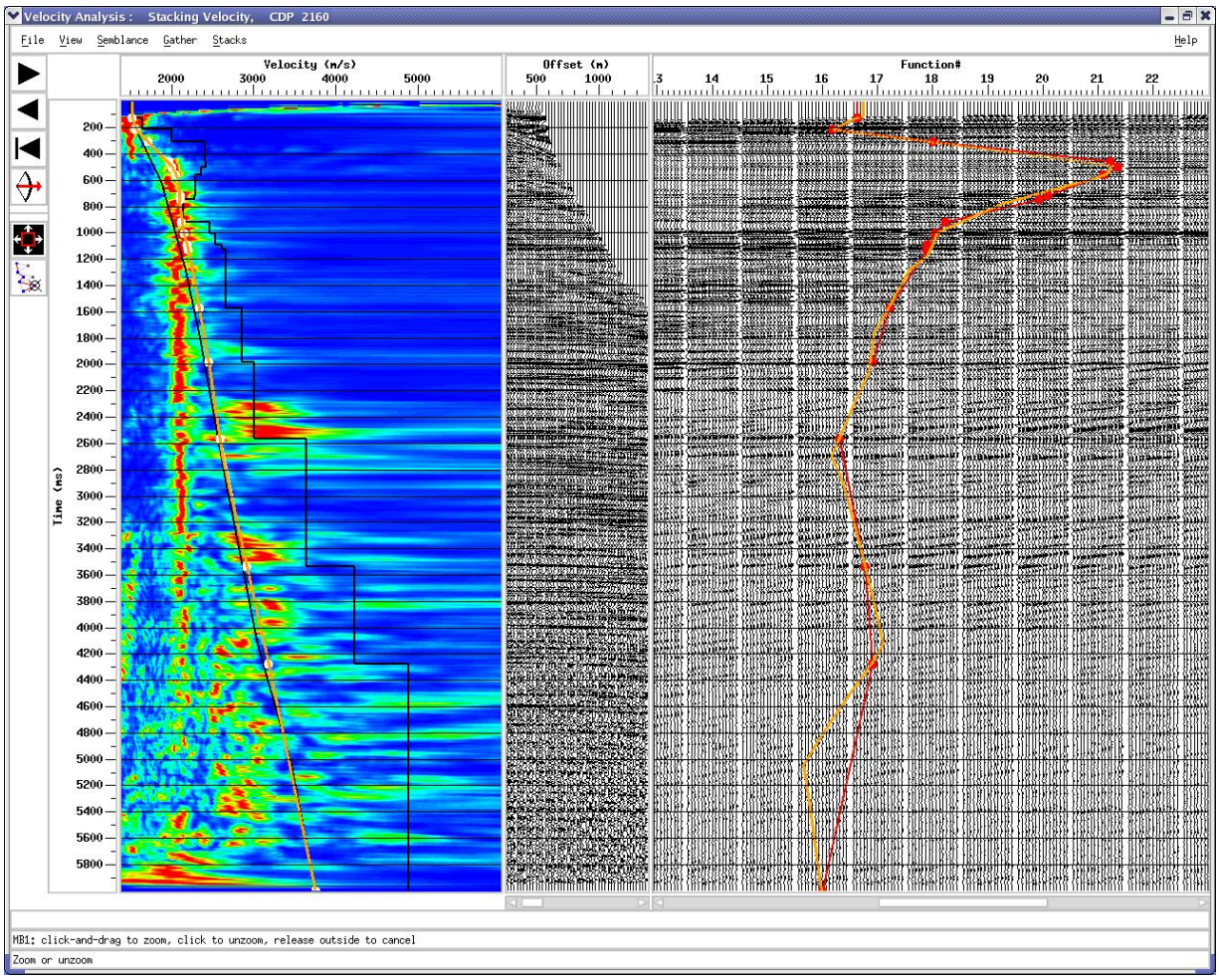


Figure 21-1: Velocity analysis for sequence 028. Graphical user interface with semblance, super-CDP gather display and function stacks.

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.

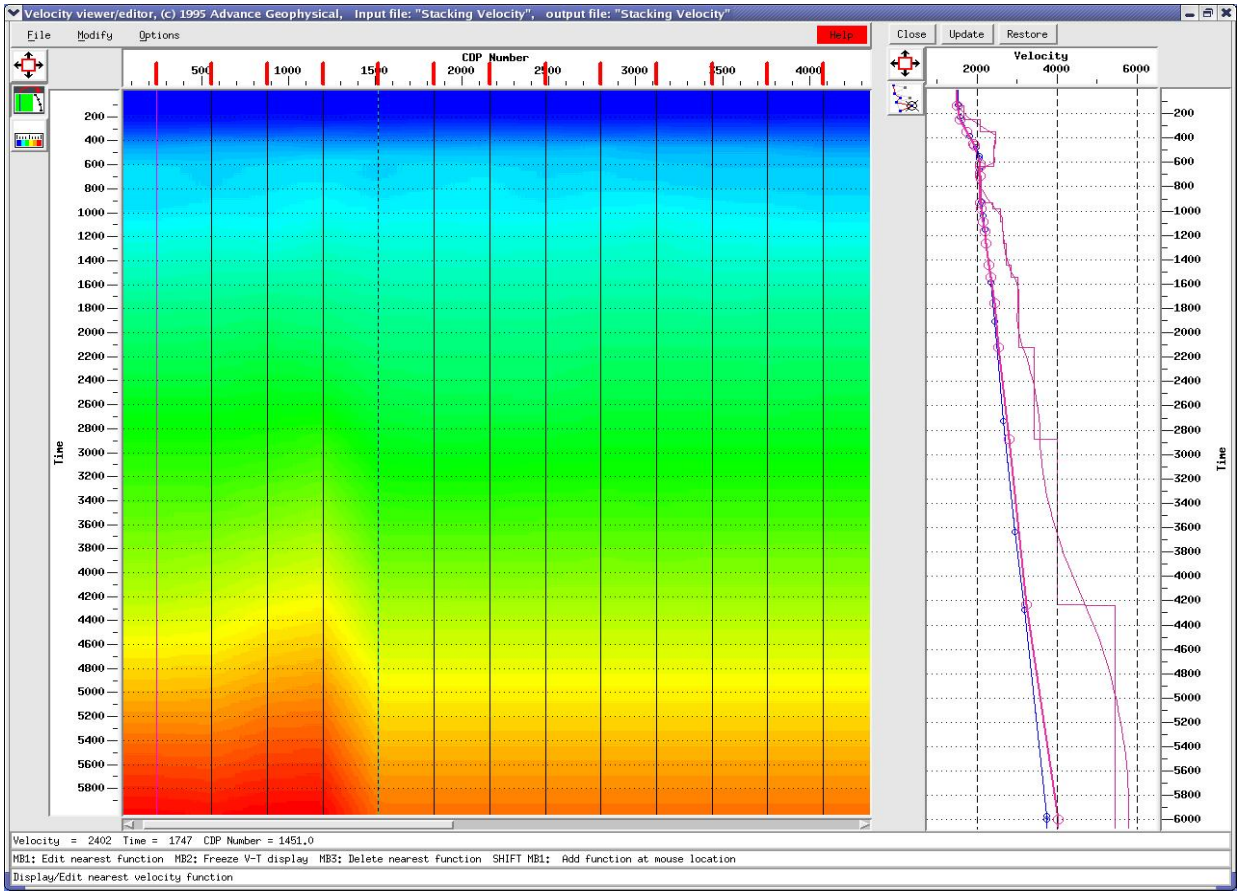


Figure 21.2: Velocity QC for sequence 028 using the Velocity Viewer/Point Editor to check for any errant picks.

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.

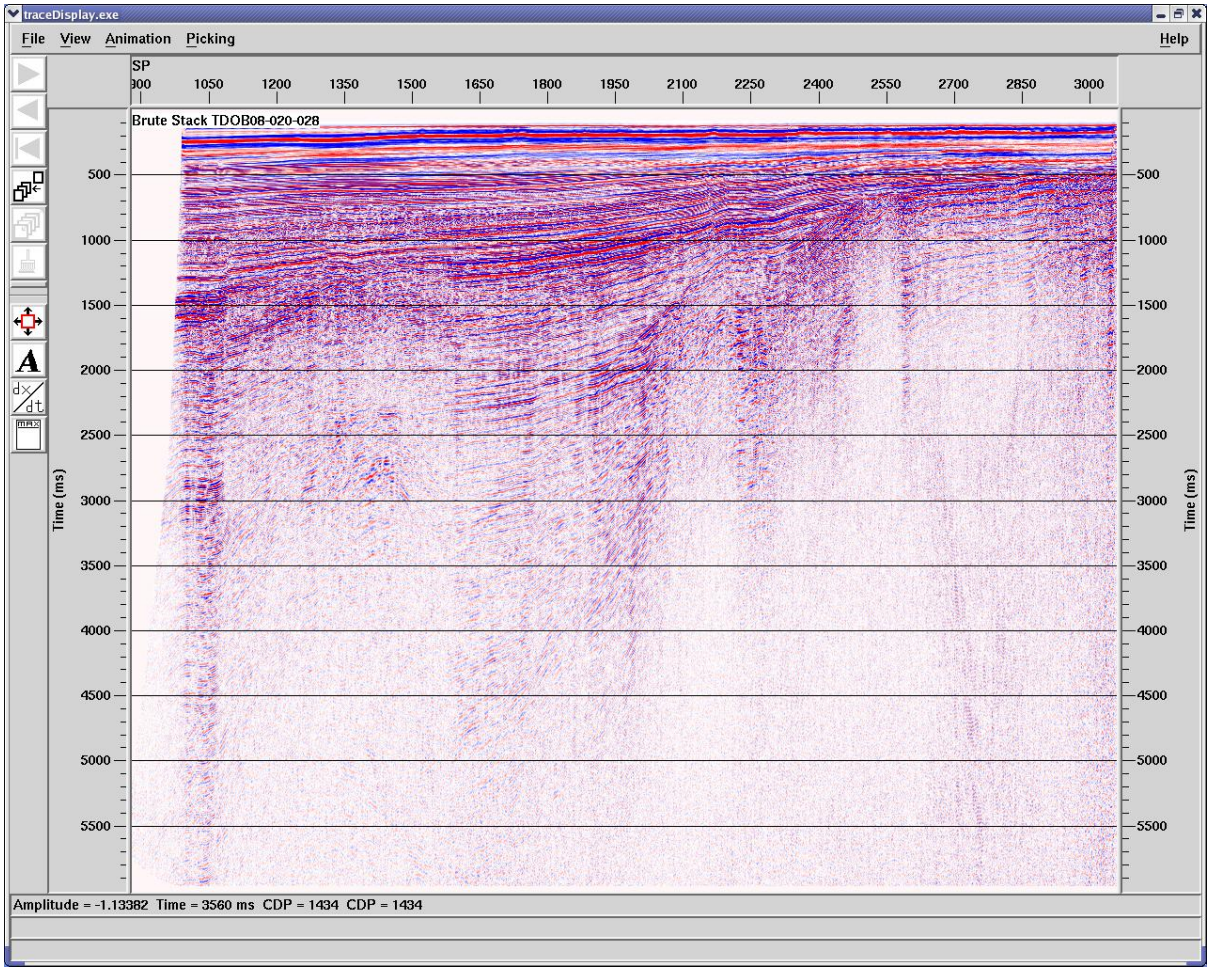


Figure 21-3: Brute stack for sequence 028 down to 6 seconds of data.

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	
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.

STEP	DETAILS	QC PROCEDURE/PRODUCT
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 5450-5950 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 5450-5950 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. 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.

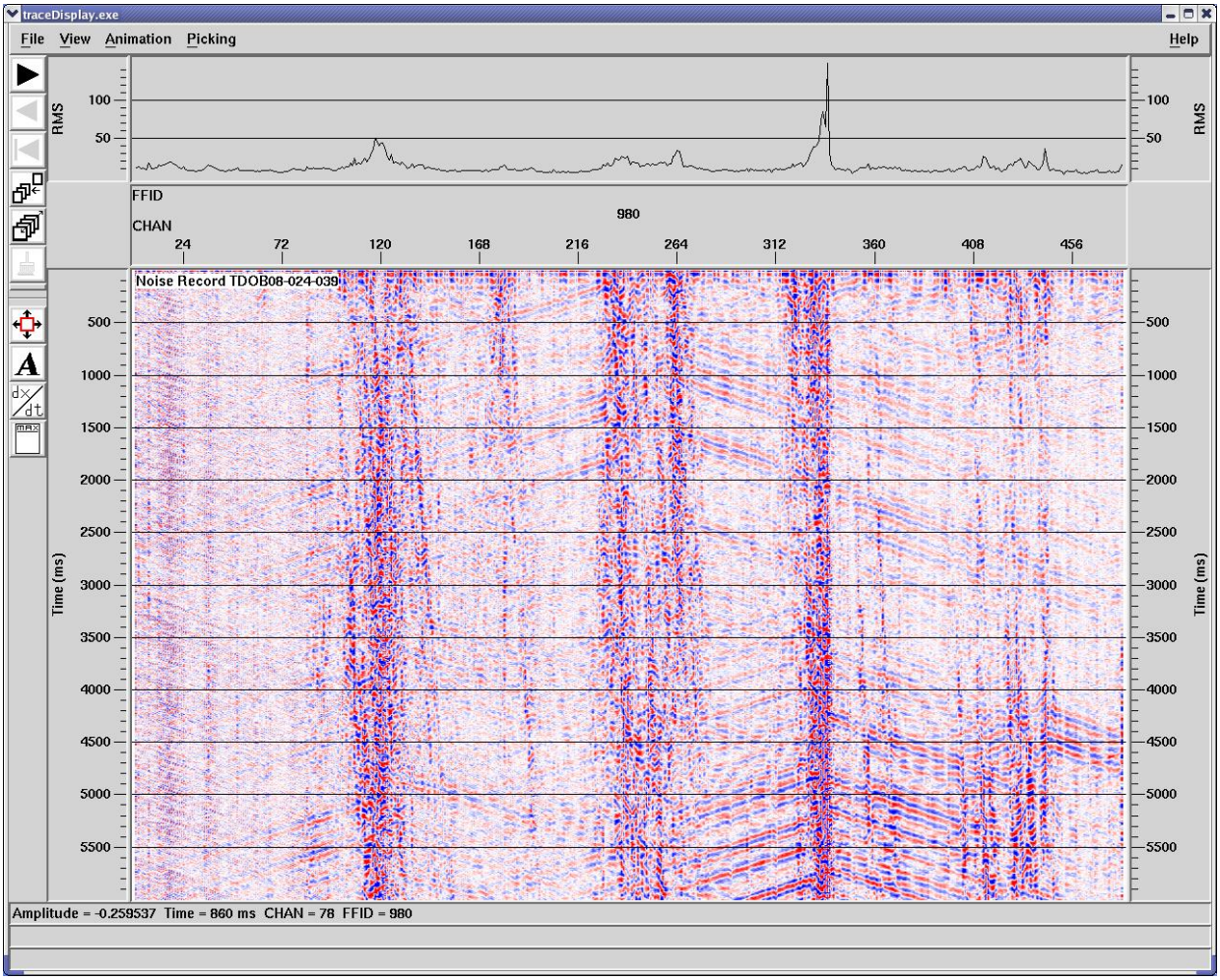


Figure 21-4: Example Noise Record with Channel RMS levels annotated, sequence 039. Swell bursts along the cable at the SOL, with the far cable end of up to 100 µb RMS noise level.

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

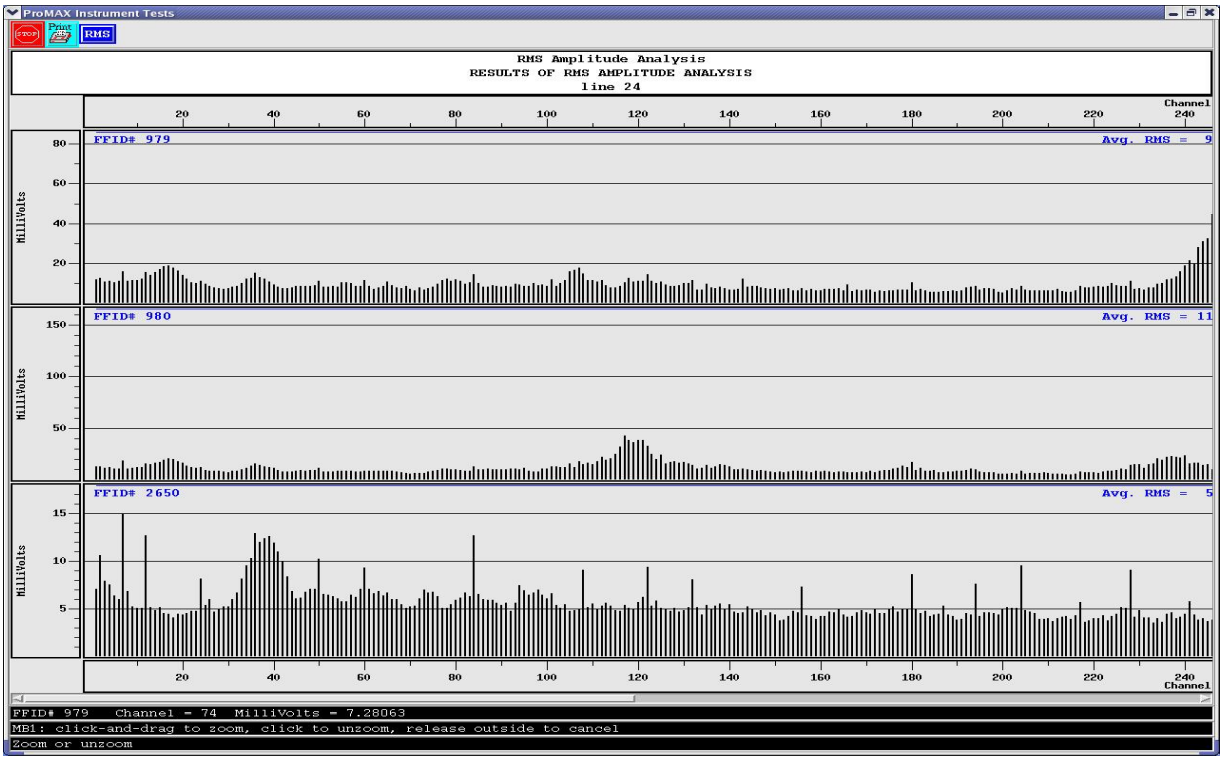


Figure 21-5: Example of analysis of Noise Records for sequence 039. Average Ambient RMS: 8.3µb.

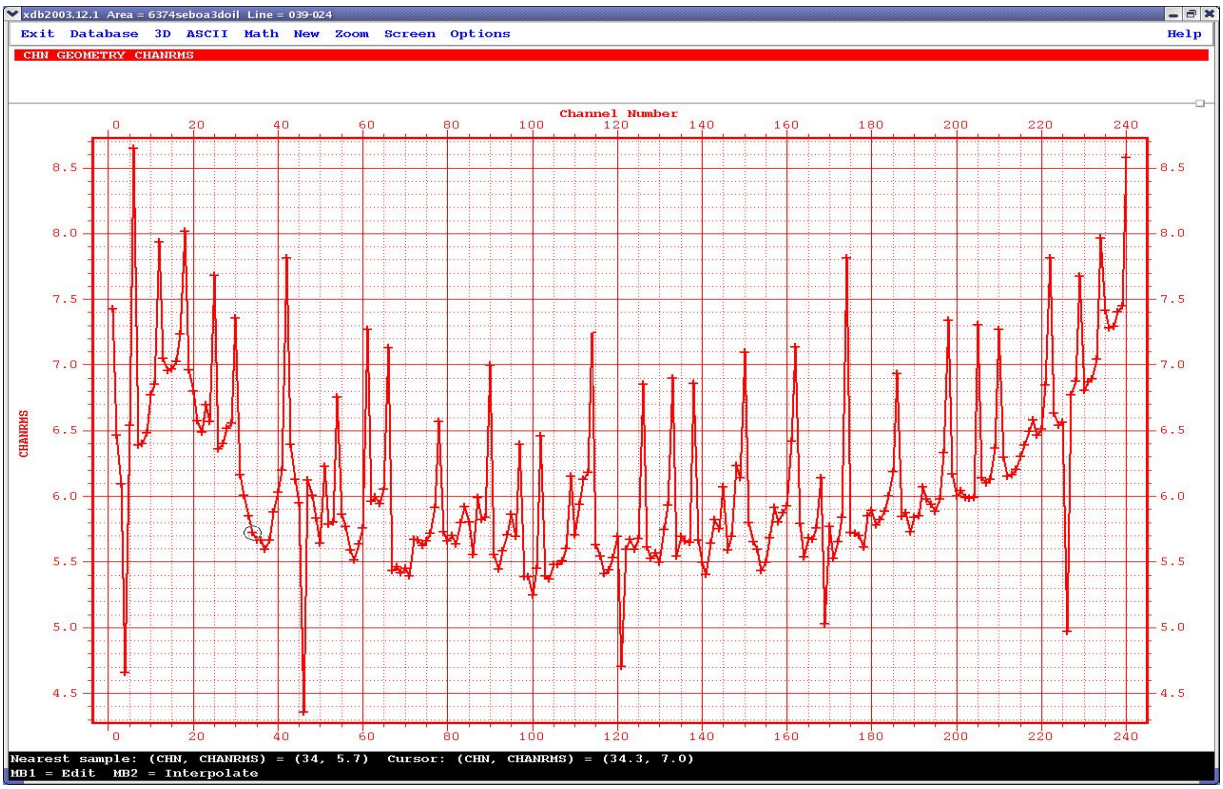


Figure 21-6: Channel stack sequence 039. The display computes the average RMS of the last 500ms of each channel and writes it to database.

‘

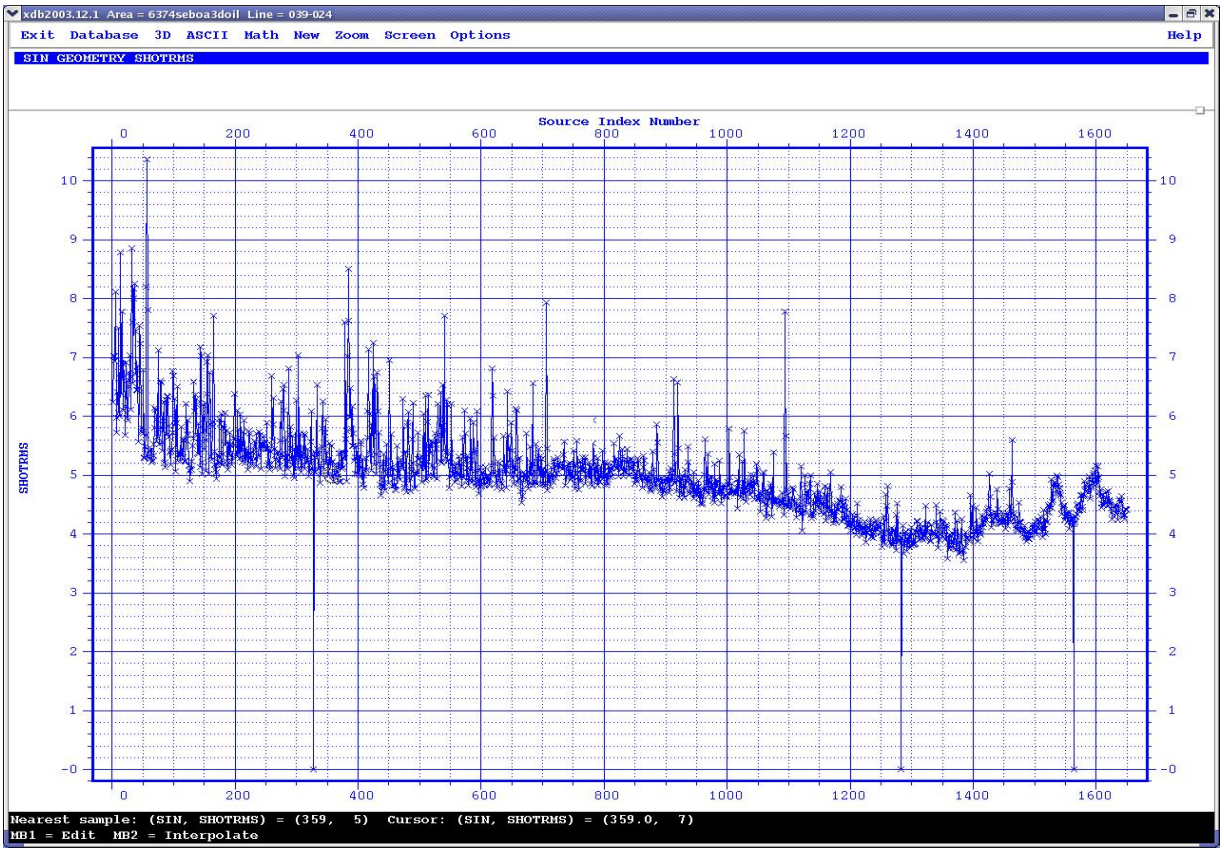


Figure 21-7: Shot stack sequence 039. The display computes the average RMS of the last 500ms of each shot and writes it to database. Note missed shotpoints 2322, 1367 and 1087 with zero RMS values.

21.9. Ambiant 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.

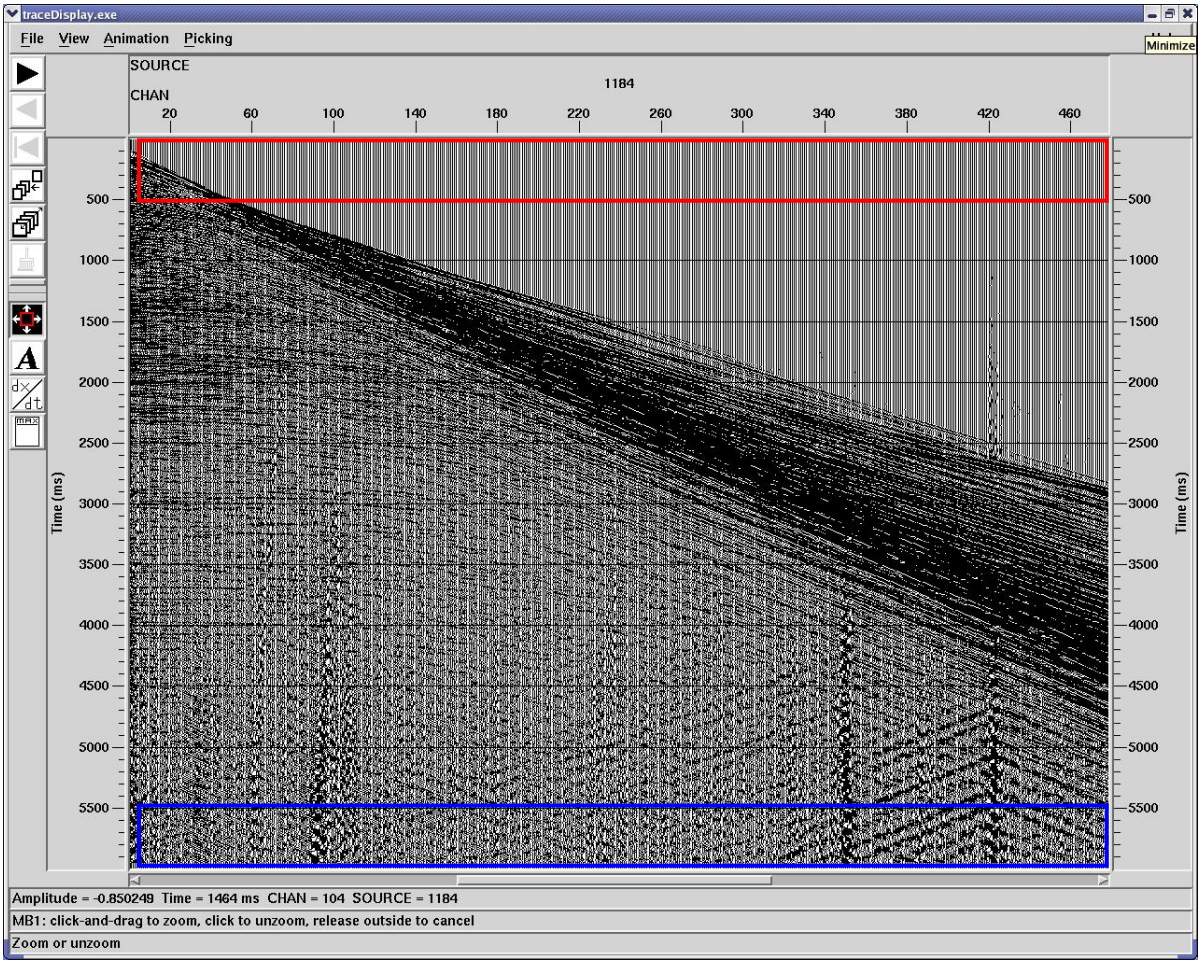


Figure 21-8: Shot gather with shallow (red) and deep (blue) RMS analysis windows annotated.

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. A few instances of change in vessel speed during line acquisition were also seen in the drop of RMS noise levels. 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 and the deep window was overdriven from time to time, 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.

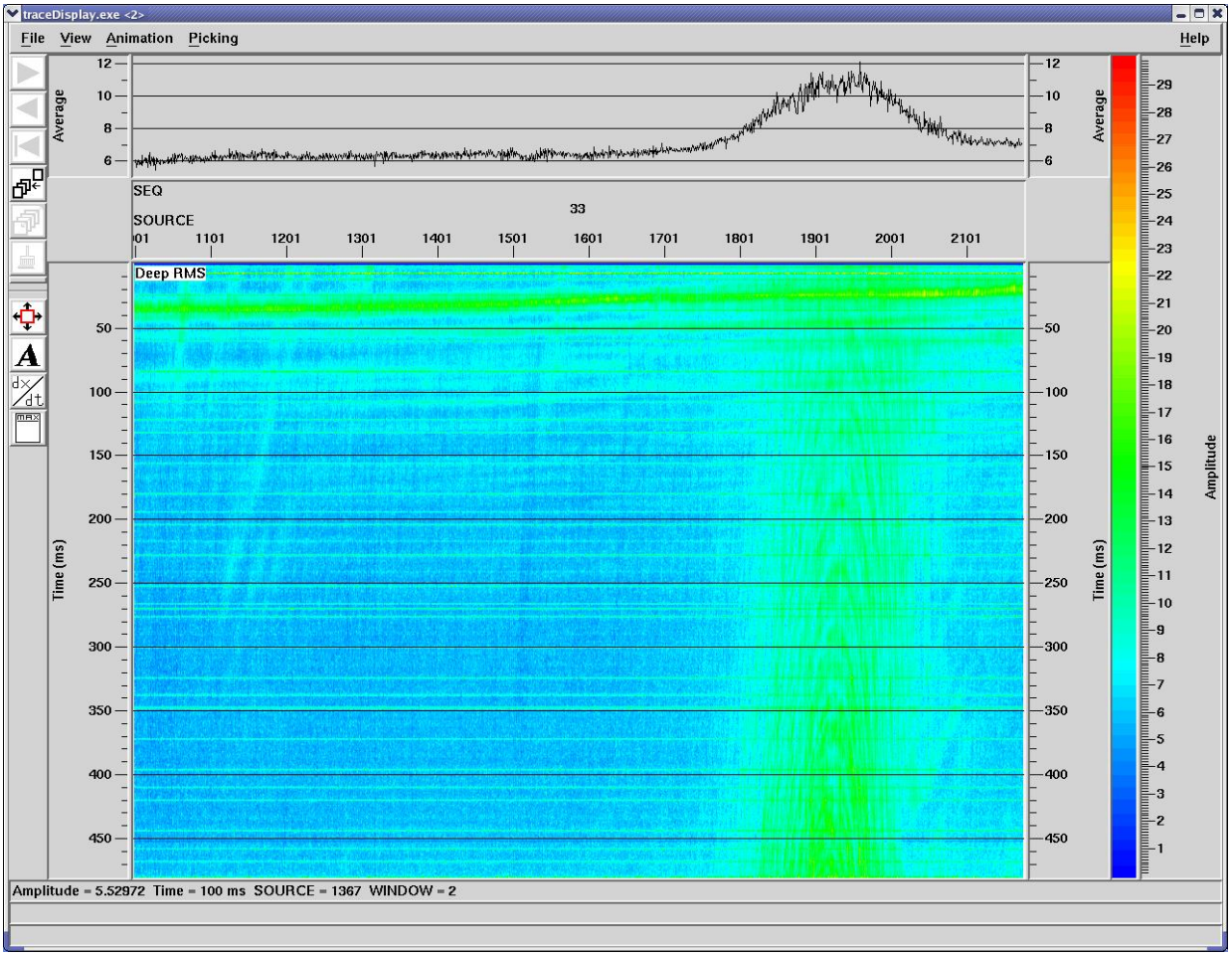


Figure 21-9: Deep RMS window for sequence 033. This is a relatively quiet line, however, note shipnoise at SP 1760 to 2100 of up to 12 µb.

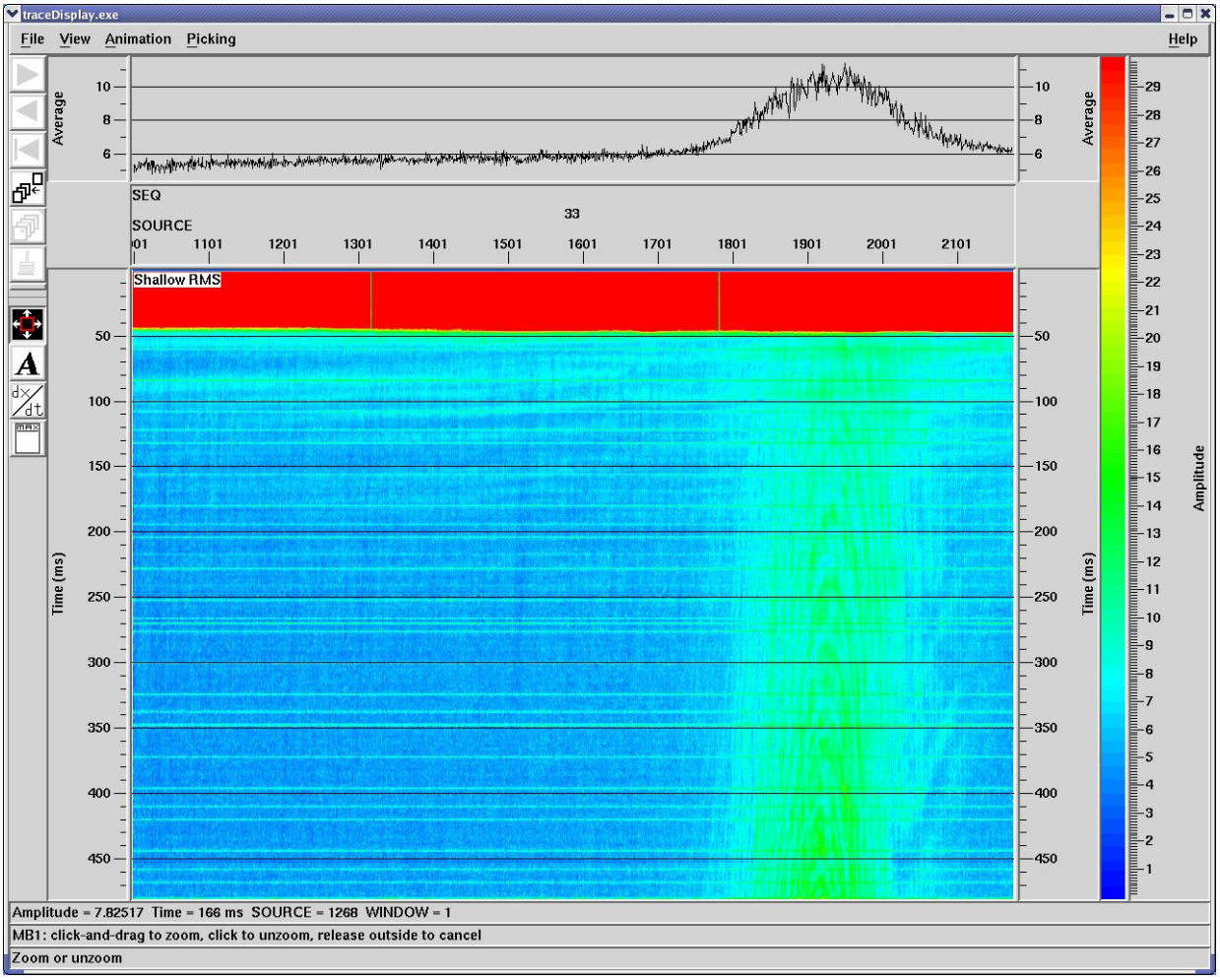


Figure 21-10: Examples of Shallow rms window QC from sequence 033. Note the direct arrival on the first 50 ms of data and missed shotpoints 1782 and 1318. Shipnoise is also evident on SP1760 to 2100.

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.

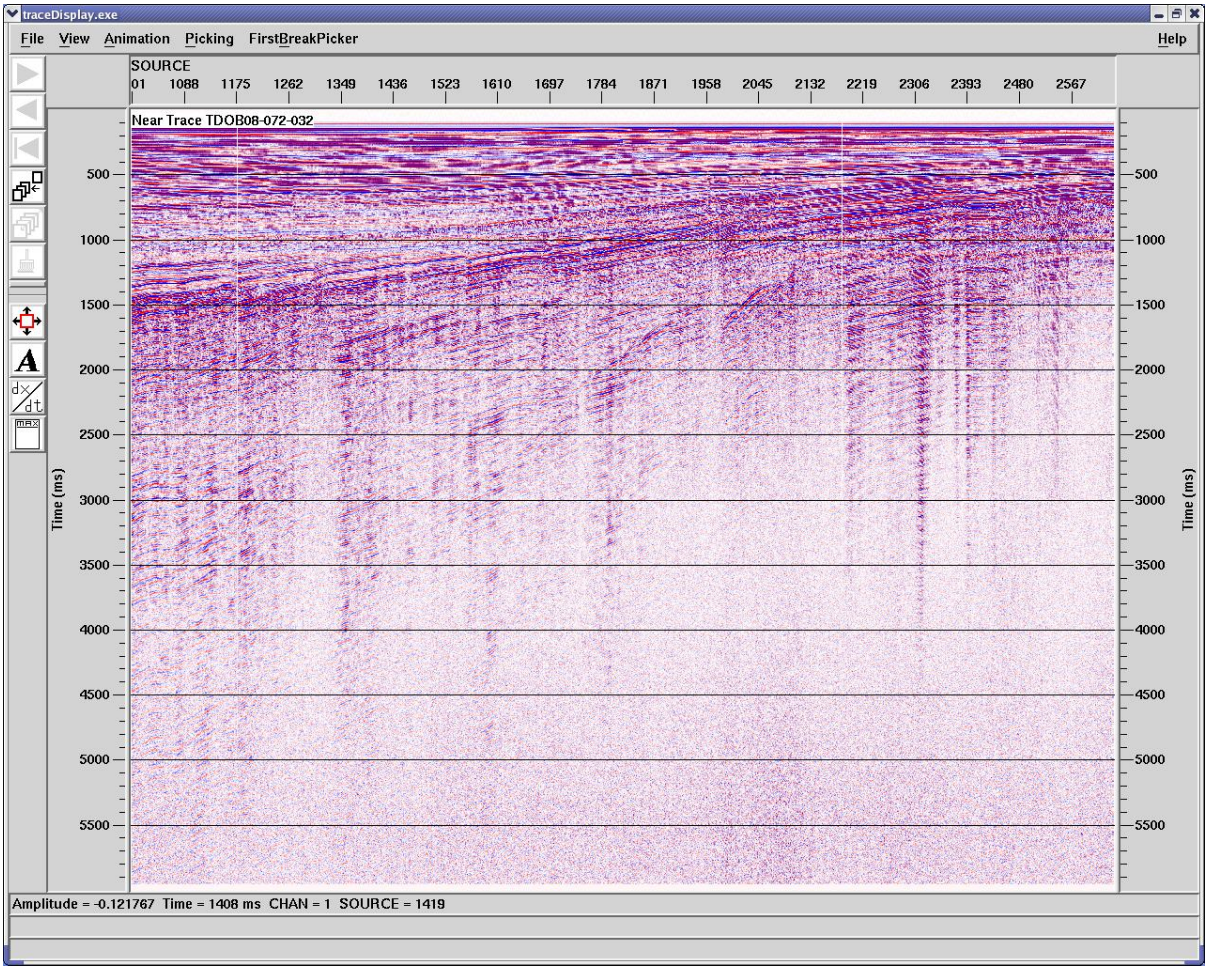


Figure 21-11: Near trace display, sequence 032. Note missed shotpoints 1177 and 2185.

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.

Hydrophones 18 (gun string 1) were dead for all sequences.

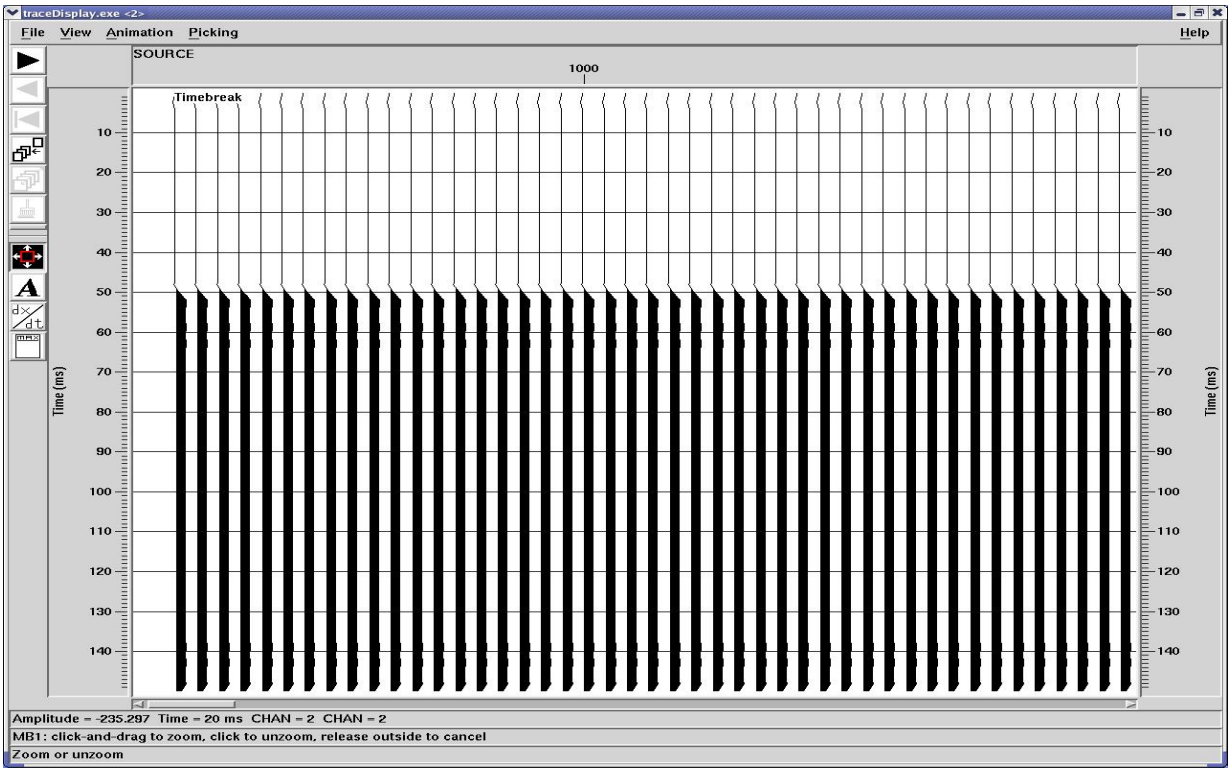


Figure 21-12: Timebreak QC (Auxiliary channel 1) sequence 042.

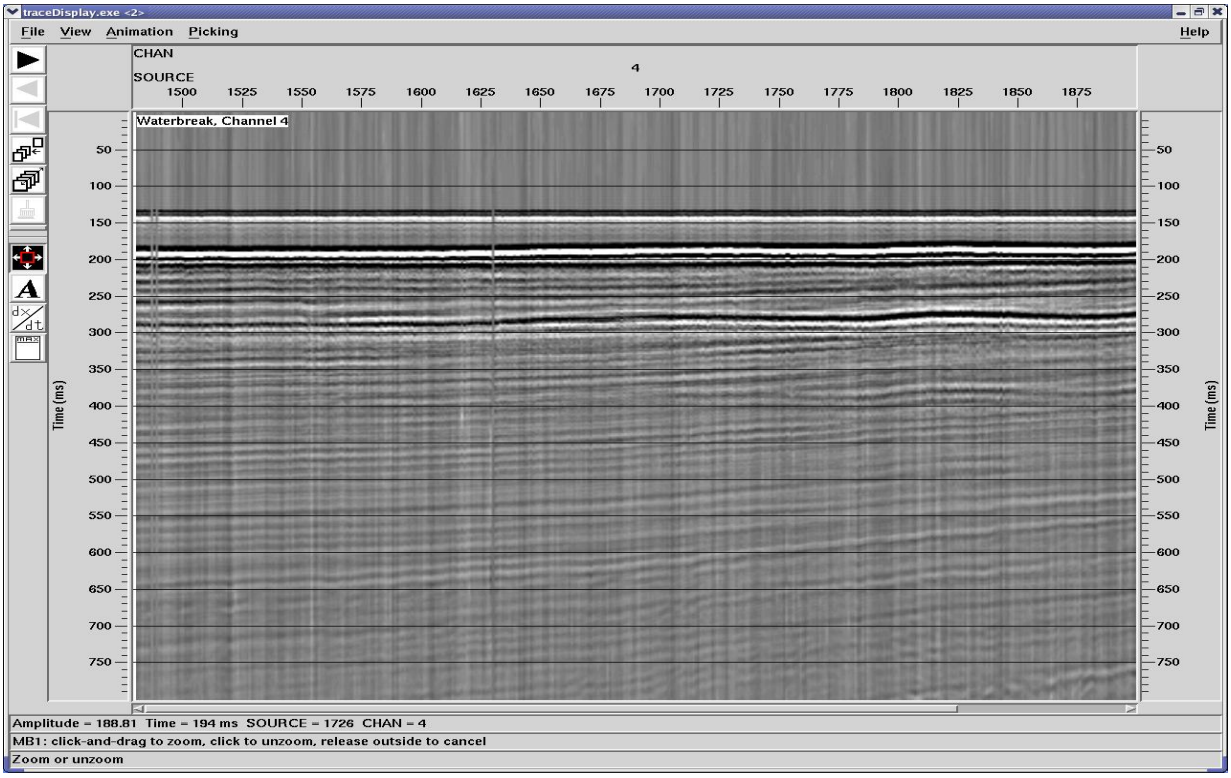


Figure 21-13: Waterbreak hydrophone QC (Auxiliary channel 4) sequence 042. Note missed SP 1487, 1489, and 1630.

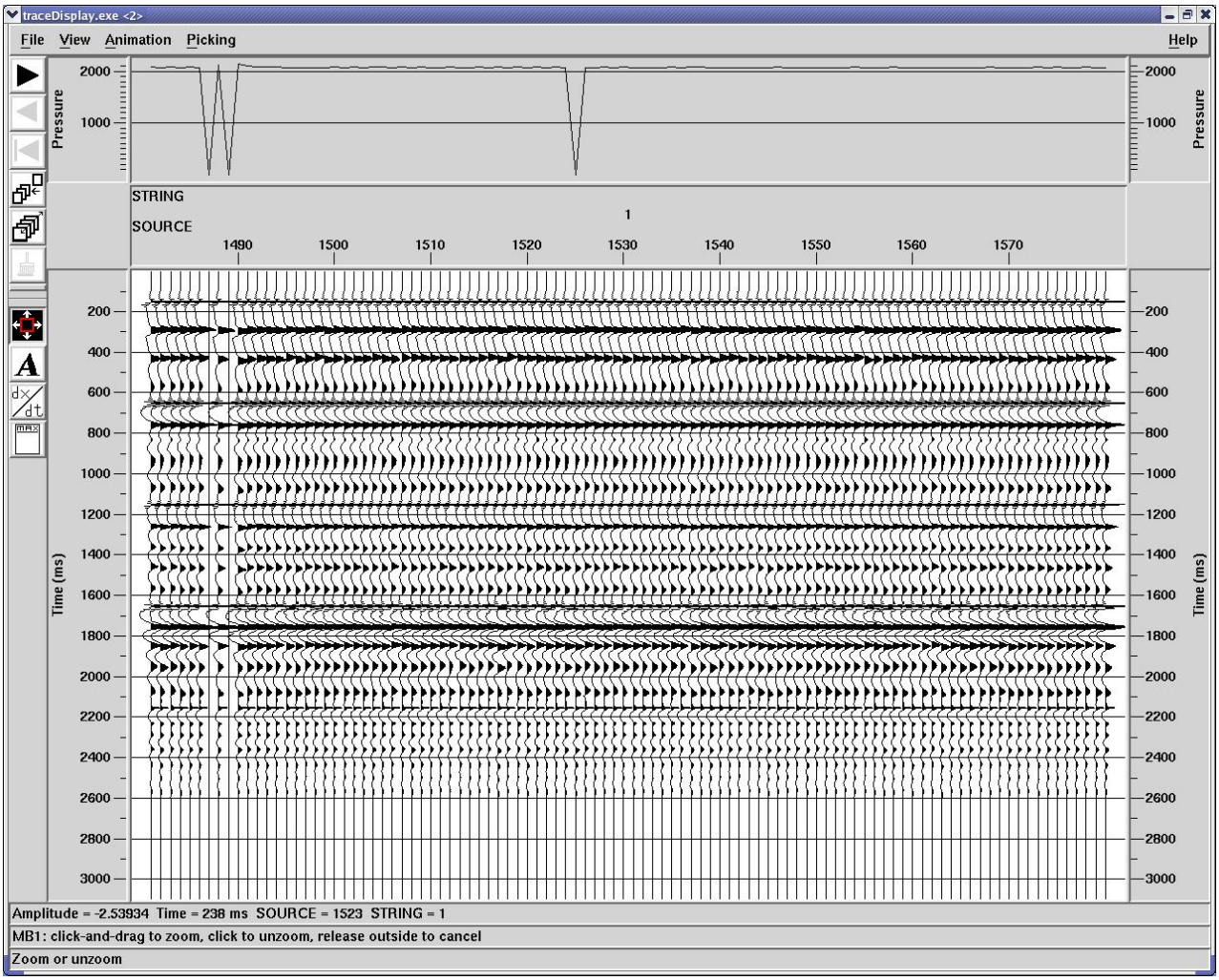


Figure 21-14: QC of vertically stacked near field hydrophones 1 to 6 on gunstring 1 (Auxiliary channels 13 to 18) on sequence 042. Note annotation of gun pressures, dead hydrophone 18 and missed SP SP 1487 and 1489 and missing gun header on SP 1525.

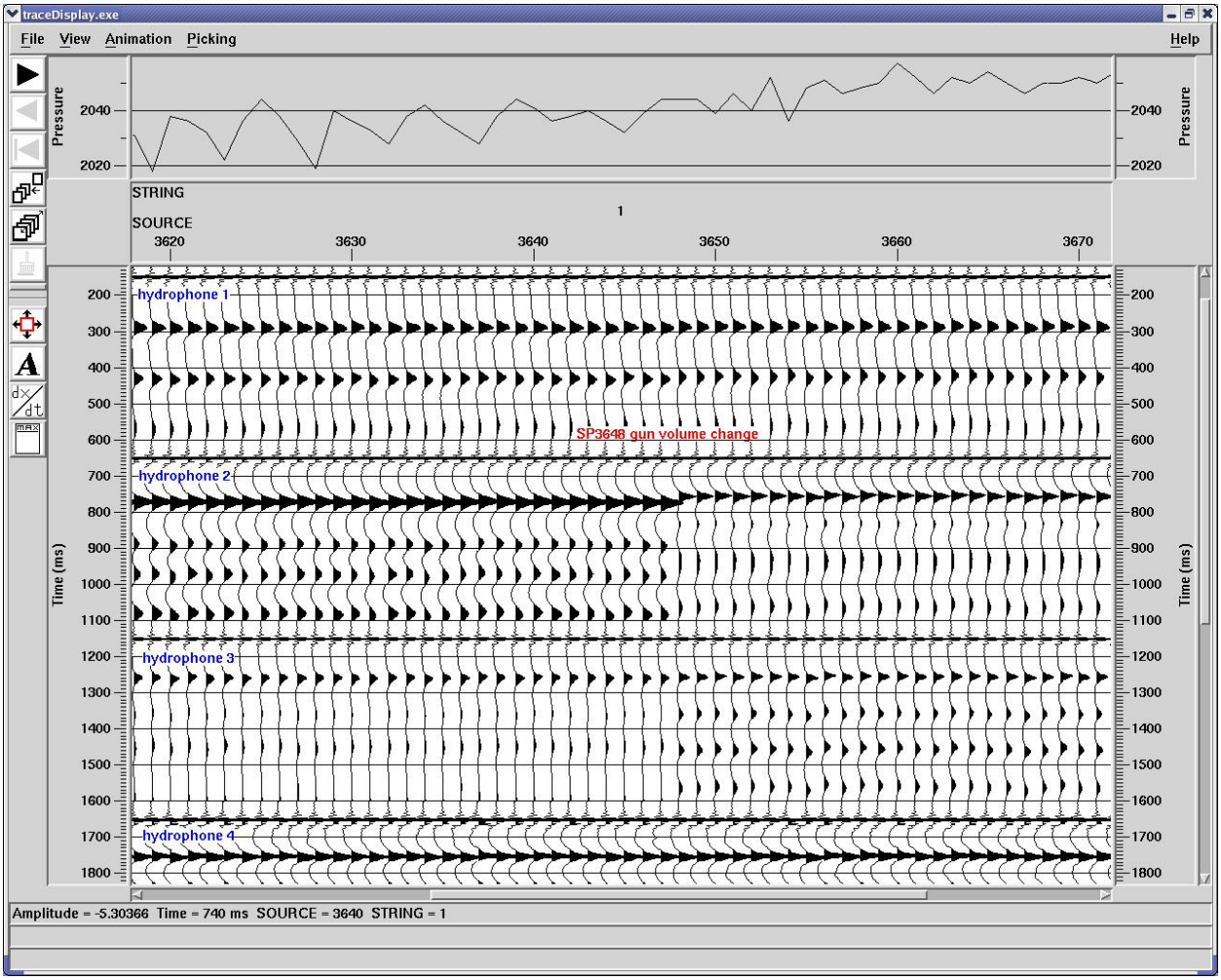


Figure 21-15: QC of vertically stacked near field hydrophones 1 to 4 on gunstring 1 (Auxiliary channels 13 to 16) on sequence 067. Note the gun volume change at SP 3648 evident in hydrophones 2 and 3.

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.

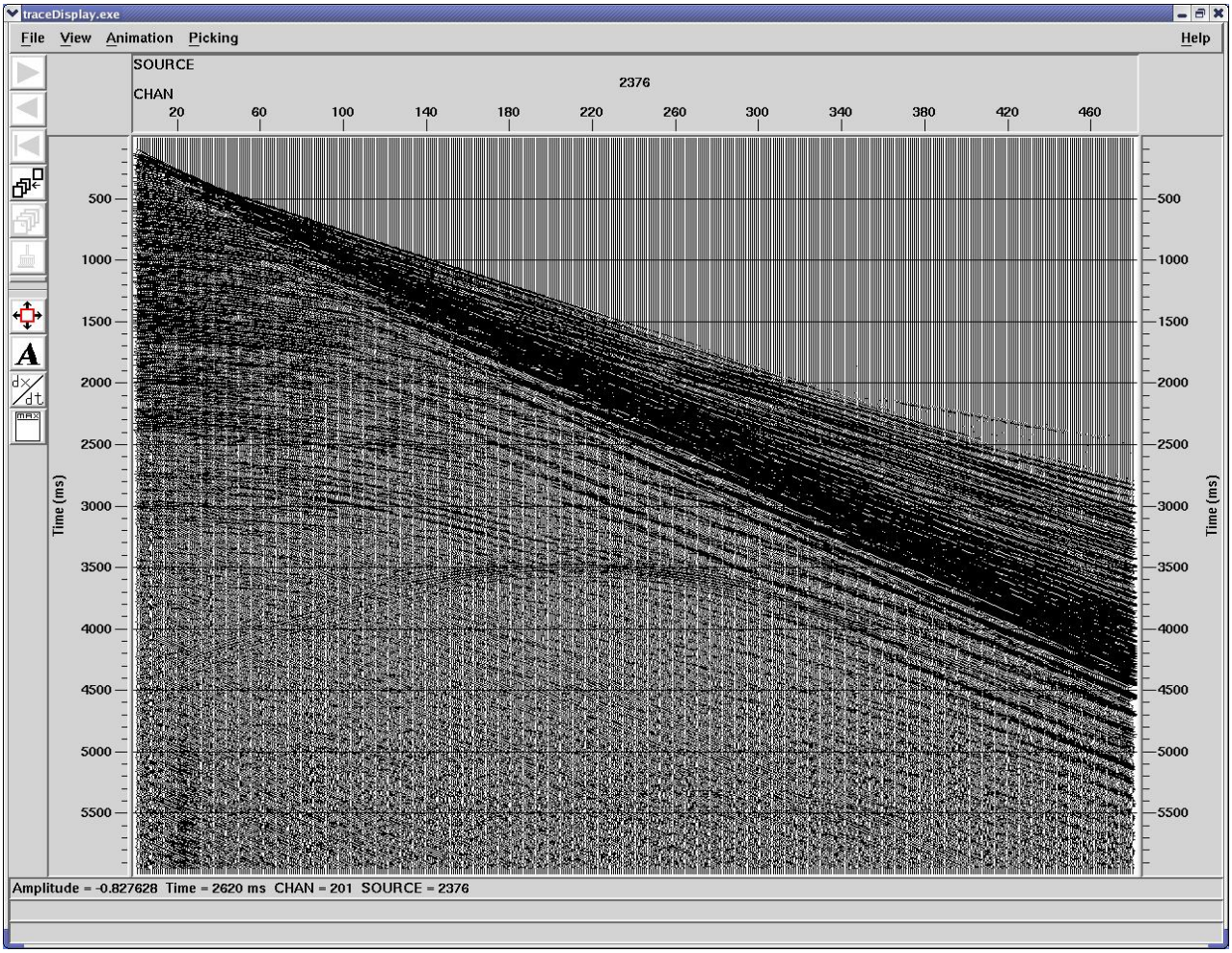


Figure 21-16: Raw shots display on SP 2376 of sequence 010. Note "mudroll", "ringing" and refraction multiples on the longer offsets. Propeller noise is also evident on the first few channels of the cable.

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.

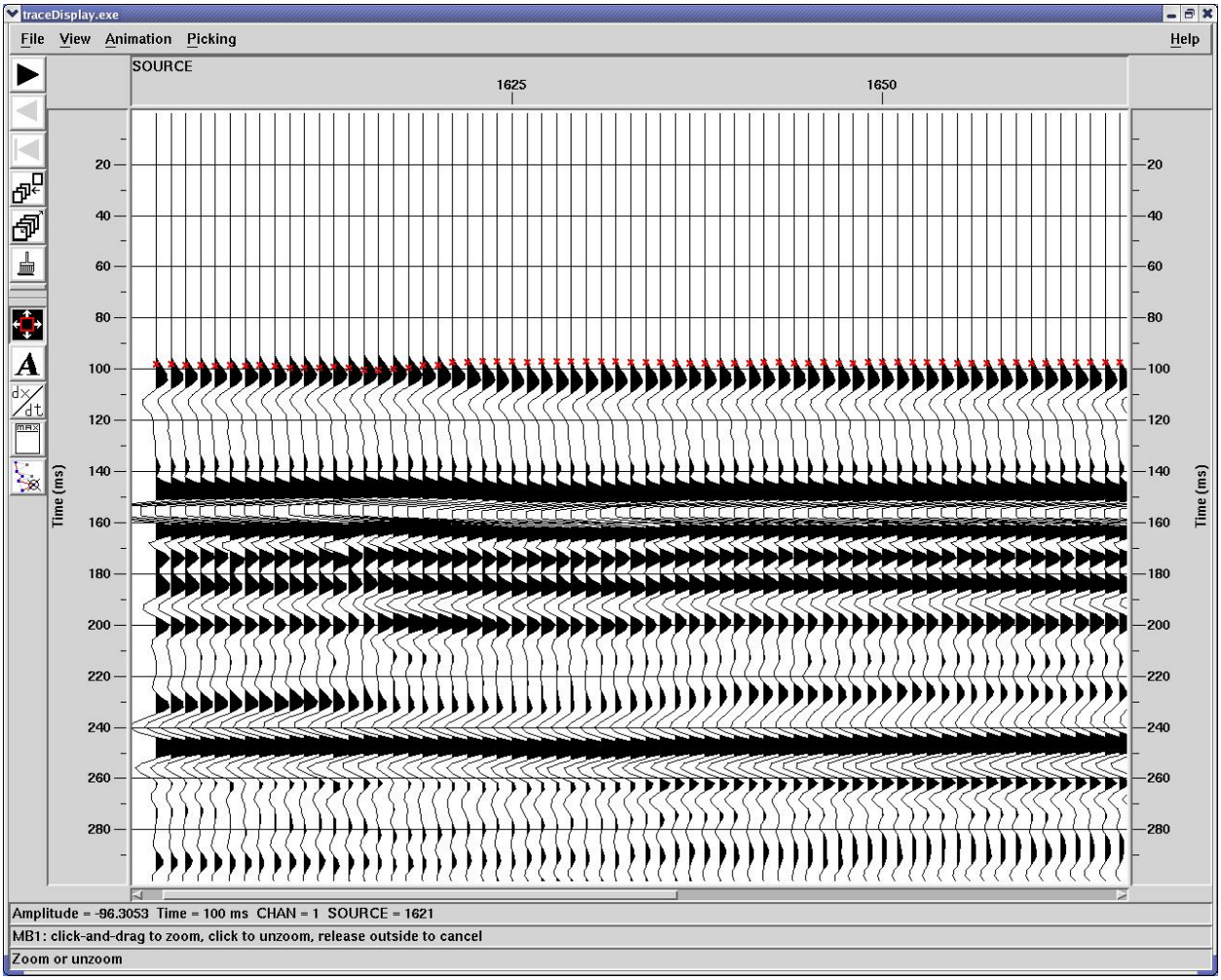


Figure 21-17: Navigation QC display, sequence 027. Robtrack temporarily wandered off-course on SP 1603 to 1621 as seen on the display.

22. Encountered problems

22.1. Propeller Noise

Channels 25 to 40 showed recurring coherent noise. The noise is affecting less than 10% of traces and has a maximum amplitude of 5-10µB. The most likely cause of this noise are waterbottom reverberations of the propeller impulse.

An investigational F-K filter effectively removes this noise with minimal data loss. More thorough testing and a meticulous surgical design of an F-K filter could further optimize noise removal and minimize data loss and introduction of artifacts.

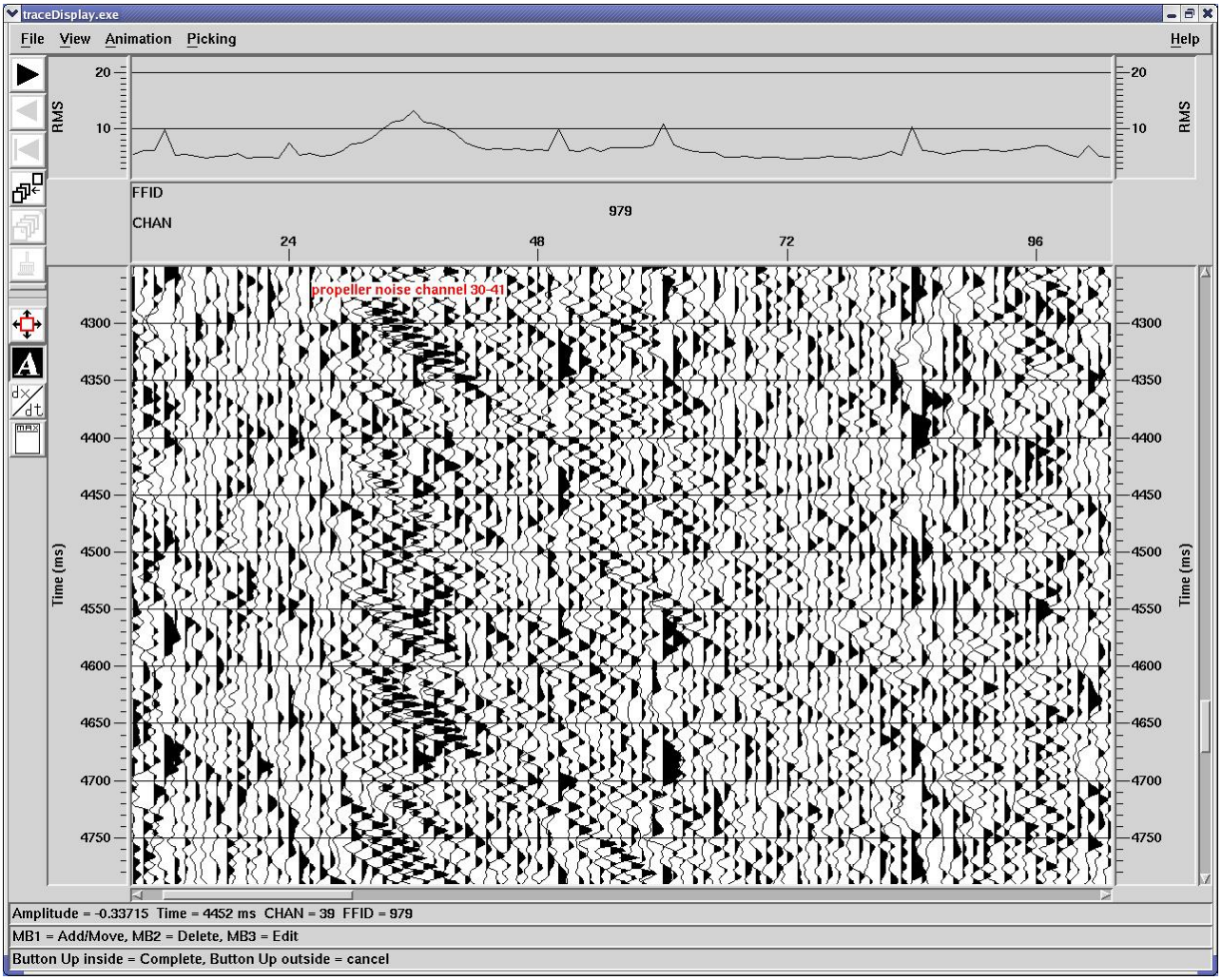


Figure 22-1: Raw shot, zoomed in on the propeller noise on sequence 028. Note the coherent character of the noise.

The following graphs show a noise record with annotated RMS and a Deep RMS window to further highlight the characteristics of the propeller noise.

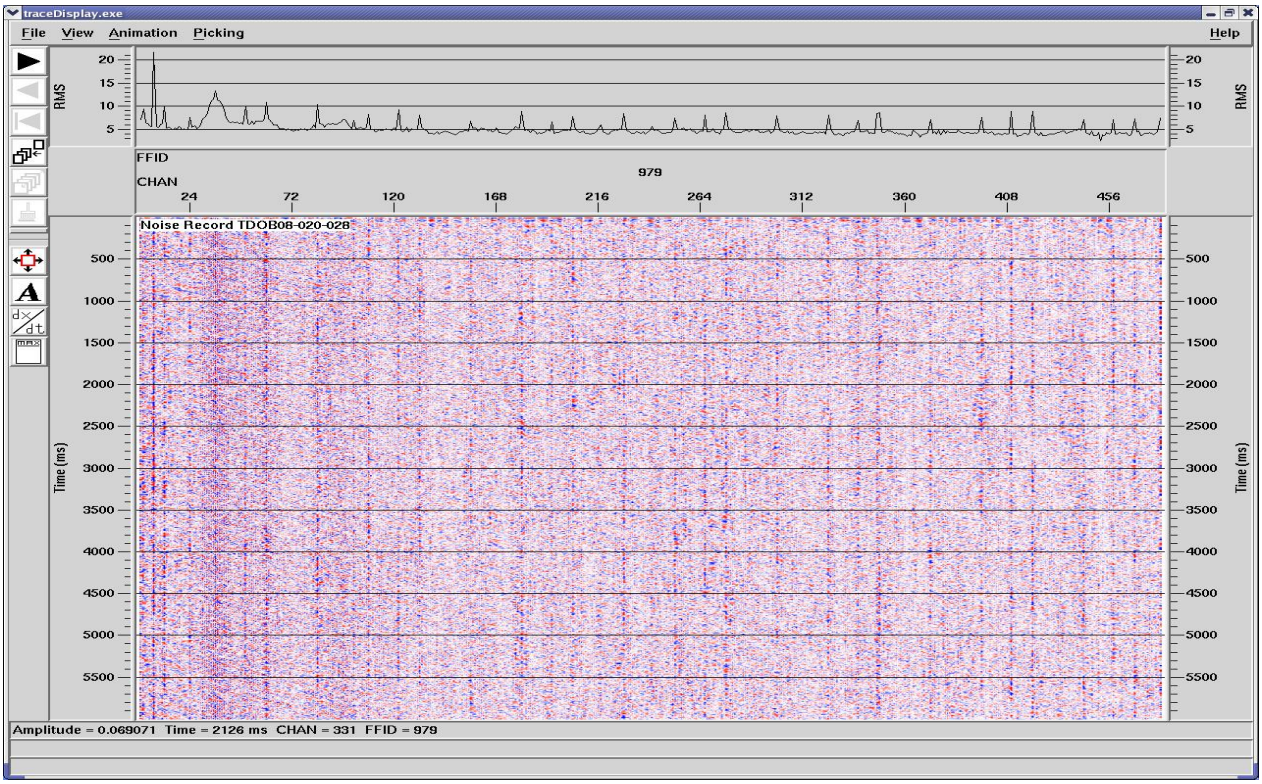


Figure 22-2: SOL noise record for sequence 028 with annotated RMS graph on top of the record. Note propeller noise of 5-15µB on channels 25 to 40.

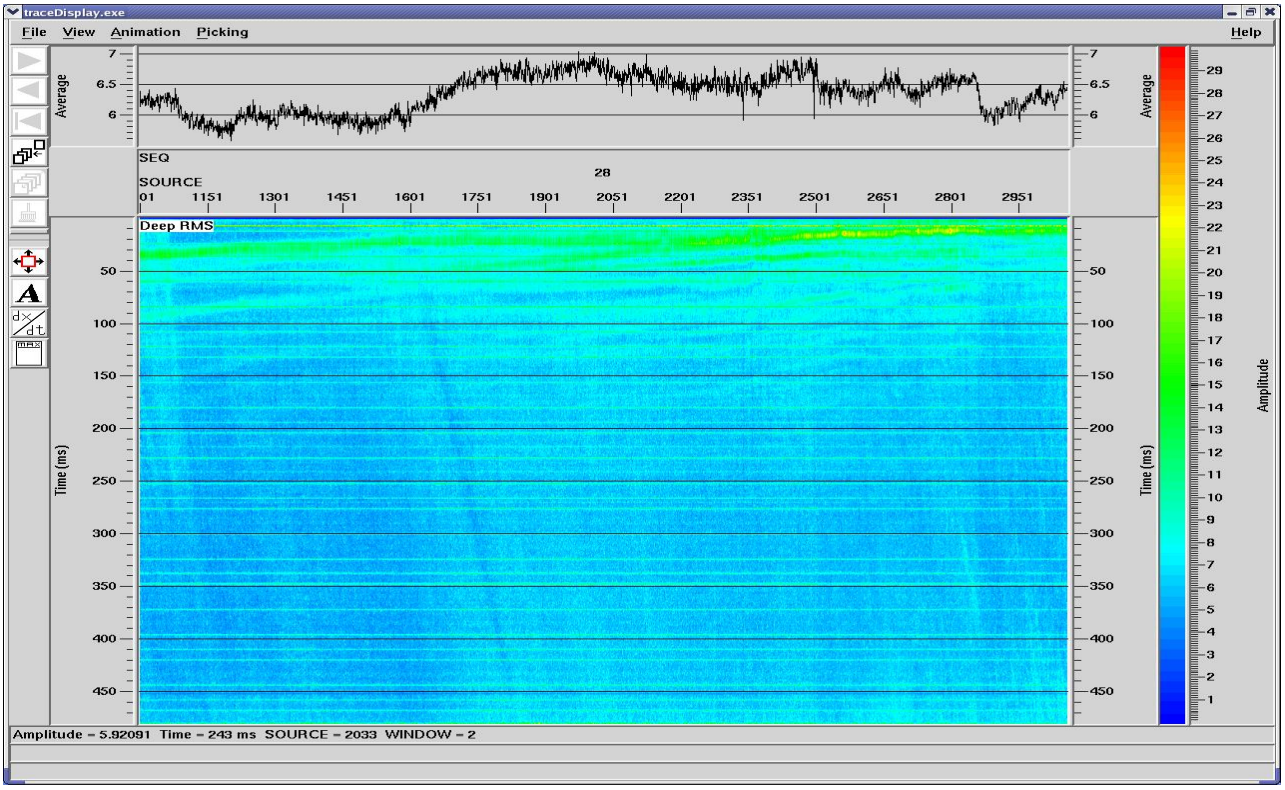


Figure 22-3: Deep RMS window for sequence 028. Note noise on channels 25 to 40.

22.2. **Shipnoise**

Shipnoise of 9.0 uB was encountered on sequence 046. It affected shotpoints 1621-1485, however, the brute stack yielded was still good.

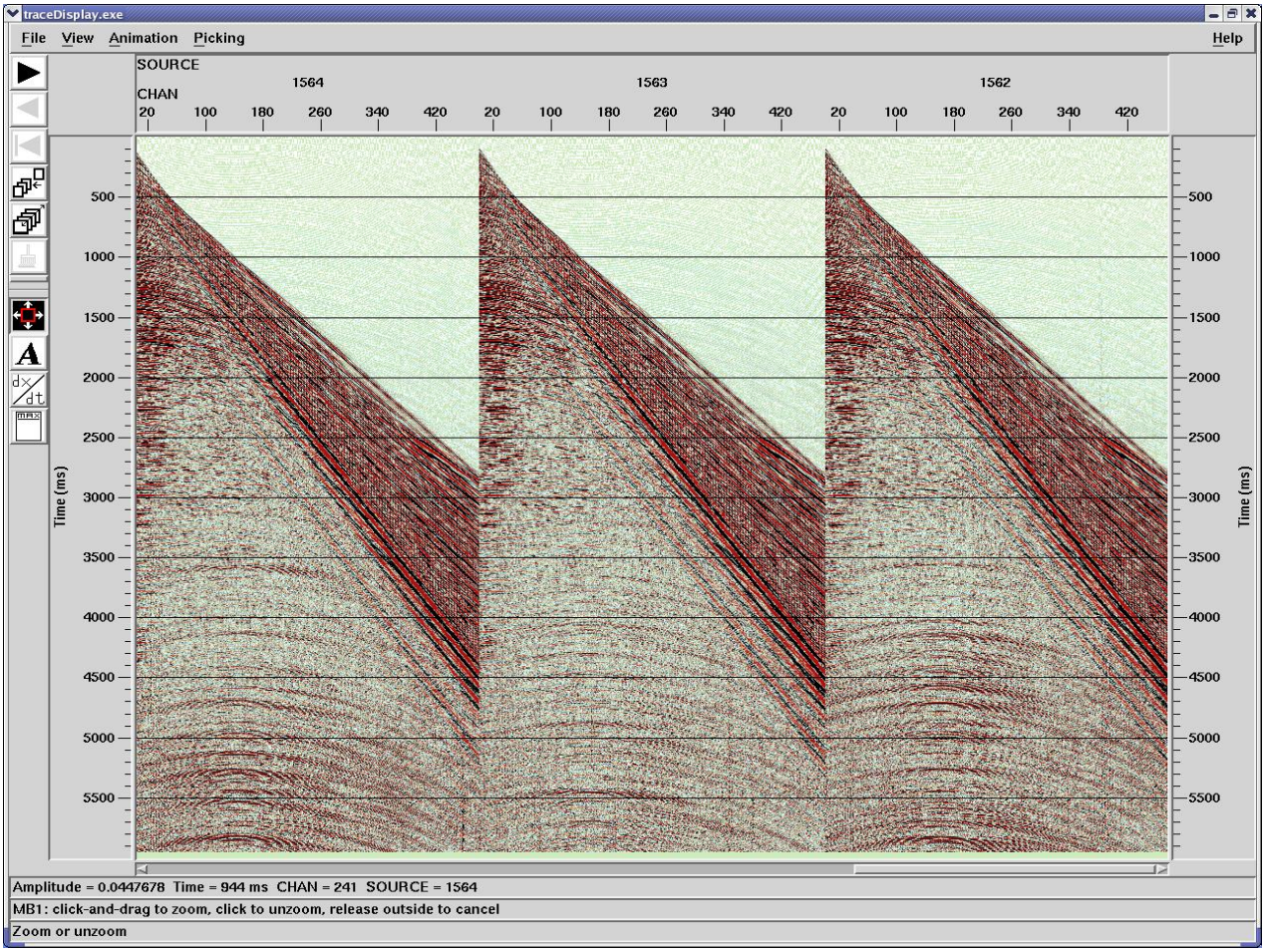


Figure 22-4: Shipnoise on shot gathers SP 1564-1562 for sequence 046.

22.3. Swell noise

Weather conditions over the survey period were varied. In general, the weather was good, with swell heights 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 25ub. Because of the high fold of coverage, this noise invariably stacked out, even with no noise attenuation processes applied to the data.

Sequences 059 up to end of job were shot during swell heights of 5.0 meters and contained strong swell noise varying from 10-12 uB. Streamer was set to 9.0 meters due to sea state on sequences 063-065 and as per client's request on sequences 060-061. At its peak, the swell bursts affected about 30% of the traces and stacked occasionally within the prospect's target area of 2seconds.

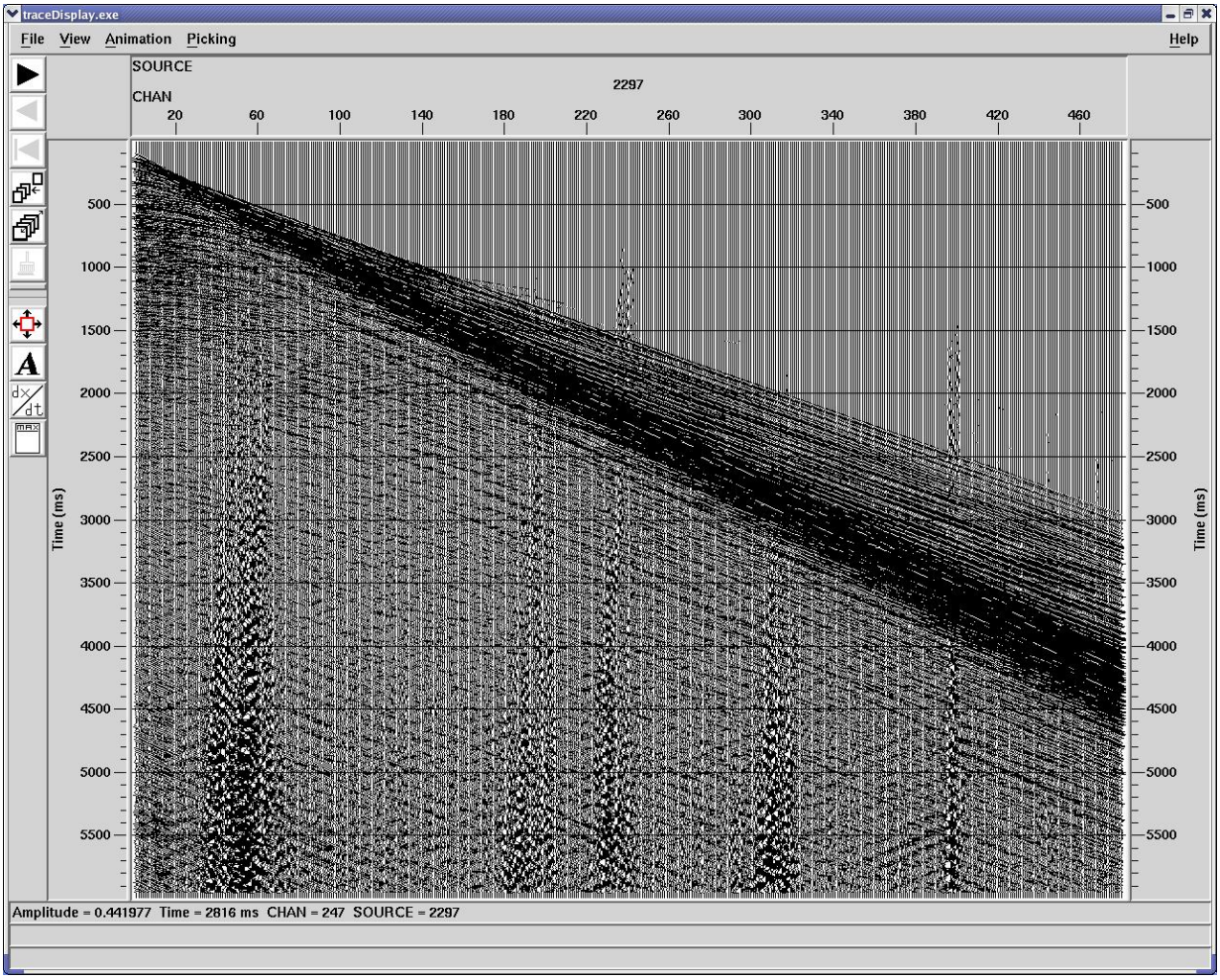


Figure 22-5: Shot gather of SP 2297 for sequence 038. Swell noise affecting approximately 30% of traces is evident.

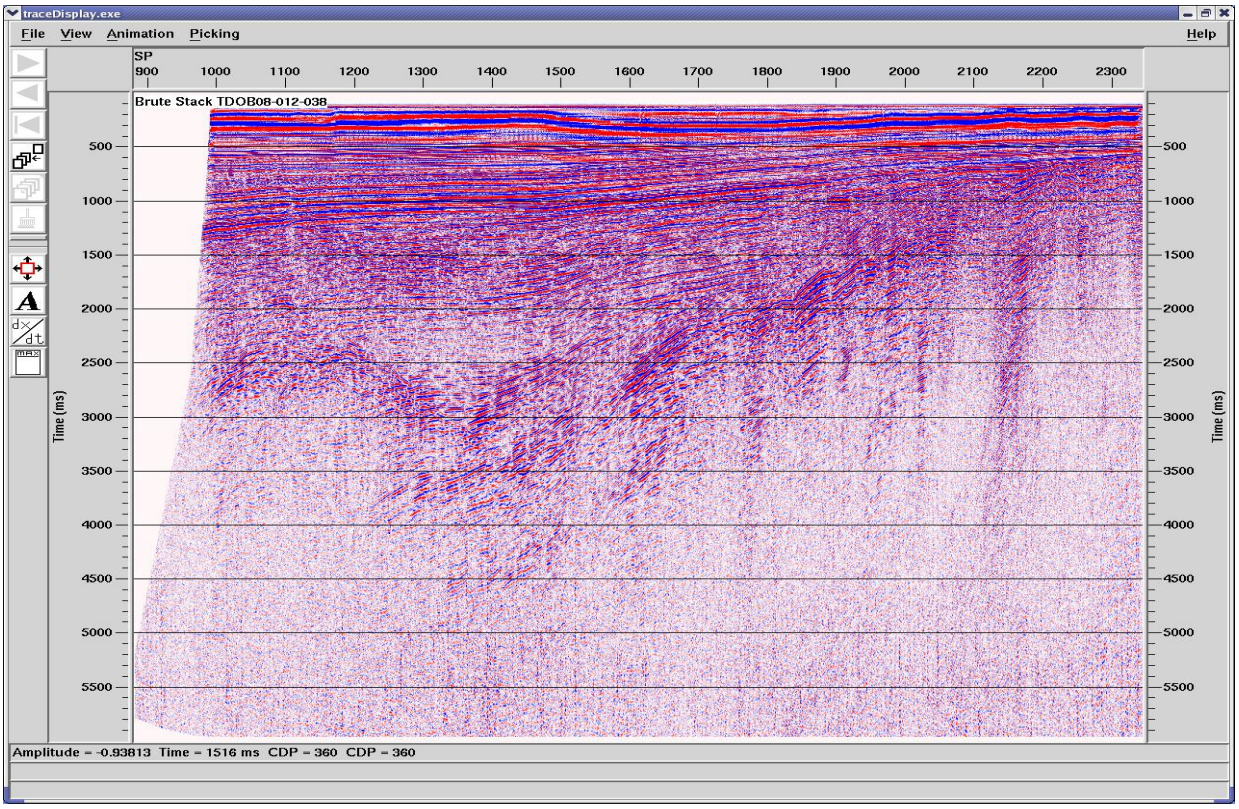


Figure 22-6: Brute stack for sequence 038. Bottom third of stack affected by slight swell noise, some bursts reaching into target area.

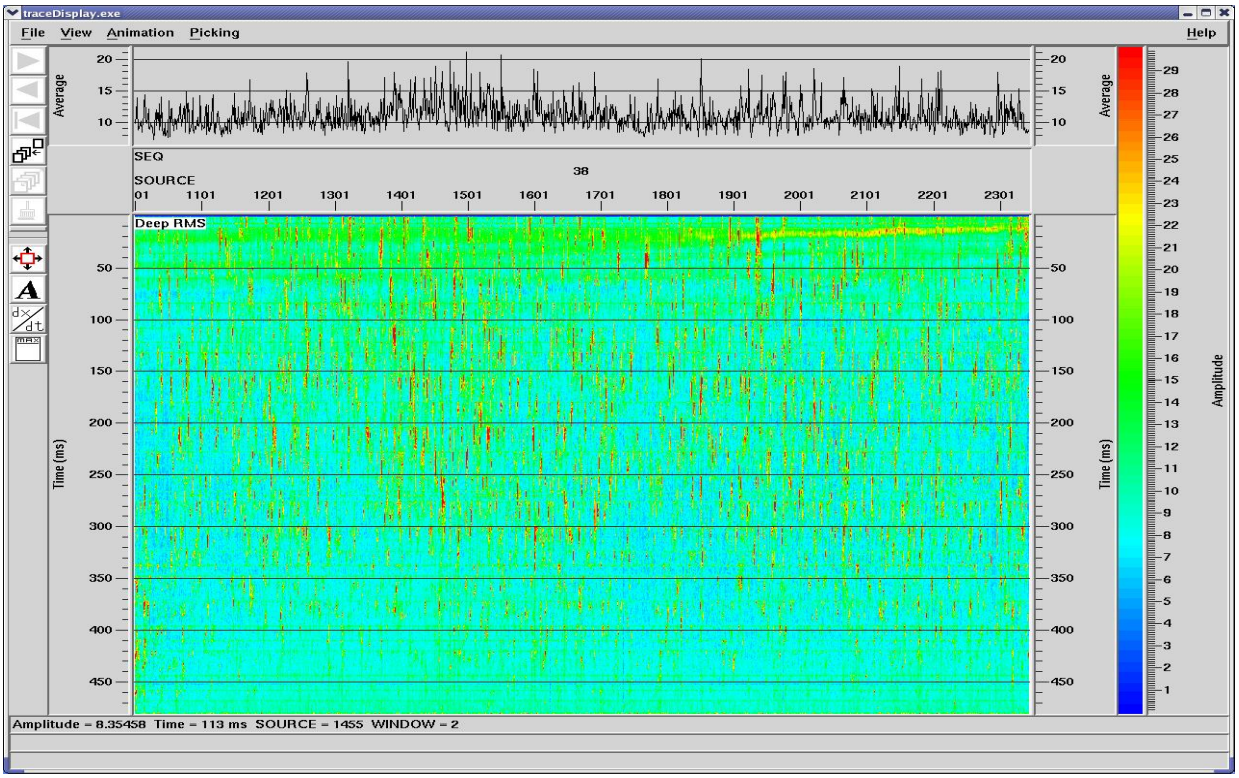


Figure 22-7: Deep window shot vs. channel RMS for sequence 038.

22.4. 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 uncompleted or missing headers as autofires, which was closely investigated to ensure correctness.

Gun delta errors, missing headers and etc. were marked both in the Observer Logs and in the QC logs. Sequence 066 was not to be processed due to airleak on gun string 2-4.

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

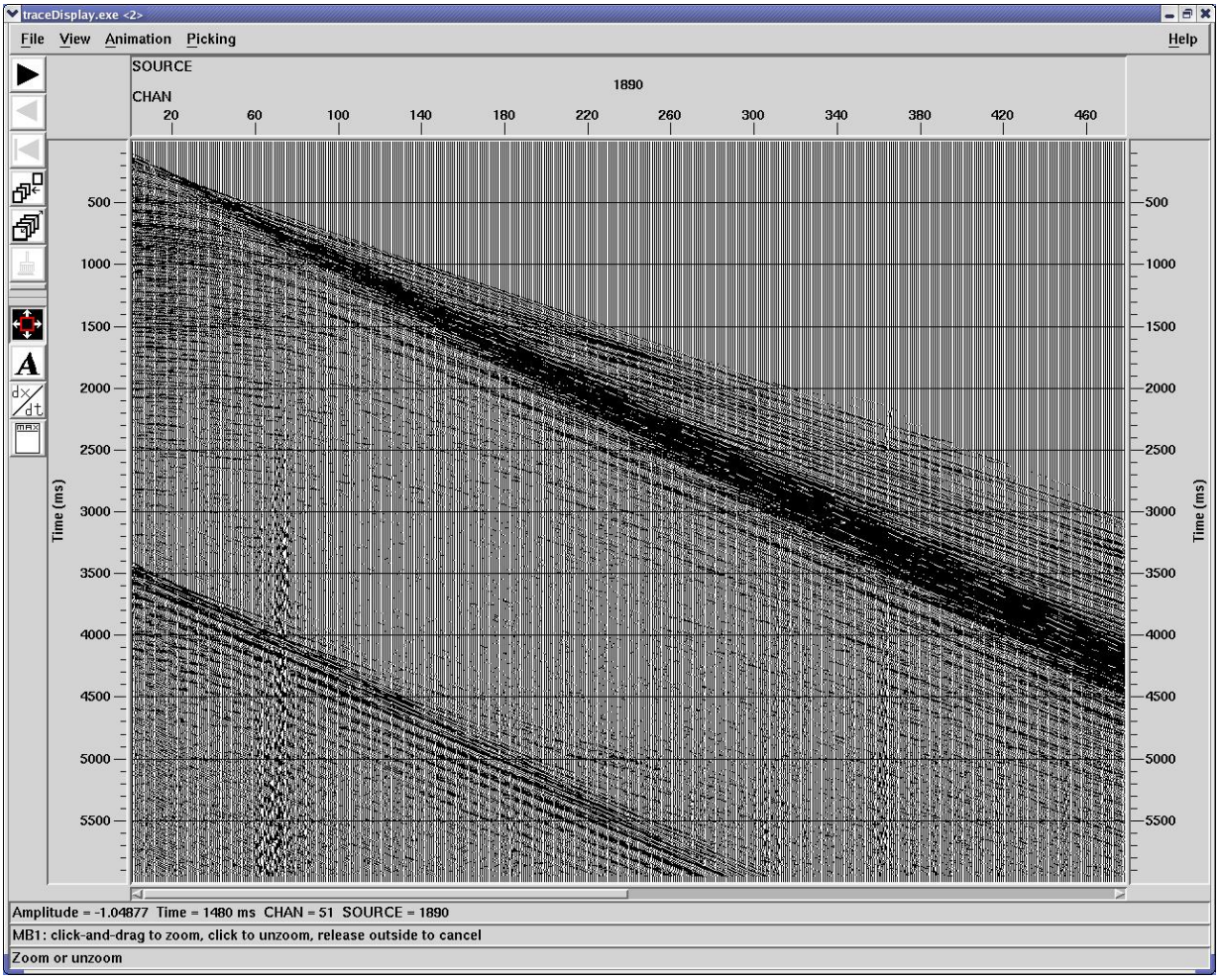


Figure 22-8: Autofire on SP 1890, sequence 062.

22.5. 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.

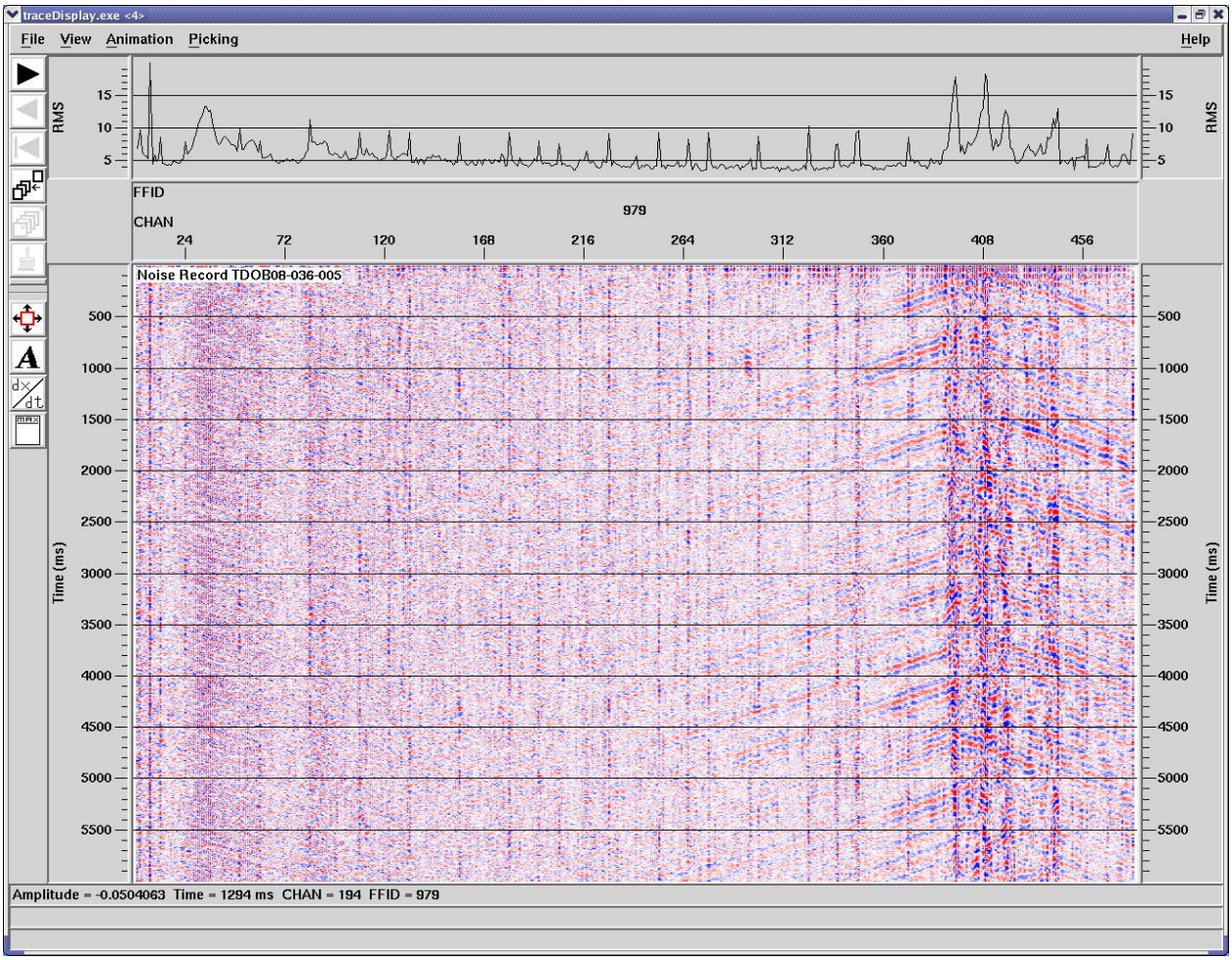


Figure 22-9: SOL noise display of sequence 005. Streamer still in turn while SOL noise records were taken.

22.6. Channels Edits

The number of bad channels did not exceed 1.7% for the entire survey. Channel 270 was particularly spiky for 17 sequences while channel 7 has been consistently noisy all throughout the survey. Other channel edits included those which failed the instrument tests based on observer logs.

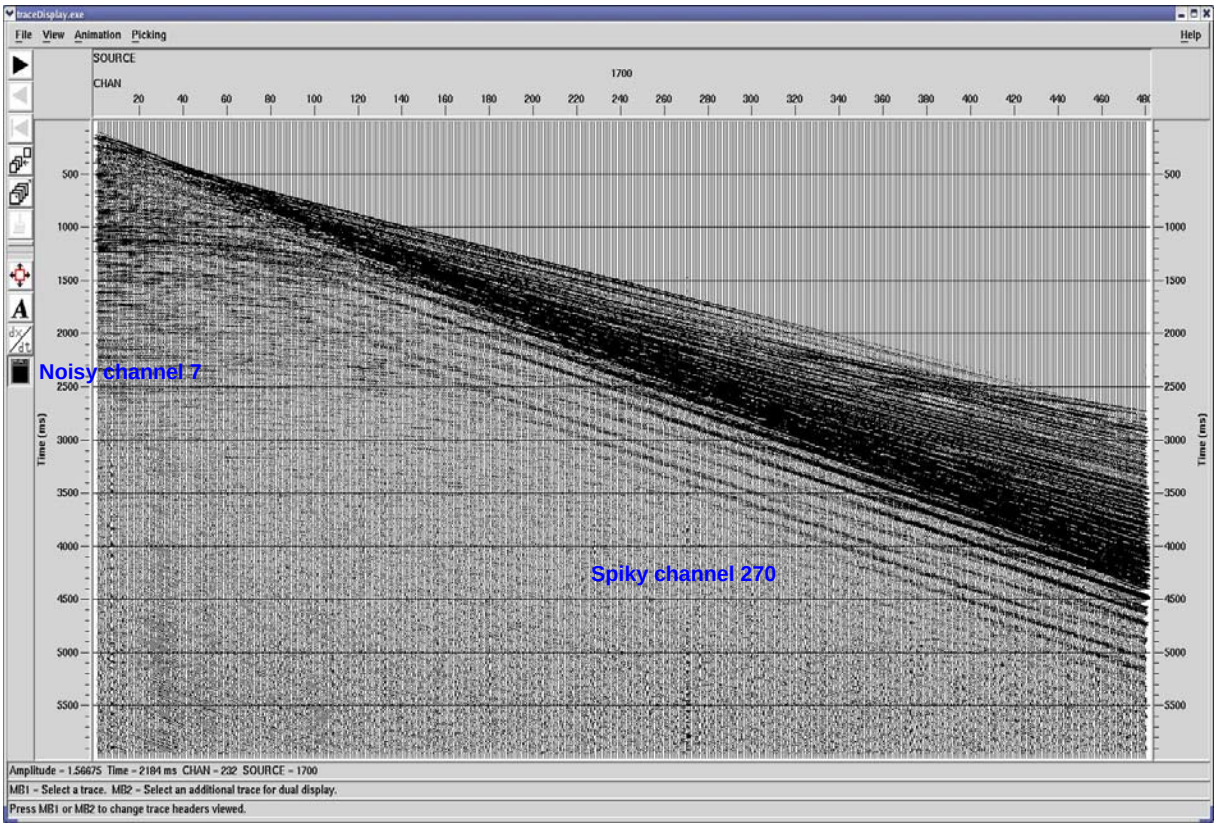


Figure 22-10: Shot gather of sequence 020 showing noisy channel 7 and spiky channel 270 as trace edits. Note propeller noise on the first few channels of the cable.

22.7. 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.

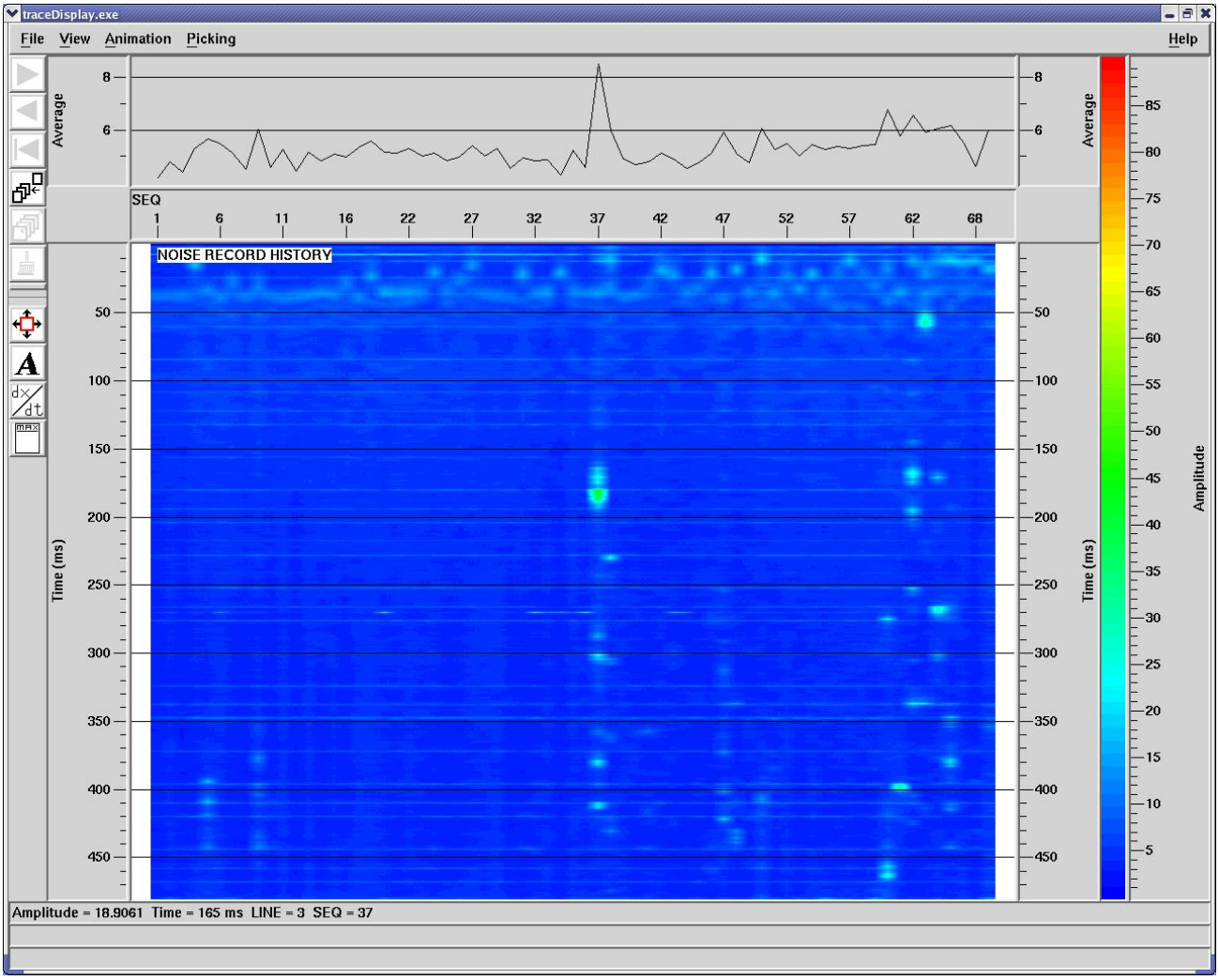


Figure 22-11 : Noise history display for sequences 001 to 069.

22.8. RMS history displays

The following display shows the line average RMS for each individual channel on the streamer for Sequences 001 to 069, calculated from the shallow RMS window at 50 to 500 ms.

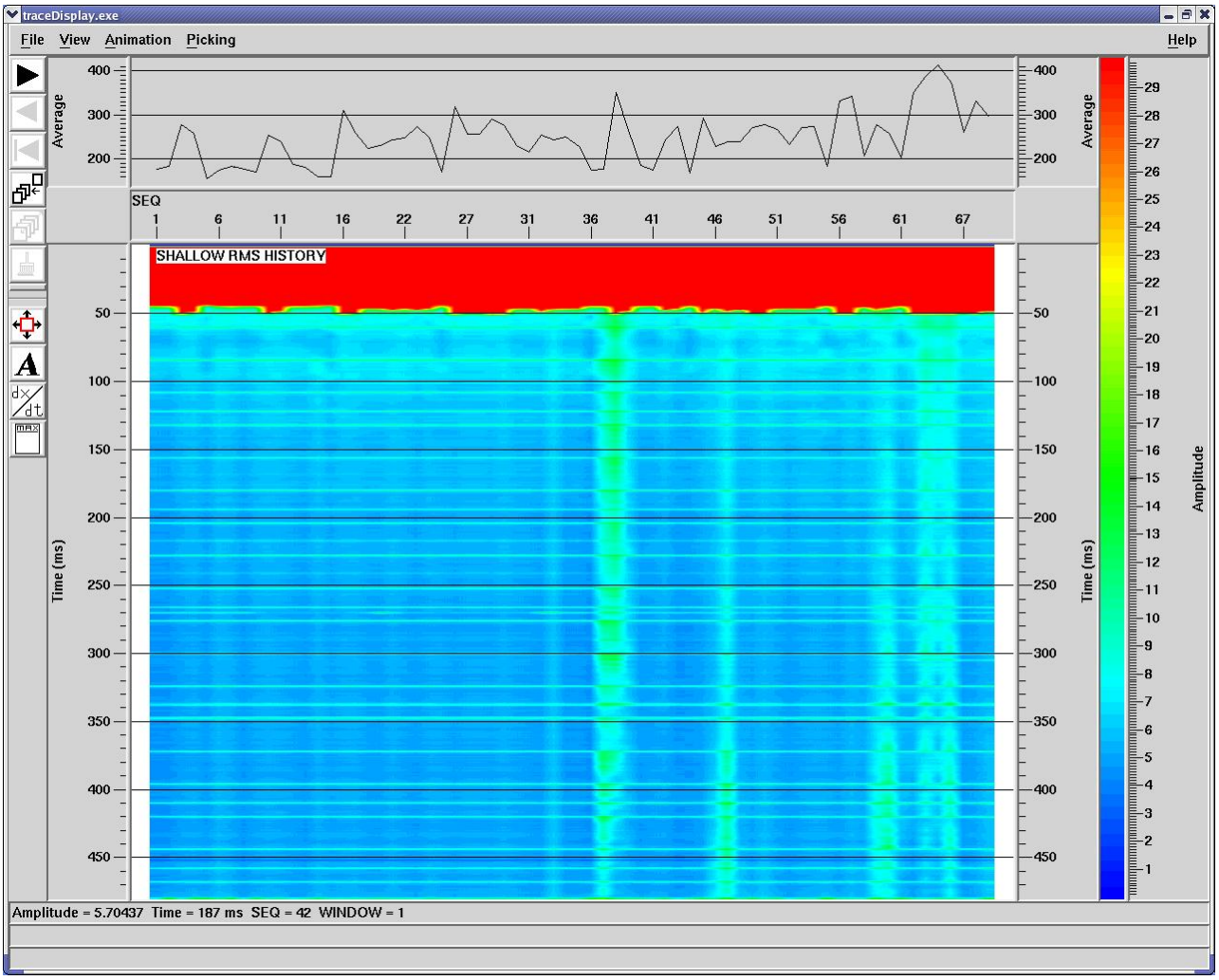


Figure 22-12: Shallow RMS history display for sequences 001 to 069. Notice the first 50 channels are dominated by the direct arrival energy.

The following display shows the line average RMS for each individual channel on the streamer for Sequences 001 to 069, calculated from the deep RMS window at 5450 to 5950 ms.

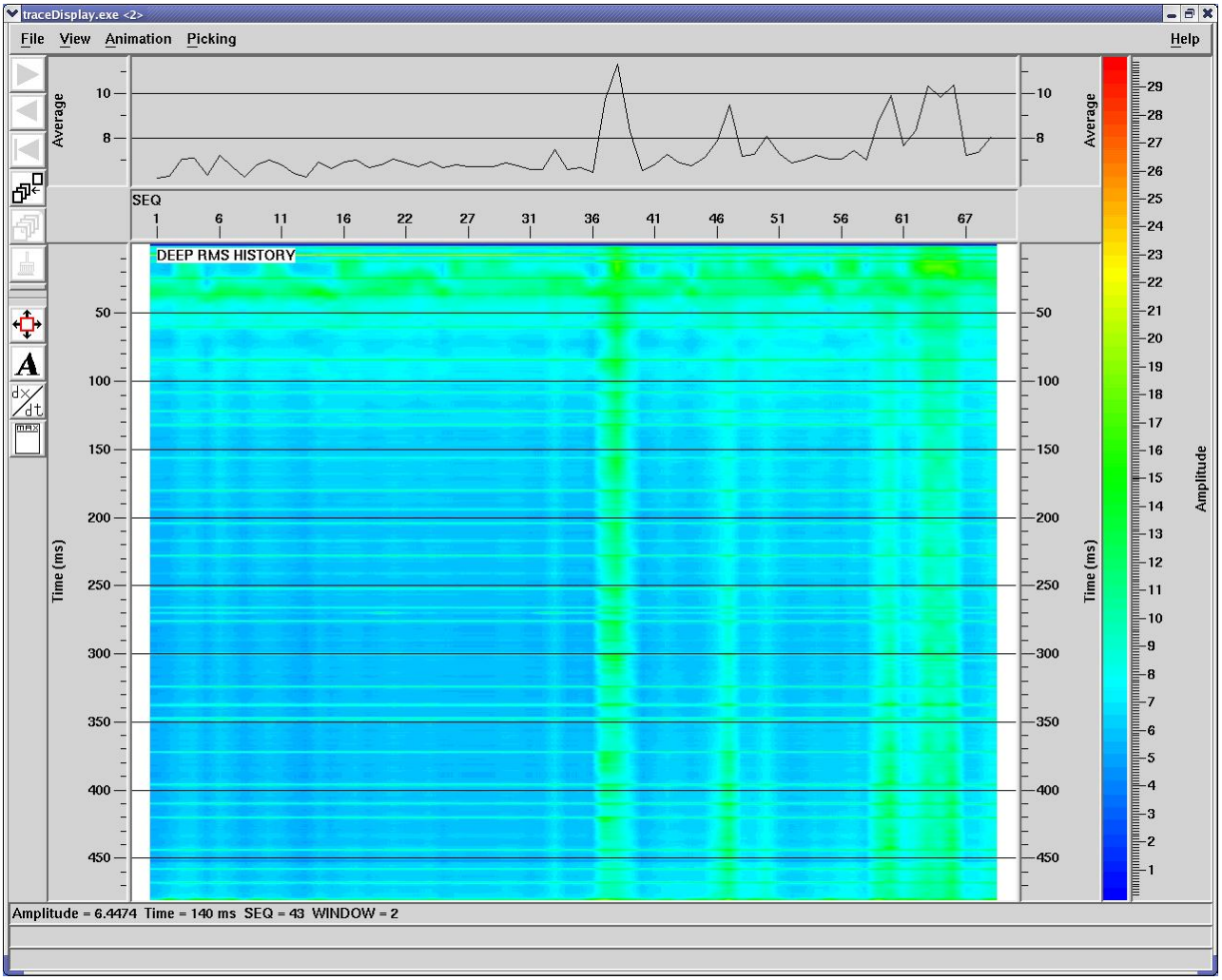


Figure 22-13: Deep RMS history display for sequences 001 to 069. Note strong swell noise affecting almost the entire lines on sequences 36 to 38 and sequences 59 to 65, and noise on channels 15-40. Channel 7 is consistently noisy throughout the survey.

23. Conclusion

Overall the data recorded on this survey was of good quality, helped by good acquisition conditions with low extraneous noise levels, except for some periods of heavy swell noise.

A total of 69 sequences were shot, mostly of good quality. Sequence 18 and 66 were not to be processed due to seal crash and air leak. The number of bad channels did not exceed 1.7% for the entire survey.

Swell noise was evident, near the end of survey as weather picked up, with a maximum ambient RMS of 7.0 uB. Sequence 036-037 was efficiently dealt with by swell noise attenuation processing. Other sequences affected by swell noise yielded relatively clean stacks despite of evident swell bursts on the shot gathers and near trace display.

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, on lapping 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.

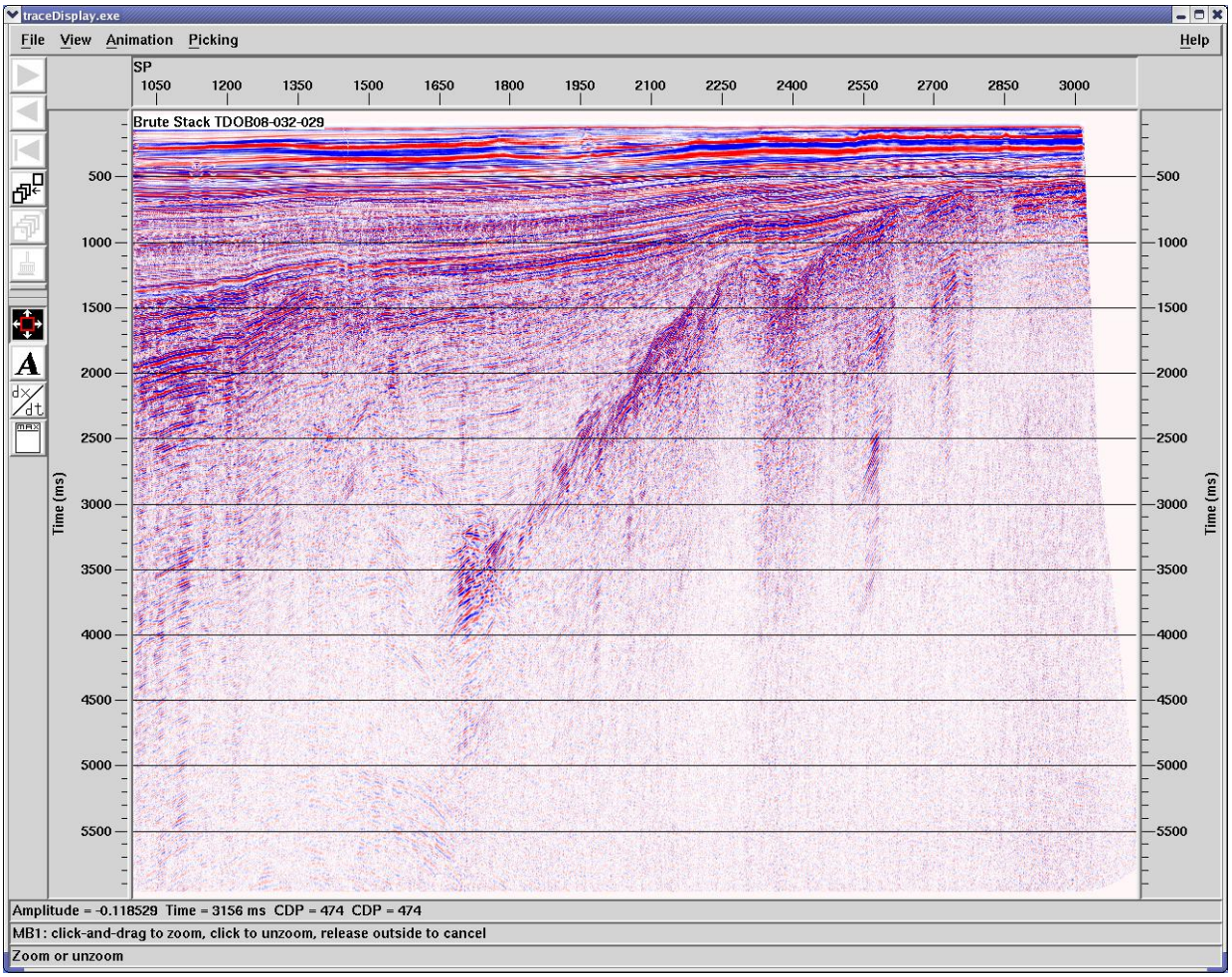


Figure 23-1: Brute stack of sequence 029.

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

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 TDOB08-025-068                SP: 1001-3887     CDP: 1-6012
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 MAY 2008
C39 END EBCDIC
```

24.2. Shipment

QC deliverables were included in the Primary and Copy Tape Shipments. The following QC products were shipped to the client at the end of the survey:

Shipment No: PT-2008-031 (Primary data)

Date: 07th May 2008

Contents cover Sequences: 001 to 069

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:

3D Oil Limited

164 Flinders Lane

Melbourne VIC 3000

Australia

Attn: Jon Keall

Shipment No: PT-2008-032 (Copy data)

Date: 07th May 2008

Contents cover Sequences: 001 to 069

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:

Fugro Seismic Imaging Pty Ltd

69 Outram Street

West Perth, WA, 6005

Australia

Attn: Simon Stewart

24.3. QC Line log

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

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

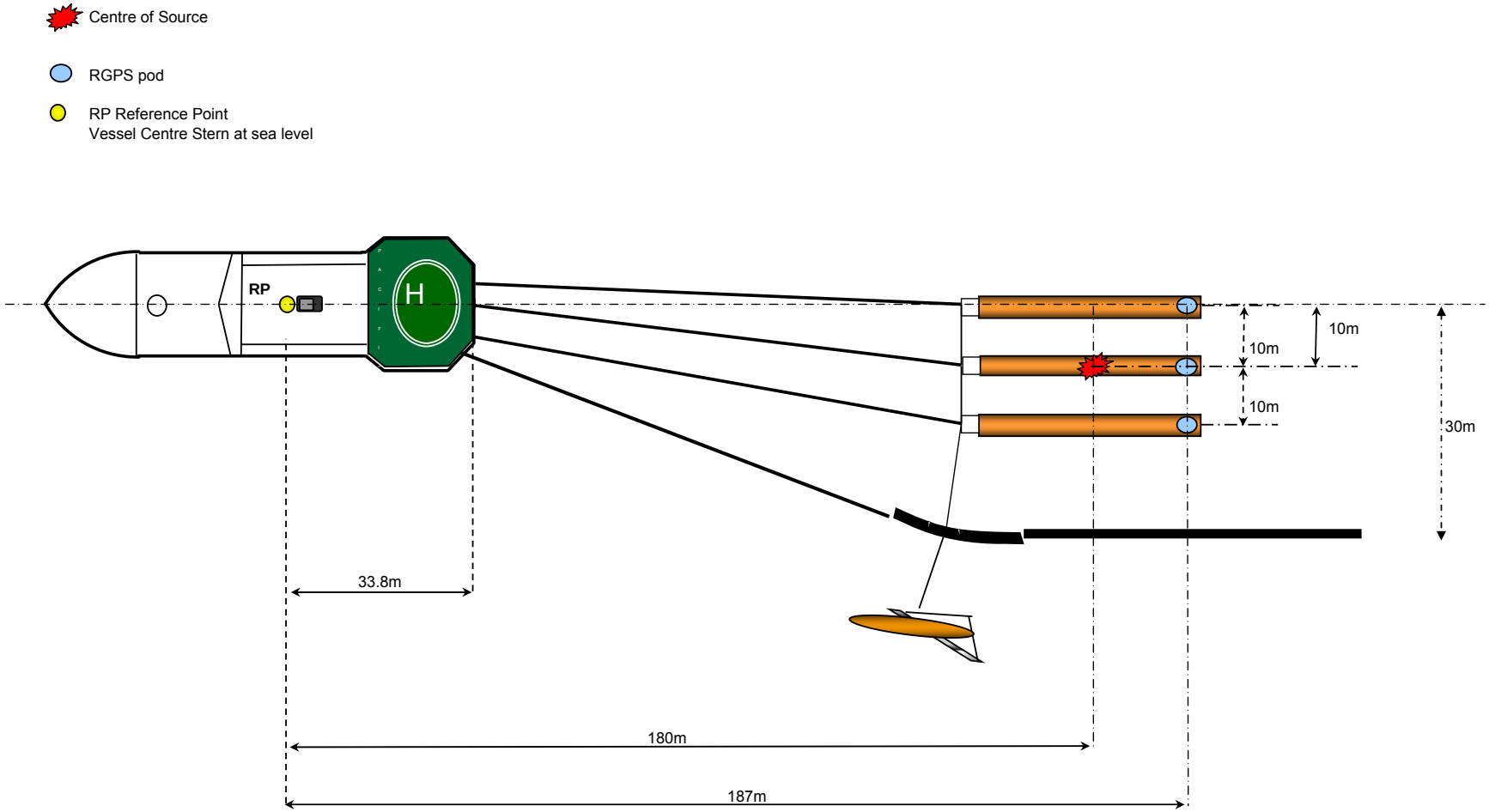
Spectra Name	***GPS Feed***	***Position Type***
V1G1	SPM1	SPM 5.16 XP
V1G2	SPM2	SPM 5.16 HP
V1G3	SPM2****	Mulifix 5 XP
V1G4	SPM2	SPM 5.16 XP
V1G5	SPM1	SPM 5.16 HP

**** V1G3 was fed by SPM1 gps receiver from seq #25 to the end of the survey.

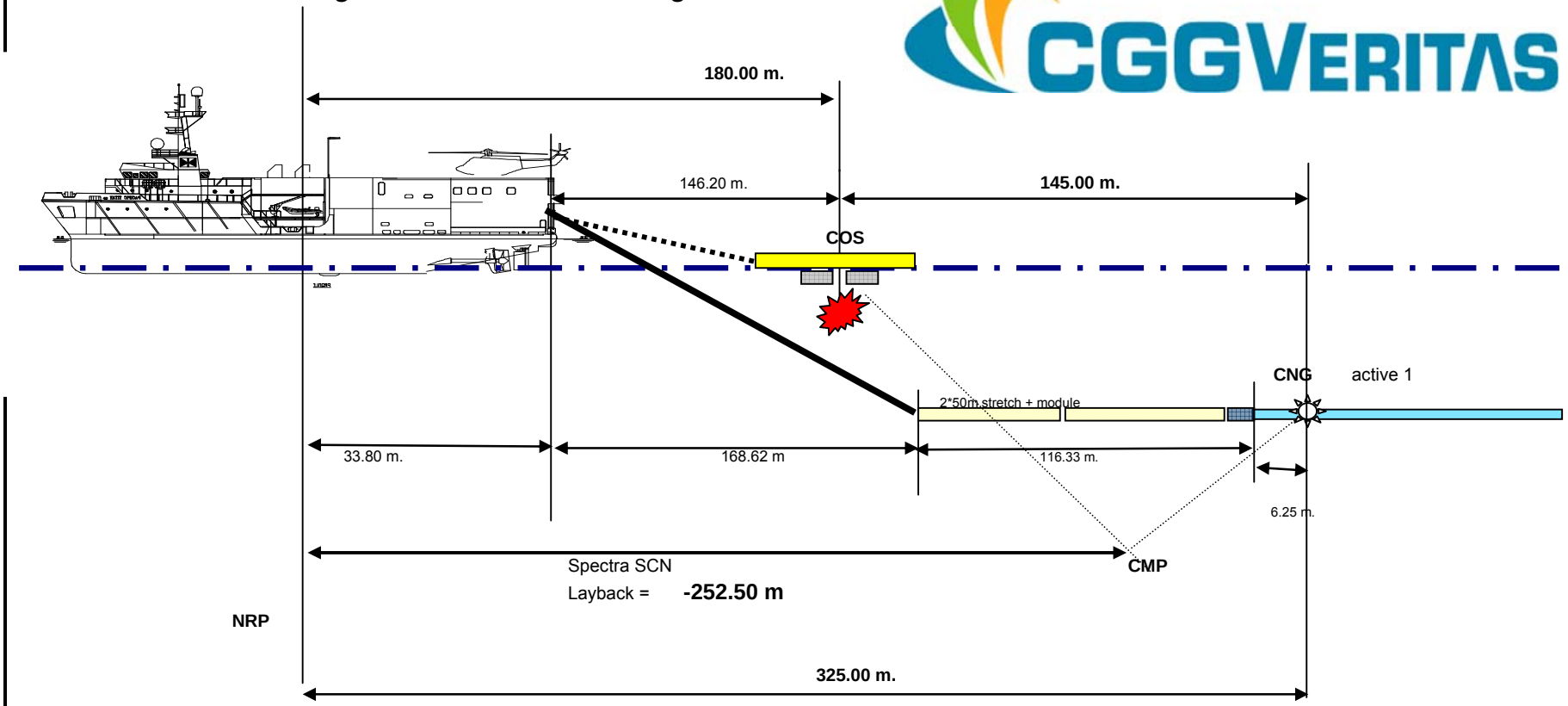
RGPS Reference Guide

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

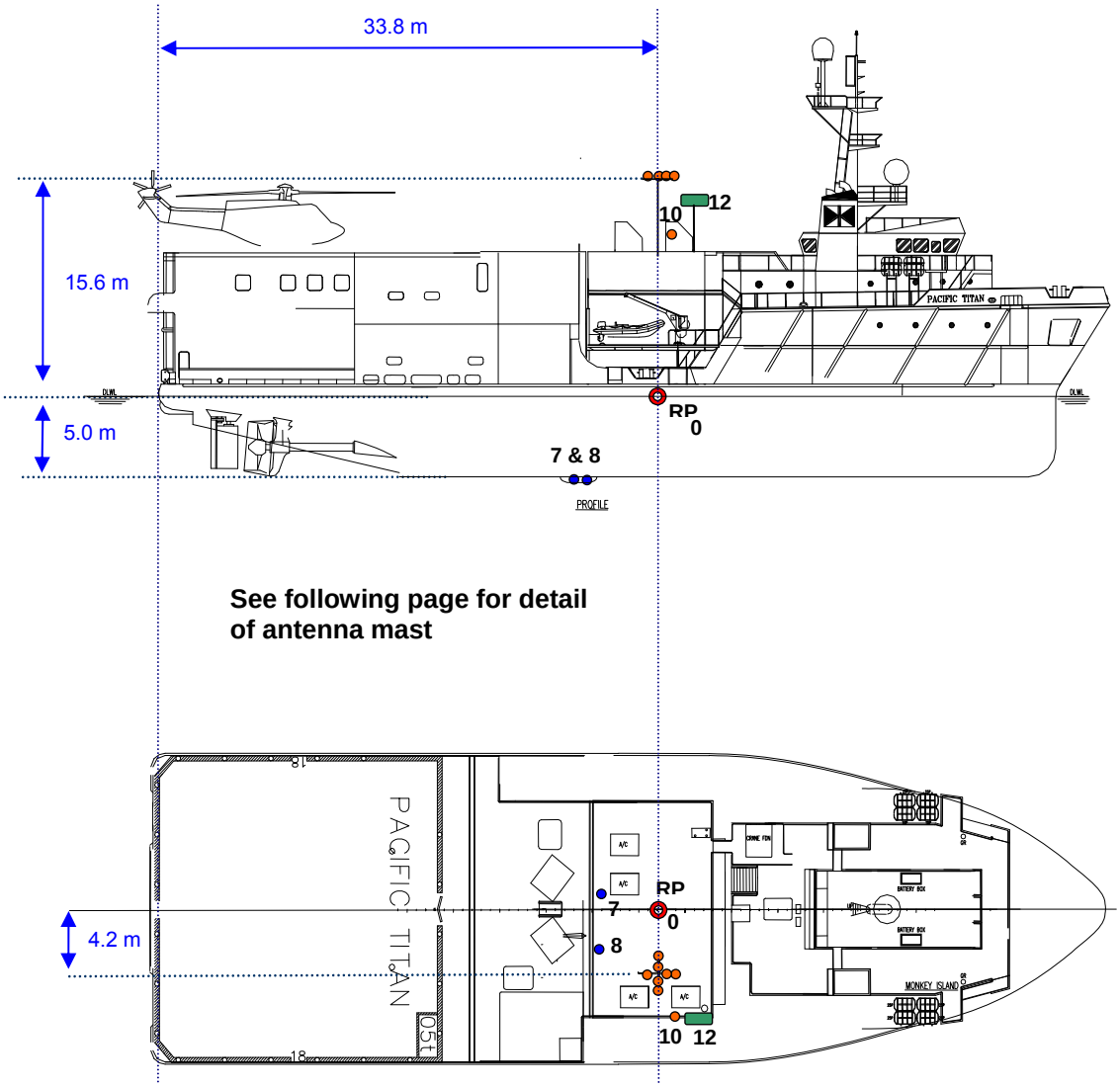


Principal Distances:			Principal Offsets:		Used as:
NRP-Stern	33.80 m.		COS-CNG	145.00 m.	
Stern-COS	146.20 m.		**NRP-CMP**	**-252.50 m**	**Spectra SCN Layback**
Stern-CNG	291.20 m.				
NRP-COS	**180.00 m.**		**NRP-CNG**	**325.00 m.**	**Offset from NRP**

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

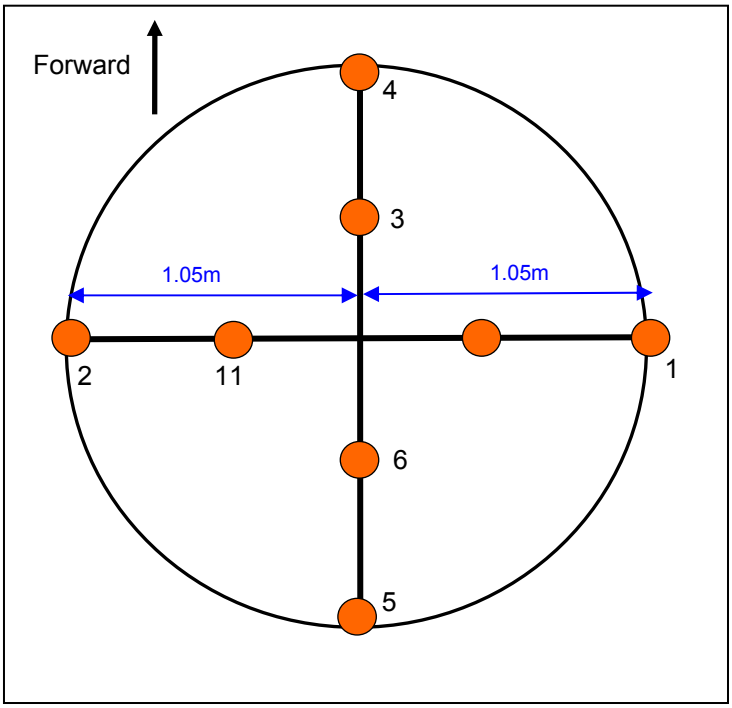
Key:	
NRP	Navgation reference point (centre of mast @ sea level)
COS	Centre of source
CNG	**Centre of near group (Trace # 001)**
CDP	Common depth point
NTRP	Near trace reflection point

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: 3D Oil
Job: 6374
Area: T41P

Line Name	Seq	FOSP	FCSP	LSP	LOSP	Line Status	Processing Comments
TDOB08-044-001	1		1001	1606		Complete	Loss of speed at Sp 1595 dw to 3.5Kts Speed back up to 4.3 Kts Sp1604
TDOB08-030-002	2		1608	1001		Complete	No E33 records for Sps 1532,1090,1077
TDOB08-022-003	3		1001	3097		Complete	Tailbuoy dropped out @ sp 1422 No E33 Record for Sps 981,1530,2436 TBR1/TBR2 global rejected
TDOB08-036-004	4		3022	1354		Complete	Tailbuoy 1 Dead @ SOL Line shut down early due to loss of recording system LGSP Sp 1354 No E33 Record for Sps 2586,2116,1501 S1C8,S1C9,S1C20 failed compass bias
TDOB08-036-005	5	1473	1353	1001		Complete	Tailbuoy 1 Dead @ SOL Seq 005 is a continuation of Line TDOB08-036 after recording system problems on Seq 004
TDOB08-050-006	6		1001	1631		Complete	Tailbuoy 1 Dead @ SOL No E33 record for SP 1534 S1C2 and S1C20 failed compass Bias.
TDOB08-034-007	7		1601	1001		Complete	Tailbuoy 1 Dead @ SOL No E33 record for SP 1105 S1C2 and S1C20 failed compass Bias.
TDOB08-046-008	8		1001	1612		Complete	Tailbuoy 1 Dead @ SOL No E33 record for 1383
TDOB08-054-009	9		1746	1001		Complete	Tailbuoy 1 Dead @ SOL No E33 record for Sp's 1651,1568,1468 S1C8,S1C9,S1C20 fialed compass bias V1G2,V1G3,V1G4 rejected d/t high U/V from SPM2 dropout
TDOB08-064-010	10		1001	2990		Complete	Tailbuoy 1 Dead @ SOL No E33 record for Sp 2174 S1C2,S1C20 fialed compass bias
TDOB08-042-011	11		2865	1001		Complete	Tailbuoy 1 Dead @ SOL No E33 Records for Sps 2401,2344,1970,1905,1892 S1C2,S1C20 failed compass bias V1G2,V1G3,V1G4 rejected d/t high U/V from SPM2 dropout
TDOB08-026-012	12		1001	1649		Complete	Tailbuoy 1 Dead @ SOL No E33 Records for Sps 1010,1215,1257,1464,1553 S1C20 failed compass bias

TDOB08-040-013	13	1604	1001	Complete	Tailbuoy 1 Dead @ SOL No E33 Records for Sp 1088 S1C2,S1C8,S1C9,S1C20, failed compass bias
TDOB08-007-014	14	1001	1553	Complete	Tailbuoy 1 Dead @ SOL S1C08 failed compass bias
TDOB08-001-015	15	1667	1001	Complete	Tailbuoy 1 Dead @ SOL No E33 Records for Sp's 1512,1121 S1C8,S1C9, failed compass bias
TDOB08-016-016	16	1001	2637	Complete	Tailbuoy 1 Dead @ SOL No E33 Records for Sp's 1126,1162,1465,2309 S1C09,S1C20 failed compass bias
TDOB08-052-017	17	3253	1001	Complete	Tailbuoy 1 Dead @ SOL No E33 Records for 3175,2589,1042 S1C09,S1C08 failed compass bias High U/V @ Sp 3136 d/t GPS V1G2,V1G3,V1G4 rejected d/t high U/V from SPM2 dropout Due to Echosounder crash ,Interpolated between sp 2613-2560
TDOB08-066-018	18	1001		NTBP	Tailbuoy 1 Dead @ SOL
TDOB08-066-019	19	1001	2359	Complete	Seq 019 is a Line TDOB08-066 after recording system problems on Seq 018 Tailbuoy 1 Dead @ SOL No E33 Records for 1003,1225,1389,1925 S1C02,S1C20 failed compass bias V1G1,V1G2,V1G3 rejected d/t high U/V from SPM2 dropout
TDOB08-070-020	20	2247	1001	Complete	Tailbuoy 1 Dead @ SOL No E33 Records for Sp 1612 S1C08 failed compass bias
TDOB08-080-021	21	1001	2367	Complete	Tailbuoy 1 Dead @ SOL No E33 Records for Sp 1236,1613,1792,1957,2364 S1C2 and S1C08 failed compass bias Global rejected V1G1 d/t spike XP dropout
TDOB08-090-022	22	1980	1001	Complete	Tailbuoy 1 Dead @ SOL No E33 Records for Sp 1434,1387,1242,1192 S1C2, S1C8, S1C9 and S1C20 failed compass bias Global rejected V1G1 d/t spike XP dropout
TDOB08-098-023	23	1001	2018	Complete	Tailbuoy 1 Dead @ SOL No E33 Records for Sp 1267,1467,1620,1821,1858,1920 S1C02,S1C20 failed compass bias

TDOB08-092-024	24	1981	1001	Complete	Tailbuoy 1 Dead @ SOL No E33 Records for Sp 1970,1126 S1C02,S1C20 failed compass bias V1G1,V1G2,V1G3 rejected d/t high U/V from SPM2 dropout
TDOB08-005-025	25	2018	1001	Complete	Tailbuoy 1 Dead @ SOL S1C8, S1C9 and S1C20 failed compass bias V1G3 rejected as not avaiable during line
TDOB08-014-026	26	1001	2625	Complete	Tailbuoy 1 Dead @ SOL No E33 Records for Sp 999,1321,1433,1669,1899,2002,2091,2197,2460 S1C02,S1C20 failed compass bias V1G1,V1G2,V1G3 rejected d/t high U/V from SPM2 dropout
TDOB08-028-027	27	2979	1001	Complete	Tailbuoy 1 Dead @ SOL No E33 Records for Sp's1496,1412,1088 S1C08,S1C09,S1C20 failed compass bias V1G1,V1G2, rejected d/t high U/V from SPM2 dropout V1G3 rejected as not available during line High U/V at Sp 2959 to 2949 d/t poor GPS quailty at that time afftecting RGPS1 and RGPS2
TDOB08-020-028	28	1001	3057	Complete	Tailbuoy 1 Dead @ SOL No E33 Records for Sp's1246,1747,2098,23339,2495,2496,2966 V1G3 rejected as not available during line
TDOB08-032-029	29	3007	1001	Complete	Tailbuoy 1 Dead @ SOL No E33 Records for Sp's2614,2488,1809,1663,1445,1216 S1C08,S1C09,S1C20 failed compass bias V1G2 rejected d/t high U/V from SPM2 dropout
TDOB08-056-030	30	1001	2470	Complete	Tailbuoy 1 Dead @ SOL No E33 Records for Sp's 1488,1867,2161 S1C02,S1C20 failed compass bias V1G4,V1G2 rejected d/t high U/V from SPM2 dropout
TDOB08-062-031	31	2442	1001	Complete	Tailbuoy 1 Dead @ SOL No E33 Records for Sp's 2201,1701,1544,1422 S1C08,S109,S1C20 failed compass bias
TDOB08-072-032	32	1001	2636	Complete	Tailbuoy 1 Dead @ SOL No E33 Records for Sp's 1177,1418,2109,2185 S1C02,S1C20 failed compass bias V1G4,V1G2 rejected d/t high U/V from SPM2 dropout

TDOB08-084-033	33		2173	1001	Complete	Tailbuoy 1 Dead @ SOL No E33 Records for Sp's 2147,1782,1589,1318 S1C08,S1C9,S1C20 failed compass bias
TDOB08-086-034	34		1001	2148	Complete	Tailbuoy 1 Dead @ SOL No E33 Records for Sp 1857 S1C20 failed compass bias
TDOB08-078-035	35		2113	1001	Complete	Tailbuoy 1 Dead @ SOL S1C2 and S1C20 failed compass Bias.
TDOB08-003-036	36		1669	1220	Complete	Tailbuoy 1 Dead @ SOL S1C2 failed compass Bias. Rejected G1R2 range and bearing d/t RGPS2 data loss
TDOB08-003-037	37	1339	1219	1001	Complete	Continuation of Seq 036 d/t Gun auto fire Tailbuoy 1 Dead @ SOL No E33 Records for Sp 1104
TDOB08-012-038	38		1001	2343	Complete	Tailbuoy 1 Dead @ SOL S1C2,S1C5 failed compass Bias. Rejected V1G2 and V1G4 d/t Spm 2 dropout Adjusted compass filter to Gate=75 and Fillter=45 due to noise caused by weather
TDOB08-024-039	39		2649	1001	Complete	SP 1970 slight drop in air pressure d/t Compressor air leak Tailbuoy 1 Dead @ SOL S1C7,S1C8,S1C20 failed compass Bias. Rejected V1G2 and V1G4 d/t Spm 2 dropout Adjusted compass filter to Gate=75 and Fillter=45 due to noise caused by weather
TDOB08-038-040	40		1001	1611	Complete	Tailbuoy 1 Dead @ SOL S1C2, failed compass Bias. Rejected V1G4 d/t Spm 2 XP dropout No E33 records for Sps 1100,1118
TDOB08-060-041	41		1704	1001	Complete	Tailbuoy 1 Dead @ SOL No E33 Records for Sp's 1242,1027 S1C02,S1C08,S1C20 failed compass bias Rejected V1R2-G1R6 and V1R2-GR6B d/t high U/V
TDOB08-074-042	42		1001	2447	Complete	Tailbuoy 1 Dead @ SOL No E33 Records for Sp's 1487,1489,1525,1630,1671,1732, 2259,2350 S1C02 failed compass bias Adjusted compass filter to Gate=75 and Fillter=45
TDOB08-082-043	43		1630	1001	Complete	Tailbuoy 1 Dead @ SOL No E33 records for Sp 1347 S1C02,S1C08,S1C20 failed compass bias

TDOB08-009-044	44	2063	1001	Complete	Tailbuoy 1 Dead @ SOL No E33 records for Sp 1956,1386,1592,1183,1468,1147 S1C02,S1C08,S1C20 failed compass bias
TDOB08-018-045	45	1001	2316	Complete	Tailbuoy 1 Dead @ SOL RGPS1 Dead @ SOL No E33 Record for Sp 1242 V1G5 rejected d/t SPM1 reboot
TDOB08-048-046	46	2641	1001	Complete	Tailbuoy 1 Dead @ SOL RGPS1 Dead @ SOL No E33 records for Sp 2425 S1C02,S1C08, failed compass bias V1G4,V1G2 rejected d/t high U/V from SPM2 dropout
TDOB08-058-047	47	1001	2792	Complete	Tailbuoy 1 Dead @ SOL No E33 records for Sp 1591,2103 S1C05.S1C02 failed compass bias Small spike in U/V from SPM2 dropout Adjusted compass filter to Gate=75 and Fillter=45 d/t swell noise
TDOB08-068-048	48	2522	1001	Complete	Tailbuoy 1 Dead @ SOL No E33 records for Sp 2481,2315,1629,1471 S1C0.S1C08,S1C20 failed compass bias
TDOB08-076-049	49	1001	2949	Complete	Tailbuoy 1 Dead @ SOL No E33 records for Sp 2643,2707 S1C20 failed compass bias rejected V1G1 d/t high UV Rejected #1 gunstring data from Sp 2700 to EOL
TDOB08-088-050	50	2747	1001	Complete	Tailbuoy 1 Dead @ SOL No E33 records for Sp 2559,1762 S1C08,S1C20 failed compass bias rejected V1G2 d/t high UV
TDOB08-096-051	51	1001	1858	Complete	Tailbuoy 1 Dead @ SOL S1C20 failed compass bias rejected V1G2,V1G4 d/t high UV caused by SPM2 dropout Rejected V1R1-G1R1 lack of sats poor positioning
TDOB08-094-052	52	1627	1001	Complete	Tailbuoy 1 Dead @ SOL S1C20 S1C08 failed compass bias
TDOB08-100-053	53	1001	1708	Complete	Tailbuoy 1 Dead @ SOL S1C20 failed compass bias
TDOB08-102-054	54	1512	1001	Complete	Tailbuoy 1 Dead @ SOL No E33 records for Sp 1173 S1C08,S1C09,S1C20 failed compass bias

TDOB08-011-055	55	2516	1001	Complete	Tailbuoy 1 Dead @ SOL No E33 records for Sp 2384,2049,1502,1417,1091 S1C02,S1C08,S1C20 failed compass bias Rejected G1R3 range and bearing d/t lack of sats poor positioning
TDOB08-010-056	56	1001	2378	Complete	Tailbuoy 1 Dead @ SOL No E33 records for Sp's 1632,2042 rejected V1G2, d/t high UV caused by SPM2 dropout
TDOB08-006-057	57	1964	1001	Complete	Tailbuoy 1 Dead @ SOL No E33 records for Sp's 1059 rejected V1G2, d/t high UV caused by SPM2 dropout Spike in UV at Sp 1640-1650 d/t lack of sats
TDOB08-015-058	58	1001	2933	Complete	Tailbuoy 1 Dead @ SOL No E33 records for 1005,1257,2399,2493,2544, S1C20 failed compass bias.
TDOB08-019-059	59	3265	1001		Tailbuoy 1 Dead @ SOL No E33 records for 3241,2897,2438,2256 tail end of cable deep sp's 1970-1958 max 10.2m
TDOB08-017-060	60	1001	3204	Complete	Tailbuoy 1 Dead @ SOL No E33 records for 1040,1263,2118,2132,2384,2845,3032 Adjusted compass filter to Gate=75 and Fillter=45 d/t swell noise Spike in U/V at Sp 1489 d/t poor GPS quailty at that time afftecting RGPS1
TDOB08-013-061	61	2741	1001	Complete	Tailbuoy 1 Dead @ SOL No E33 records for 1992,1786,1574
TDOB08-008-062	62	1001	2222	Complete	Tailbuoy 1 Dead @ SOL No E33 records for Sp's 1308,1851,2081 S1C02 failed compass bias. Adjusted compass filter to Gate=75 and Fillter=45 d/t swell noise
TDOB08-004-063	63	1809	1001	Complete	Tailbuoy 1 Dead @ SOL No E33 records for Sp 1275 S1C08 failed compass bias. Adjusted compass filter to Gate=75 and Fillter=45 d/t swell noise rejected V1G2 and V1G4 d/t high UV from SPM2 dropout

TDOB08-002-064	64	1001	1414	Complete	Tailbuoy 1 Dead @ SOL No E33 records for Sp 1282 S1C02 failed compass bias. Adjusted compass filter to Gate=75 and Fillter=45 d/t swell noise
TDOB08-027-065	65	1001	3649	Complete	Tailbuoy 1 Dead @ SOL No E33 records for Sp 1068,1399,1495,1849,2142,2210, 2324,2520,3034,3101,3408 Adjusted compass filter to Gate=75 and Fillter=45 d/t swell noise Rejected V1R1 network d/t high UV caused by RGPS1 reboot
TDOB08-023-066	66	3914		NTBP	Tailbuoy 1 Dead @ SOL No E33 records for Sp 1002,2088,3112,3504,3544,3847 Rejected V1R1 network d/t high UV caused by RGPS1
TDOB08-023-067	67	3914	1001	Complete	Tailbuoy 1 Dead @ SOL No E33 records for Sp's 3756,3489,2594,2096,1815
TDOB08-025-068	68	1001	3887	Complete	Tailbuoy 1 Dead @ SOL No E33 records for Sp 1002,2088,3112,3504,3544,3847 Rejected V1R1 network d/t high UV caused by RGPS1 connection loss V1G5 rejected d/t SPM1 drop out
TDOB08-021-069	69	3739	1001	Complete	Tailbuoy 1 Dead @ SOL No E33 records for Sp's3759,2926,2636,2160,1408,1314

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

PROJECT DETAILS Client : CGG Veritas – Asia Pacific
9 Serangoon North Ave. 5
CGGVeritas Hub
Singapore 554531
Tel: +65 6723 5630
Fax: +65 6723 5552
Cell: +65 9186 3619

Contractor : Subsea 7 (Singapore) Pte Ltd
No 39 Tampines Street 92,
#02-00 2E Capital Building
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 º		*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

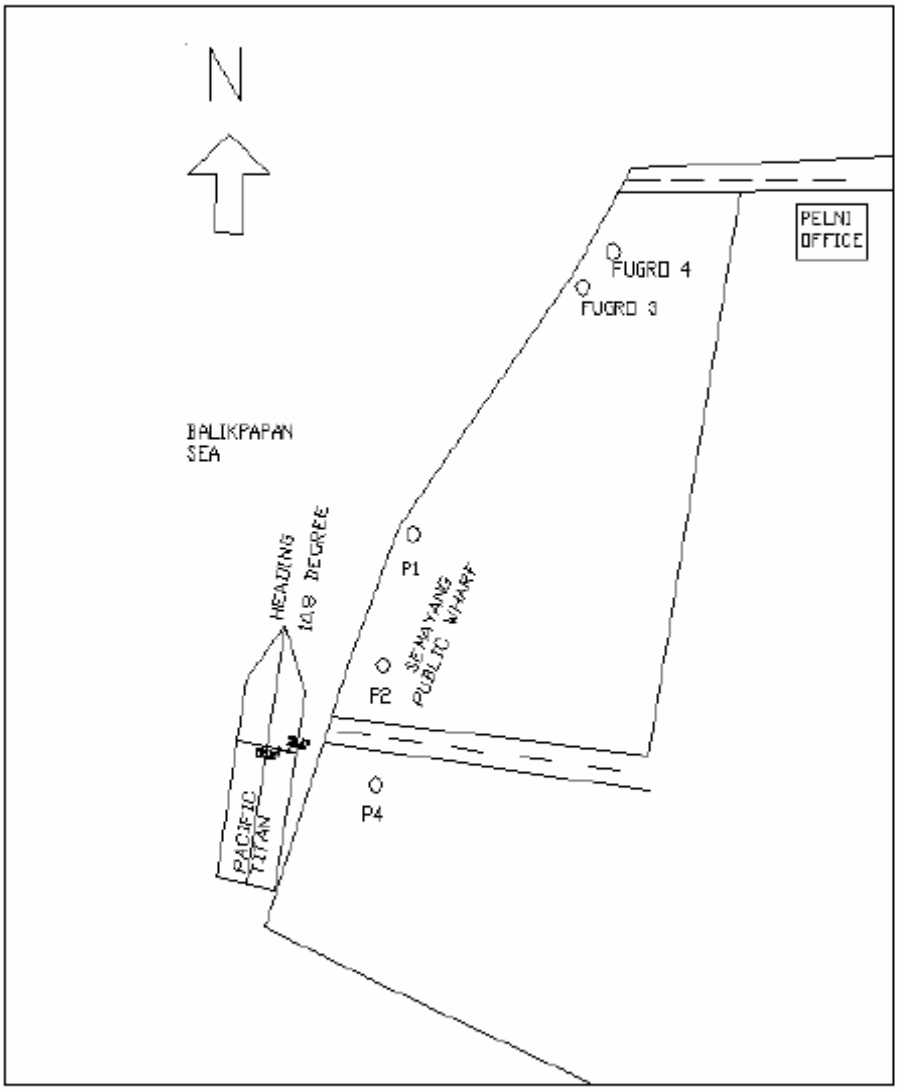
The DGPS verification checks and gyro calibrations were conducted in difference time. The Total Station was set up at P4 and referenced to P2 as backsight (Refer to Appendix C). Range and bearing measurements were observed to the prisms installed on board the barge, same survey procedure was used for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

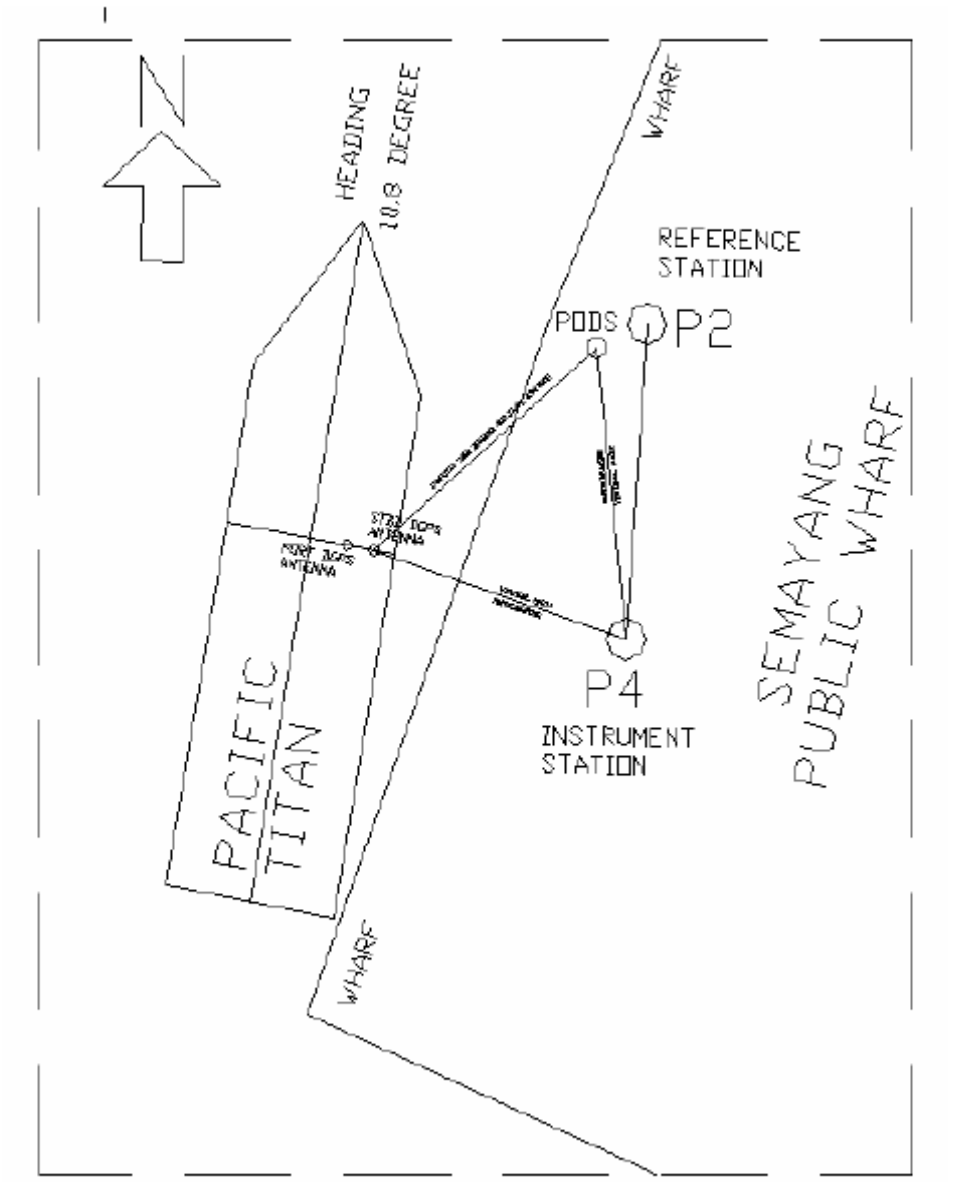
4. GEODETIC PARAMETERS

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



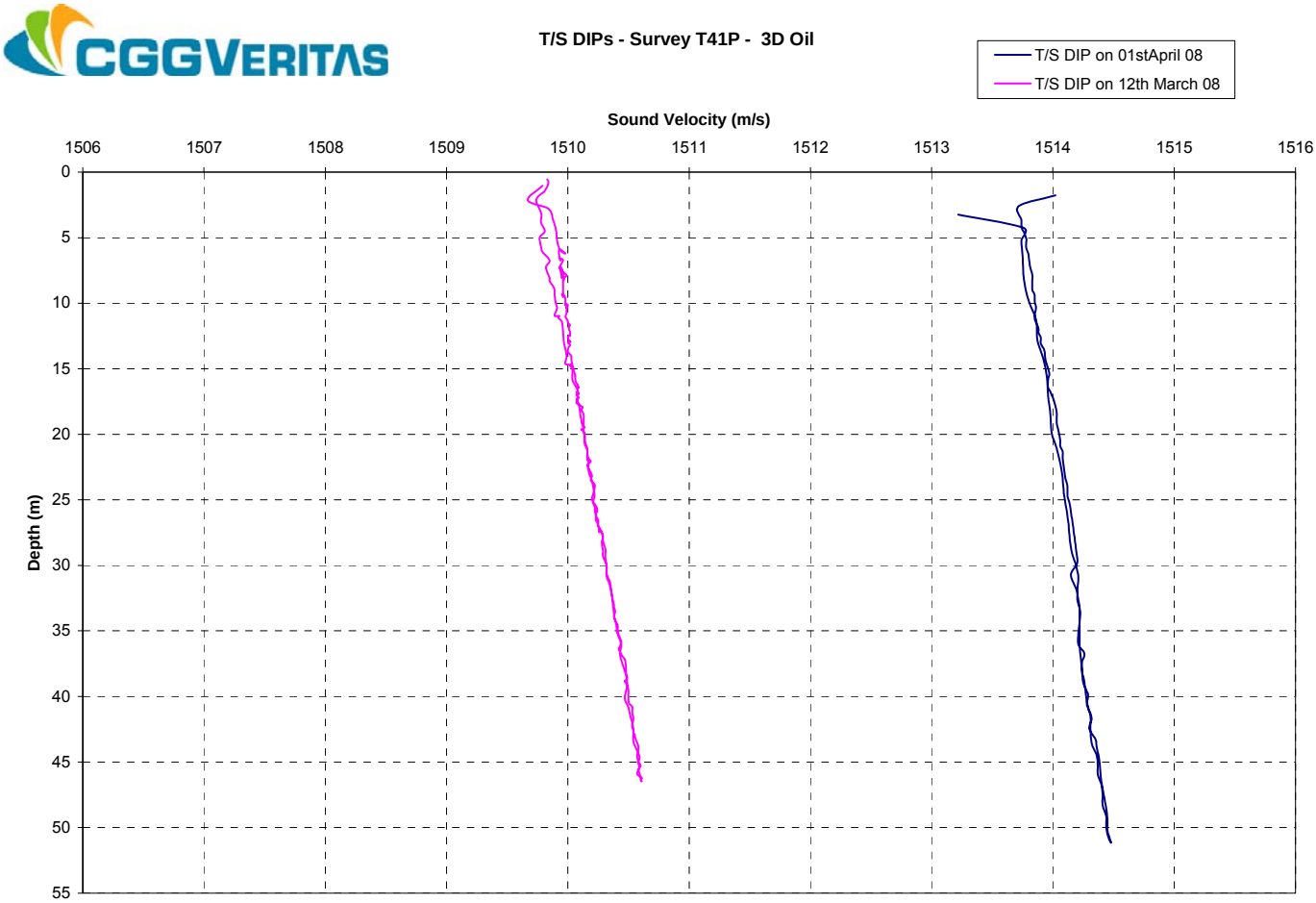

HEADING
10.8 DEGREE
WHARF
REFERENCE
STATION
PODS
P2
SEMAYANG
PUBLIC WHARF
P4
INSTRUMENT
STATION
PACIFIC
TITAN
WHARF

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	040° 01' 01" S
Long	145° 21' 21" E
Date:	12th March 08
Time:	20:15 GMT
	07:15 Local Time
1510.02	Mean Velocity on deploy
1510.36	Mean Velocity on recovery
1510.19	Mean Velocity

Position	
Lat	040° 18' 39" S
Long	146° 05' 01" E
Date:	01st April 08
Time:	09:27 GMT
	20:17 Local Time
1514.19	Mean Velocity on deploy
1514.03	Mean Velocity on recovery
1514.11	Mean Velocity



Appendix 5 Medevac Plan

MEDEVAC M/V Pacific Titan
CLIENT: SEBOA - Consortium Members Group Shoot
SURVEY N°: 501 11 89 07 06 00

M/V Pacific Titan
Tel Bridge: +881 631 852 021
Tel Bridge: +872 356 304 510
Tel PC : +47 51 40 76 12
Tel IR : +47 51 40 76 11

CGGVERITAS

INJURED / SICK PERSON
Indicate: number of persons concerned
Nature of Injuries
Position of the ship
Weather Conditions

Radiotelephone, Inmarsat

Radiotelephone, Inmarsat

1 CONTACT:

1.1

For diagnosis, Support and Medevac advice

- **ISOS Sydney**
  +61 2 9372 2468
- **Frontier Medical** (Emergency Contact)
  +27 7 6840 3344
- **AUSSAR** (Australian Search and Rescue)
  +61 2 6230 6811 / 1800 641 792
- **Victoria Air Ambulance**
  000 / 1300 883 200

1.2

For Medevac Initiation

Decision made by Pacific Titan Captain and onboard Doctor.

Depending on severity 2 methods of evacuation may be used

1. Pacific Titan sails to Portland or Burnie or Lakes Entrance or Eden and evacuates patient ashore via chase vessel or FRC.

2. Helicopter evacuation via AUSSAR or Victoria Air Ambulance then shoreside reception via ISOS or Frontier Topside Support.

Shoreside assistance triggered by calling ISOS or Frontier and agent

2 CONTACT:

Local contacts

2.1

AGENT

Robbie Robertson
Mob: +61 417 819 593
If not available
Oliver Barz
Mob: +61 418 894 359

Agent will co ordinate shore side reception of patient and arrange transport to Hospital if necessary.

LOCAL HOSPITALS

Portland and District Hospital (Portland)
Tel: +61 3 5521 0333
Alfred Hospital (Melbourne)
Tel: +61 3 9276 2000
N/W Regional Hospital (Burnie-Tas)
Tel: +61 3 6430 6666
Central Gippsland Health Services Hospital (Lakes Entrance - Sale)
Tel: +61 3 5143 8600
Pambula District Hospital (Eden)
Tel: +61 2 6495 6002

If further medical treatment required then patient will be re patriated by ISOS

3 CONTACT:

3.1

VOM

- **Serge Laigre** - Singapore
Office: +65 6723 5599
Mob: +65 9183 4109

Swire Pacific Australia
- **Steve Harris (HSE Manager)**
Office: +61 8 9430 5434
Mob: +61 412 928 275

Client: Consortium Members
- **Frank Renton**
Office (24h): +61 4 2868 1314

- **Andrew White (APM Santos)**
Office: +61 8 8116 7260
Mob: +61 417 086 407

3.2

If VOM not available

Singapore
- **Christian Brige** (OM)
Office: +65 6723 5621
Mob: +65 9852 1710
- **Bob Joyce** (QHSE Mgr)
Office: +65 6723 5565
Mob: +65 8112 9152

Australia
- **Paul Mier** (Assistant VOM)
Office: +61 8 9214 6208
Mob: +61 4479 5554

For information and repatriation
International SOS:
Contract #: 15A MMS 000074

ISOS Enquiries via Singapore
Tel: +65 6338 7800

Frontier Medical (UK)
Duty Manager (24Hrs)
Tel: +44 7872 841 695

EVACUATION ONSHORE:

If confirmed by the Doctor and Captain as necessary and feasible. **Onboard Doctor will accompany patient ashore until ISOS take over.**
Provide passport

TRANSFER TO HOSPITAL:

In co-ordination with local contacts (see step 2.1), who will assist with all administrative formalities & co ordinate with PC/Capt/VOM

M/V Pacific Titan — Medevac SEBOA-Group Shoot Australia
Created by: S. Laigre 08th March 2008 V1.4

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Appendix 6 Contact List

CONTACT LIST: CGGVeritas - Marine 2D Seismic Acquisition Services for South East Basin, Offshore Australia - M/V Pacific Titan
March 2008 - July 2008

Address	Location	Name	Mobile	Phone	Fax	E-mail
Pacific Titan		**Bridge**		Phone: +881 631 852 021 (Iridium)		E-mail: pacific.titan@swireships.com
Seismic Survey Vessel				Phone: +872 356 304 510 (Inmarsat B)	Fax: +872 335 385 513 (Inmarsat B)	
				Phone: +47 51 40 76 14 (VSAT)		
		Party Chief (Office)		Phone: +47 51 40 76 12 (VSAT)		E-mail: om.titan@cggveritas.com (Party Chief)
		Haydn Brook	Mob: +61 437 952 303			E-mail: chnav.titan@cggveritas.com (Nav Dept)
		Sigurd Ostenrud	Mob: +65 9232 7329			
	Singapore	**Instruments Room**		Phone: +47 51 40 76 11 (VSAT)		E-mail: chobs.titan@cggveritas.com (Record.Dept)
						E-mail: seisqc.titan@cggveritas.com (Processor Dept)
						E-mail: chmech.titan@cggveritas.com (Source Dept)
						E-mail: hse.titan@cggveritas.com (HSE Advisor)
		Client (office)		Phone: +47 51 40 76 13 (VSAT)		
CGGVeritas APAC		**Office**		Phone: +65 6723 5500	Fax: +65 6723 5552	
9 Serangoon North Ave 5		**Serge LAIGRE** (Pacific Titan Operations Manager)	Mob: +65 9183 4109	Phone: +65 6723 5599		E-mail: serge.laigre@cggveritas.com
CGGVeritas Hub		**Rollin Delzer (Senior VP Marine)**	Mob: +65 8200 5907	Phone: +65 6723 5604		E-mail: rollin.delzer@cggveritas.com
Singapore 554 531		**Michelle Tay** (Marine Secretary)	Mob: +65 8263 0010	Phone: +65 6723 5584		E-mail: Michelle.Tay@cggveritas.com
		Christian Brige (Marine Operations Manager)	Mob: +65 9852 1710	Phone: +65 6723 5621		E-mail: christian.brige@cggveritas.com
		Chewy Chua (Navigation Analyst)	Mob: +65 9756 3204	Phone: +65 6723 5618		E-mail: Chewy.Chua@cggveritas.com
		Tony Nash (Navigation Analyst)	Mob: +65 8113 5118	Phone: +65 6723 5645		E-mail: Anthony.Nash@cggveritas.com
		Fabrice Mandroux (ATG Geophysist)	Mob: +65 9385 9041	Phone: +65 6723 5619		E-mail: fabrice.mandroux@cggveritas.com
		Dominique Bottier (Sales & Marketing Manager)	Mob: +65 9182 4984	Phone: +65 6723 5608		E-mail: dominique.bottier@cggveritas.com
	Singapore	**Emmanuel Haget** (Marine Resources Manager)	Mob: +65 9105 2358	Phone: +65 6723 5642		E-mail: emmanuel.haget@cggveritas.com
		William Jee (Regional Logistics Supervisor)	Mob: +65 9040 2200	Phone: +65 6723 5617		E-mail: william.jee@cggveritas.com
		Graham Knight (Instrument Manager)	Mob: +65 9628 8428	Phone: +65 6723 5616		E-mail: Graham.Knight@cggveritas.com
		Jeff Cleland (ATG Regional Supervisor)	Mob: +65 9106 3619	Phone: +65 6723 5630		E-mail: Jeff.Cleland@cggveritas.com
		Bob Joyce (QHSE Manager)	Mob: +1 281 639 7170	Phone: +65 6723 5565		E-mail: Bob.Joyce@cggveritas.com
		Richard John Watson (Maritime Technical Manager)	Mob: +65 9105 2403	Phone: +65 6723 5611		E-mail: RichardJohn.Watson@cggveritas.com
		Mark Plummer (OS Equipment - Mechanics)	Mob: +65 8222 9699	Phone: +65 6723 5543		E-mail: mark.plummer@cggveritas.com
		Tay Kar Hong (Asst Maritime Technical Manager)	Mob: +65 9644 4631	Phone: +65 6723 5649		E-mail: KarHong.Tay@cggveritas.com
		Didier Eledut (Crew Manager Singapore)	Mob: +65 8201 2748	Phone: +65 6723 5649		E-mail: didier.eledut@cggveritas.com
		Francois Monchy (HR Manager - France)	Mob: +33 6 8368 9082	Phone: +33 1 6447 3090		E-mail: francois.monchy@cggveritas.cm
Swire Pacific Offshore		**Office**		Phone: +65 6496 8280	Fax: +65 6496 8270	E-mail: survey.services@swire.com.sg
Survey Services Division (SSD)		**Ramoo Selvam** (Chief Operating Officer / Marketing)	Mob: +65 9191 2222	Phone: +65 6496 8282		E-mail: ramoo.selvam@swire.com.sg
1 Loyang Way 4		**Yvon F. Koster** (General Manager)	Mob: +65 8181 8882	Phone: +65 6496 8283		E-mail: yvon.koster@swire.com.sg
Singapore 507028		**Teddy Tan** (Accounting Manager)	Mob: +65 9635 0047	Phone: +65 6496 8285		E-mail: teddy.tan@swire.com.sg
		Lee Lee Chin (Jr. Accountant)	Mob: +65 9748 4223	Phone: +65 6496 8291		E-mail: lee.leechin@swire.com.sg
	Singapore	**Allan Wank** (Technical Manager)	Mob: +65 8333 3163	Phone: +65 6496 8284		E-mail: allan.wank@swire.com.sg
		Ian Mbd Samli (QHSE)	Mob: +65 9191 8080	Phone: +65 6496 8288		E-mail: ian.abdullahsamli@swire.com.sg
		Michelle Chin (Purchasing & Logistics)	Mob: +65 9780 7851	Phone: +65 6496 8293		E-mail: michelle.chin@swire.com.sg
		Joyce Tan (Buyer)	Mob: +65 9136 0262	Phone: +65 6496 8292		E-mail: joyce.tan@swire.com.sg
		Jancy Lee (Crew Administrator)	Mob: +65 9618 0262	Phone: +65 6496 8286		E-mail: jancy.lee@swire.com.sg
		Susan Teo (Administrator)	Mob: +65 9698 4838	Phone: +65 6496 8287		E-mail: susan.teo@swire.com.sg
2nd Floor Queensgate Centre		**Steve Harris** (Operations & HSE Manager)	Mob: +61 412 928 275	Phone: +61 8 9430 5434	Fax: +61 9430 7849	E-mail: sharris@spopty.com.au
cnr William & Newman Streets	Australia	**Nigel Gribble** (Secretary)		Phone: +61 8 9430 5434		E-mail: ngribble@spopty.com.au
Fremantle , WA 6160, Australia		**Malcolm Hearnden** (Manager)	Mob: + 61 412 505 434	Phone: +61 8 9430 5434		E-mail: mhearnden@spopty.com.au
		Simone Osten (Crewing)		Phone: +61 8 9430 5434		E-mail: sosten@spopty.com.au
Monsoon	Philippines	**Diosdado G. Ramos** (General Manager)	Mob: +63 917 5212 897	Phone: +63 2 5223 181	Fax: +63 2 5254 852	E-mail: dgramos@monsoon.com.ph
		Mae (Crewing operation)		Phone: +63 2 5253 051		E-mail: operations@monsoon.com.ph
Telstart Travels Agency	Singapore	**Shamim**	Mob: +65 9824 4530	Phone: +65 6726 9012		E-mail: shamim@telstartravels.com
	India	**Sujeet**	Mob: +91 9820 042 116			E-mail: ttplmar@telstartravels.com
		Farida	Mob: +91 9821 510 062			E-mail: farida@telstartravels.com
MARITIME AGENT:						E-mail: ntsa@ntshipping.com.au
NT Shipping Agencies		**Robbie Robertson** (Operations Manager)	Mob: +61 4 1781 9593	Phone: +61 8 8947 2570	Fax: +61 8 8947 2640	E-mail: robbie@ntshipping.com.au
East Arm Wharf	Singapore	**Oliver Barz**	Mob: +61 4 1889 4359			
Berrimah Road		**Christie Beeson** (Crew Logistic)				E-mail: Christie@ntshipping.com.au
Berrimah NT 0828						
General Medical Rescue Advice		**ISOS Sydney**		Phone: +61 2 9372 2468	Fax: +61 2 9372 2455	
		ISOS Singapore		Phone: +65 6338 7800		
		AusSAR 24 hr contact		Phone: +61 2 6230 6811		
		- Aviation Rescue		Phone: 1800 815 257		
		- Maritime Emergency		Phone: 1800 641 792		
		Victoria Air Ambulance		Phone: 1300 883 200		Email: air.ambulance@mas.vic.gov.au
Consortium Members		**Frank Renton**		Phone: +61 4 1868 1314	Fax:	Email: F.Renton@empest.com.au
SANTOS		Mike Giles (Project Manager)	Mob: +61 437 816 312	Phone: +61 8 8116 7952	Fax: +61 8 8116 7258	
		Andrew White (APM)	Mob: +61 417 086 407	Phone: +61 8 8116 7260		Email: Andrew.White@santos.com
				Phone: +61 8 8332 2949		
		Stuart Brew	Mob: +61 412 552 055	Phone: +61 8 8116 7625		
			Mob:	Phone: +61 8 8278 7515		
		Nick Fox (HSE Manager)	Mob: +61 407 395 015	Phone: +61 8 8116 5151		
				Phone: +61 8 8327 1594		
		Alan Jones (alternate)	Mob: +61 427 520 773	Phone: +61 8 8116 7303		
				Phone: +61 8 8357 6212		
		Phillip Oatley (alternate)		Phone: +61 8 8116 7946		
				Phone: +61 8 8271 7532		
Duty Incident Manager		Roger Kennett	Mob: +61 419 180 935	Phone: +61 8 8116 7846	Fax: +61 8 8116 7065	
		Nick Lagonik	Mob: +61 400 383 020	Phone: +61 8 8116 7349	Fax: +61 8 8116 7113	
		Mark McFarlane	Mob: +61 438 788 138	Phone: +61 8 8116 5269	Fax: +61 8 8116 7113	
		Colin Cruickshank	Mob: +61 419 169 254	Phone: + 61 8 8116 7855	Fax: + 61 8 8116 7755	
		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
Fishing Vessel – Exoil (M/V)				Phone: +61 3 9699 7439		

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 0600		+61 3 5143 0633	
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 8066 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 9945 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 5712 (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									