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1. Survey Information and Objectives

The M/V Pacific Titan mobilised for SANTOS LIMITED in Portland, Australia on the 08th of November 2004 to perform a marine seismic 2D survey in the Discovery Bay / Otway Basin area called OEP04 2D MSS.

The pre-plotted survey consisted of 35 lines totalling 973.170 full fold kilometres.
The actually acquired numbers were: 999.200 f.f. km + 108.000 run-out km = 1,107.200 sail km.

The Pacific Titan acquired the survey with a 6000m digital Streamer and a 3040 cu/in Source towed at 5m depth. The array was spread over 3 sub-arrays. All 3 “gun arrays” had GPS positioning.

See the enclosed CWO for further details about the Survey parameters.

The Multiwave job number was: 6211.

A Safety audit was carried out on the 15th October 2004 with a few minor findings. Also onboard cross department inspections were carried out on the 2nd and 3rd of December where 7 different areas of responsibility were covered. Also here there were only minor findings.

Production started on the 09th of November and completed on the 26th of November 2004. All lines were labelled OEP04-XX-YY-ZZZ where OEP04 is the line prefix, XX is the unique line nr, YY is the attempt nr for the line and ZZZ is the sequence number, unique for each line or part of line. Shot point numbering were kept the same. The lines started with shot point numbering always incrementing from 1001 regardless of direction the line was shot. A Soft Start procedure was used prior to start of all lines. The time of each soft start was logged in the navigation as well as the observer's logs.

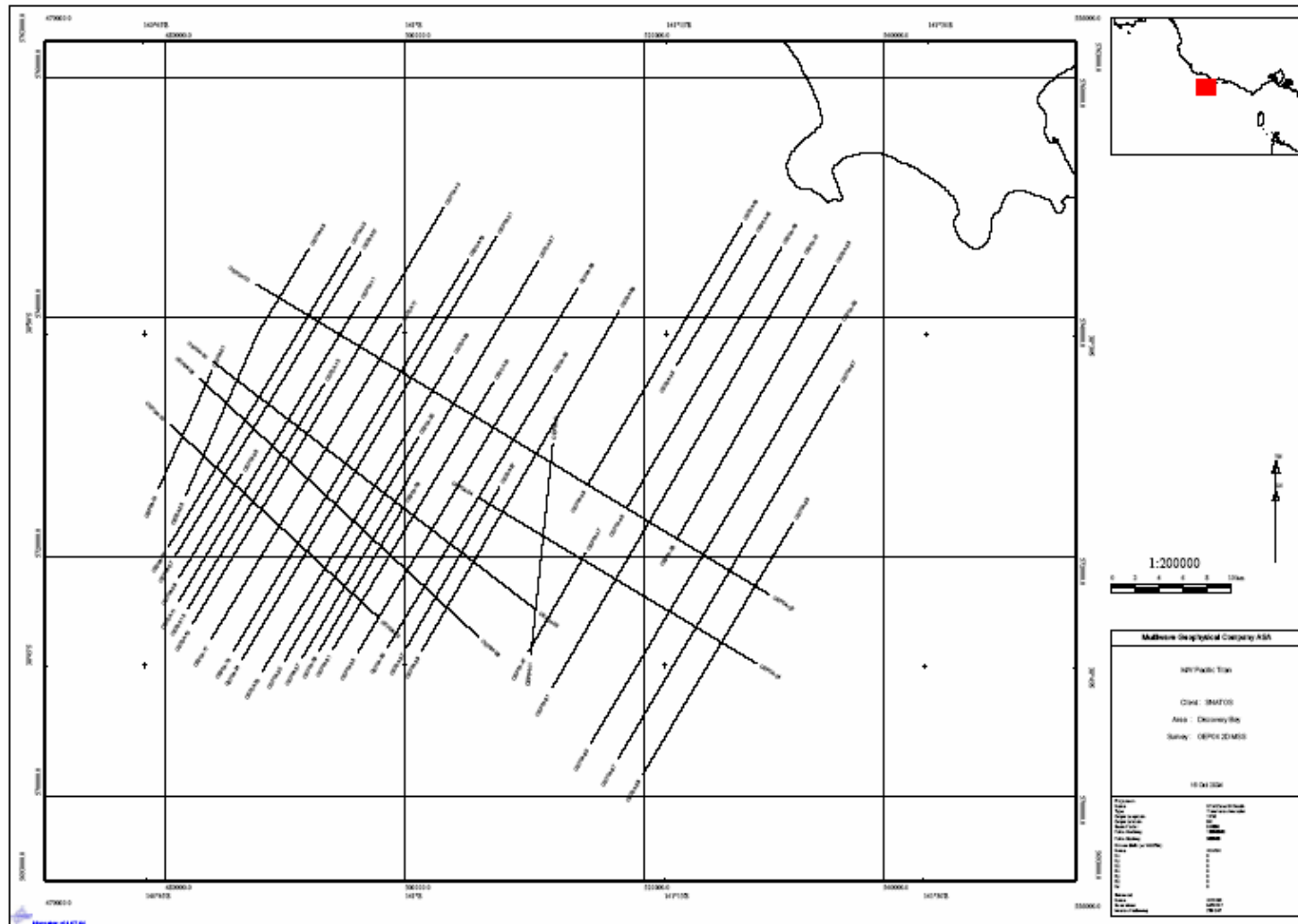
Recording length was 8 sec and the streamer towed at 7 m depth when weather permitted. Also 8m and 9m depths were used when weather (swell) created too much sea noise. No guard vessel was used during the survey.

In addition to the maritime, the Multiwave seismic crew one MMO (Marine Mammal Observer) as well as one QC representative were present onboard.

2. Area Map



3. Program Map OEP04



4. Minutes of Meeting - Start-up Meeting.

Who: Santos and Multiwave.

Where: Onboard the M/V Pacific Titan in Portland Australia.

When: 08th of November 2004.

Present:

John Hughes (host), Drew Douglas (client rep), Rebecca Pirzl (MMO), seismic crew and captain.

The meeting concentrated on environmental issues.

The first topic covered was the whale activity expected in the survey area. It was presented pictures of blue whales and sperm whales taken in the vicinity of the survey area. It was highlighted that shooting will stop if any whales are observed within 3000 m of the guns.

Next topic covered the lobster fishing which will commence on the 15th of November. The fishing goes on by traps lowered down to the seabed through a rope. On the surface is normally an orange buoy. The rock lobster fishing will seldom go beyond the 100m. water depth line. However also crab traps will be present, but far less of them.

As a consequence of this, the easternmost lines will have priority as they will exceed into the lobster fishing area.

The meeting continued with an overview over the different environmental rules and regulations which take effect in the area. Act No. 10190/1985 – Occupational Health and Safety Act, Code Of Environmental Practice from 1996 and Occupational Health and Safety (Incident Notification) Regulations of 1997 (S.R. No. 25/1997)

5. Contract Work Order

CONTRACT	
Client:	SANTOS LIMITED
Vessel(s):	Pacific Titan
Job Number:	6211
Area:	Southern Margin, Australia
Type of Survey:	2D
Area, or total km:	App 973.170 Km Full-Fold sail km
Line Heading:	Various
Number of Lines:	16
Line Length:	Variable
Acquisition Method:	Single streamer / single source
Estimated Start Date:	30 th October-04
Estimated Duration:	35 Days
STREAMER	
Type of Streamer	Seal
Number of Streamers	1
Streamer Length	6000 m
No. of Channels	480
Group Interval	12.5 m
Streamer Depth	7 m ideal
Water Depth	Greater than 20 m
RECORDING	
Instrument Type	Sercel - Seal
Record Length	8 sec
Sample Rate	2 msec
Recording Filter: Hi-cut	206 Hz @ 276 dB/Octave
Recording Filter: Lo-cut	3.0 Hz, 6 dB/Oct
Filter Type	Linear Phase
Pre-Amplifier Gain	0 db
Tape Format	Seg D Rev.1
Recording Media	3590 Tape
Tape Copy	Yes
SOURCE	
Source Type	Bolt long-life Airguns
Source Controller	GunLink 2000
Number of Sources	1
Source Separation	n/a
Volume per Source	3040 cu.in.
Source Depth	5 m
Source Pressure	2000 psi / 138 Bar
Source Length	14.7 m
Number of Sub-arrays per Source	3
Sub-array Separation	10
Flip/Flop	n/a
Shot Point Interval per Shot	25 m
Near Fields to be recorded?	Yes
Source Firing Specifications	+/- 1.0 ms
Signed:	

6. Vessel Description

6.1. Vessel Specifications – Pacific Titan

The M/V Pacific Titan is capable of performing both 2D and 3D seismic data acquisition. For 2D work the vessel can tow a 12 000 meters streamer. For 3D seismic work the vessel can do dual source / dual streamer (2X6000m) or dual source / three streamer (3X4000m) 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.



Section 1: General Information

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, molded: 18.5 m
Depth, molded: 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: Kelvin Hughes Nucleus 6000A
ARPA
Secondary Radar: JRC JMA 3210 Daylight
GPS: Furuno GP 30
Echo Sounder: Simrad ED-162
Communications: G.M.D.S.S. Skanti
SSB,VHF,Inmarsat C 456304540 /
456304550
Weather Fax: Furuno 207
Vsat: Instrumentroom +47 51 40 76 11
Party Chief +47 51 40 76 12
Chiefs office +47 51 40 76 13
Fax +47 51 40 76 14
High Speed data link: NERA Inmarsat system:
Tel (873) 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 helicopter deck.
P.A. System
Stainless steel gun deck.
Helicopter deck rated for Bell 212 or equivalent with lights.

6.2. Seismic Particulars

Streamer and Sensors Details

Item	description	type	amount	remark
Streamer	24 bit, digital distributed electronic	SEAL Sercel	Up to 12 km active	50 mm diameter
Depth Control	Digicourse	5011	40	Located every 300 m along the streamer
Buoyancy		Isopar M		
Retrievers		Concorde	12	1 every 900 meters
Streamer skin	Polyurethane	3.3mm		
Hydrophones	NH-95-250			
Section Length	150 m			
Section diameter	50 mm			
Lead-in	350 m			
Group Length	12.5 m			
No of hydrophones per group	16			256 nF Group capacitance 17.4 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		

Recording System Details

Item	description	type	amount	remark
Acquisition	SEAL Vs 4.0	Sercel	1	Max 10 000 channels
Format	SED D Vs1	De-multiplexed		
Recording	3590 cartridge	IBM computer	3	
Computer	Sun	Blade 1000	2	
Bird Controller		Digicourse		
Graphic user interface	Unix	X11 Ultra 5		
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	UNIX			Ethernet

Section 1: General Information

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	Sun	Blade 2000		
Terminals	Sun	21"	2	
Graphic user interface	Unix	X11 Ultra 5		
Remote	X terminal			Sat. link
Network	UNIX			Ethernet
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		

Navigation Details

item	description	type	amount	remark
<u>Navigation online</u>	Concept	Spectra		
<u>Navigation offline</u>	FGPS	SeisPos		
Work Stations	PC workstations	Shuttle	2	
Network	Ethernet	100 Mbit		TCP/IP
PC workstation	Shuttle			
Printer	HP			Network to 12"
Compasses	Digicourse	5011		Every 300 meter along the streamer
Streamer positioning	RGPS	Various	1	Geotrack, Tracks
Source Positioning	RGPS	Various	3	Geotrack, Tracks
Acoustics	N/A			
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	Robtrak	STS500		
Helmsman Steering display	Spectra	Shuttle		

Section 1: General Information

Source and Mechanical Department Details

item	description	type	amount	remark
Guns	Long Life	Bolt		6 gun positions per sub-array 8 guns per sub-array
Hanging Plates	Multiwave design	Multiwave		
Chambers	40 – 300 cu.in.			
Cluster	2-gun cluster	Bolt	12	2 clusters on per 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 3000	Seamap		32 guns, expandable
Solenoid Power Supply	Gunlink 3000	Seamap		25 ms fire pulse width
Deflector	Multiwave	6 foils	2	
Gun Winches		Dual/single	2 * 3	Slip-ring, Air
Streamer winches		Single	4	Each 9000 m (50 mm)
Spooling Device	Marine Project Development	Linear	4	Spooling on each streamer winch individually
Tow Points	ODIM	Flexible	3	
Winch Control	ODIM		2	Hydraulic remote