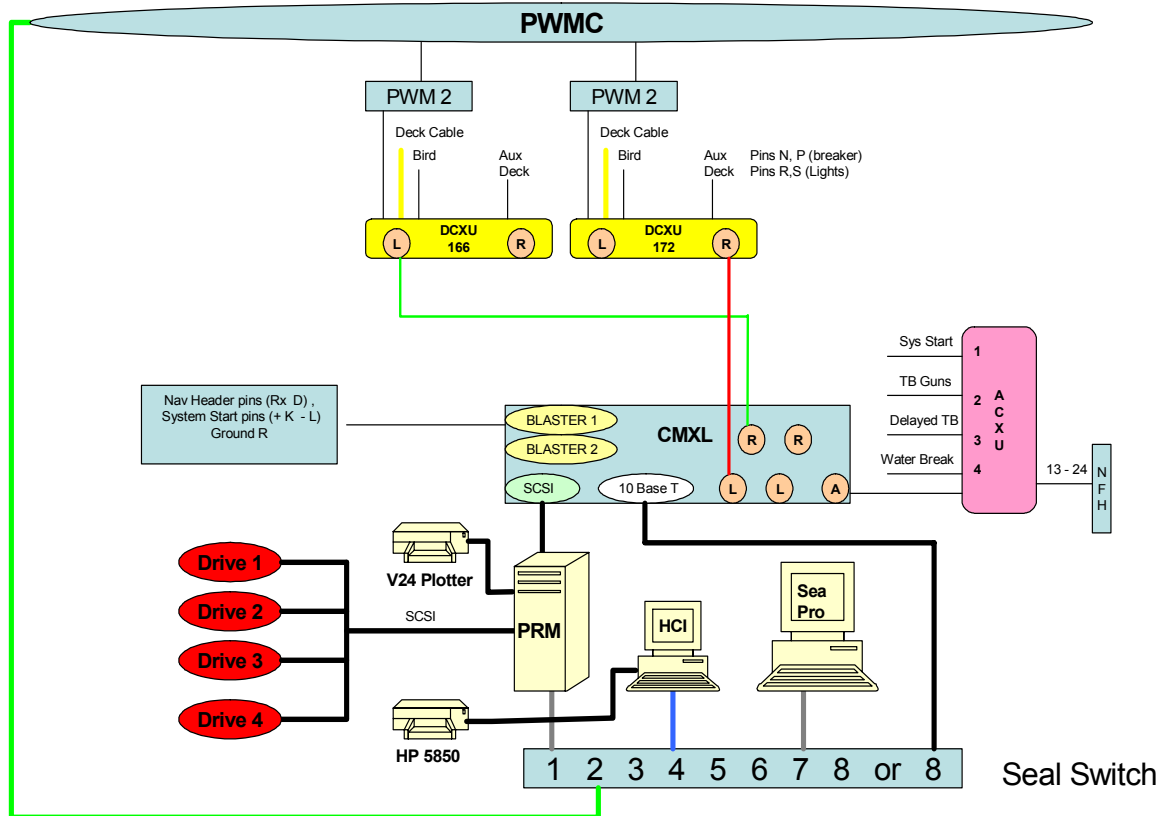


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1. Instrumentation and QC System Description



Recording	Seal	Seal v. 4.24
Tape drives	IBM 3590	N/A
Plotter	Veritas 24"	N/A
Onboard QC	SeaPro QC	SeaPro QC v. 4.0
Source Controller	Gunlink 2000	v. 4.73
Auxiliary Systems	Seal ACXU	N/A
Bird Controller	Digicourse DMU + PC	Sys3w01
Tension Monitor	Seal	HAU (head auxiliary unit)
Bird Type	Digicourse	5011

2. Instrumentation and QC Tests

2.1. Start-up Tests

Before the beginning of the survey a complete set of instrument tests was performed. These tests were as follows:

- Instrument Noise
- Instrument Pulse
- Instrument Distortion
- Instrument Crosstalk
- Instrument Gain/Phase
- Instrument Common Mode
- Field Impulse
- Field Hydrophone Leakage
- Field Capacitance
- Field Cut Off
- Field Noise

The start of contract tests were recorded to tape, and sent to the processing centre together with the seismic data. The result of the Start of Job Instrument tests was good, with all system tests well in specification and no bad seismic hydrophone groups on the streamer.

2.2. Additional Client Tests

No additional tests were required during the survey.

2.3. Instrument and Sensor Tests

The instrument test consists of 6 tests, and the Sensor test consists of 5 tests.

The daily test and monthly uses the same test setup. They were run on daily bases if time permitted. Start of Job and End of Job test are recorded to 3590 tape including digital copy. All other days are recorded on CD.

Following tests are only recorded on 3590 Tape and do not have a digital copy: Instrument Pulse and Sensor Impulse.

Following tests are only have digital data and are not recorded to 3590 data cartridge: Sensor Capacitance and Sensor Cut-off.

Occasional high sensor noise levels were recorded during QC tests due to the inclement weather conditions. The high noise levels were random throughout the survey.

Trace 319 was changed out at the first available opportunity after it failed.

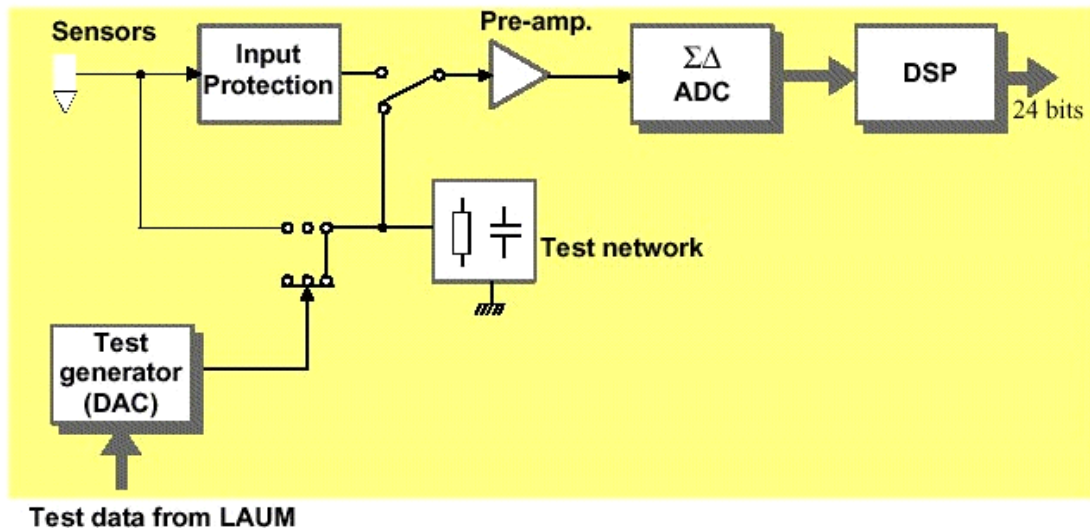
Channel 15 and 17 failed cut-off sensor test on the 24 November 2004. Previously and following this date both channel 15 and 17 remained well in specification.

Section 5: Instrumentation and QC

Date	Test	Instruments						Field					Comments
		Noise	Pulse	Distortion	Cross Talk	Gain / Phase	Common Mode	Impulse	Capacitance	Cutoff	Noise	Hydro Leakage	
9 Nov 04	Start up	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	All passed
10 Nov 04	Daily	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	All passed
11 Nov 04	Daily	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	All passed
16 Nov 04	Daily	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	All passed
17 Nov 04	Daily	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	All passed
18 Nov 04	Daily	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	319 dead
19 Nov 04	Daily	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	319 dead
20 Nov 04	Daily	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	319 dead
21 Nov 04	Daily	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	319 dead
23 Nov 04	Daily	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	All passed
24 Nov 04	Daily	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	Channel 15 & 17 failed Cutoff
25 Nov 04	Daily	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	All passed
26 Nov 04	End of Job	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	All passed

2.4. Instrument Test and Sensor Test Description

2.4.1. General



Above is a simplified block diagram of the circuitry involved in each FDU addressed when launching Instrument or Sensor tests from the Seal. The test circuitry in each FDU mainly consists of a current generator (Digital-to-Analog Converter), and a test network. The input to acquisition channel is selected depending on the test function to carry out:

- Signal from the sensor (e.g. noise test)
- Signal from both sensor and the DAC (e.g. Field Impulse test)
- Signal from both the DAC and the test network (e.g. Gain test)

The necessary test signals (DC voltage, sine wave or pulse) are generated by the FDU's DAC from basic signals stored in LAUM's. The gain, filter type and sample rate parameters are user-selectable in Instrument tests, and system selected in most Field tests.

2.4.2. Instrument Noise Test

This test is to measure the noise of the ADC converter in the FDU. The converter's input is connected to the internal test network. A DFT is performed and the noise spectral power below 3Hz is computed. As the total energy of the output signal is known, the total noise within the bandwidth can be deduced.

2.4.3. Instrument Gain and Phase Test

This test is used to check for any drift of the gain and phase of the FDU's built in ADC converter within the band from DC to the filter's cut-off frequency.

The ADC supplies a pulse with known amplitude and width to the internal test network. The ADC input is connected to the internal test network. The voltage across the internal test network is measured. A DFT is computed on the DSP's output signal (for different test frequencies) and compared to a model computed with the same frequencies. The error is computed in terms of difference in amplitude and phase with respect to the model.

The test returns the maximum error computed in amplitude and phase.

2.4.4. Instrument Distortion Test

This test is used to check the FDU's built in ADC converter for linear response. A sine wave with known amplitude and frequency is applied to its input via the internal test network. The test returns the ratio of the spectral power of the output signal to the spectral power of all harmonics within the bandwidth determined by the selected filter.

2.4.5. Instrument CMRR Test

This test is used to measure the Common Mode Rejection Ratio of the FDU's built in ADC converter. A sine wave with known amplitude and frequency is applied to both of its inputs via the internal test network. The test returns the ratio of the RMS value of the output voltage, relative to the input, to the common mode voltage.

2.4.6. Instrument Cross Talk Test

This test is used to measure cross talk between FDU's. The test includes two sequences:

During the first sequence, the test generator applies a sine wave to the test network in each **even** FDU. The ADC converter in each **odd** FDU measures the resulting voltage across its own test network. (The test generator in odd FDU's is disabled).

Conversely, during the second test sequence, the test sine wave is fed to each **odd** FDU and the resulting voltage is measured across the test network in each **even** FDU.

The ratio of the measured voltage to the theoretical value of the test signal is computed and displayed as Instrument Cross talk for each FDU.

2.4.7. Instrument Pulse Test

This test is used to record the response of the instrument channel to a pulse (one sample long).

2.4.8. Sensor Impulse Test

This test is used for acquisition of the impulse response on each channel used in the spread.

The DAC (digital to Analog Converter) supplies a known pulse to the seismic channel input, and the resulting signal at the ADC (Analog to digital Converter) output is recorded.

2.4.9. Sensor Capacitance Test

This test is used to measure the capacitance of the seismic sensor connected on the channel input. The DAC supplies a sine wave with known frequency and amplitude to the channel input. The DftCorr of the output from the ADC is computed at the test frequency. Knowing the current supplied to the sensor, the total impedance can be computed.

The capacitance can finally be computed by using the imaginary part of the impedance.

2.4.10. Sensor Cut-off Frequency Test

With hydrophones as input sensors, measuring the cut-off frequency of the seismic channel is equivalent to determining the pulse response for the channel. The DAC supplies a pulse (with known amplitude and width) to the channel input. From the resulting voltage, measured by the ADC, the cut-off frequency of the channel is computed using a least-squares method.

2.4.11. Sensor Noise Test

In this test the noise picked by the hydrophones on each channel used in the spread is measured by performing data acquisition with no Firing Order.

2.4.12. Sensor Leakage Test

This test is used to measure the global leakage resistance between the seismic channel and the earth ground. During this test, the test generator creates a leak current at precisely determined points in the test network, via the FDU's earth resistance. The resulting voltage at particular points in the network is measured. As the output current of the test generator is known, the measurements allow the system to determine the leakage resistance on the positive and negative input paths of the channel. Finally the total resistance to ground can then be calculated.

2.5. End of Job Test

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

- Instrument Noise
- Instrument Pulse
- Instrument Distortion
- Instrument Crosstalk
- Instrument Gain/Phase
- Instrument Common Mode
- Field Impulse
- Field Hydrophone Leakage
- Field Capacitance
- Field Cut Off
- Field Noise

The result of the End of Job instrument tests was good and all tests were passed. Comparing results from all the instrument tests showed that the system was stable and in specification throughout the survey.

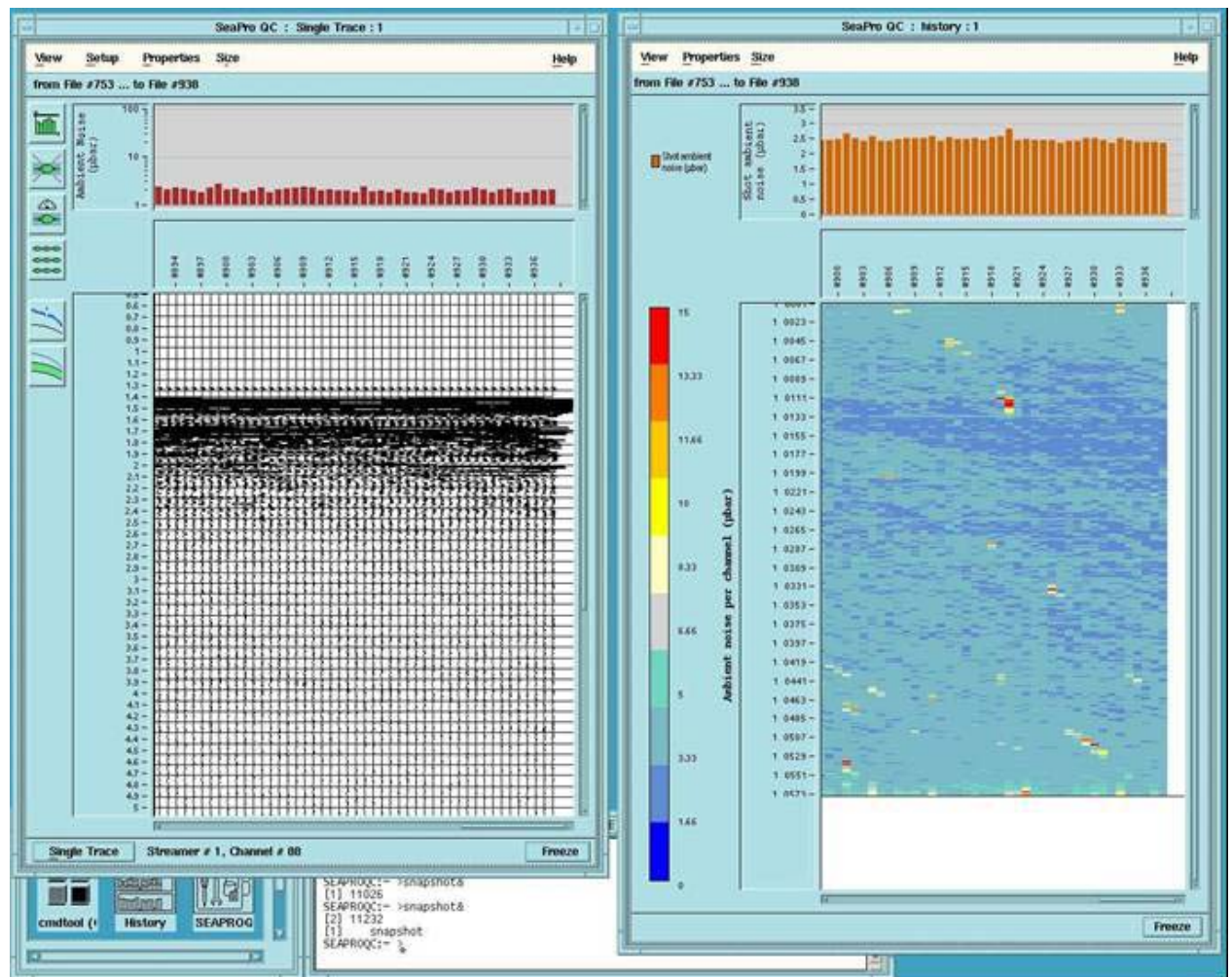
3. QC Products and Processing Sequence

SeaPro QC was used during this survey to perform online QC of the seismic data. The SeaPro was set up to produce a screen plot of all shots. It also displayed a Single Trace display and a noise versus channel/shot history. The auxiliary channels were displayed, with a zoomed in view of the timing.

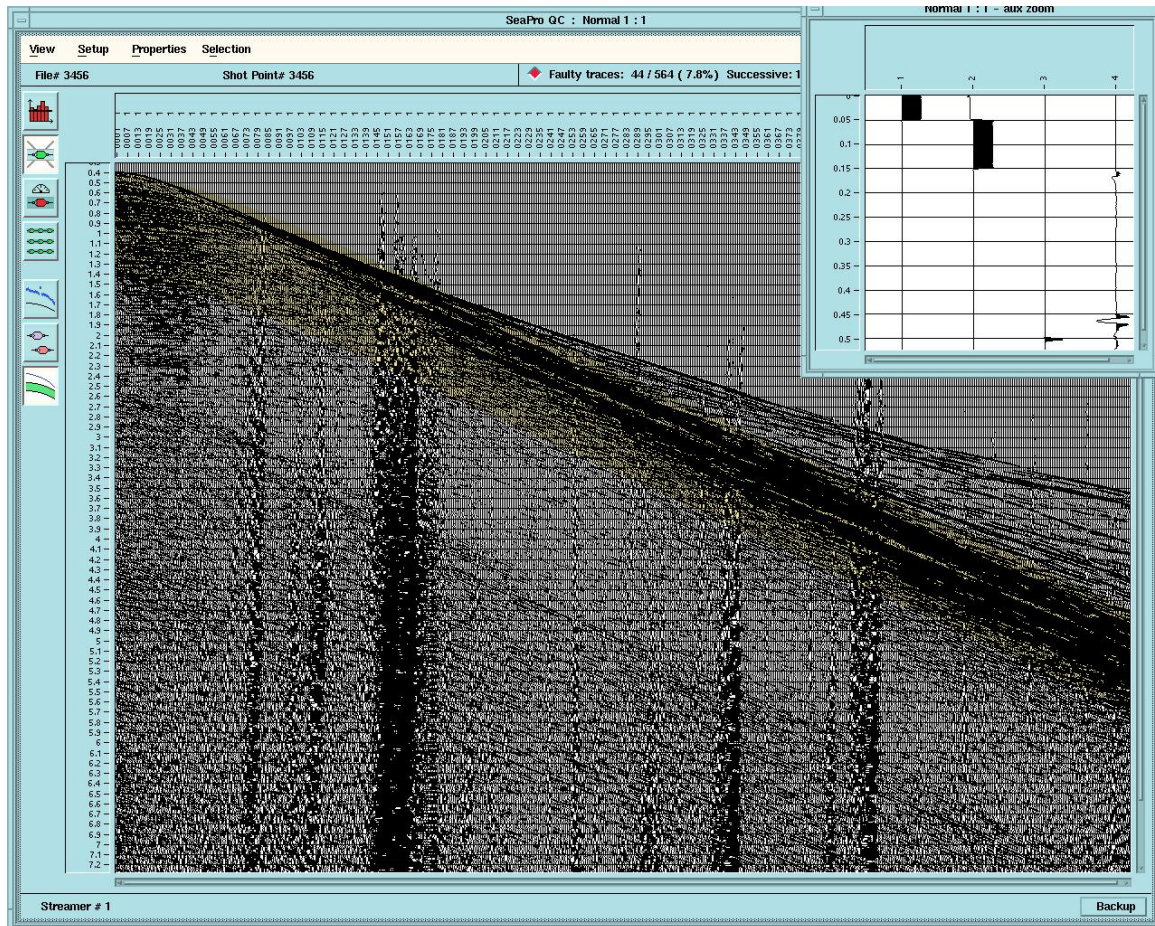
A ProMax system was in use during the survey to further monitor the quality of the Seismic data, and to produce brute stacks.

[See separate report in Section 6.](#)

3.1. SeaPro QC Screen 1



3.2. SeaPro QC Screen 2



4. Tape Log

Client	Santos Limited - Essential Petroleum		BOX 1					
Area	Otway Basin Victoria, Au							
Survey	6211-2D		Vessel MV Pacific Titan					
Date	Line Name	Tape	Seq	FF	LF	FSP	LSP	Comments
9/11/04	OEP04-26-01-001	001	1	979	1102	981	1102	SOL
9/11/04	OEP04-26-01-001	002	1	1102	2232	1102	2231	EOL Complete
10/11/04	OEP04-59-01-002	003	2	979	1112	981	1112	SOL
10/11/04	OEP04-59-01-002	004	2	1113	2112	1113	2111	EOL Complete
10/11/04	OEP04-51-01-003	005	3	979	2259	981	2261	SOL
10/11/04	OEP04-51-01-003	006	3	2260	2793	2262	2794	EOL Complete
10/11/04	OEP04-57-01-004	007	4	979	2238	981	2238	SOL
10/11/04	OEP04-57-01-004	008	4	2239	2582	2239	2581	EOL Complete
10/11/04	OEP04-47-01-005	009	5	979	1512	981	1511	SOL
10/11/04	OEP04-45-01-006	010	6	979	1592	981	1590	SOL/EOL Complete
10/11/04	OEP04-53-01-007	011	7	981	1607	981	1607	SOL Incomplete
11/11/04	OEP04-53-02-008	012	8	1465	1540	1467	1539	NTBP
11/11/04	OEP04-55-01-009	013	9	979	2010	981	2010	SOL
11/11/04	OEP04-55-01-009	014	9	2011	2760	2011	2759	EOL Complete
11/11/04	OEP04-49-01-010	015	10	979	2145	981	2144	SOL/EOL Complete
11/11/04	OEP04-53-03-011	016	11	1465	1658	1467	1657	NTBP
12/11/04	OEP04-43-01-012	017	12	1518	2145	1520	2144	Incomplete
12/11/04	OEP04-53-04-013	018	13	1465	1472	1467	1472	NTBP
16/11/04	OEP04-02-01-014	019	14	979	2178	981	2178	SOL
16/11/04	OEP04-02-01-014	020	14	2179	3141	2179	3140	EOL Complete
16/11/04	OEP04-06-01-015	021	15	979	1705	981	1705	SOL
16/11/04	OEP04-06-01-015	022	15	1706	2492	1706	2492	EOL Complete
17/11/04	OEP04-10-01-016	023	16	979	2084	985	2083	SOL Complete
17/11/04	OEP04-08-01-017	024	17	979	2178	982	2181	SOL Complete
17/11/04	OEP04-08-01-017	025	17	2179	2402	2182	2404	EOL Complete
17/11/04	OEP04-41-01-018	026	18	979	1844	981	1843	SOL/EOL Complete
17/11/04	OEP04-31-01-019	027	19	979	1126	981	1126	SOL
17/11/04	OEP04-31-01-019	028	19	1127	2169	1127	2168	EOL Complete
17/11/04	OEP04-39-01-020	029	20	979	2178	981	2178	SOL
17/11/04	OEP04-39-01-020	030	20	2179	2446	2179	2445	EOL Complete

Section 5: Instrumentation and QC

Client	Santos Limited - Essential Petroleum	BOX 2						
Area	Otway Basin Victoria, Au							
Survey	6211-2D	Vessel M/V Pacific Titan						
Date	Line Name	Tape	Seq	FF	LF	FSP	LSP	Comments
18/11/04	OEP04-53-05-021	31	21	1485	1617	1487	1597	SOL
18/11/04	OEP04-53-05-021	32	21	1618	2205	1598	2184	EOL Complete
20/11/04	OEP04-04-01-022	33	22	979	2178	981	2178	SOL
20/11/04	OEP04-04-01-022	34	22	2179	2211	2179	2210	EOL Complete
21/11/04	OEP04-29-01-023	35	23	979	1690	981	1689	SOL Complete
21/11/04	OEP04-37-01-024	36	24	979	1756	981	1750	SOL Complete
21/11/04	OEP04-43-02-025	37	25	979	1670	981	1669	SOL Complete
21/11/04	OEP04-33-01-026	38	26	979	1736	981	1736	SOL
21/11/04	OEP04-33-01-026	39	26	1737	2467	1737	2467	Continued
21/11/04	OEP04-33-01-026	40	26	2468	2557	2468	2556	EOL Complete
21/11/04	OEP04-21-01-027	41	27	979	1427	981	1427	SOL
21/11/04	OEP04-21-01-027	42	27	1428	2627	1428	2627	Continued
21/11/04	OEP04-21-01-027	43	27	2628	2780	2628	2779	EOL Complete
22/11/04	OEP04-15-01-028	44	28	979	1056	981	1055	NTBP
23/11/04	OEP04-15-02-029	45	29	979	1027	981	1003	NTBP
23/11/04	OEP04-15-03-030	46	30	979	2178	981	2178	SOL
23/11/04	OEP04-15-03-030	47	30	2179	2759	2179	2758	EOL Complete
23/11/04	OEP04-19-03-031	48	31	979	2178	981	2178	SOL
23/11/04	OEP04-19-03-031	49	31	2179	2661	2179	2660	EOL Complete
23/11/04	OEP04-27-03-032	50	32	979	1403	981	1403	SOL
23/11/04	OEP04-27-03-032	51	32	1404	2603	1404	2603	Continued
24/11/04	OEP04-27-03-032	52	32	2604	2675	2604	2674	EOL Complete
24/11/04	OEP04-35-01-033	53	33	979	1703	981	1703	SOL
24/11/04	OEP04-35-01-033	54	33	1704	2191	1704	2190	EOL Complete
24/11/04	OEP04-25-01-034	55	34	979	2002	981	2001	SOL Complete
24/11/04	OEP04-17-01-035	56	35	979	2178	981	2178	SOL
24/11/04	OEP04-17-01-035	57	35	2179	2364	2179	2363	EOL Complete
24/11/04	OEP04-23-01-036	58	36	979	1711	981	1711	SOL
24/11/04	OEP04-23-01-036	59	36	1712	2362	1712	2361	EOL Complete
24/11/04	OEP04-07-01-037	60	37	979	2178	981	2178	SOL

Client	Santos Limited - Essential Petroleum	BOX 3						
Area	Otway Basin Victoria, Au							
Survey	6211-2D	Vessel M/V Pacific Titan						
Date	Line Name	Tape	Seq	FF	LF	FSP	LSP	Comments
25/11/04	OEP04-07-01-037	61	37	2179	2317	2179	2316	EOL Complete
25/11/04	OEP04-13-01-038	62	38	979	1494	981	1493	SOL Incomplete
25/11/04	OEP04-03-01-039	63	39	979	1045	981	1027	NTBP
25/11/04	OEP04-13-02-040	64	40	1352	2009	1350	2008	SOL Complete
25/11/04	OEP04-05-01-041	65	41	979	2178	981	2178	SOL
25/11/04	OEP04-05-01-041	66	41	2179	2301	2179	2300	EOL Complete
25/11/04	OEP04-11-01-042	67	42	979	2178	981	2178	SOL
25/11/04	OEP04-11-01-042	68	42	2179	2305	2179	2304	EOL Complete
26/11/04	OEP04-03-02-043	69	43	979	1020	981	1020	SOL
26/11/04	OEP04-03-02-043	70	43	1021	1659	1021	1658	EOL Incomplete
26/11/04	OEP04-09-01-044	71	44	979	1535	981	1534	SOL Complete
26/11/04	OEP04-01-01-045	72	45	979	1562	981	1561	SOL Complete
26/11/04	OEP04-03-03-046	73	46	1515	1668	1518	1669	SOL
26/11/04	OEP04-03-03-046	74	46	1669	2059	1670	2059	EOL Complete
End of OEP survey								