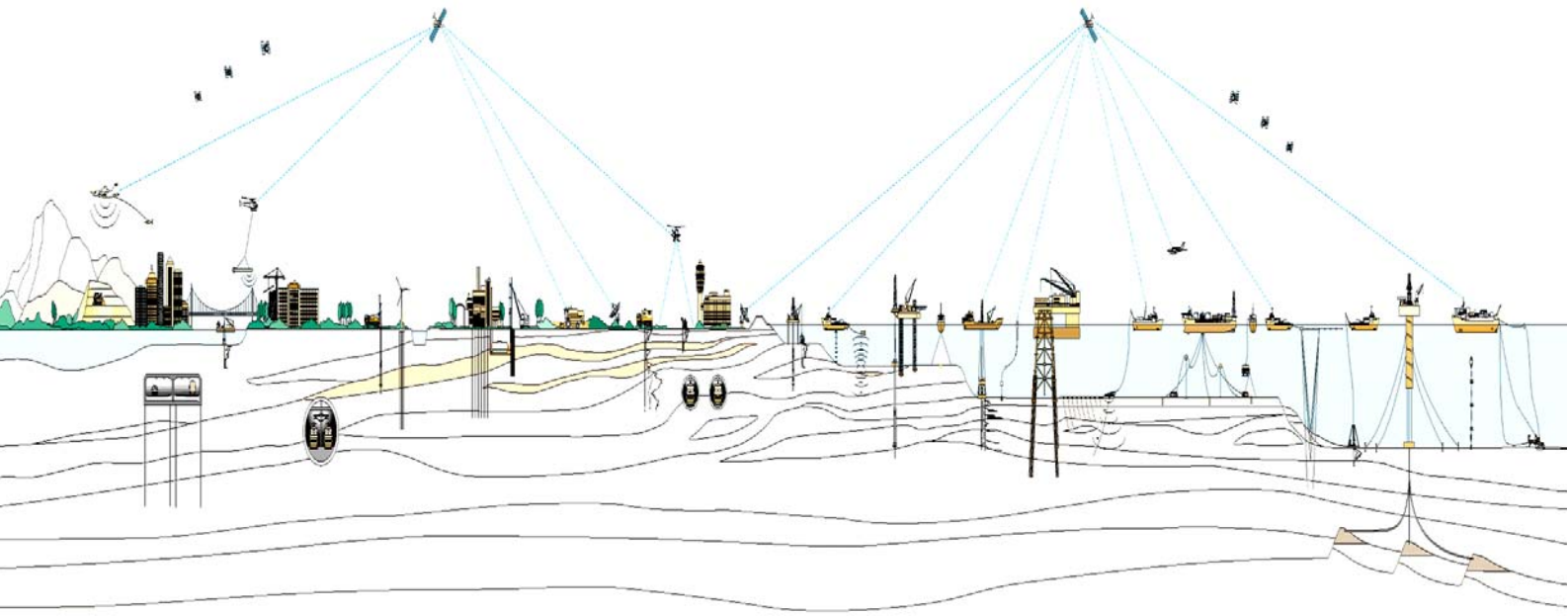
HILL-1 POSITIONING REPORT
OF THE OCEAN EPOCH

FUGRO TGS PROJECT NO.: 3637A3

Prepared for
SANTOS OFFSHORE PTY LTD



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Santos

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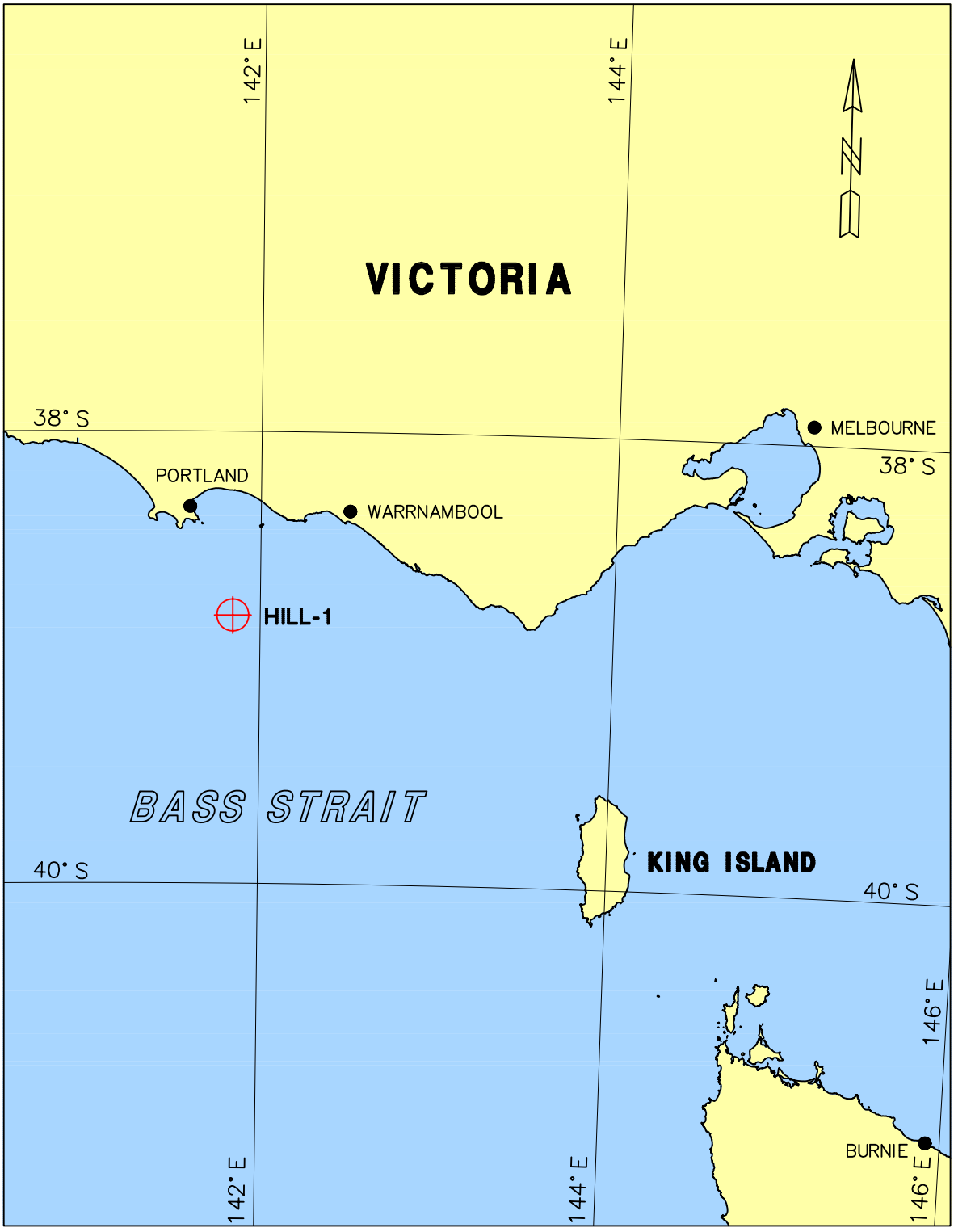


ABSTRACT

This report details the positioning services provided by Fugro TGS (Australia) Ltd (Fugro TGS), prior to and during the positioning of the semi-submersible drilling rig Ocean Epoch at the Hill-1 location for Santos Offshore Pty Ltd (Santos).

Positioning of the Ocean Epoch during the approach to and at the Hill-1 location was provided by Fugro TGS' SkyFix/SkyFix Spot Differential GPS (Differential GPS) interfaced to Fugro TGS' MultiFix 3 multiple reference station positioning software and Fugro TGS' GNS2 navigation software. The two anchor handling vessels (AHVs), Lady Dawn and Pacific Challenger were positioned using Fugro TGS' Tracs/Tug Display Vessel Tracking System (VTS). The Ocean Epoch was positioned at the Hill-1 location at 0100 on 8 December 2003.

Intended Hill-1 Location

The coordinates of the intended Hill-1 location were provided by Santos as follows:

Datum: GDA94

Latitude : 38° 48' 50.370" South
Longitude : 141° 50' 39.580" East

Projection: MGA Zone 54, CM 141° East

Easting : 573 303.44m
Northing : 5 703 526.08m

Rig Positioning Tolerance : ± 25m

Intended Rig Heading : 240.0° (T)

Final Differential GPS Drillstem Position at the Hill-1 Location

The final Differential GPS Position of the Ocean Epoch drillstem at the Hill-1 location was computed from data observed between 1036 and 1136 on 9 December 2003. The final position is as follows:

Datum: GDA94

Latitude : 38° 48' 50.381" South
Longitude : 141° 50' 39.579" East

Projection: MGA Zone 54, CM 141° East

Easting : 573 303.40m
Northing : 5 703 525.73m

The final Differential GPS drillstem position is 0.35m on a bearing of 185.6° (T) from the intended Hill-1 location.

Final Rig Heading : 240.5° (T)

All times quoted in this report are Eastern Standard Summer Time (UTC + 11.0 hours).

1. RESULTS

1.1 FINAL DIFFERENTIAL GPS POSITION OF THE OCEAN EPOCH DRILLSTEM AT THE HILL-1 LOCATION

The Ocean Epoch was positioned at the Hill-1 location at 0100 on 8 December 2003.

The final Differential GPS position of the Ocean Epoch drillstem at the Hill-1 location, was determined using Fugro TGS' MultiFix 3 positioning software interfaced to a BD112 GPS card, with differential corrections being provided by Fugro TGS' SkyFix Spot Differential GPS services.

The final fix routine, within Fugro TGS' GNS2 navigation software version 2.48, was used to compute the final Differential GPS position of the drillstem at the Hill-1 location. A total of 720 position fixes were recorded at 5 second intervals between 1036 and 1136 on 8 December 2003.

Refer to Appendix A for the GNS2 final Differential GPS position printouts at the Hill-1 location. Associated graphs are located in Appendix B.

Differential corrections from the SkyFix Spot reference stations in Melbourne, Sydney and Adelaide were used in the MultiFix 3 software computations to derive the final Differential GPS position.

The final surface coordinates of the Ocean Epoch drillstem at the Hill-1 location, determined from Differential GPS observations are as follows:

Total number of samples used = 720.

The computed antenna position is as follows:

GPS Antenna Position

Datum: WGS84

Latitude	:	38° 48' 50.925" South	(S.D. 0.30m)
Longitude	:	141° 50' 37.893" East	(S.D. 0.39m)
Ellipsoidal Height	:	14.04m	(S.D. 0.54m)

Transforming the above WGS84 coordinates to GDA94 coordinates using the parameters in section 6, gives the following antenna coordinates:

GPS Antenna Position

Datum: GDA94

Latitude	:	38° 48' 50.925" South
Longitude	:	141° 50' 37.893" East
Ellipsoidal Height	:	14.04m

By applying a distance of 43.97m on a bearing of 67.6° (T) from the antenna position, the following drillstem coordinates are calculated:

Final Differential GPS Position of the Drillstem at the Hill-1 Location

Datum: GDA94

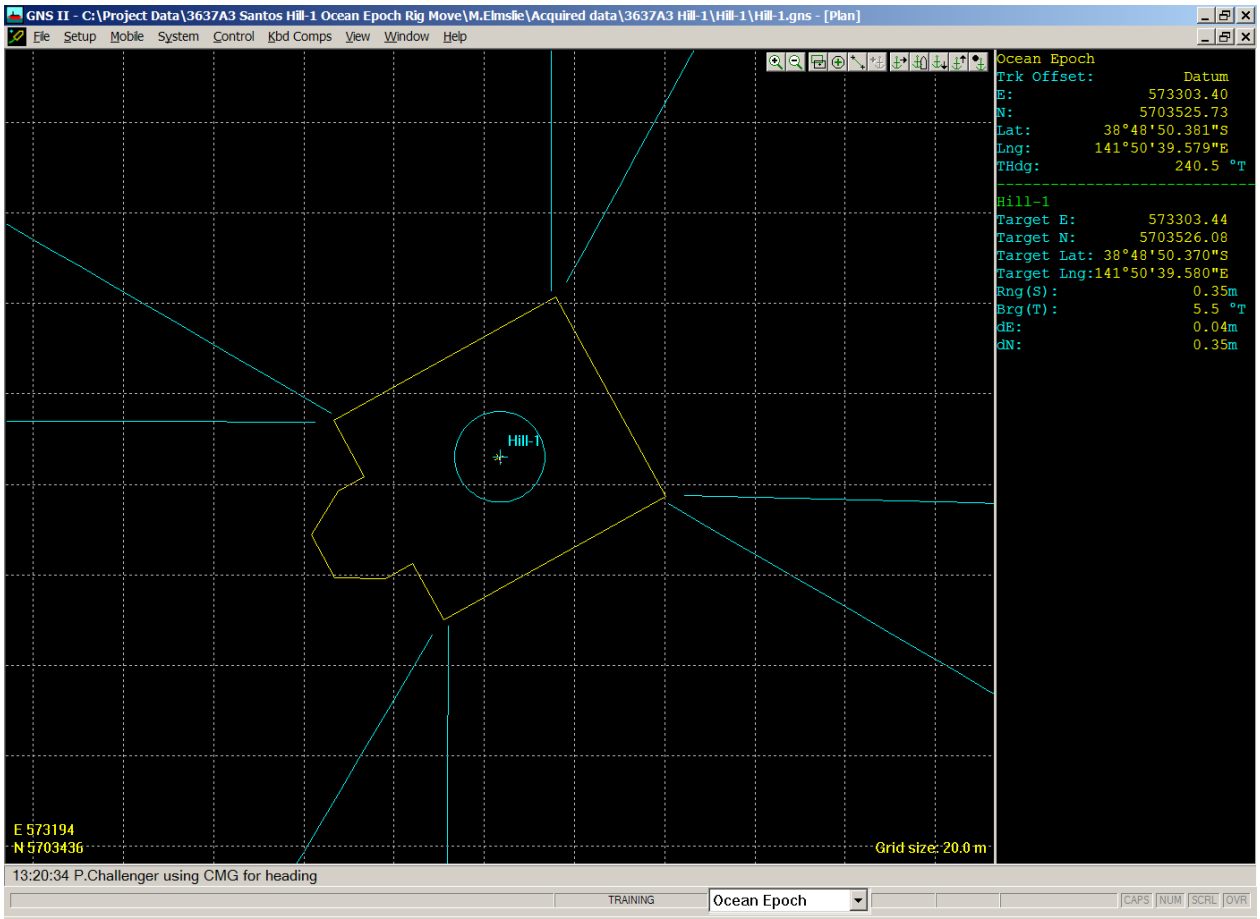
Latitude : 38° 48' 50.381" South
Longitude : 141° 50' 39.579" East

Projection: MGA Zone 54, CM 141° East

Easting : 573 303.40m
Northing : 5 703 525.73m

This final Differential GPS position of the drillstem is 0.35m on a bearing of 185.6° (T) from the intended Hill-1 location.

Final Rig Heading : 240.5° (T)



SkyFix Spot Differential GPS Position and Intended Position at the Hill-1 Location

1.2 OCEAN EPOCH ANCHOR POSITIONS

Deployed anchor positions were derived from the computed anchor function within the GNS2 software. The function takes into account the length of anchor chain out, water depth, anchor tension and the wet weight of anchor chain to compute the deployed anchor positions. The final anchor positions are tabulated below:

Datum: GDA94 Projection: MGA Zone 54, CM 141° East

Anchor	Intended Anchor Position		Final Anchor Position	
	Easting (m)	Northing (m)	Easting (m)	Northing (m)
Anchor 1	573 282.00	5 702 316.00	573 286.00	5 702 268.00
Anchor 2	572 693.00	5 702 477.00	572 640.00	5 702 397.00
Anchor 3	572 090.00	5 703 545.00	572 050.00	5 703 535.00
Anchor 4	572 256.00	5 704 131.00	572 266.00	5 704 119.00
Anchor 5	573 325.00	5 704 736.00	573 318.00	5 704 775.00
Anchor 6	573 914.00	5 704 575.00	573 912.00	5 704 641.00
Anchor 7	574 517.00	5 703 507.00	574 500.00	5 703 488.00
Anchor 8	574 351.00	5 702 921.00	574 357.00	5 702 924.00

Difference of final anchor positions from the intended anchor positions.

Anchor	Dropped by	Easting (m)	Northing (m)
Anchor 1	L.Dawn	-4	+48
Anchor 2	P.Challenger	+53	+80
Anchor 3	P.Challenger	+40	+10
Anchor 4	P.Challenger	-10	+13
Anchor 5	P.Challenger	+7	-39
Anchor 6	P.Challenger	+1	-66
Anchor 7	Ocean Epoch	+17	+20
Anchor 8	P.Challenger	-6	-3

Horizontal distance and bearing from the Ocean Epoch fairleads to the final anchor positions.

Anchor	Bearing (T)	Horizontal Distance (ft)
Anchor 1	179.8°	4006
Anchor 2	210.2°	4161
Anchor 3	269.5	3980
Anchor 4	299.7°	3800
Anchor 5	359.6°	3978
Anchor 6	28.4°	4036
Anchor 7	91.0	3795
Anchor 8	119.7°	3860

Ocean Epoch anchor details are located in Appendices C, D and E of this report.

2. SAFETY

A pre-rig move meeting was held at Fugro TGS' Perth offices on 27 November 2003. Fugro TGS personnel M. Elmslie and B. O'Brien were present. During the meeting safety procedures were discussed including correct operation and handling of equipment. It was also confirmed that personnel had been issued with the appropriate safety equipment.

Should an incident occur, Fugro TGS' procedures require the incident to be recorded on the appropriate forms and Fugro TGS' QA & Safety Manager to be notified immediately. The QA & Safety Manager will initiate a full and thorough investigation with corrective action being introduced to prevent further incidents.

On 7 December 2003 at 1030 Fugro TGS pesonnel attended a fire and abandonment drill.

There were no incidents involving Fugro TGS personnel during this project. Fugro TGS personnel carried out their duties at all times in accordance with Company and Statutory Regulations and Guidelines.

When demobilising the Ocean Epoch, all equipment was packed securely in the designated area where it would not cause obstructions. All heavy or fragile boxes were clearly labelled to avoid accidents during handling.

A project debrief was also held at Fugro TGS' Perth offices on 11 December 2003. During the meeting the safety procedures that had been undertaken were discussed and reviewed. It was noted that all personnel had taken due care and as a result there had been no incidents.

3. SUMMARY

3.1 REQUIREMENTS

Fugro TGS (Australia) Ltd were contracted by Santos Offshore Pty Ltd to provide personnel and positioning equipment consisting of Fugro TGS' SkyFix/SkyFix Spot Differential GPS for the rig move of the Ocean Epoch to the Hill-1 location.

The project requirements were as follows:

(a) Provide real-time positioning of the semi-submersible drilling rig Ocean Epoch and the anchor handling vessels Lady Dawn and Pacific Challenger during the anchor recovery at the Megamouth-1 location.

(b) Provide real-time positioning of the semi-submersible drilling rig Ocean Epoch and the anchor handling vessels Lady Dawn and Pacific Challenger, during transit to the Hill-1 location.

(c) Differential GPS Positioning of the Ocean Epoch at the Hill-1 location.

(d) Real-time positioning (including GNS2 fixing/logging/streaming) of the Ocean Epoch, Lady Dawn and Pacific Challenger during anchor deployment operations at the Hill-1 location.

(e) Determine the final Differential GPS position of the Ocean Epoch drillstem at the Hill-1 location using a Multiple Reference Station Differential GPS solution.

(f) The provision of a comprehensive positioning report containing the final Differential GPS position of the Ocean Epoch drillstem and anchors at the Hill-1 location.

The positioning requirements were as follows:

(a) Intended Hill-1 location:

Datum: GDA94

Latitude	:	38° 48' 50.370" South
Longitude	:	141° 50' 39.580" East

Projection: MGA Zone 54, CM 141° East

Easting	:	573 303.44m
Northing	:	5 703 526.08m

(b) Positioning tolerance : ± 25m

(c) Intended rig heading : 240.0° (T)

3.2 SUMMARY OF EVENTS

All times quoted are in Western Standard Time (UTC + 8.0 hours).

1 December 2003

0800 Fugro TGS personnel depart Perth. (UTC+8.00).
1435 Arrive Melbourne.
1500 Check into accommodation, notified that personnel will not be departing for Ocean Epoch until 3 December 2003.
2359 Fugro TGS personnel on standby.

2 December 2003

0000 Fugro TGS personnel on standby.
1200 Fugro TGS personnel on standby notified that personnel will depart for the Ocean Epoch until 4 December 2003.
2359 Fugro TGS personnel on standby.

3 December 2003

0000 Fugro TGS personnel on standby.
1200 Fugro TGS personnel on standby.
2359 Fugro TGS personnel on standby.

4 December 2003

0530 Fugro TGS personnel check into Bristows heliport, Essendon.
0645 Depart Essendon for Ocean Epoch.
0800 Arrive Ocean Epoch.
0900 Container found, waiting for crane to lift container into accessible position.
1500 Commence mobilisation.
1555 #5 PCC passed to L.Dawn.
1604 L.Dawn chasing out #5.
1621 #5 off bottom.
1625 Heaving in #5.
1700 Mobilisation complete, navigation operational, AHV's not receiving TRACS.
1710 #5 bolstered.
1721 #5 PCC passed back to rig.
1916 #1 PCC passed to L.Dawn.
1923 L.Dawn chasing out #1.
1944 #1 off bottom.
1945 Heaving in #1.
2025 #1 bolstered.
2040 #1 PCC passed back to rig.
2050 #8 PCC passed to L.Dawn.

4 December 2003 (continued)

2057 L.Dawn chasing out #8.
2110 Casing cut.
2115 Commence Deballasting to 38'.
2124 #8 off bottom.
2125 Heaving in #8.
2142 BL transferred to P.Challenger.
2219 #8 bolstered.
2229 #8 PCC passed back to rig.
2230 BL returned to rig.
2242 #4 PCC passed to L.Dawn.
2250 L.Dawn chasing out #4. TRACS operational.
2311 #4 off bottom.
2312 Heaving in #4.
2355 #4 bolstered.
0027 #4 PCC passed back to rig.
0050 All stop deballasting, rig at 38'.
0109 #6 PCC passed to P.Challenger.
0118 P.Challenger chasing out #6.
0125 L.Dawn connected to tow bridle.
0133 P.Challenger @ #6, waiting for L.Dawn to take up weight on tow bridle.
0158 #6 off bottom.
0200 Heaving in #6.
0207 Resume deballasting to 30'.
0253 #6 bolstered (upside down).
0300 #6 PCC passed back to rig.
0346 #2 PCC passed to P.Challenger.
0355 P.Challenger chasing out #2.
0412 All stop deballasting @ 26'.
0415 #2 off bottom.
0420 Heaving in #2.
0506 #2 bolstered (upside down).
0510 Resume deballasting to 25'.
0511 #2 PCC passed back to rig.
0512 Turning #2 in bolster.
0526 #2 bolstered correct way.
0545 Finish deballasting @ 25'.

5 December 2003

0550 #6 bolstered correct way.
0607 #4 bolstered correct way.
0620 #3 PCC passed to P.Challenger.
0625 P.Challenger chasing out #3.
0648 #3 off bottom.
0650 Heaving in #3.
0655 Commence heaving in #7.
0723 All stop heaving while #3 is bolstered.
0800 Santos Survey rep J.Tighe arrives.
0835 Resume heaving in #7.
0900 #7 bolstered, commence toe to Hill-1.
1200 Rig position 38°45.5' S 148°22.7' E Course 148° DTOG 322nm.
2011 Commence solar obs.
2019 Complete solar obs.

6 December 2003

0000 Rig position 39°17.3' S 147°03.0' E Course 238° DTOG 264nm.
1200 Rig position 39°23.9' S 146°03.0' E Course 274° DTOG 202nm.
1430 GPS signal lost in MultiFix.
1545 GPS antenna replaced, GPS signal returns.
2010 Commence Solar obs.
2030 Complete solar obs, C-O of –86.80° calc'd and entered into GNS2.

7 December 2003

0000 Rig position 39°19.6' S 144°37.1' E Course 274° DTOG 135nm.
1030 Fugro TGS personnel attend fire and abandonment drill.
1045 Fire drill complete.
1130 Advised by Barge engineer that amount of chain to be paid out is to be 4000', new anchor coords calc'd.
1200 Rig position 39°13.5' S 143°12.9' E Course 270.1° DTOG 68.9nm.
1300 Fugro TGS personnel attend weekly safety meeting.
2335 L.Dawn shortening tow wire.

8 December 2003

0002 Ballasting down to 30'.
0007 At WP5, commencing run in.
0048 Dropping #7 to 400'.
0100 #7 on bottom, 574 473 5 703 488.
0128 Rig over Hill-1 location.
0130 #3 assigned to P.Challenger.

8 December 2003 (continued)

0146 #3 PCC passed to P.Challenger.
0202 P.Challenger running out #3.
0222 #3 on bottom, 572 103 5 703 535.
0256 #6 assigned to P.Challenger.
0304 #6 PCC passed to P.Challenger.
0317 P.Challenger running out #6.
0333 #6 on bottom, 573 943 5 704 698.
0400 #6 PCC passed back to rig.
0412 #2 assigned to P.Challenger.
0420 #2 PCC passed to P.Challenger.
0436 P.Challenger running out #2.
0453 #2 on bottom, 572 580 5 702 296.
0518 #2 PCC passed back to rig.
0536 #8 assigned to P.Challenger.
0539 #8 PCC passed to P.Challenger.
0549 P.Challenger running out #8.
0604 #8 on bottom, 577 441 5 702 875.
0607 L.Dawn disconnected from tow bridle.
0629 #8 PCC passed back to rig.
0648 #4 assigned to P.Challenger.
0650 #4 PCC passed to P.Challenger.
0655 P.Challenger running out #4.
0716 #4 on bottom, 572 189 5 704 163.
0727 #1 PCC passed to L.Dawn.
0822 #1 on bottom, 573 285 5 702 182.
0837 #4 PCC passed back to rig.
0852 #5 PCC passed to P.Challenger.
0910 #1 PCC passed back to rig.
0920 #5 on bottom, 573 318 5 704 906.
0925 Storm tensioning.
0950 #5 PCC passed back to rig.
1155 Rig at 55' draft.
1225 Rig crawl finished.
1936 Commence preliminary fix.
1946 Complete preliminary fix, rig 0.88m on a bearing of 231.9°(T) from the intended Hill-1 location.
2100 Spudding in.

9 December 2003

0500 Commence running of 30” casing.
0900 Complete running of 30” casing.
1036 Commence final fix.
1136 Complete final fix, final rig location is 0.35m on a bearing of 185.6°(T) from intended location.
1425 Commence demobilisation.
1500 Stopped demobilisation, waiting on crane lift.
1645 Recommence demobilisation.
1710 Demobilisation complete.

10 December 2003

0845 Fugro TGS personnel depart Ocean Epoch.
1000 Arrive Essendon airport.
1145 Depart Melbourne.
1215 Arrive Perth (UTC +8.00).

4. EQUIPMENT ANALYSIS

4.1 EQUIPMENT PERFORMANCE

During the positioning of the semi-submersible drilling rig Ocean Epoch from the Megamouth-1 location to the Hill-1 location, no significant problems were encountered with Fugro TGS' equipment or software.

A problem arose on the Ocean Epoch on 6 December 2003 at 1430. The AD251 GPS antenna was not receiving any satellites and therefore a position could not be calculated by the BD112 GPS card. The antenna was replaced and the navigation system returned to functioning correctly.

It should be noted that this issue caused no delays to the Hill-1 rig move.

5. EQUIPMENT CHECKS AND CALIBRATIONS

5.1 DIFFERENTIAL GPS CHECK FIX

A Differential GPS check fix of the drillstem position of the Ocean Epoch at the Megamouth-1 location was computed using SkyFix Spot Differential GPS. 120 fixes were taken. Appendix G contains the results of the check fix of the Ocean Epoch drillstem position at the Megamouth-1 location.

The published Differential GPS coordinates of the Ocean Epoch drillstem at the Megamouth-1 location are as follows:

Datum : GDA94

Latitude	:	38° 35' 44.229" South
Longitude	:	148° 16' 31.859" East

Projection : MGA Zone 55, CM 147° East

Easting	:	611 077.19m
Northing	:	5 727 325.06m

The computed Differential GPS check fix coordinates of the Ocean Epoch drillstem are as follows:

Datum : GDA94

Latitude	:	38° 35' 44.305" South
Longitude	:	148° 16' 31.905" East

Projection : MGA Zone 55, CM 147° East

Easting	:	611 078.26m
Northing	:	5 727 322.71m

The Differential GPS check fix of the Ocean Epoch drillstem position is 2.58m on a bearing of 194.7°(T) from the published Megamouth-1 location.

The client representative reviewed all geodetic parameters and antenna offsets at which time Fugro TGS' equipment was accepted as operating correctly.

5.2 GYROCOMPASS CALIBRATION

The S.G. Brown 1000S Gyrocompass installed onboard the Ocean Epoch was calibrated on 6 December 2003 using a marine sextant. A series of measurements of the horizontal angle between the centreline of the rig and the sun was observed while accurately recording local time at the instant of each observation. The gyrocompass heading was simultaneously recorded within GNS2 data files.

Fugro TGS' Solar Observation software was used to determine the azimuth of the sun for each observation. The observed horizontal angle was applied to the sun's azimuth to determine the true heading of the rig. Each Computed (C) true heading was then compared with the Observed (O) gyrocompass heading to determine the Computed minus Observed (C-O) value for the gyrocompass. The C-O value in GNS2 was set to zero prior to conducting the gyrocompass calibration.

Observation Date : 6 December 2003

Average Local Time (HMS)	Average Horizontal Angle (DMS)	Azimuth Sun (DMS)	Azimuth RO (DMS)	Calculated (C) True Heading (D.D)	Observed (O) True Heading (D.D)	C-O (D.D)
20:23:13	329° 08' 00"	241° 26' 36"	272° 18' 36"	272.31°	359.20°	-86.89°
20:23:58	328° 39' 00"	241° 19' 32"	272° 40' 32"	272.68°	359.50°	-86.82°
20:24:32	328° 09' 00"	241° 14' 12"	273° 05' 12"	273.09°	360.00°	-86.91°
20:25:10	326° 05' 00"	241° 08' 14"	275° 03' 14"	275.05°	360.80°	-85.75°
20:25:54	325° 38' 00"	241° 01' 18"	275° 23' 18"	275.39°	361.30°	-85.91°
20:26:51	328° 28' 00"	240° 52' 20"	272° 24' 20"	272.41°	359.30°	-86.89°
20:27:45	329° 17' 00"	240° 43' 48"	271° 26' 48"	271.45°	358.70°	-87.25°
20:28:09	328° 43' 00"	240° 40' 01"	271° 57' 01"	271.95°	359.20°	-87.25°
20:28:41	328° 19' 00"	240° 34' 57"	272° 15' 57"	272.27°	359.30°	-87.03°
20:29:14	327° 46' 00"	240° 29' 44"	272° 43' 44"	272.73°	359.50°	-86.77°
20:29:42	327° 07' 00"	240° 25' 18"	273° 18' 18"	273.30°	360.50°	-87.20°
20:30:20	327° 35' 00"	240° 19' 16"	272° 44' 16"	272.74°	359.70°	-86.96°

Mean C-O = -86.80°

The mean C-O of -86.80° was input into the GNS2 navigation software and used during the final fix routine at the Hill-1 location. See Appendix F for the gyrocompass calibration results.

6. GEODETIC PARAMETERS

The datum for coordinates determined by Fugro TGS' SkyFix and SkyFix Spot Differential GPS are referenced to International Terrestrial Reference Frame 2000 (ITRF2000). The datum for coordinates listed in this report are referenced to the Geocentric Datum of Australia 1994 (GDA94).

6.1 ITRF2000 DATUM AND PROJECTION

Datum	:	**ITRF2000 (Epoch 1997.0)**
Ellipsoid/Spheroid	:	Geodetic Reference System 1980 (GRS80)
Semi-major Axis (a)	:	6 378 137.000m
Semi-minor Axis (b)	:	6 356 752.314m
Eccentricity Squared (e^2)	:	0.006 694 380
Flattening ($^1/_f$)	:	298.257 222 101
Projection Name	:	**Universal Transverse Mercator (UTM)**
Projection Type	:	Universal Transverse Mercator (UTM)
UTM Zone	:	50 South
Central Meridian (CM)	:	117° East
Scale factor on the CM	:	0.9996
False Easting	:	500 000m
False Northing	:	10 000 000m
Latitude of Origin	:	0° (Equator)
Unit of Measure	:	International Metre

Note: The WGS84 datum and the ITRF2000 datum are consistent in the order of a few centimetres and are considered to be the same.

6.2 GDA94 DATUM AND PROJECTION

Datum	:	**Geocentric Datum of Australia 1994 (GDA94)**
Ellipsoid/Spheroid	:	Geodetic Reference System 1980 (GRS80)
Semi-major Axis (a)	:	6 378 137.000m
Semi-minor Axis (b)	:	6 356 752.314m
Eccentricity Squared (e^2)	:	0.006 694 380
Flattening ($^1/_f$)	:	298.257 222 101
Projection Name	:	**Map Grid of Australia (MGA)**
Projection Type	:	Universal Transverse Mercator (UTM)
MGA Zone	:	54
Central Meridian (CM)	:	141° East
Scale factor on the CM	:	0.9996
False Easting	:	500 000m
False Northing	:	10 000 000m
Latitude of Origin	:	0° (Equator)
Unit of Measure	:	International Metre

Note: Where an accuracy of a metre or greater is required, the WGS84 datum and the GDA94 datum are considered to be the same.

6.3 DATUM TRANSFORMATION - ITRF2000 TO GDA94

From the Geocentric Datum of Australia Technical Manual (Version 2.2) produced by the Inter-governmental Committee on Surveying & Mapping (ICSM), the ITRF2000 datum and the WGS84 datum are consistent at a level in the order of a few centimetres and are considered to be the same. Similarly, where an accuracy of a metre or greater is required, the GDA94 datum and the WGS84 datum are considered to be the same. In January 1994 the GDA94 datum and the ITRF datum were coincident, however the GDA94 datum is moving with the Australian tectonic plate in a North northeastly direction at a rate of approximately 7 centimetres per year.

The following 7-parameter datum transformation was used by Fugro TGS' GNS2 software to convert ITRF2000 coordinates to GDA94 coordinates:

Dx	=	0.000m
Dy	=	0.000m
Dz	=	0.000m
Rx	=	0.000"
Ry	=	0.000"
Rz	=	0.000"
Scale	=	0.000 p.p.m.

The sign convention used in Fugro TGS' GNS2 software is that used by the US Department of Defence, where a positive rotation about the Z axis is an anti-clockwise movement of the X and Y axes (when viewed from the North Pole looking towards the centre of the Earth).

7. EQUIPMENT DESCRIPTIONS

7.1 GNS2

GNS2 (General Navigation System) is Fugro TGS' third generation of On-line Navigation Survey Control software. It has been written by Fugro TGS' Software Support Group in C++ for operation under Windows® 95 or Windows® 98 or Windows® NT. GNS2 adheres to the operation and dialogue conventions of the Microsoft Windows® environment. Attention has been paid to preserving a consistent operator interface, while at the same time modifying individual dialogue boxes to reflect specific logical circumstances. It has been designed for operation with a pointing device such as a mouse or a tracker ball but control can still be effected in case of the absence or failure of such a device.

The program has the ability to accommodate a large number and variety of mobiles, including surface vessels/ships, anchor handling vessels, tugs, barges, ROVs, towfish, aircraft, vehicles and submersibles etc. The only limiting factors on the number of mobiles that can be tracked in GNS2 are the number of input/output serial communication ports available on the computer and the computer's memory.

For the input/output (I/O) of navigation and sensor data, GNS2 employs intelligent multi-channel serial communications boards to expand a computer's serial input/output facility. Currently GNS2 can support up to 26 communication (Comm) ports, which would consist of the computer's two internal Comm ports and three 8 channel serial communications boards fitted in the computer's internal expansion slots.

If Least Squares Computations (LSCs) are employed for positional calculations, whether two-dimensional (2D), three-dimensional (3D) or altitude aided, GNS2 uses standard iteration routines for the minimisation of residuals using 'variation of coordinate' algorithms. The number of positioning systems/computations that GNS2 can handle, is only limited by the number of I/O serial communication ports available on the computer and the computer's memory.

All input observables are accepted on interrupt. Screen updates and other internal triggers are paced to once per second but time critical activities occur at discrete moments as required.

The GNS2 application workspace can extend beyond the display area, which is normally restricted to a single monitor connected to the computer. By using one or more multiple VGA cards, an enlarged display area can spread across multiple monitors.

Currently GNS2 can display 14 different types of view windows. Several copies of the same type of view window can be invoked at any one time. This may be required when several mobiles are being tracked and a Plan, Helmsman's or Bullseye display are required for each one or when the data on several Comm ports are to be viewed simultaneously. Each window can be individually sized to optimise use of the available display area.

GNS2 can be operated in 2 modes; GNS2 Master or GNS2 Remote. GNS2 Master has the full functionality of GNS2. GNS2 Remote is run on a separate computer and allows independent configuration of the graphics display and its associated numeric information. GNS2 Remote is operated on Anchor Handling Vessels or anywhere where positional information is required. (eg. Vessel Masters, ROV Pilots, Winch Control Stations). The link between GNS2 Master and GNS2 Remote can be via a telemetry link or hard wired cable.

7.2 GLOBAL POSITIONING SYSTEM (GPS)

System Description

The NAVSTAR GPS (Navigational Satellite Timing and Ranging Global Positioning System) is a USA Military all-weather, space-based positioning system that transmits signals from a constellation of satellites orbiting the Earth. It is capable of providing suitably equipped users worldwide with accurate three-dimensional positions on, or near, the Earth's surface. The accuracy of these determined positions can vary from a few millimetres to several 10's of metres depending on the GPS receiver and on the method of data acquisition and processing. System design consists of three integrated parts: the Ground Control Segment, the Space Segment and the User Segment.

The operational space segment consists of 24 production satellites and 3 active spares; the term Space Vehicle (SV) is used as a synonym for satellite. The satellites are in high orbits, at approximately 20,200km, having an orbit period of 12 hours. They are arranged in 6 orbital planes, inclined at 55 degrees with near circular orbits. The configuration provides complete 4-satellite (3D) coverage worldwide.

GPS Observations

There are two important types of GPS observations (observables): Pseudo-range and Carrier Phase. Carrier phase is sometimes also referred to as carrier beat phase. Pseudo-range techniques are generally used for navigation. In high-precision baseline surveying the carrier phase is used. Although the (undifferenced) phase can be used directly, it has become common practice, at least in surveying applications, to process certain linear combinations of the original carrier phase observations (double differences and triple differences).

Pseudo-ranges

The pseudo-range is a measure of the distance between the satellite and the receiver at the epochs of transmission and reception of the signals. The transit time of the signals is measured by comparing (correlating) identical pseudo-random noise (PRN) codes generated by the satellite and by the receiver. A code-tracking loop within the receiver shifts the internal replica of the PRN code in time until maximum correlation occurs. The codes generated at the receiver are derived from the receiver's own clock, and the codes of the satellite transmissions are generated by the satellite system of clocks. It follows that unavoidable timing errors in both the satellite and the receiver clock will cause the measured quantity (pseudo-range) to differ from the geometric distance.

Where instantaneous positions are required, pseudo-range is the preferred observable. Given the satellite ephemeris (i.e. the position of the satellite at the epoch of transmission), there are seven unknowns: two clock errors, three receiver coordinates and the ionospheric and tropospheric delays. The effect of the satellite clock error is negligible for the typical navigation solution, particularly considering that the time errors are indistinguishable from the ionospheric and tropospheric delays. The satellite clocks are constantly monitored and synchronised with GPS time as maintained by the control centre. Actual offsets of the satellite clocks are approximated by polynomials in time and transmitted as part of the navigation message to the user for the correction of the measured pseudo-ranges. The ionospheric and tropospheric delays can be computed on the basis of ionospheric and tropospheric models, thus there are four unknowns left X, Y, Z and receiver clock error. These can be determined from four pseudo-ranges measured simultaneously to four GPS satellites.

Carrier Phase

The phase observable is the difference between the phase of the carrier signal of the satellite, measured at the receiver, and the phase of the local oscillator within the receiver at the epoch of measurement. This can be regarded as a biased range measurement of the satellite-receiver distance with the integer number of carrier waves being unknown. The wavelength of the L1 carrier is about 19cm. Because of the fraction of the carrier phase is measured, the term "interferometry" is often used to describe carrier phase techniques.

7.3 SkyFix/SkyFix Spot Differential GPS (DGPS)

Differential GPS (DGPS)

GPS is primarily a USA Defence space-based positioning system capable of operating worldwide and in all weather conditions. The USA Military can degrade the accuracy of GPS with the use of Selective Availability (SA) to control the accuracy of Pseudo-range measurements. Essentially, the user is given a false Pseudo-range for each satellite so that the resulting measurement is in error by a controlled amount. On the 1 May 2000 SA was discontinued conditionally and coincided with the successful demonstration of the ability to selectively deny GPS signals on a regional basis. SA has been set to zero and can be reinstated during periods of heightened global tension.

GPS signals are affected by several sources of positional bias, the largest of which was SA. The remaining biases of the ionosphere, the troposphere, time, satellite ephemeris and inherent reciever noise also give rise to substantial bias of position.

Differential GPS is a means by which the civil user can improve the accuracy and quality of GPS to the 1-3 metre level. It requires a receiver be located at a precisely known point from which pseudo-range corrections for each satellite can be determined and monitored. These pseudo-range corrections are then communicated by means of a telecommunications link to users at unknown locations. In the relative mode, most of the important systematic errors common to the known station and at the unknown location cancel out to improve the accuracy of the computed position.

SkyFix/SkyFix Spot Differential

SkyFix

Fugro TGS (Australia) Ltd introduced its SkyFix Differential GPS System in Australia in February 1991, using the Inmarsat Pacific and Indian Ocean marine communications satellites as the differential data broadcast link. Extensive performance trials and projects undertaken to date have shown SkyFix to meet the best industry expectations in terms of quality of service and accuracy.

Satellite communications systems, particularly at the Inmarsat L-band frequencies of 1.5 GHz are reliable and free of the interference associated with the crowded MF/HF bands. This high data integrity gives users confidence that the corrections will be continuously received without interference.

The SkyFix Australian network comprises of reference stations at Dampier, Broome, Perth, Adelaide, Melbourne, Sydney, Cairns and Darwin.

SkyFix Spot

The SkyFix Spot Differential GPS System was launched in Australia in December 1994, using the OPTUS high powered focused communications satellite as the differential data broadcast link. Projects undertaken to date have shown SkyFix Spot to meet the industry expectations in terms of quality of service and accuracy.

The SkyFix Spot system has a link capacity of 1200 bits per second, similar to the SkyFix system but because it is only transmitting corrections from the Australian network an update rate of better than five seconds is achieved.

The OPTUS satellite uses the L-band frequencies of 1.5586 GHz and are very reliable and free of interference avoiding data loss associated with the crowded MF/HF bands.

The SkyFix Spot network comprises of reference stations at Dampier, Broome, Perth, Adelaide, Melbourne, Sydney, Cairns, Darwin, Alice Springs and also Ujung Pandang and Jakarta in Indonesia and Wellington, New Zealand.

The differential corrections generated at each reference station are brought via landline links to the data hub and control centre in Singapore, where the system is monitored for performance and quality. From there, a composite message containing full RTCM 104 version 2 formatted data from all reference stations are sent via dual redundant links to Satellite Earth Stations at Sentosa Island, Singapore, O.T.C. Perth, Western Australia and OPTUS, Perth, Western Australia, for uplink and broadcast over the Inmarsat Pacific and Indian Ocean Region satellites and the OPTUS Satellite.

The SkyFix/SkyFix Spot system includes a 24 hour monitoring facility to ensure the validity of data received at the control centre from the Differential GPS reference stations, and that the same data are received over the SkyFix/SkyFix Spot satellite data link.

7.4 TRIMBLE BD112 GPS CARD

Standard Features

Sub-meter accuracy
Real-time positioning
12 Channel GPS receiver 1, 5 or 10 Hz update rate
Two RS-232 serial ports
RTCM SC-104 input
NMEA-0183 output
TSIP interface protocol
Carrier phase
1 PPS output

Physical Characteristics

Size	115mm L x 80mm W x 22 mm D
Weight	68.1 g (.15 lbs)
Operating temperature	-40°C to +70°C (-40°F to +158°F)
Storage temperature	-40°C to +85°C (-40°F to +185°F)

Compact Dome Antenna

Diameter	5.68″ D (14.6cm)
Height	3.38″ (8.6cm)
Weight	294g
Power	35–40 mA @ +5 VDC @ 25°C

Technical Specifications

General	12 parallel channels track up to 12 satellites, L1 C/A code with carrier filtering
Update rate	1, 5 or 10Hz. Default is 5 Hz
Accuracy	Typically less than one meter RMS; Assumes at least 5 satellites, PDOP less than 4, and RTCM SC-104 standard format broadcast from a Trimble 4000RS™, BD112 reference station or equivalent reference station
Time to first fix	< 30 seconds, typical
NMEA messages	ALM, GCA, GLL, GSA, GSV, VTG, ZDA
Power consumption	500 mA @ +5 V (Includes compact dome antenna power, typical at 25°C)

7.5 MultiFix 3

7.5.1 System Overview

MultiFix 3 is Fugro TGS' third generation *multiple reference station* differential GPS (DGPS) real time position computation and quality control program. It is an integral part of the Fugro TGS SkyFix Premier service but can also be used with the standard SkyFix service. MultiFix 3 has more advanced features than its predecessor, MultiFix 2, including being able to use dual frequency receivers and form real time 'Iono-Free DGPS position solutions'.

MultiFix 3 is one of a series of programs available under the group name Zero, which includes other tools and utilities with a similar user interface and layout structure, like static and dynamic position comparison programs, a correction monitor program, a terminal program and a replay utility.

MultiFix 3 takes in Almanac, Ephemeris and Raw Code and Carrier measurements from a single or dual frequency GPS receiver (or, for replay, from logged files). It takes in RTCM SC104 Version 2 differential correction messages from one or more RTCM correction delivery systems. It also takes in RTCM Type 15 or Fugro TGS Proprietary RTCM Type 55 Ionospheric range corrections generated at selected SkyFix Premier reference stations and broadcast via the Fugro TGS global network of high (SkyFix Spot-Optus) and low (SkyFix-Inmarsat) power satellite based L-Band beams.

Key features of the program are:

- No limit on the number of RTCM correction delivery systems (data links)
- No limit on the number of RTCM differential reference stations
- No limit on the number of computations (solutions)
- Each computation can employ corrections from any combination of reference stations available
- Computations are weighted least squares with statistical evaluation based upon the UKOOA recommendations
- No limit on the number of outputs
- No limit on the number of view windows
- View windows can be customised
- Extra NMEA outputs can be defined
- TCP/IP communication via sockets for GPS, RTCM and position data transfer between networked computers

MultiFix 3 has been designed in a modular fashion such that data is passed between modules as if over a computer network. The core module MultiFix 3 performs the computation of position. Additional modules are available and more will be made available in the future. While a single computer can be used, the various modules will equally be able to be run on different computers, provided there is a network interconnection.

MultiFix 3 uses the EGM96 geoid/spheroid separation model.

The RTCM corrections that are generated at reference stations are contaminated by a variety of error components, one of which is Ionospheric delay. The Ionospheric delay is currently more variable because of greater sun spot activity. MultiFix 2 and MultiFix 3's standard computation uses the Klobuchar Ionospheric delay model. This model is updated periodically but is not responsive to the current short-term variability. MultiFix 3 has an additional calculation option when working with dual frequency receivers and in receipt of Type 15 or 55 RTCM messages. With dual frequency receivers, estimates can be made of the Ionospheric delay by examining the differences between the measurements from the two frequencies. If the same procedure for estimation of Ionospheric delay is performed at the reference stations

and on the mobile, both the RTCM corrections and the pseudo-ranges can have the Ionospheric delay removed, effectively providing an Iono-Free DGPS position solution.

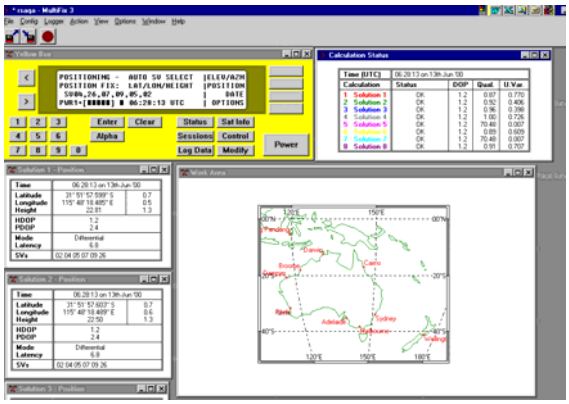
7.5.2 Hardware Requirements

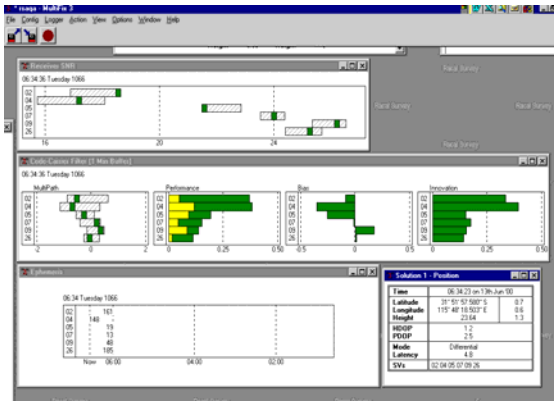
Optimum requirements for MultiFix 3 are:

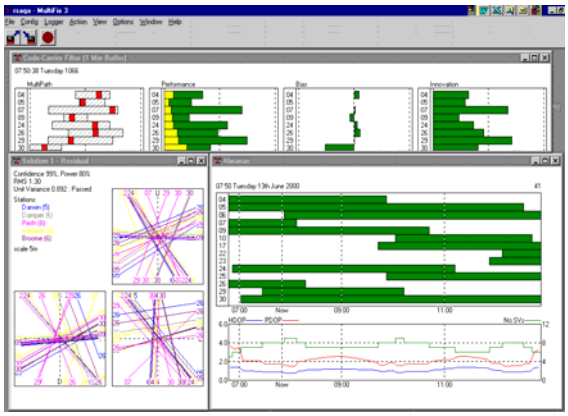
- 350 MHz Pentium II computer
- 32 Mb RAM
- Windows 95, 98 or NT operating system
- Graphics resolution of at least 800 x 600 pixels
- Intelligent multi-port serial I/O board

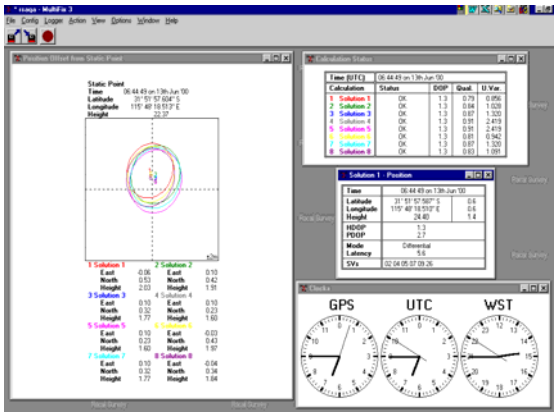
7.5.3 Positioning and Quality Control Displays

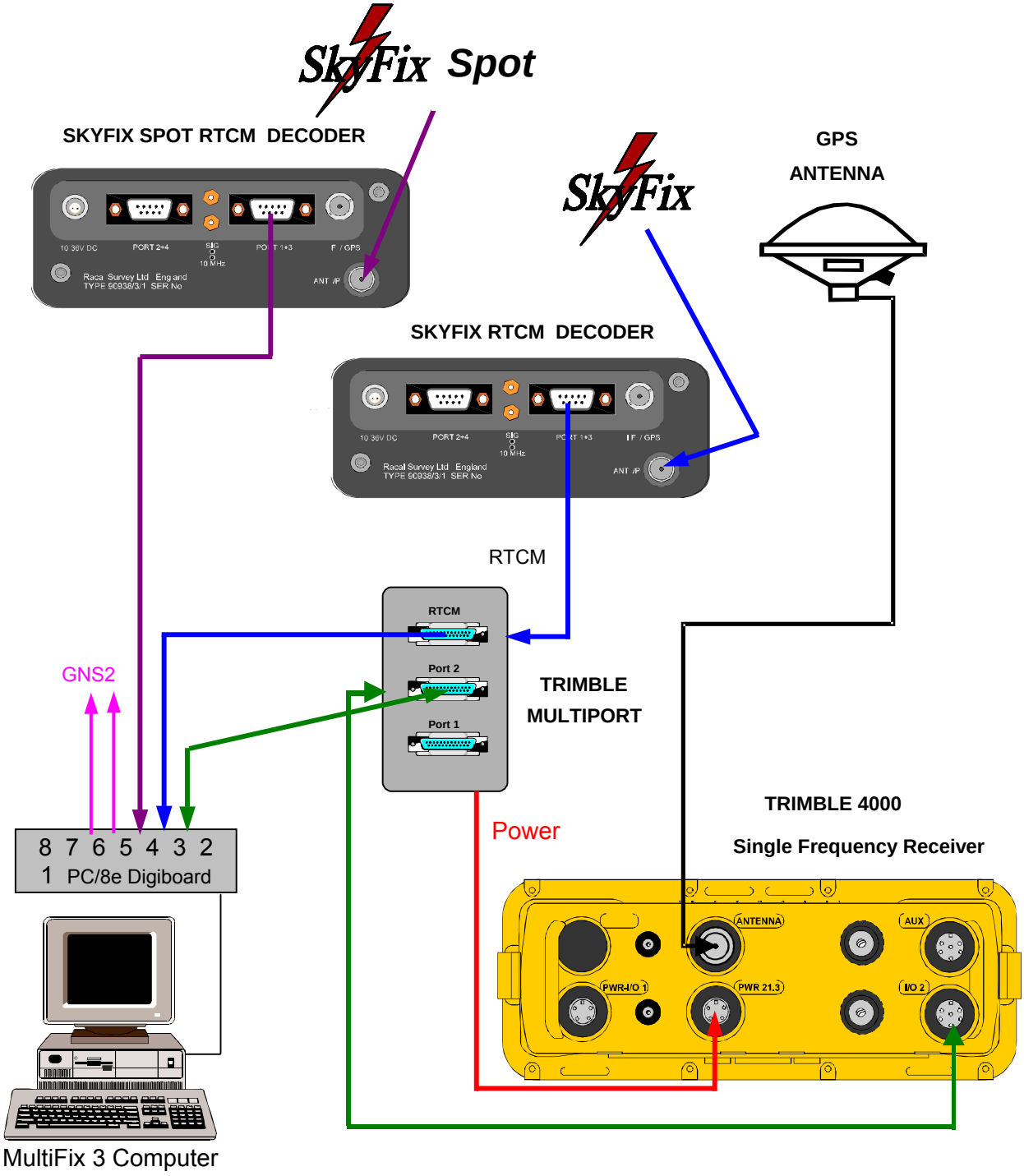
MultiFix 3 has a large number of features to accomodate the user requirements of highly accurate positions with quality control (QC) information and outputs in different formats. MultiFix 3 runs in a Windows environment, which allows the user to design a preferred screen layout by opening, sizing and placing the numerous displays that are available. Examples of the various displays can be found below.











Typical MultiFix 3 Interconnection With Trimble 4000 GPS Receiver

7.6 TRACS TDMA

Tracs TDMA (Time Division Multiple Access) is a high speed, intelligent network radio datalink which can operate in the VHF or UHF bands to provide an addressable network with integrated position reporting from an integrated/internal GPS receiver. The standard Tracs units are fitted with a Trimble SK8 GPS receiver, or a Trimble DSM GPS receiver.

Each unit in the network is assigned a unique address (1 to 255) enabling messages can be specifically addressed to that unit. A broadcast address (0) is provided to allow multiple units to receive a message, for example RTCM corrections. The system manages the data bandwidth by dividing it into timeslots synchronised by means of GPS 1PPS (pulse per second) timing pulse from an internal GPS receiver.

The standard Tracs system has a frequency band of 455.0MHz to 465.0MHz (frequency module 53R). The channel frequencies can be selected in 25kHz steps and the units are equipped with the facility to pre-store 10 selected frequencies within the 10MHz band. Units for use in Australia are fitted with 471MHz radios.

There are four types of messages that can be transmitted in a Tracs network.

- Position Reports automatically generated from the SK8 or DSM GPS receiver as a NMEA type or Raw Pseudo Range information.
- Transparent messages used to send unformatted data across the network eg. RTCM corrections.
- Open messages used to provide a general-purpose data link between units. This format is used by GNS to transfer information.
- Configuration messages used for remote configuration of units using the Destination ID to identify which unit is being configured.

7.7 S.G. BROWN 1000S GYROCOMPASS

The S.G. Brown 1000S Gyrocompass is a compact, simple-to-operate master heading reference instrument employing the effect of gravity and the earth's rotation to produce a True North reference. This reference may be read off the compass card or from a digital display and can be interfaced to the GNS2 navigation system.

The normal starting cycle of the instrument is fully automatic and is initiated when the system power supply is switched on. A fail safe control circuit is incorporated which ensures that the compass is not damaged after a power failure when power is restored; the compass will restart automatically and carry out its normal settling program.

8. PERSONNEL AND EQUIPMENT

8.1 PERSONNEL

The following personnel were employed on this project:

For : Fugro TGS (Australia) Ltd

M. Elmslie	:	Surveyor/Team Leader
B. Lobban	:	Engineer

For : Santos Offshore Pty Ltd

J. Tighe	:	Client Representative

8.2 EQUIPMENT

The following equipment was provided for this project:

Ocean Epoch

2 x Compaq Computer, inc monitor, keyboard (for GNS2 / MultiFix 3)
1 x Fugro TGS SkyFix Mini Rig Portable
3 x SkyFix/SkyFix Spot MK II Receivers
1 x Compaq Computer, inc. monitor, keyboard (for GNS2 Remote)
1 x S.G. Brown 1000S Gyrocompass
1 x Uninteruptable Power Supply (UPS)
1 x Canon BJC-1000 Printer
1 x Epson LX300 Printer
2 x SkyFix Spot Antenna 90962/3/1
2 x BD112 GPS Receivers
2 x Tracs Bricks
2 x Tracs Multiplexer
2 x UHF Antennae
1 x Marine Sextant
1 x Laptop Computer

Lady Dawn And Pacific Challenger (Each)

1 x Tracs Geopod
1 x Fluxgate compasses
1 x Tracs Box and Interface Box
1 x Compaq computer, inc. monitor, keyboard (GNS2 Tug Display)
1 x Uninteruptable Power Supply (UPS)

plus all associated software (GNS 2 version 2.48, MultiFix 3 version 1.32) c/w cables, consumables, software dongles etc.

Spare

1 x Tracs Geopod
1 x Fluxgate Compass
1 x Tracs Box and Interface Box

9. DISTRIBUTION

Copies of this report have been distributed as follows:

Santos Offshore Pty Ltd	: 3 copies
Attn: Mr Ole Moller	: 1 electronic copy
Fugro TGS (Australia) Ltd	: 1 copy

Michael Elmslie
Surveyor

Anthony Kerr
Survey Manager

APPENDIX A

FINAL DIFFERENTIAL GPS DRILLSTEM POSITION AT HILL-1

THALES **Thales GeoSolutions Group Ltd**

FINAL POSITION FIX – DIFFERENTIAL GPS

Job Description: Hill-1 Rig Move
Job Number: 3637A3
Thales Surveyor: M.Elmslie
Client: Santos
Client Representative: J.Tighe

Sampling started: 9 Dec 2003 10:36:45
Sampling end: 9 Dec 2003 11:36:40

Ocean Epoch

Intended datum location

Datum: GDA94 (GRS80)
Latitude: 38°48'50.37"S Longitude: 141°50'39.58"E
Projection: MGA94 Zone 54
Easting: 573303.44 m Northing: 5703526.08 m

Final Antenna Position (T1 Thales UKOOA):

Sample size: 720 fixes used out of a total of 720.

Antenna offset

X: 5.45m Y: 43.63m Z: 0.00m
Range: 43.97m Rel Brg from datum to antenna: 7.1°

Datum: WGS 84
Latitude: 38°48'50.925"S Longitude: 141°50'37.893"E Spheroidal Ht: 14.04m
Datum: GDA94 (GRS80)
Latitude: 38°48'50.925"S Longitude: 141°50'37.893"E Spheroidal Ht: 14.04m
Projection: MGA94 Zone 54
Easting: 573262.59 Northing: 5703509.36 Spheroidal Ht: 14.04m

Standard deviations

Long or E: 0.39m
Lat or N: 0.30m
Height: 0.54m
Position: 0.49m

Final Datum Position

Datum: GDA94 (GRS80)
Latitude: 38°48'50.381"S Longitude: 141°50'39.579"E

Projection: MGA94 Zone 54
Easting: 573303.40 m Northing: 5703525.73 m

Mean corrected heading: 240.5°T
SD heading: 0.1°T
Intended heading: 240.0°T
Difference from intended: 0.5°
Gyro C-O: -86.8°
Convergence: -0.53°

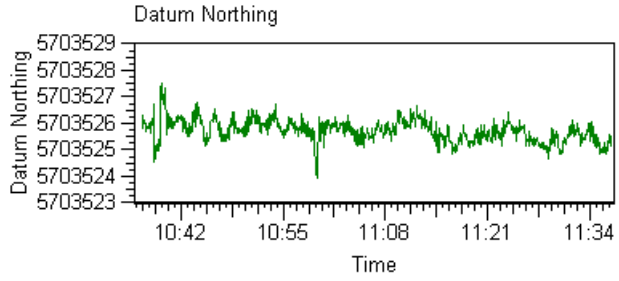
Final Datum Position is 0.35m on a bearing of 185.6°T (186.1°G) from the intended location.

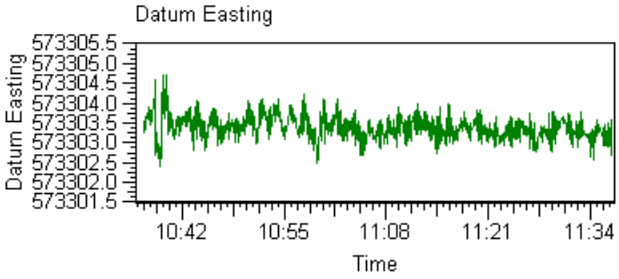
APPENDIX B

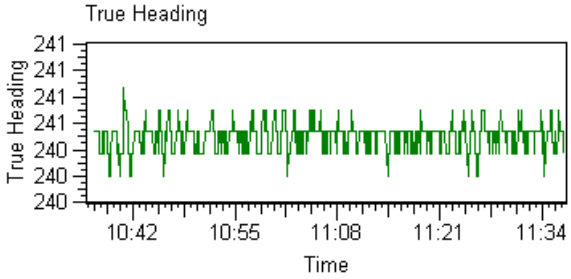
GNS2 STATIC DIFFERENTIAL GPS FIX GRAPHS

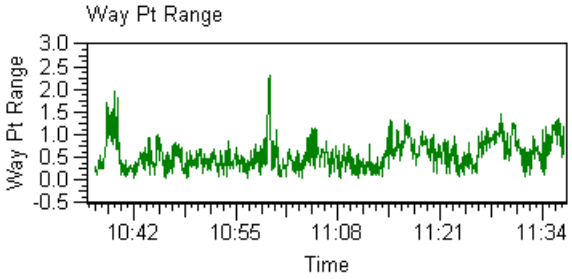
THALES **Thales GeoSolutions (Australasia) Limited**

Project: Positioning Report of the Ocean Epoch
Client: Santos

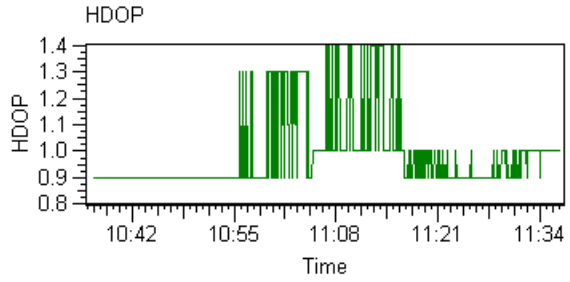


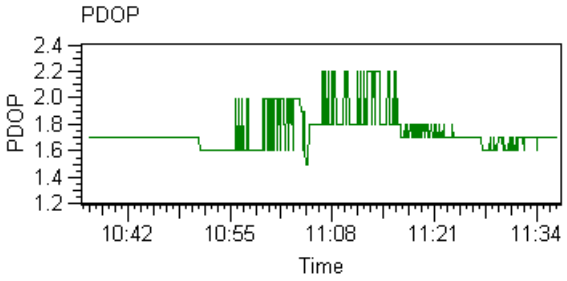


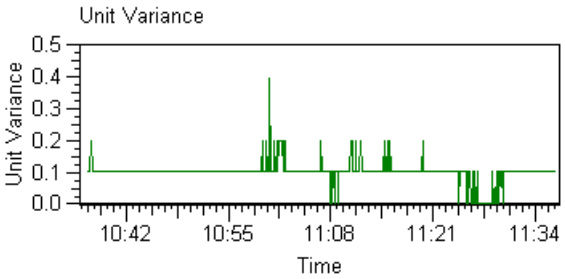


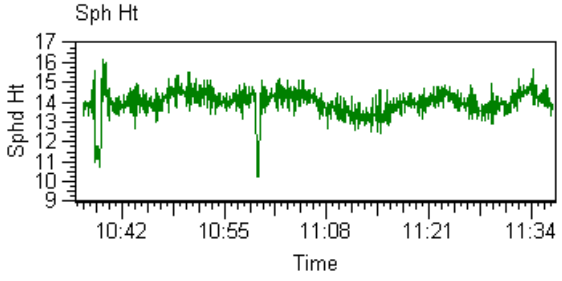


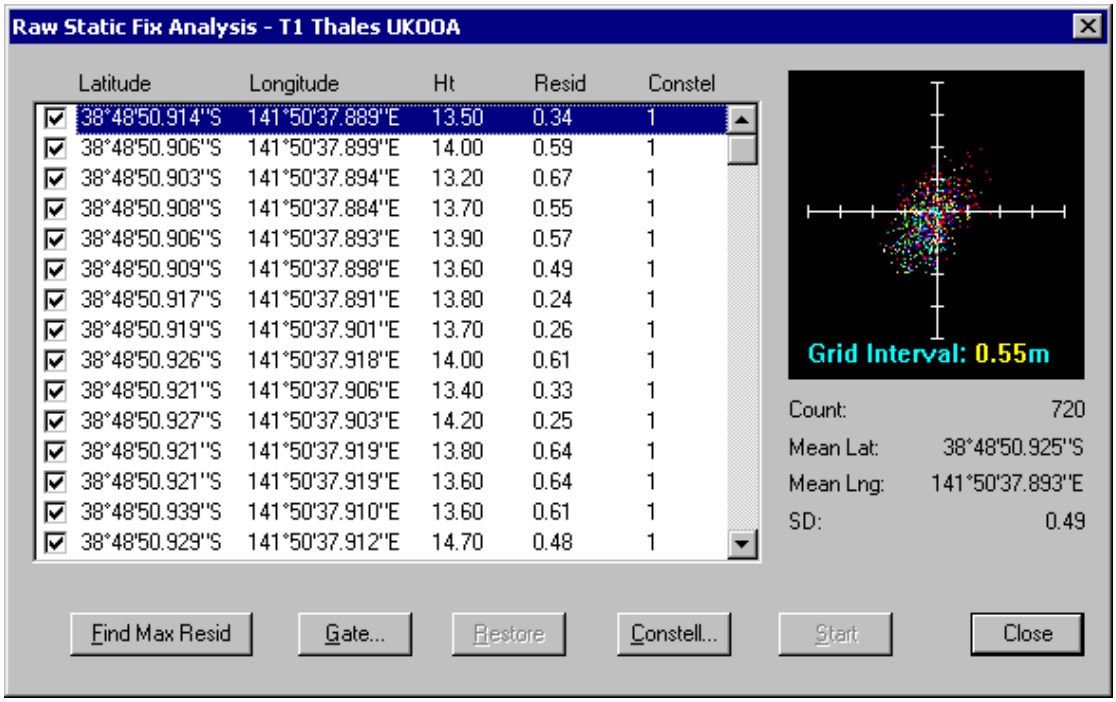
Project: Positioning Report of the Ocean Epoch
Client: Santos










Raw Static Fix Analysis - T1 Thales UKOOA
Latitude Longitude Ht Resid Constel
38°48'50.914"S 141°50'37.889"E 13.50 0.34 1
38°48'50.906"S 141°50'37.899"E 14.00 0.59 1
38°48'50.903"S 141°50'37.894"E 13.20 0.67 1
38°48'50.908"S 141°50'37.884"E 13.70 0.55 1
38°48'50.906"S 141°50'37.893"E 13.90 0.57 1
38°48'50.909"S 141°50'37.898"E 13.60 0.49 1
38°48'50.917"S 141°50'37.891"E 13.80 0.24 1
38°48'50.919"S 141°50'37.901"E 13.70 0.26 1
38°48'50.926"S 141°50'37.918"E 14.00 0.61 1
38°48'50.921"S 141°50'37.906"E 13.40 0.33 1
38°48'50.927"S 141°50'37.903"E 14.20 0.25 1
38°48'50.921"S 141°50'37.919"E 13.80 0.64 1
38°48'50.921"S 141°50'37.919"E 13.60 0.64 1
38°48'50.939"S 141°50'37.910"E 13.60 0.61 1
38°48'50.929"S 141°50'37.912"E 14.70 0.48 1
Grid Interval: 0.55m
Count: 720
Mean Lat: 38°48'50.925"S
Mean Lng: 141°50'37.893"E
SD: 0.49
Find Max Resid
Gate...
Restore
Constell...
Start
Close

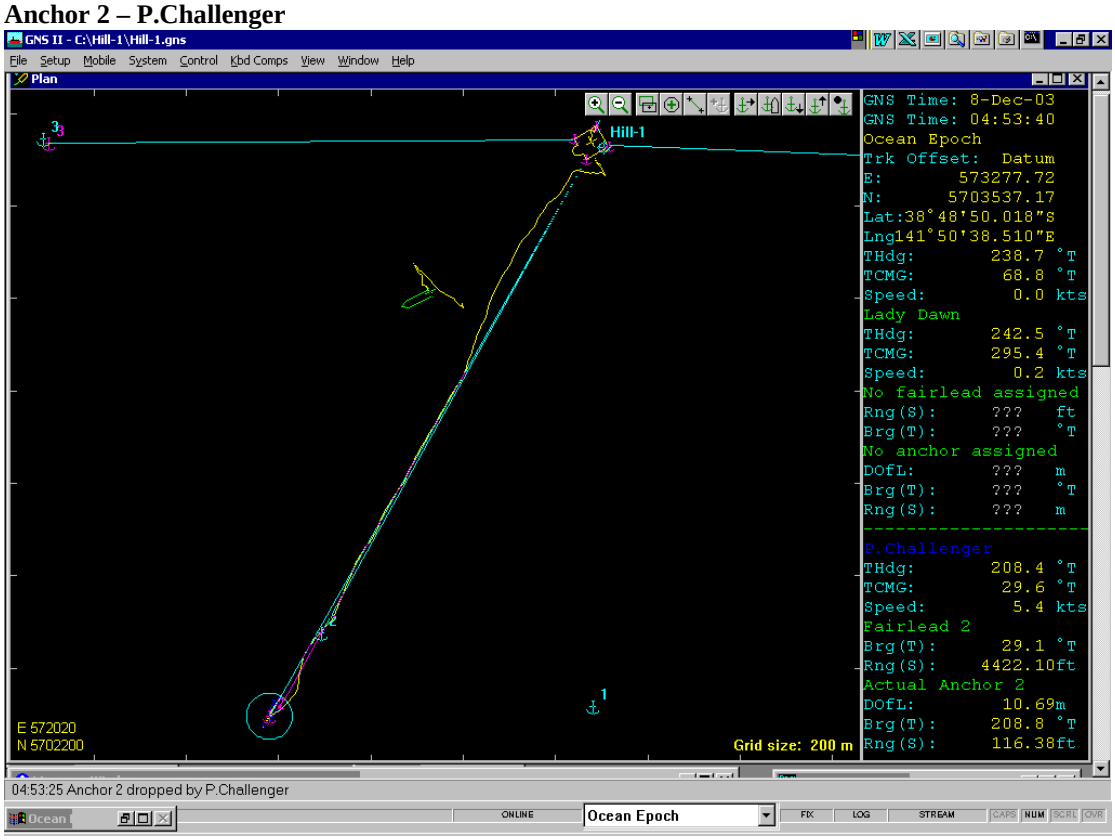
APPENDIX C

ANCHOR DEPLOYMENT GRAPHICS

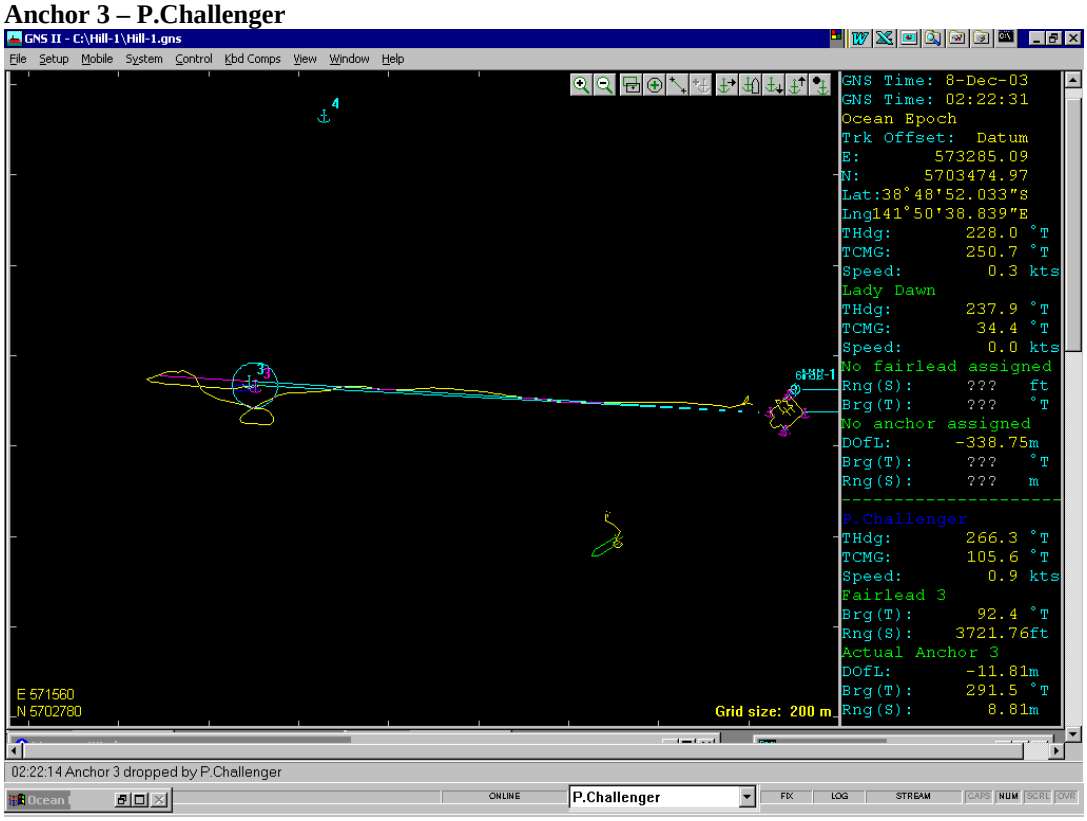
Anchor 1 – L.Dawn

No runline display available.

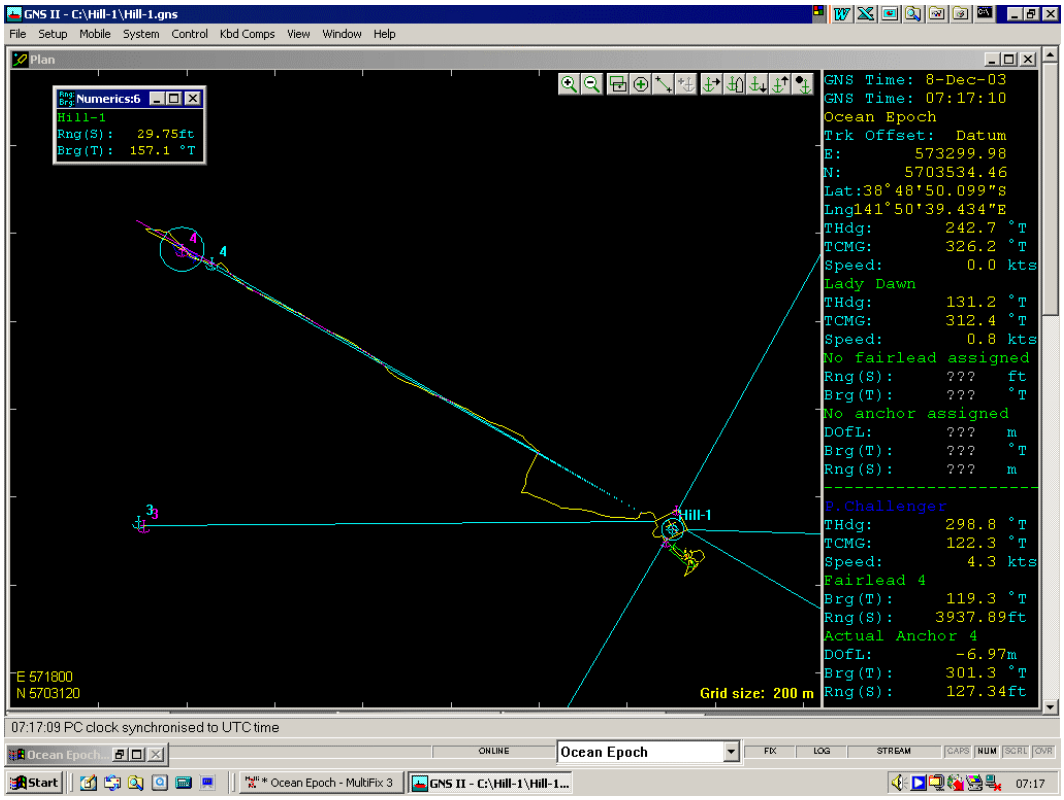
Anchor 2 – P.Challenger



Anchor 3 – P.Challenger

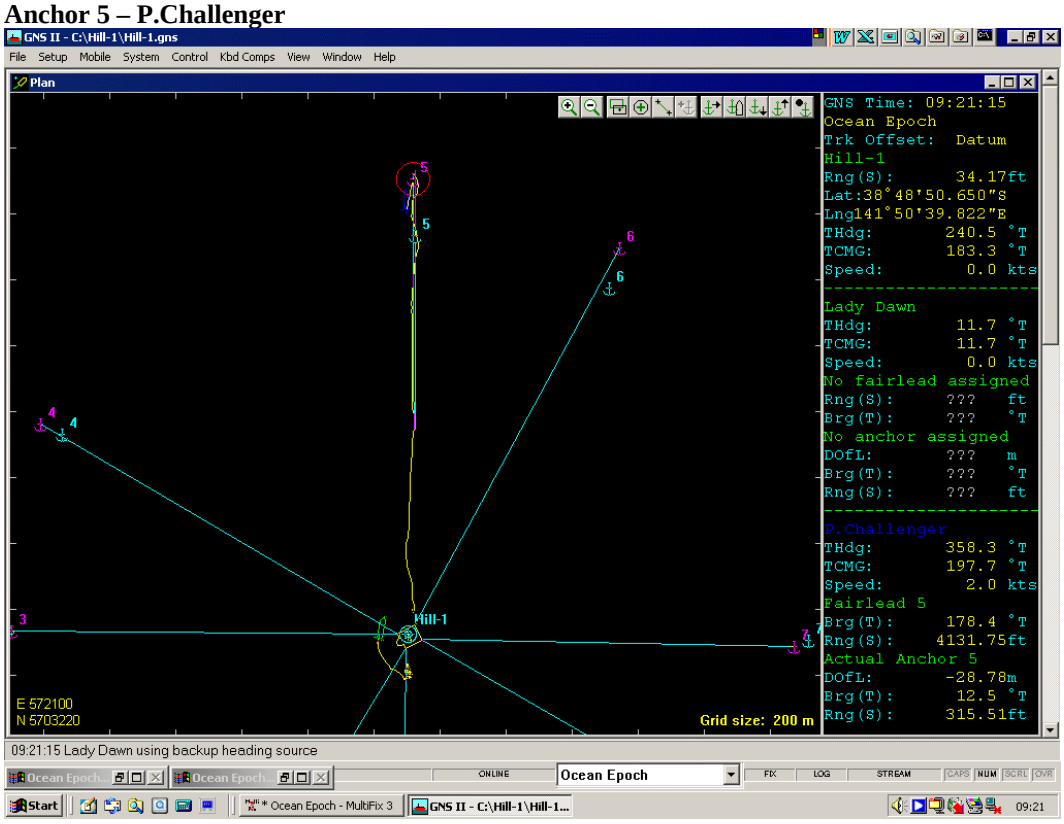


Anchor 4 – P.Challenger

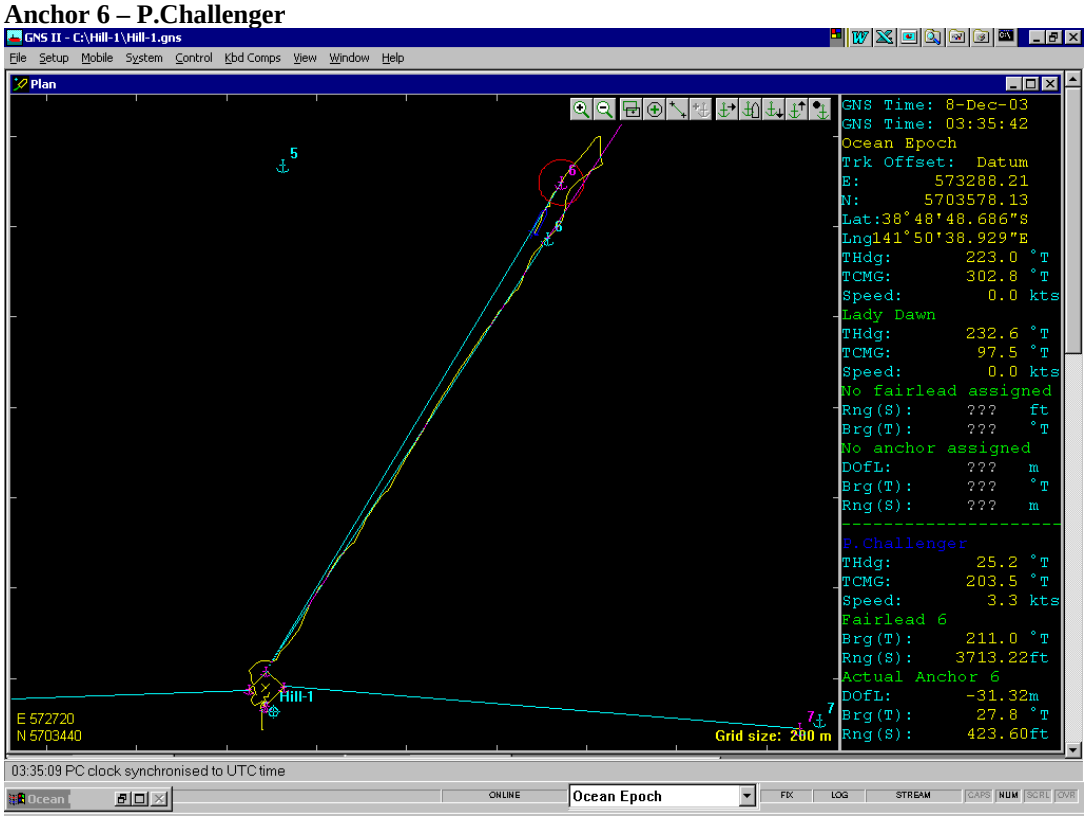


Project: Hill-1 Positioning Report of the Ocean Epoch
Client: Santos

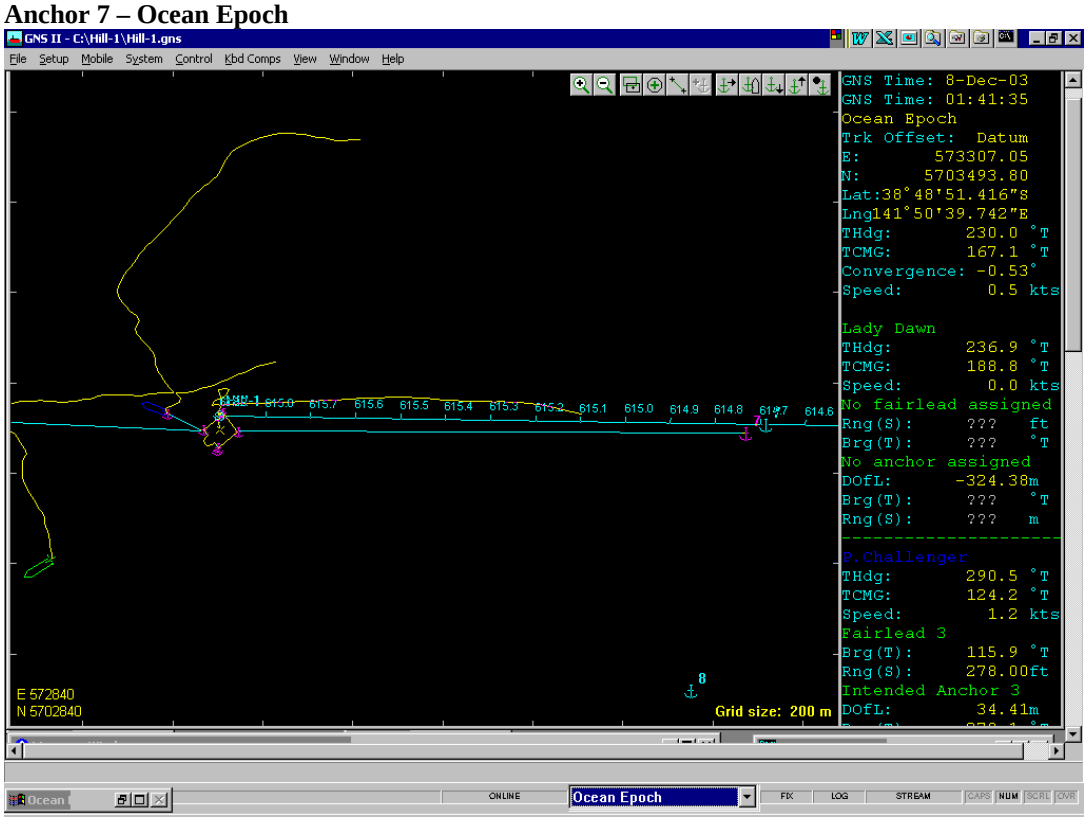
Anchor 5 – P.Challenger



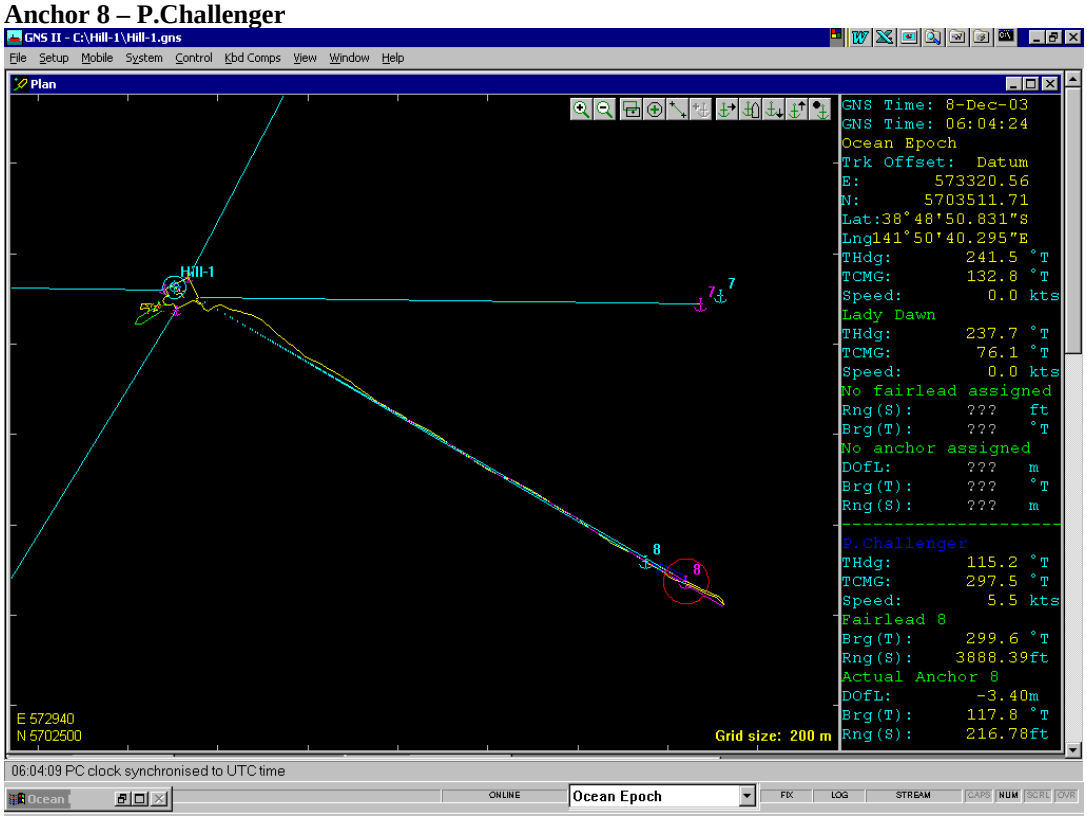
Anchor 6 – P.Challenger



Anchor 7 – Ocean Epoch



Anchor 8 – P.Challenger



APPENDIX D

OCEAN EPOCH ANCHOR PATTERN DETAILS AT HILL-1

THALES

OCEAN EPOCH ANCHOR POSITIONS

9 Dec 2003 13:37

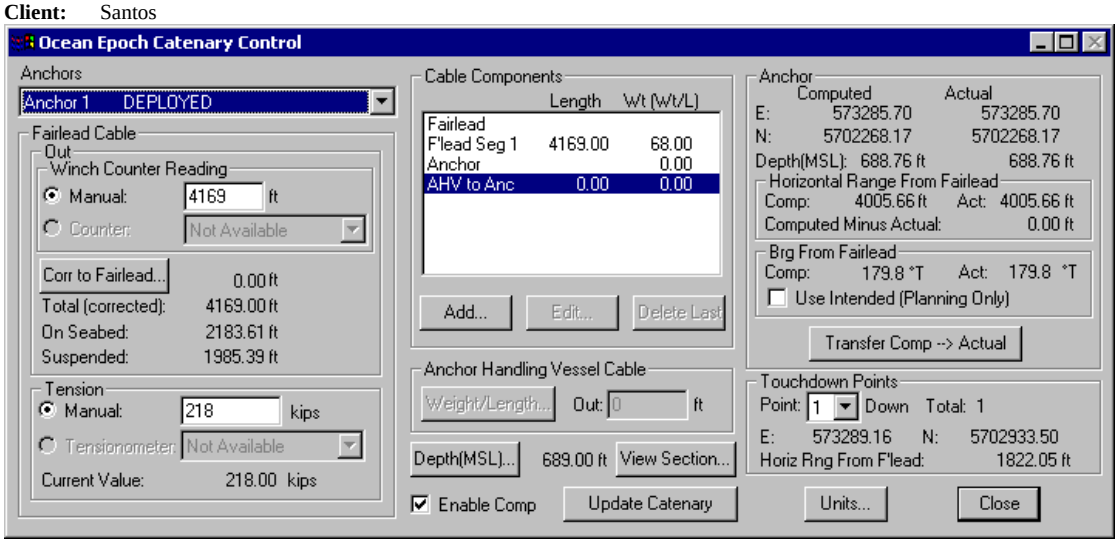
Main Anchors

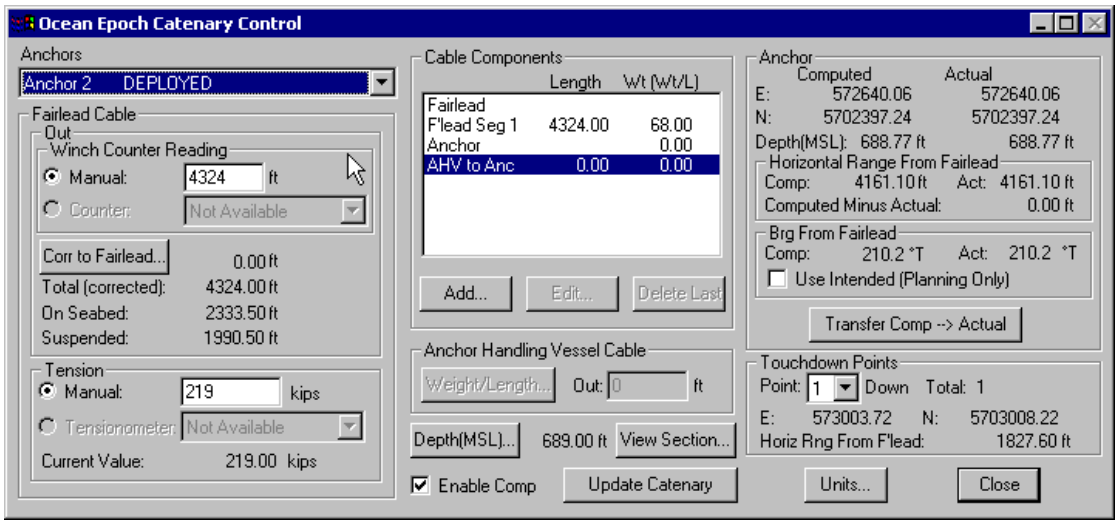
Name	Intended E	Intended N	Dropped E	Dropped N
Anchor 1	573281.57	5702316.36	573285.70	5702268.17
Anchor 2	572693.26	5702476.90	572640.06	5702397.24
Anchor 3	572089.88	5703544.65	572049.65	5703534.88
Anchor 4	572255.86	5704131.45	572265.69	5704118.86
Anchor 5	573325.31	5704735.80	573318.13	5704774.91
Anchor 6	573913.62	5704575.26	573912.22	5704641.45
Anchor 7	574517.01	5703507.49	574500.14	5703487.70
Anchor 8	574351.01	5702920.70	574356.94	5702923.64

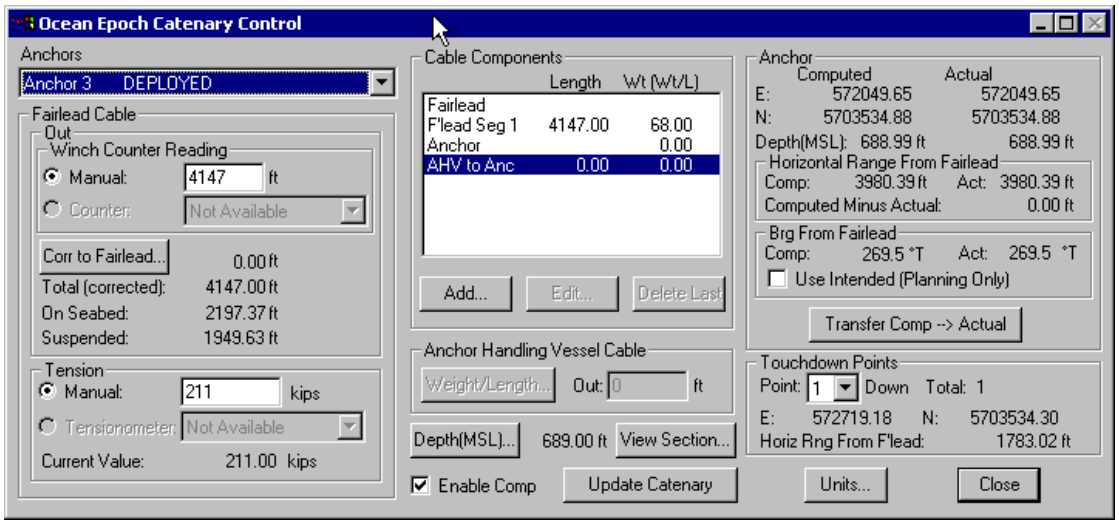
APPENDIX E

OCEAN EPOCH ANCHOR CATENARY CALCULATIONS

Project: Positioning Report of the Ocean Epoch
Client: Santos

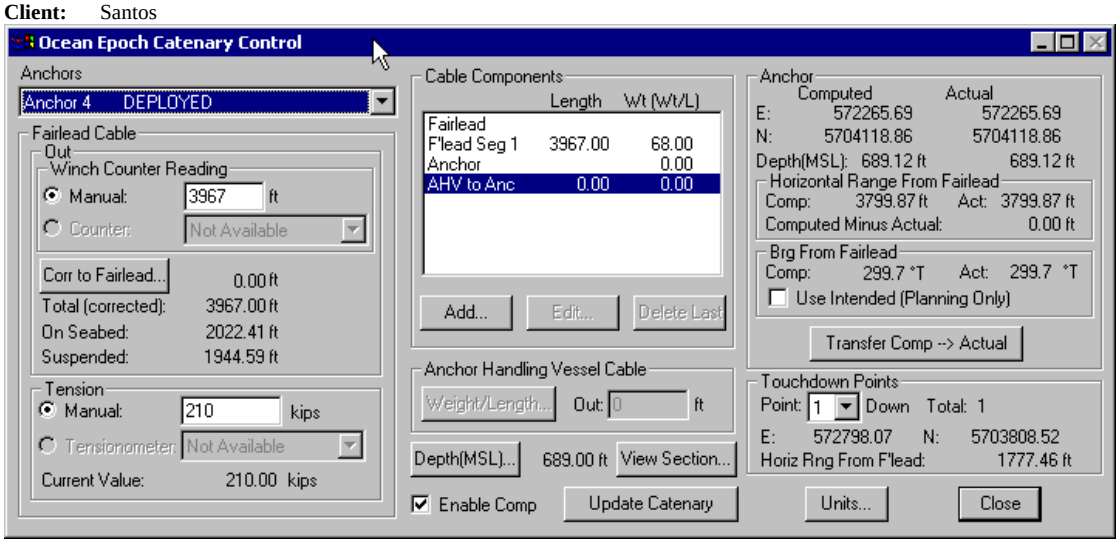


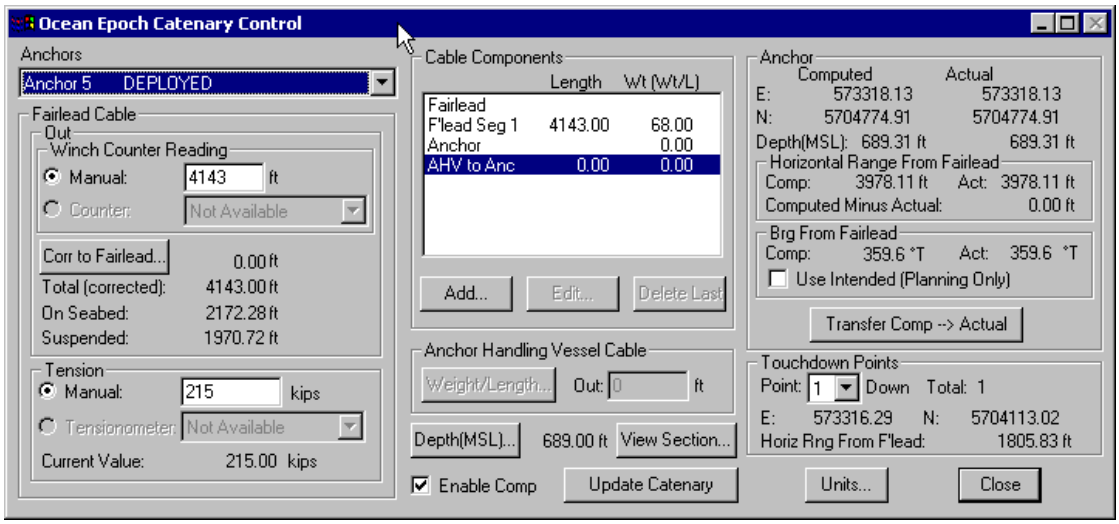


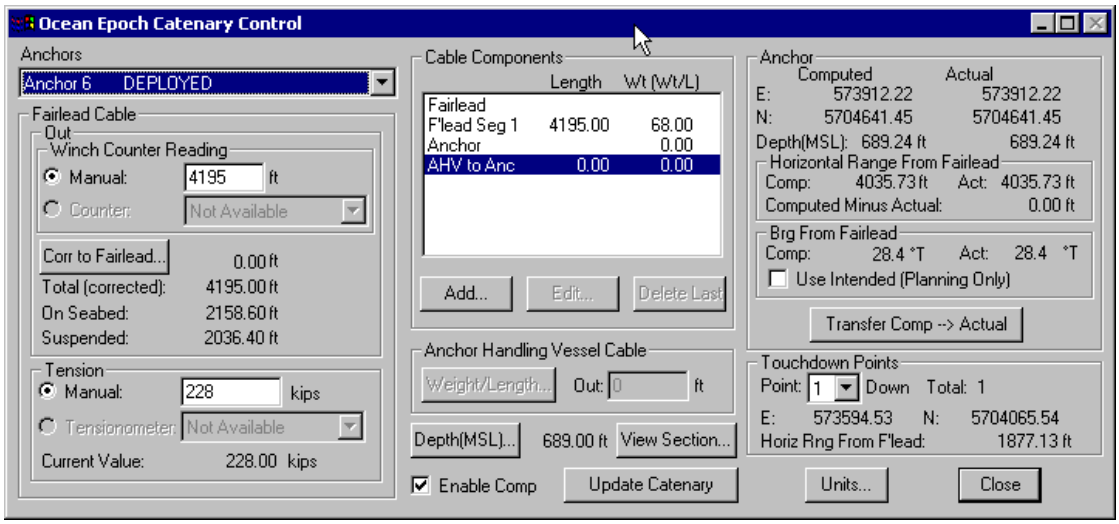


Thales GeoSolutions (Australasia) Limited

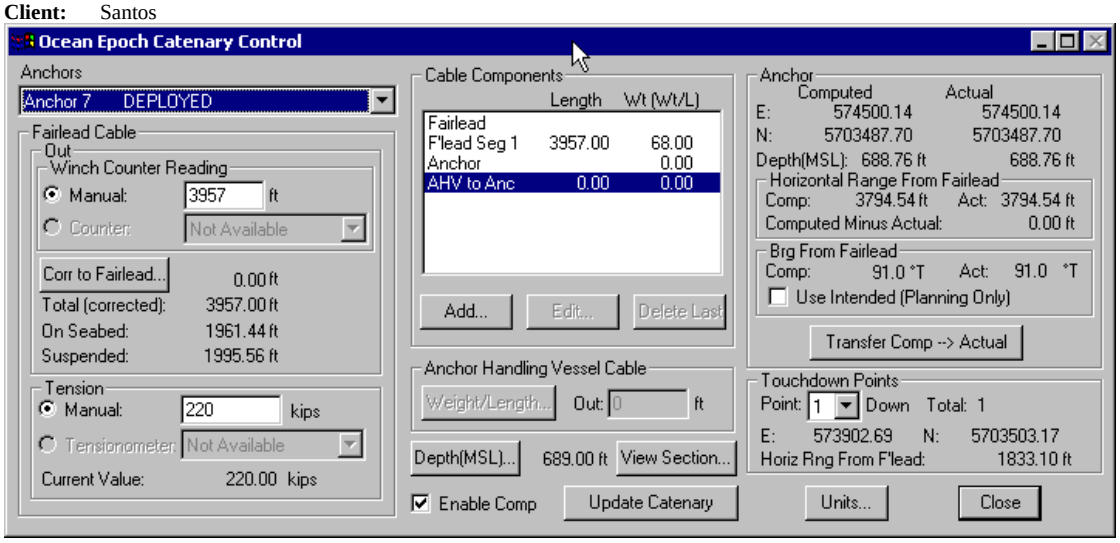
Project: Positioning Report of the Ocean Epoch
Client: Santos

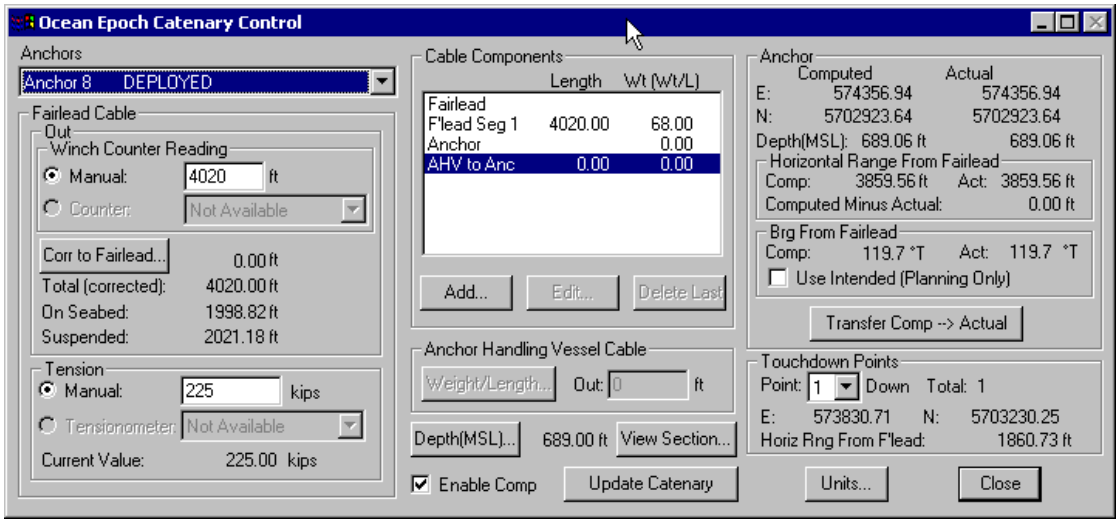






Project: Positioning Report of the Ocean Epoch
Client: Santos





APPENDIX F

GYROCOMPASS CALIBRATION REPORT

Thales GeoSolutions (Australasia) Limited

ABN 82 000 601 909

Solar Observation for Azimuth (Hour Angle) 2003

Thales Job Number: 3637A3
Job Description: Hill-1 Ocean Epoch Rig Move
Client: Santos
Party Chief: M.Elmslie
Surveyor: M.Elmslie
Rig Name: Ocean Epoch
Date: 6 December 2003

Control Point Co-ordinates

Datum: GDA94 Projection: UTM Zone 54S CM 141° East

Latitude (DMS):	-039	20	51
Longitude (DMS):	145	02	56
UTC Correction (HMS):	11.00		

Total Station Observations:

Face	Local Time (HMS)			Observed Direction to R.O. (DMS)			Observed Direction to Sun (DMS)			Observed (O) True Heading (D.D)
Left	20	23	13	000	00	00	329	08	00	359.20
Right	20	23	13	180	00	00	149	08	00	
Left	20	23	58	000	00	00	328	39	00	359.50
Right	20	23	58	180	00	00	148	39	00	
Left	20	24	32	000	00	00	328	09	00	360.00
Right	20	24	32	180	00	00	148	09	00	
Left	20	25	10	000	00	00	326	05	00	360.80
Right	20	25	10	180	00	00	146	05	00	
Left	20	25	54	000	00	00	325	38	00	361.30
Right	20	25	54	180	00	00	145	38	00	
Left	20	26	51	000	00	00	328	28	00	359.30
Right	20	26	51	180	00	00	148	28	00	
Left	20	27	40	000	00	00	329	17	00	358.70
Right	20	27	50	180	00	00	149	17	00	
Left	20	28	09	000	00	00	328	43	00	359.20
Right	20	28	09	180	00	00	148	43	00	
Left	20	28	41	000	00	00	328	19	00	359.30
Right	20	28	41	180	00	00	148	19	00	
Left	20	29	14	000	00	00	327	46	00	359.50
Right	20	29	14	180	00	00	147	46	00	
Left	20	29	42	000	00	00	327	07	00	360.50
Right	20	29	42	180	00	00	147	07	00	
Left	20	30	20	000	00	00	327	35	00	359.70
Right	20	30	20	180	00	00	147	35	00	

Signature

SURVEYOR/PARTY CHIEF

CLIENT SURVEY REPRESENTATIVE

THALES

Thales GeoSolutions (Australasia) Limited

ABN 82 000 601 909

Solar Observation for Azimuth (Hour Angle) 2003

Thales Job Number: 3637A3
Job Description: Hill-1 Ocean Epoch Rig Move
Client: Santos
Party Chief: M.Elmslie
Surveyor: M.Elmslie
Rig Name: Ocean Epoch
Date: 6 December 2003

Datum: GDA94 Projection: UTM Zone 54S CM 141° East

Average Local Time (HMS)			Average Horizontal Angle (DMS)			Azimuth Sun (DMS)			Azimuth RO (DMS)			Calculated (C) True Heading (D.D)	Observed (O) True Heading (D.D)	C-O (D.D)
20	23	13.0	329	08	00	241	26	36	272	18	36	272.31	359.20	-86.89
20	23	58.0	328	39	00	241	19	32	272	40	32	272.68	359.50	-86.82
20	24	32.0	328	09	00	241	14	12	273	05	12	273.09	360.00	-86.91
20	25	10.0	326	05	00	241	08	14	275	03	14	275.05	360.80	-85.75
20	25	54.0	325	38	00	241	01	18	275	23	18	275.39	361.30	-85.91
20	26	51.0	328	28	00	240	52	20	272	24	20	272.41	359.30	-86.89
20	27	45.0	329	17	00	240	43	48	271	26	48	271.45	358.70	-87.25
20	28	09.0	328	43	00	240	40	01	271	57	01	271.95	359.20	-87.25
20	28	41.0	328	19	00	240	34	57	272	15	57	272.27	359.30	-87.03
20	29	14.0	327	46	00	240	29	44	272	43	44	272.73	359.50	-86.77
20	29	42.0	327	07	00	240	25	18	273	18	18	273.30	360.50	-87.20
20	30	20.0	327	35	00	240	19	16	272	44	16	272.74	359.70	-86.96

Mean C-O **-86.80**

Signature

SURVEYOR/PARTY CHIEF

CLIENT SURVEY REPRESENTATIVE

APPENDIX G

DIFFERENTIAL GPS CHECK FIX

THALES **Thales GeoSolutions Group Ltd**

CHECK POSITION FIX – DIFFERENTIAL GPS

Job Description: Rig Move
Job Number: 3634A3
Thales Surveyor: M.Elmslie
Client: Santos
Client Representative: J.Tighe

Sampling started: 4 Dec 2003 17:01:45
Sampling end: 4 Dec 2003 17:11:50

Ocean Epoch

Published datum location

Datum: GDA94 (GRS80)
Latitude: 38°35'44.229"S Longitude: 148°16'31.859"E
Projection: MGA94 Zone 55
Easting: 611077.19 m Northing: 5727325.06 m

Final Antenna Position (T1 Thales UKOOA):

Sample size: 120 fixes used out of a total of 120.

Antenna offset

X: 5.45m Y: 43.63m Z: 0.00m
Range: 43.97m Rel Brg from datum to antenna: 7.1°

Datum: WGS 84
Latitude: 38°35'44.957"S Longitude: 148°16'30.289"E Spheroidal Ht: 23.89m
Datum: GDA94 (GRS80)
Latitude: 38°35'44.957"S Longitude: 148°16'30.289"E Spheroidal Ht: 23.89m
Projection: MGA94 Zone 55
Easting: 611038.88 Northing: 5727303.16 Spheroidal Ht: 23.89m

Standard deviations

Long or E: 0.26m
Lat or N: 0.17m
Height: 0.35m
Position: 0.31m

Final Datum Position

Datum: GDA94 (GRS80)
Latitude: 38°35'44.305"S Longitude: 148°16'31.905"E

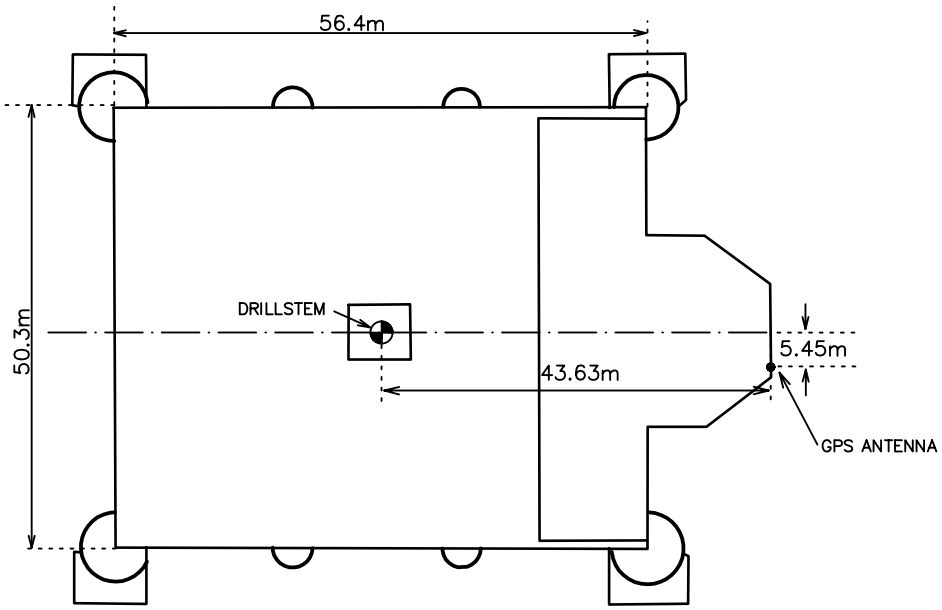
Projection: MGA94 Zone 55
Easting: 611078.26 m Northing: 5727322.71 m

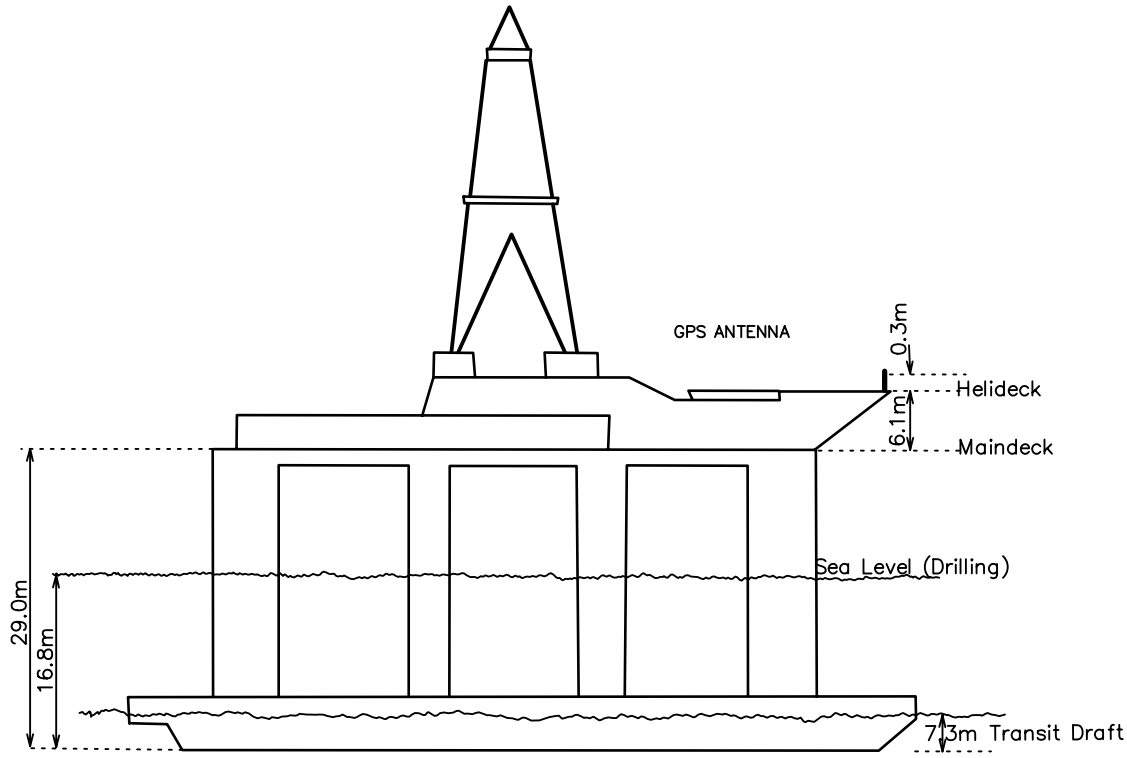
Mean corrected heading: 235.7°T
SD heading: 1.0°T
Intended heading: 238.2°T
Difference from intended: -2.5°
Gyro C-O: -87.0°
Convergence: -0.80°

Final Datum Position is 2.58m on a bearing of 154.7°T (155.5°G) from the published location.

APPENDIX H

OCEAN EPOCH OFFSET DIAGRAM





OCEAN EPOCH

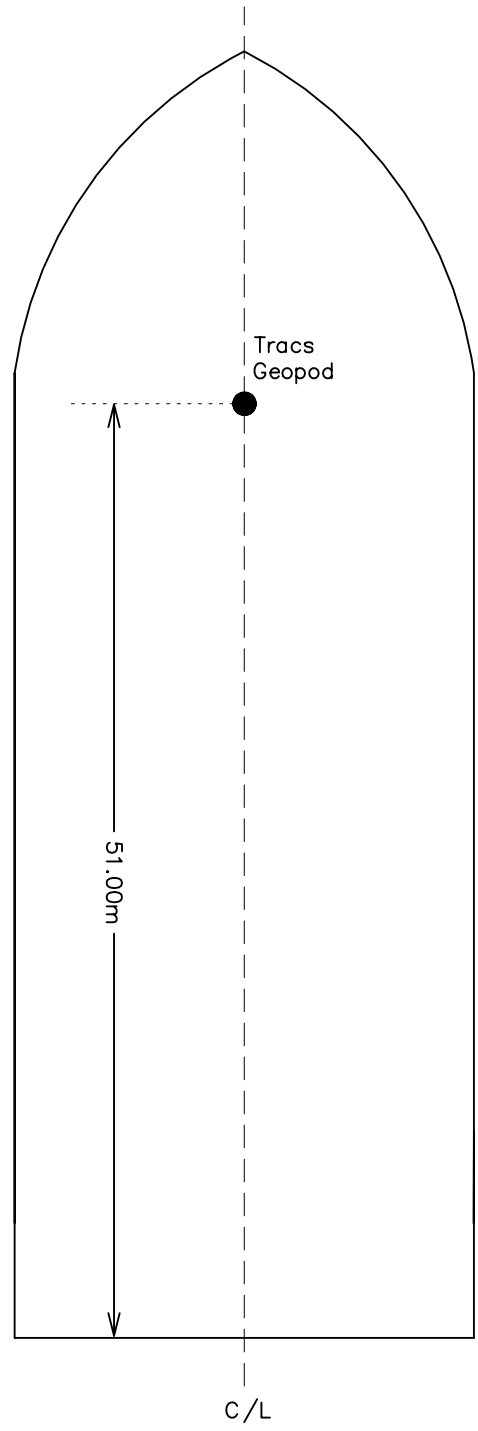
(Not To Scale)

APPENDIX I

LADY DAWN AND PACIFIC CHALLENGER OFFSET DIAGRAMS

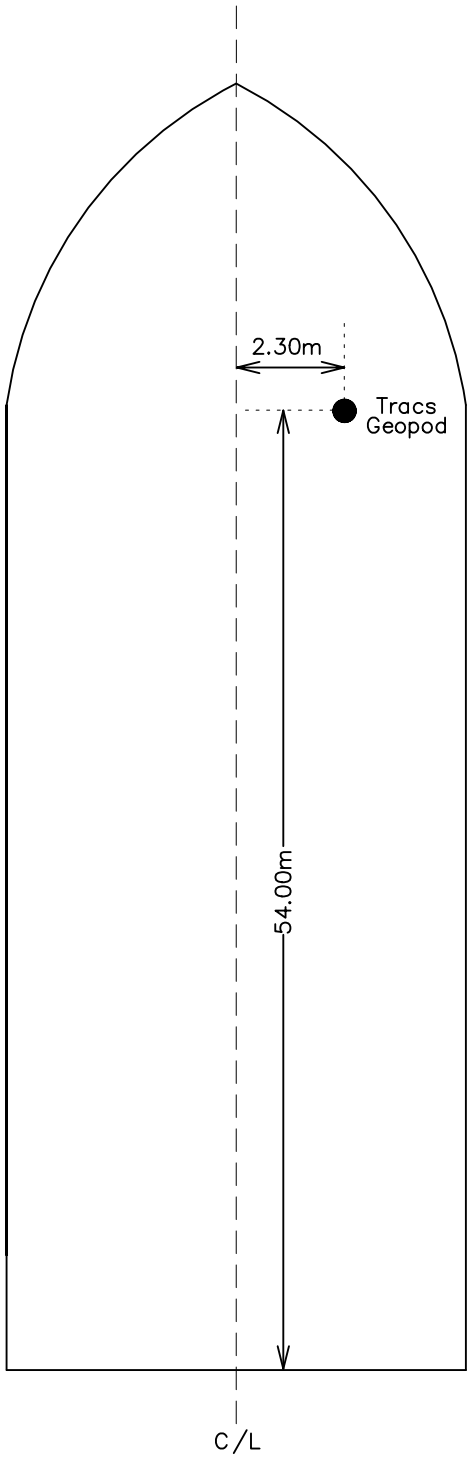
LADY DAWN

(NOT TO SCALE)



PACIFIC CHALLENGER

(NOT TO SCALE)



APPENDIX J

GNS2 CONFIGURATION FILE PRINTOUT

GNS II CONFIGURATION FILE A:\Hill-1\Hill-1.gns

JOB DETAILS
Job Number : 3637A3
Job Description : Rig Move
Company : Thales GeoSolutions Group Ltd
Client : Santos
Time Zone : GMT ~~+10:00~~ 11:00

WORKING SPHEROID
GDA94 (GRS80)
Semi-major : 6378137.000 m
e Squared : 0.006694380023

WORKING PROJECTION
MGA94 Zone 54
Lat of Origin : 00°00'00.000"N
Long of Origin : 141°00'00.000"E
False Easting : 500000.00
False Northing : 10000000.00
Scale Factor : 0.999600
Units : Metres

GPS TRANSFORMATION
From : WGS 84
Semi-major : 6378137.000 m
e Squared : 0.006694380067
To : GDA94 (GRS80)
Dx : 0.000 m
Dy : 0.000 m
Dz : 0.000 m
Rot x : 0.0000 secs
Rot y : 0.0000 secs
Rot z : 0.0000 secs
Scale : 0.0000 ppm

WAYPOINTS

Megamouth-1	E: 1133948.54	N: 5702911.90	Ht:	0.00 m	Horz Toll:	10.00 m Hc
WP2	E: 1016611.60	N: 5618845.81	Ht:	0.00 m		
WP3	E: 973533.92	N: 5621600.63	Ht:	0.00 m		
WP4	E: 699883.69	N: 5651997.27	Ht:	0.00 m		
Hill-1	E: 573303.44	N: 5703526.08	Ht:	0.00 m	Horz Toll:	10.00 m Hc
WP0	E: 1141599.52	N: 5684092.43	Ht:	0.00 m		
WP5	E: 578301.21	N: 5703449.52	Ht:	0.00 m	Horz Toll:	11000.00 m I

TRACK GUIDANCE
None defined

MOBILES
Ocean Epoch (semi-sub rig)
Shape Definition: Ocean Epoch
Line:-
X: -5.40 m Y: 44.80 m
X: -11.00 m Y: 34.90 m
X: -11.00 m Y: 28.20 m

Verified by: (sign)_____ (print)_____

```
    X: -25.20 m  Y:  28.20 m
    X: -25.20 m  Y: -28.20 m
    X:  25.20 m  Y: -28.20 m
    X:  25.20 m  Y:  28.20 m
    X:  11.00 m  Y:  28.20 m
    X:  11.00 m  Y:  34.90 m
    X:   5.40 m  Y:  44.80 m
    X:  -5.40 m  Y:  44.80 m

  Tracking Point       : Datum
  Pitch and Roll Centre: Datum

  Selected Sources:-
   Primary Position : Manual
   Backup Position  : T1 Thales UKOOA (Using Antenna Offset : Gps_ae)
   Primary Heading  : Manual
   Primary Height   : Datum Displacement
   Pitch and Roll   : Manual
   Soundings        : Manual
   Speed            : Position Filter
   Course Made Good : Posn Filter CMG

  Equipment:-
   S1 SGB 1000S
    Status:  ON   Interface: COM6
    C-O: -86.8 degs  Stale Time: 5.0 s  SD: 0.1 degs
     Filter: Off  Gate: Off  Time Constant: 5.0 s  Sample Dwell: 0.5 s

   T1 Thales UKOOA
    Status:  ON   Interface: Sock1
    Antenna Offset Selected: Gps_ae
     X:    5.45 m Y:   43.63 m Z:    0.00 m Rng:   43.97 m Brg:  7.1°
    Apply Pitch Roll: Off  Stale Time: 5.0 s  Posn SD: 3.0 m  Ht SD: 1.0 m
    Update posn only when diff corrected
    Filter: Off  Time Constant:60.0 s  Sample Dwell: 0.5 s
    Gate: Off  Gate Width: 9.0 xSD  Minimum Gate: 0.0 m

   T2 Thales UKOOA
    Status:  ON   Interface: Sock2
    Antenna Offset Selected: Gps_ae
     X:    5.45 m Y:   43.63 m Z:    0.00 m Rng:   43.97 m Brg:  7.1°
    Apply Pitch Roll: Off  Stale Time: 5.0 s  Posn SD: 3.0 m  Ht SD: 1.0 m
    Update posn regardless of whether diff corrected
    Filter: Off  Time Constant:60.0 s  Sample Dwell: 0.5 s
    Gate: Off  Gate Width: 9.0 xSD  Minimum Gate: 0.0 m

   T3 Tracs TDMA Master
    Status:  ON   Interface: COM10
    Antenna Offset Selected: Datum
     X:    0.00 m Y:    0.00 m Z:    0.00 m Rng:    0.00 m Brg:  0.0°

   T6 Thales UKOOA
    Status:  ON   Interface: Sock3
    Antenna Offset Selected: Gps_ae
     X:    5.45 m Y:   43.63 m Z:    0.00 m Rng:   43.97 m Brg:  7.1°

Verified by: (sign)_____ (print)_____
```

GNS II CONFIGURATION FILE A:\Hill-1\Hill-1.gns

Apply Pitch Roll: Off Stale Time: 5.0 s Posn SD: 3.0 m Ht SD: 1.0 m
Update posn regardless of whether diff corrected
Filter: Off Time Constant:60.0 s Sample Dwell: 0.5 s
Gate: Off Gate Width: 9.0 xSD Minimum Gate: 0.0 m

Defined Offsets:-
Datum
X: 0.00 m Y: 0.00 m Z: 0.00 m Rng: 0.00 m Brg: 0.0°
Gps_ae
X: 5.45 m Y: 43.63 m Z: 0.00 m Rng: 43.97 m Brg: 7.1°
Fairlead 7
X: -26.93 m Y: -31.90 m Z: 0.00 m Rng: 41.75 m Brg:220.2°

Lady Dawn (ship)
Shape Definition: Lady Dawn
Line:-
X: 0.00 m Y: 0.00 m
X: 7.50 m Y: 0.00 m
X: 7.50 m Y: 56.00 m
X: 0.00 m Y: 69.00 m
X: -7.50 m Y: 56.00 m
X: -7.50 m Y: 0.00 m
X: 0.00 m Y: 0.00 m

Tracking Point : Datum
Pitch and Roll Centre: Datum

Selected Sources:-
Primary Position : T4 Tracs TDMA Remote (Using Antenna Offset : Tracs)
Primary Heading : T4 Tracs TDMA Remote
Primary Height : Datum Displacement
Pitch and Roll : Manual
Soundings : Manual
Speed : Position Filter
Course Made Good : Posn Filter CMG

Equipment:-
T4 Tracs TDMA Remote
Status: ON Interface: Not defined
Antenna Offset Selected: Tracs
X: 0.00 m Y: 51.00 m Z: 0.00 m Rng: 51.00 m Brg: 0.0°

Defined Offsets:-
Datum
X: 0.00 m Y: 0.00 m Z: 0.00 m Rng: 0.00 m Brg: 0.0°
Tracs
X: 0.00 m Y: 51.00 m Z: 0.00 m Rng: 51.00 m Brg: 0.0°

P.Challenger (ship)
Shape Definition: P_Challenger
Line:-
X: -6.50 m Y: 0.00 m
X: -6.50 m Y: 50.00 m
X: 0.00 m Y: 63.00 m
X: 6.50 m Y: 50.00 m

Verified by: (sign)_____ (print)_____

GNS II CONFIGURATION FILE A:\Hill-1\Hill-1.gns

X: 6.50 m Y: 0.00 m
X: -6.50 m Y: 0.00 m

Tracking Point : Datum
Pitch and Roll Centre: Datum

Selected Sources:-
Primary Position : T5 Tracs TDMA Remote (Using Antenna Offset : Tracs)
Primary Heading : T5 Tracs TDMA Remote
Backup Heading : T5 Tracs TDMA Remote
Primary Height : Datum Displacement
Pitch and Roll : Manual
Soundings : Manual
Speed : Position Filter
Course Made Good : Posn Filter CMG

Equipment:-
T5 Tracs TDMA Remote
Status: ON Interface: Not defined
Antenna Offset Selected: Tracs
X: -2.30 m Y: 54.00 m Z: 0.00 m Rng: 54.05 m Brg:357.6°

Defined Offsets:-
Datum
X: 0.00 m Y: 0.00 m Z: 0.00 m Rng: 0.00 m Brg: 0.0°
Tracs
X: -2.30 m Y: 54.00 m Z: 0.00 m Rng: 54.05 m Brg:357.6°

ANCHORS
Ocean Epoch
Fairleads:-

Name	X	Y	Z	Rng	Brg
Fairlead 1	-26.93 m	27.90 m	0.00 m	38.78 m	316.0°
Fairlead 2	-26.93 m	31.90 m	0.00 m	41.75 m	319.8°
Fairlead 3	26.93 m	31.90 m	0.00 m	41.75 m	40.2°
Fairlead 4	26.93 m	27.90 m	0.00 m	38.78 m	44.0°
Fairlead 5	26.93 m	-27.90 m	0.00 m	38.78 m	136.0°
Fairlead 6	26.93 m	-31.90 m	0.00 m	41.75 m	139.8°
Fairlead 7	-26.93 m	-31.90 m	0.00 m	41.75 m	220.2°
Fairlead 8	-26.93 m	-27.90 m	0.00 m	38.78 m	224.0°

Main Intended Positions:-

Name	Easting	Northing	Depth	Tolerance
Anchor 1	573281.57	5702316.36	0.00 m	50.00 m
Anchor 2	572693.26	5702476.90	0.00 m	50.00 m
Anchor 3	572089.88	5703544.65	0.00 m	50.00 m
Anchor 4	572255.86	5704131.45	0.00 m	50.00 m
Anchor 5	573325.31	5704735.80	0.00 m	50.00 m
Anchor 6	573913.62	5704575.26	0.00 m	50.00 m
Anchor 7	574517.01	5703507.49	0.00 m	50.00 m
Anchor 8	574351.01	5702920.70	0.00 m	50.00 m

Main Actual Positions:-

Verified by: (sign)_____ (print)_____

GNS II CONFIGURATION FILE A:\Hill-1\Hill-1.gns

Name	Easting	Northing	Depth	Tolerance
Anchor 1	573285.70	5702268.17	209.93 m	50.00 m
Anchor 2	572640.06	5702397.24	209.94 m	50.00 m
Anchor 3	572049.65	5703534.88	210.00 m	50.00 m
Anchor 4	572265.69	5704118.86	210.04 m	50.00 m
Anchor 5	573318.13	5704774.91	210.10 m	50.00 m
Anchor 6	573912.22	5704641.45	210.08 m	50.00 m
Anchor 7	574500.14	5703487.70	209.93 m	50.00 m
Anchor 8	574356.94	5702923.64	210.03 m	50.00 m

Verified by: (sign)_____ (print)_____

APPENDIX K

DAILY REPORT SHEETS

THALES GEOSOLUTIONS (AUSTRALASIA) LIMITED
DAILY RECORD SHEET

Date: 01-Dec-2003 Client: Santos Job No.: 3637A3 Vessel: Ocean Epoch Location: Hill-1

Equipment	Op	
Ocean Epoch		
SkyFix		
SkyFix Spot		
Gyro		
GNS 2		
MultiFix 3		
Tracs		

Equipment	Op	
AHV's		
TRACS		
Fluxgate		

Thales Personnel
M.Elmslie(ME)
B.Lobban (BL)
Client Personnel
(Santos)
G.Howard
(ECL)
J.Tighe

WX	Sea State	Swell	Wind Dir.
0000			
0600			
1200			
1800			

DIARY OF OPERATIONS

TIME	Time Zone=UTC+11.00 **Monday, 01 December 2003**
0800	Thales personnel depart Perth. (UTC+8.00)
1435	Arrive Melbourne.
1500	Check into accommodation, notified that personnel will not be departing for Ocean Epoch until 03 December 2003.
2359	Thales personnel on standby.

Forms are to be completed daily in duplicate on all vessels. Each form should be countersigned by the Clients Representative, the original being retained on board until the next crew change or at the end of job, whichever is the earlier, when they should be returned to the PERTH office.

Signature _____
SURVEYOR/ENGINEER

WHITE	: Accounts Department
BLUE	:Operations Department
YELLOW	: Clients Representative

Signature _____
CLIENT REPRESENTATIVE

THALES GEOSOLUTIONS (AUSTRALASIA) LIMITED
DAILY RECORD SHEET

Date: 02-Dec-2003 Client: Santos Job No.: 3637A3 Vessel: Ocean Epoch Location: Hill-1

Equipment	Op	
Ocean Epoch		
SkyFix		
SkyFix Spot		
Gyro		
GNS 2		
MultiFix 3		
Tracs		

Equipment	Op	
AHV's		
TRACS		
Fluxgate		

Thales Personnel
M.Elmslie(ME)
B.Lobban (BL)
Client Personnel
(Santos)
G.Howard
(ECL)
J.Tighe

WX	Sea State	Swell	Wind Dir.
0000			
0600			
1200			
1800			

DIARY OF OPERATIONS

TIME	Time Zone=UTC+11.00 **Tuesday, 02 December 2003**
0000	Thales personnel on standby.
1200	Thales personnel on standby notified that personnel will depart for the Ocean Epoch until 04 December 2003.
2359	Thales personnel on standby.

Forms are to be completed daily in duplicate on all vessels. Each form should be countersigned by the Clients Representative, the original being retained on board until the next crew change or at the end of job, whichever is the earlier, when they should be returned to the PERTH office.

Signature _____
SURVEYOR/ENGINEER

WHITE : Accounts Department
BLUE :Operations Department
YELLOW : Clients Representative

Signature _____
CLIENT REPRESENTATIVE

THALES GEOSOLUTIONS (AUSTRALASIA) LIMITED
DAILY RECORD SHEET

Date: 03-Dec-2003 Client: Santos Job No.: 3637A3 Vessel: Ocean Epoch Location: Hill-1

Equipment	Op	
Ocean Epoch		
SkyFix		
SkyFix Spot		
Gyro		
GNS 2		
MultiFix 3		
Tracs		

Equipment	Op	
AHV's		
TRACS		
Fluxgate		

Thales Personnel
M.Elmslie(ME)
B.Lobban (BL)
Client Personnel
(Santos)
G.Howard
(ECL)
J.Tighe

WX	Sea State	Swell	Wind Dir.
0000			
0600			
1200			
1800			

DIARY OF OPERATIONS

TIME	Time Zone=UTC+11.00 **Wednesday, 03 December 2003**
0000	Thales personnel on standby.
1200	Thales personnel on standby.
2359	Thales personnel on standby.

Forms are to be completed daily in duplicate on all vessels. Each form should be countersigned by the Clients Representative, the original being retained on board until the next crew change or at the end of job, whichever is the earlier, when they should be returned to the PERTH office.

Signature _____
SURVEYOR/ENGINEER

WHITE	: Accounts Department
BLUE	:Operations Department
YELLOW	: Clients Representative

Signature _____
CLIENT REPRESENTATIVE

THALES GEOSOLUTIONS (AUSTRALASIA) LIMITED
DAILY RECORD SHEET

Date: 04-Dec-2003 Client: Santos Job No.: 3637A3 Vessel: Ocean Epoch Location: Hill-1

Equipment	Op	
Ocean Epoch	✓	
SkyFix	✓	
SkyFix Spot	✓	2
Gyro	✓	
GNS 2	✓	
MultiFix 3	✓	
Tracs	✓	

Equipment	Op	
AHV's		
TRACS	✓	2
Fluxgate	✓	2

Thales Personnel
M.Elmslie(ME)
B.Lobban (BL)
Client Personnel
(Santos)
G.Howard
(ECL)
J.Tighe

WX	Sea State	Swell	Wind Dir.
0000			
0600			
1200			
1800			

DIARY OF OPERATIONS

TIME	Time Zone=UTC+11.00 **Thursday, 04 December 2003**
0530	Thales personnel check into Bristows heliport, Essendon.
0645	Depart Essendon for Ocean Epoch.
0800	Arrive Ocean Epoch.
0900	Container found, waiting for crane to lift container into accessible position.
1500	Commence mobilisation.
1555	#5 PCC passed to L.Dawn.
1604	L.Dawn chasing out #5.
1621	#5 off bottom.
1625	Heaving in #5.
1700	Mobilisation complete, navigation operational, AHV's not receiving TRACS.
1710	#5 bolstered.
1721	#5 PCC passed back to rig.
1916	#1 PCC passed to L.Dawn.
1923	L.Dawn chasing out #1.
1944	#1 off bottom.
1945	Heaving in #1.
2025	#1 bolstered.
2040	#1 PCC passed back to rig.
2050	#8 PCC passed to L.Dawn.
2057	L.Dawn chasing out #8.
2110	Casing cut.
2115	Commence Deballasting to 38'.

Forms are to be completed daily in duplicate on all vessels. Each form should be countersigned by the Clients Representative, the original being retained on board until the next crew change or at the end of job, whichever is the earlier, when they should be returned to the PERTH office.

Signature _____
SURVEYOR/ENGINEER

WHITE	: Accounts Department
BLUE	:Operations Department
YELLOW	: Clients Representative

Signature _____
CLIENT REPRESENTATIVE

THALES GEOSOLUTIONS (AUSTRALASIA) LIMITED
DAILY RECORD SHEET

Date: 04-Dec-2003 Client: Santos Job No.: 3637A3 Vessel: Ocean Epoch Location: Hill-1

Equipment	Op	
Ocean Epoch	✓	
SkyFix	✓	
SkyFix Spot	✓	2
Gyro	✓	
GNS 2	✓	
MultiFix 3	✓	
Tracs	✓	

Equipment	Op	
AHV's		
TRACS	✓	2
Fluxgate	✓	2

Thales Personnel
M.Elmslie(ME)
B.Lobban (BL)
Client Personnel
(Santos)
G.Howard
(ECL)
J.Tighe

WX	Sea State	Swell	Wind Dir.
0000			
0600			
1200			
1800			

DIARY OF OPERATIONS

TIME	Time Zone=UTC+11.00 **Thursday, 04 December 2003**
2124	#8 off bottom.
2125	Heaving in #8.
2142	BL transferred to P.Challenger.
2219	#8 bolstered.
2229	#8 PCC passed back to rig.
2230	BL returned to rig.
2242	#4 PCC passed to L.Dawn.
2250	L.Dawn chasing out #4. TRACS operational.
2311	#4 off bottom.
2312	Heaving in #4.
2355	#4 bolstered.

Forms are to be completed daily in duplicate on all vessels. Each form should be countersigned by the Clients Representative, the original being retained on board until the next crew change or at the end of job, whichever is the earlier, when they should be returned to the PERTH office.

Signature _____
SURVEYOR/ENGINEER

WHITE	: Accounts Department
BLUE	:Operations Department
YELLOW	: Clients Representative

Signature _____
CLIENT REPRESENTATIVE

THALES GEOSOLUTIONS (AUSTRALASIA) LIMITED
DAILY RECORD SHEET

Date: 05-Dec-2003 Client: Santos Job No.: 3637A3 Vessel: Ocean Epoch Location: Hill-1

Equipment	Op	
Ocean Epoch	✓	
SkyFix	✓	
SkyFix Spot	✓	2
Gyro	✓	
GNS 2	✓	
MultiFix 3	✓	
Tracs	✓	

Equipment	Op	
AHV's		
TRACS	✓	2
Fluxgate	✓	2

Thales Personnel
M.Elmslie(ME)
B.Lobban (BL)
Client Personnel
(Santos)
G.Howard
(ECL)
J.Tighe

WX	Sea State	Swell	Wind Dir.
0000			
0600			
1200			
1800			

DIARY OF OPERATIONS PAGE 6 OF 13

TIME	Time Zone=UTC+11.00 **Friday, 05 December 2003**
0027	#4 PCC passed back to rig.
0050	All stop deballasting, rig at 38'.
0109	#6 PCC passed to P.Challenger.
0118	P.Challenger chasing out #6.
0125	L.Dawn connected to tow bridle.
0133	P.Challenger @ #6, waiting for L.Dawn to take up weight on tow bridle.
0158	#6 off bottom.
0200	Heaving in #6.
0207	Resume deballasting to 30'.
0253	#6 bolstered (upside down).
0300	#6 PCC passed back to rig.
0346	#2 PCC passed to P.Challenger.
0355	P.Challenger chasing out #2.
0412	All stop deballasting @ 26'.
0415	#2 off bottom.
0420	Heaving in #2.
0506	#2 bolstered (upside down).
0510	Resume deballasting to 25'.
0511	#2 PCC passed back to rig.
0512	Turning #2 in bolster.
0526	#2 bolstered correct way.
0545	Finish deballasting @ 25'.

Forms are to be completed daily in duplicate on all vessels. Each form should be countersigned by the Clients Representative, the original being retained on board until the next crew change or at the end of job, whichever is the earlier, when they should be returned to the PERTH office.

Signature _____ SURVEYOR/ENGINEER

WHITE	: Accounts Department
BLUE	:Operations Department
YELLOW	: Clients Representative

Signature _____ CLIENT REPRESENTATIVE

THALES GEOSOLUTIONS (AUSTRALASIA) LIMITED
DAILY RECORD SHEET

Date: 05-Dec-2003 Client: Santos Job No.: 3637A3 Vessel: Ocean Epoch Location: Hill-1

Equipment	Op	
Ocean Epoch	✓	
SkyFix	✓	
SkyFix Spot	✓	2
Gyro	✓	
GNS 2	✓	
MultiFix 3	✓	
Tracs	✓	

Equipment	Op	
AHV's		
TRACS	✓	2
Fluxgate	✓	2

Thales Personnel
M.Elmslie(ME)
B.Lobban (BL)
Client Personnel
(Santos)
G.Howard
(ECL)
J.Tighe

WX	Sea State	Swell	Wind Dir.
0000			
0600			
1200			
1800			

DIARY OF OPERATIONS PAGE 7 OF 13

TIME	Time Zone=UTC+11.00 **Friday, 05 December 2003**
0550	#6 bolstered correct way.
0607	#4 bolstered correct way.
0620	#3 PCC passed to P.Challenger.
0625	P.Challenger chasing out #3.
0648	#3 off bottom.
0650	Heaving in #3.
0655	Commence heaving in #7.
0723	All stop heaving while #3 is bolstered.
0800	Santos Survey rep J.Tighe arrives.
0835	Resume heaving in #7.
0900	#7 bolstered, commence toe to Hill-1.
1200	Rig position 38°45.5' S 148°22.7' E Course 148° DTOG 322nm.
2011	Commence solar obs.
2019	Complete solar obs.

Forms are to be completed daily in duplicate on all vessels. Each form should be countersigned by the Clients Representative, the original being retained on board until the next crew change or at the end of job, whichever is the earlier, when they should be returned to the PERTH office.

Signature _____ SURVEYOR/ENGINEER

WHITE	: Accounts Department
BLUE	:Operations Department
YELLOW	: Clients Representative

Signature _____ CLIENT REPRESENTATIVE

THALES GEOSOLUTIONS (AUSTRALASIA) LIMITED
DAILY RECORD SHEET

Date: 06-Dec-2003 Client: Santos Job No.: 3637A3 Vessel: Ocean Epoch Location: Hill-1

Equipment	Op	
Ocean Epoch	✓	
SkyFix	✓	
SkyFix Spot	✓	2
Gyro	✓	
GNS 2	✓	
MultiFix 3	✓	
Tracs	✓	

Equipment	Op	
AHV's		
TRACS	✓	2
Fluxgate	✓	2

Thales Personnel
M.Elmslie(ME)
B.Lobban (BL)
Client Personnel
(Santos)
G.Howard
(ECL)
J.Tighe

WX	Sea State	Swell	Wind Dir.
0000			
0600			
1200			
1800			

DIARY OF OPERATIONS

TIME	Time Zone=UTC+11.00 **Saturday, 06 December 2003**
0000	Rig position 39°17.3' S 147°03.0' E Course 238° DTOG 264nm.
1200	Rig position 39°23.9' S 146°03.0' E Course 274° DTOG 202nm.
1430	GPS signal lost in MultiFix.
1545	GPS antenna replaced, GPS signal returns.
2010	Commence Solar obs.
2030	Complete solar obs, C-O of –86.80° calc'd and entered into GNSI2

Forms are to be completed daily in duplicate on all vessels. Each form should be countersigned by the Clients Representative, the original being retained on board until the next crew change or at the end of job, whichever is the earlier, when they should be returned to the PERTH office.

Signature _____
SURVEYOR/ENGINEER

WHITE	: Accounts Department
BLUE	:Operations Department
YELLOW	: Clients Representative

Signature _____
CLIENT REPRESENTATIVE

THALES GEOSOLUTIONS (AUSTRALASIA) LIMITED
DAILY RECORD SHEET

Date: 07-Dec-2003 Client: Santos Job No.: 3637A3 Vessel: Ocean Epoch Location: Hill-1

Equipment	Op	
Ocean Epoch	✓	
SkyFix	✓	
SkyFix Spot	✓	2
Gyro	✓	
GNS 2	✓	
MultiFix 3	✓	
Tracs	✓	

Equipment	Op	
AHV's		
TRACS	✓	2
Fluxgate	✓	2

Thales Personnel
M.Elmslie(ME)
B.Lobban (BL)
Client Personnel
(Santos)
G.Howard
(ECL)
J.Tighe

WX	Sea State	Swell	Wind Dir.
0000			
0600			
1200			
1800			

DIARY OF OPERATIONS PAGE 9 OF 13

TIME	Time Zone=UTC+11.00 **Sunday, 07 December 2003**
0000	Rig position 39°19.6' S 144°37.1' E Course 274° DTOG 135nm.
1030	Thales personnel attend fire and abandonment drill.
1045	Fire drill complete.
1130	Advised by Barge engineer that amount of chain to be paid out is to be 4000', new anchor coords calc'd.
1200	Rig position 39°13.5' S 143°12.9' E Course 270.1° DTOG 68.9nm
1300	Thales personnel attend weekly safety meeting.
2335	L.Dawn shortening tow wire.

Forms are to be completed daily in duplicate on all vessels. Each form should be countersigned by the Clients Representative, the original being retained on board until the next crew change or at the end of job, whichever is the earlier, when they should be returned to the PERTH office.

Signature _____ SURVEYOR/ENGINEER

WHITE : Accounts Department
BLUE :Operations Department
YELLOW : Clients Representative

Signature _____ CLIENT REPRESENTATIVE

THALES GEOSOLUTIONS (AUSTRALASIA) LIMITED
DAILY RECORD SHEET

Date: 08-Dec-2003 Client: Santos Job No.: 3637A3 Vessel: Ocean Epoch Location: Hill-1

Equipment	Op	
Ocean Epoch	✓	
SkyFix	✓	
SkyFix Spot	✓	2
Gyro	✓	
GNS 2	✓	
MultiFix 3	✓	
Tracs	✓	

Equipment	Op	
AHV's		
TRACS	✓	2
Fluxgate	✓	2

Thales Personnel
M.Elmslie(ME)
B.Lobban (BL)
Client Personnel
(Santos)
G.Howard
(ECL)
J.Tighe

WX	Sea State	Swell	Wind Dir.
0000			
0600			
1200			
1800			

DIARY OF OPERATIONS PAGE 10 OF 13

TIME	Time Zone=UTC+11.00 **Monday, 08 December 2003**
0002	Ballasting down to 30'
0007	At WP5, commencing run in.
0048	Dropping #7 to 400'.
0100	#7 on bottom, 574 473 5 703 488.
0128	Rig over Hill-1 location.
0130	#3 assigned to P.Challenger.
0146	#3 PCC passed to P.Challenger.
0202	P.Challenger running out #3.
0222	#3 on bottom, 572 103 5 703 535.
0256	#6 assigned to P.Challenger.
0304	#6 PCC passed to P.Challenger
0317	P.Challenger running out #6.
0333	#6 on bottom, 573 943 5 704 698.
0400	#6 PCC passed back to rig.
0412	#2 assigned to P.Challenger.
0420	#2 PCC passed to P.Challenger.
0436	P.Challenger running out #2.
0453	#2 on bottom, 572 580 5 702 296.
0518	#2 PCC passed back to rig.
0536	#8 assigned to P.Challenger.
0539	#8 PCC passed to P.Challenger
0549	P.Challenger running out #8.

Forms are to be completed daily in duplicate on all vessels. Each form should be countersigned by the Clients Representative, the original being retained on board until the next crew change or at the end of job, whichever is the earlier, when they should be returned to the PERTH office.

Signature _____ SURVEYOR/ENGINEER

WHITE	: Accounts Department
BLUE	:Operations Department
YELLOW	: Clients Representative

Signature _____ CLIENT REPRESENTATIVE

THALES GEOSOLUTIONS (AUSTRALASIA) LIMITED
DAILY RECORD SHEET

Date: 08-Dec-2003 Client: Santos Job No.: 3637A3 Vessel: Ocean Epoch Location: Hill-1

Equipment	Op	
Ocean Epoch	✓	
SkyFix	✓	
SkyFix Spot	✓	2
Gyro	✓	
GNS 2	✓	
MultiFix 3	✓	
Tracs	✓	

Equipment	Op	
AHV's		
TRACS	✓	2
Fluxgate	✓	2

Thales Personnel
M.Elmslie(ME) (ME)
B.Lobban (BL)
Client Personnel
(Santos)
G.Howard
(ECL)
J.Tighe

WX	Sea State	Swell	Wind Dir.
0000			
0600			
1200			
1800			

DIARY OF OPERATIONS PAGE 11 OF 13

TIME	Time Zone=UTC+11.00 **Monday, 08 December 2003**
0604	#8 on bottom, 577 441 5 702 875.
0607	L.Dawn disconnected from tow bridle.
0629	#8 PCC passed back to rig.
0648	#4 assigned to P.Challenger.
0650	#4 PCC passed to P.Challenger.
0655	P.Challenger running out #4.
0716	#4 on bottom, 572 189 5 704 163.
0727	#1 PCC passed to L.Dawn.
0822	#1 on bottom, 573 285 5 702 182.
0837	#4 PCC passed back to rig.
0852	#5 PCC passed to P.Challenger.
0910	#1 PCC passed back to rig.
0920	#5 on bottom, 573 318 5 704 906.
0925	Storm tensioning.
0950	#5 PCC passed back to rig.
1155	Rig at 55' draft.
1225	Rig crawl finished.
1936	Commence preliminary fix.
1946	Complete preliminary fix, rig 0.88m on a bearing of 231.9°(T) from the intended Hill-1 location.
2100	Spudding in.

Forms are to be completed daily in duplicate on all vessels. Each form should be countersigned by the Clients Representative, the original being retained on board until the next crew change or at the end of job, whichever is the earlier, when they should be returned to the PERTH office.

Signature _____ SURVEYOR/ENGINEER

WHITE	: Accounts Department
BLUE	:Operations Department
YELLOW	: Clients Representative

Signature _____ CLIENT REPRESENTATIVE

THALES GEOSOLUTIONS (AUSTRALASIA) LIMITED
DAILY RECORD SHEET

Date: 09-Dec-2003 Client: Santos Job No.: 3637A3 Vessel: Ocean Epoch Location: Hill-1

Equipment	Op	
Ocean Epoch	✓	
SkyFix	✓	
SkyFix Spot	✓	2
Gyro	✓	
GNS 2	✓	
MultiFix 3	✓	
Tracs	✓	

Equipment	Op	
AHV's		
TRACS	✓	2
Fluxgate	✓	2

Thales Personnel
M.Elmslie(ME)
B.Lobban (BL)
Client Personnel
(Santos)
G.Howard
(ECL)
J.Tighe

WX	Sea State	Swell	Wind Dir.
0000			
0600			
1200			
1800			

DIARY OF OPERATIONS PAGE 12 OF 13

TIME	Time Zone=UTC+11.00 **Tuesday, 09 December 2003**
0500	Commence running of 30" casing.
0900	Complete running of 30" casing.
1036	Commence final fix.
1136	Complete final fix, final rig location is 0.35m on a bearing of 185.6°(T) from intended location.
1425	Commence demobilisation.
1500	Stopped demobilisation, waiting on crane lift.
1645	Recommence demobilisation.
1710	Demobilisation complete.

Forms are to be completed daily in duplicate on all vessels. Each form should be countersigned by the Clients Representative, the original being retained on board until the next crew change or at the end of job, whichever is the earlier, when they should be returned to the PERTH office.

Signature _____ SURVEYOR/ENGINEER

WHITE	: Accounts Department
BLUE	:Operations Department
YELLOW	: Clients Representative

Signature _____ CLIENT REPRESENTATIVE

THALES GEOSOLUTIONS (AUSTRALASIA) LIMITED
DAILY RECORD SHEET

Date: 10-Dec-2003 Client: Santos Job No.: 3637A3 Vessel: Ocean Epoch Location: Hill-1

Equipment	Op	
Ocean Epoch		
SkyFix		
SkyFix Spot		
Gyro		
GNS 2		
MultiFix 3		
Tracs		

Equipment	Op	
AHV's		
TRACS		
Fluxgate		

Thales Personnel
M.Elmslie(ME)
B.Lobban (BL)
Client Personnel
(Santos)
G.Howard
(ECL)
J.Tighe

WX	Sea State	Swell	Wind Dir.
0000			
0600			
1200			
1800			

DIARY OF OPERATIONS PAGE 13 OF 13

TIME	Time Zone=UTC+11.00 **Wednesday, 10 December 2003**
0845	Thales personnel depart Ocean Epoch.
1000	Arrive Essendon airport.
1145	Depart Melbourne.
1215	Arrive Perth (UTC +8.00)

Forms are to be completed daily in duplicate on all vessels. Each form should be countersigned by the Clients Representative, the original being retained on board until the next crew change or at the end of job, whichever is the earlier, when they should be returned to the PERTH office.

Signature _____
SURVEYOR/ENGINEER

WHITE	: Accounts Department
BLUE	:Operations Department
YELLOW	: Clients Representative

Signature _____
CLIENT REPRESENTATIVE