DATA ACQUISITION SUPERVISION REPORT

For the

2007 SILVEREYE 3D SURVEY

Conducted by

ORIGIN ENERGY RESOURCES LIMITED

In The Exploration Licence Area

Block T/44P
Offshore Tasmania

SURVEY START DATE 2nd January 2008
SURVEY COMPLETION DATE 30th January 2008

Volume 1 Seismic Data Acquisition

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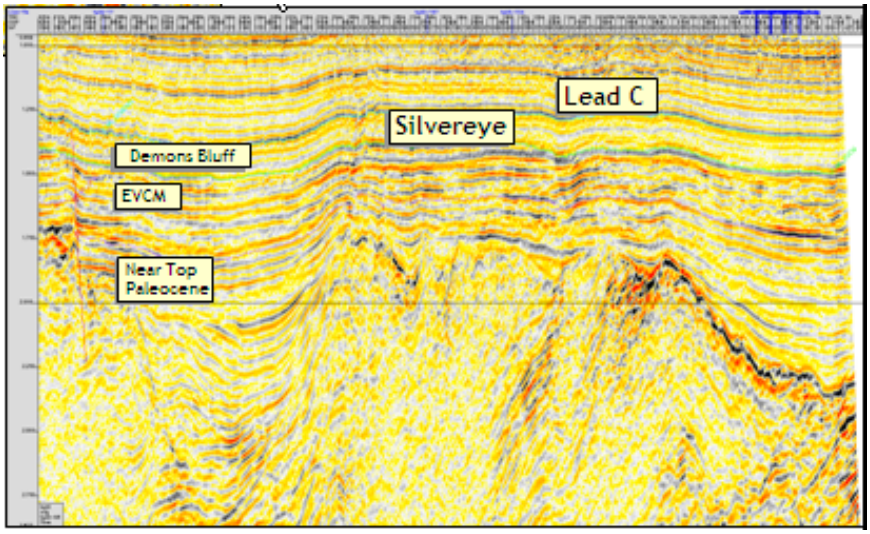
1 INTRODUCTION

1.1 OBJECTIVES

The objective of the Silvereye 3D survey was to conduct a marine seismic survey in the safest and most efficient way possible.

The Silvereye 3D survey will enable Origin to properly map the Silvereye Lead and Lead C closures and determine if Lead C is contained within the Silvereye Lead or if the two structures are independent of each other.



Origin Energy contracted Petroleum Geo-Services (PGS) to conduct a high quality 3D seismic survey of some 321.70 full fold square kilometres over the Silvereye 3D Survey area. The location is in the T/44P block offshore Tasmania.

The seismic survey vessel was the M/V Pacific Explorer with Total Marine Services TMS providing the marine crew. Petroleum Geo-Services Marine Acquisition, Singapore supplied the seismic personnel and logistics. Enquest Pty Ltd provided the on board supervision and marine mammal observers for the survey. Processing was to be done by CGGVeritas.

1.2 SURVEY PARAMETRES

The following is a summary of the survey parameters:

Survey Type	: 3D
Client	: Origin Energy
Survey Name	: Silvereye 3D MSS
SP Interval	: 18.75m
Source	: 2 x 3090 in^3. Bolt guns
Streamer Length	: 6 x 6000 metres
Groups	: 6 x 480

Positioning

Primary	: Fugro Starfix HP
Secondary	: Fugro Skyfix XP
Tertiary	: MRDGPS

Water Depth	: 50m to 58m
Number of Sail Lines	: 45
Survey Surface Area	: 321.70 km^2 Full Fold (calculated by shotpoints)
Contractor	: Petroleum Geo-Services Marine Acquisition, Singapore
Vessel	: M/V Pacific Explorer
Client Representation	: Enquest Pty. Limited

Survey Datum	: GDA94
Ellipsoid	: GRS1980
Semi Major Axis	: 6378137 m
1/Flattening	: 298.257222101 (based on AUSLIG 2000)
GPS Datum	: *WGS84*
Ellipsoid	: *WGS84*
Semi Major Axis	: *6378137 m*
1/Flattening	: *298.257223563*
Geoidal height	: -0.35m (max value -0.03m, min value -0.84m)

Datum Shift WGS84 to GDA94

X-Translation	: 0.0 m
Y-Translation	: 0.0 m
Z-Translation	: 0.0 m
X-Axis Rotation *	: 0.0 “
Y-Axis Rotation *	: 0.0 “
Z-Axis Rotation *	: 0.0 “
Scale Correction	: 0.0 *10-6

* Bursa-Wolf sign convention

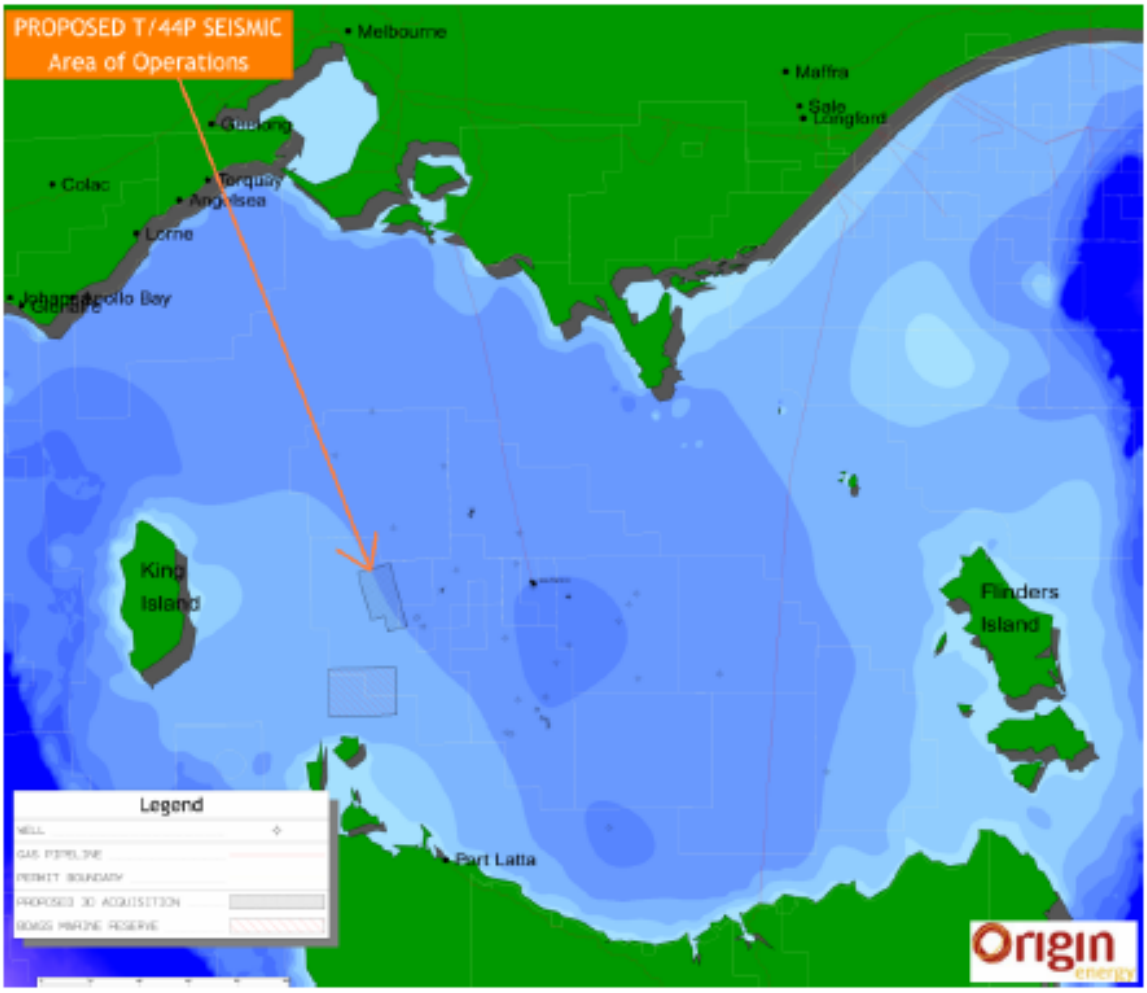
Projection	: Universal Transverse Mercator
Projection System	: UTM, Zone 55 (South)
Central Meridian	: 147°E
Scale Factor on C.M.	: 0.9996
Latitude of Origin	: 0º
False Northing	: 10,000,000m
False Easting	: 500,000m

1.3 ACQUISITION PARAMETERS

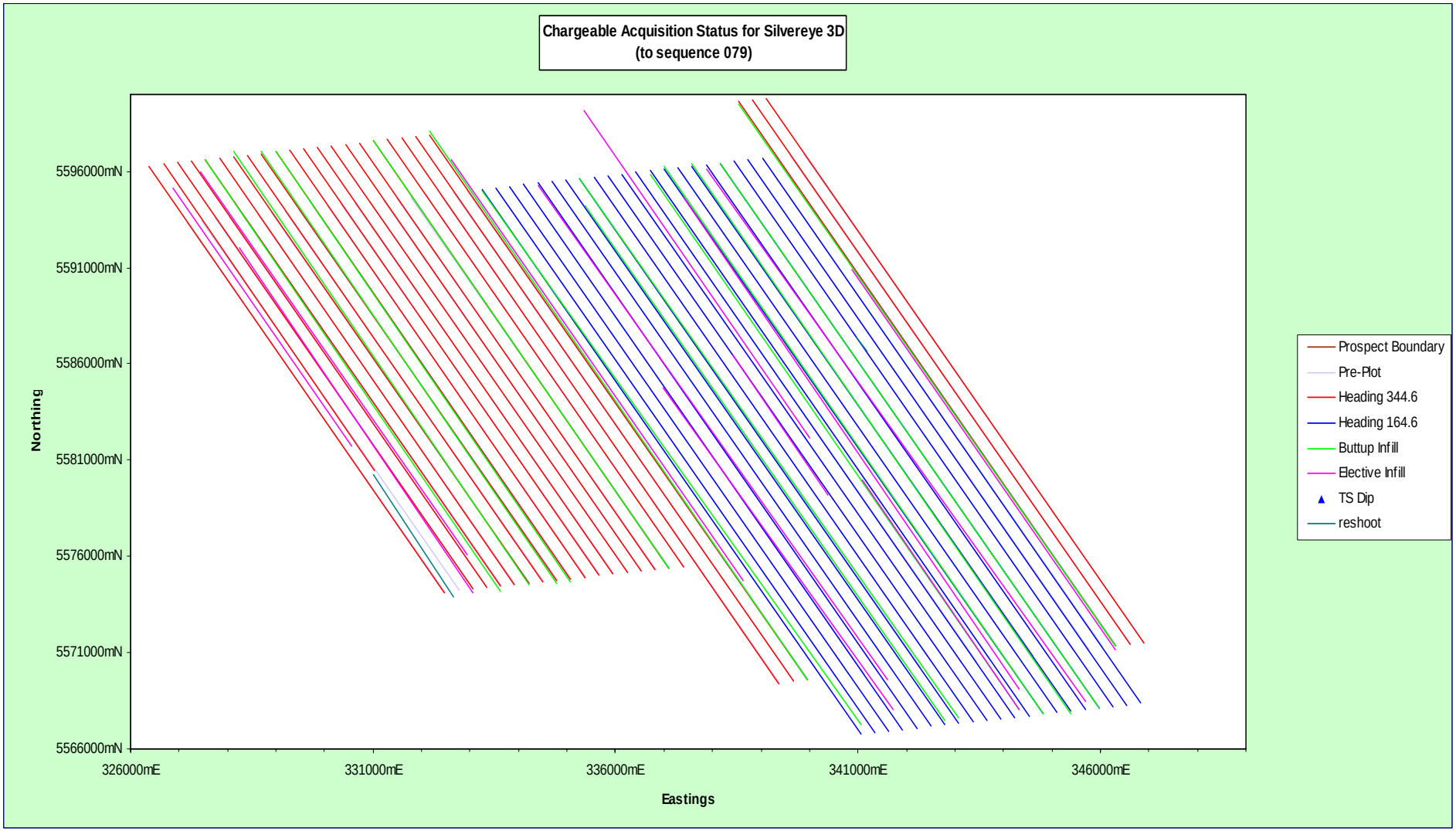
Recording System	: gAS (generic Acquisition System)
Record Length	: 6144ms
Sample Interval	: 2ms
Low Cut Filter	: 4.6Hz @ 6db/octave
High Cut Filter	: 206Hz @ 276dB/Oct
Tape Format	: SEG-D 8036, Rev 2
Digital Filter	: Linear
Number of Sub-Arrays/Array	: 3
Array Length	: 15.0m
Sub Array Separation	: 10.0m +/- 2m

Total Number of Guns	: 31 per Array
Capacity of Each Sub-Array	: (1, 4) 1140 in³, (2, 5) 730 in³, (3, 6) 1220 in³
Typical Output	: 158.44 bar/metres pk-pk
Primary / Bubble Ratio	: 31.26
Pressure	: 2000 psi +/- 200 psi
Source Depth	: 6.0 metres
Group Length	: 12.5 metres
Group Interval	: 12.5 metres
Group Sensitivity	: 20.0v/ bar
Hydrophones per Group	: 16
Streamer Depth	: 7 metres +/- 1.0m
Typical Noise	: 6.0 to 12.0 microbars
Offset (In-line)	: 118m
Nav. Ref.-Centre Source	: 332m
Integrated Navigation System	: Spectra
Coverage Binning System	: Census
Echo Sounder	: Simrad EA500, 38/200 kHz (max. sounding depth 2200m)

1.4 LOCATION MAP



1.5 PROGRAM MAP



2 SYNOPSIS

2.1 OVERVIEW

The survey consisted of 45 pre-plotted sail lines with a total of 321.70 full fold square kilometres [calculated from total shotpoints] over the Silvereye 3D survey area, located offshore Tasmania. A final total of 12869.1000 full fold kilometres of surface coverage equivalent to 321.7275 full fold square kilometres were recorded.

The vessel used was the M/V Pacific Explorer, which is a purpose built vessel owned by PGS. The periodically poor weather conditions encountered on prospect played a large part in the final cost of the survey, as the majority of standby time was attributed to weather effects. The workboat was used for any streamer maintenance, which helped in reducing equipment down time.

An offshore mobilization occurred between the 01st-02nd of January 2008 after completing the previous survey for the SEBOA Consortium.

Production commenced on the 02nd of January with line 1534P1001.

Seven periods of weather standby were experienced during the survey. These occurred on January 02nd-03rd, 11th, 13th-14th, 18th, 20th-21st, 27th-28th, 28th.

A personnel change was conducted by helicopter on the 05th of January using a helicopter chartered by Origin. Two Processors disembarked and one Origin employee arrived onboard. The operation was conducted without incident.

One medevac occurred on the 07th of January when a seaman was airlifted ashore following a back injury sustained whilst bunkering with the chase boat. The injury was not life-threatening but seriously impeded the mobility of the seaman.

The operation to remove barnacles from the streamers commenced on the 15th of January and continued, weather permitting, until the January crew change. The work boat was used during line changes to travel along each streamer with the barnacle removal tool deployed.

The final full-pass prime line of the survey (1282P1068) was recorded on the 21st of January.

The survey was temporarily halted on the 21st of January to enable the vessel to go alongside in the Tasmanian port of Burnie to facilitate a full crew change [marine and seismic crews], which took place on the 23rd of January.

Production recommenced at 16:22 on the 26th and continued till 10:10 on the 29th of January. Line OS073D1294F2079 was the final line of the survey. During this period there were 2 interludes for weather. The official end of survey was taken when the vessel crossed the geographical midpoint between this and the next survey. This was at 18:09 on 30th January at 39 10 56.00 S, 144 00 00.00 E.

The chase boat was used on a couple of occasions to transfer personnel to and from the mainland. Initially the Port of Melbourne was used, but towards the end of the survey this was changed to the [Tasmanian] port of Burnie.

2.2 CHARGEABLE PRIME SURVEY PRODUCTION BY SEQUENCE

Prime Production between 2nd and 29th Jan 2008

Seq	Line	Dir	FCSP	LCSP	KM	KMFF	CMP	SQKMFF
001	1534P1	345	2066	841	22.98750	19.98750	275.85000	5.996250
002	1258P1	165	1001	2567	29.38125	26.38125	352.57500	7.914375
003	1522P1	345	1720	841	16.50000	13.50000	198.00000	4.050000
004	1246P1	165	1001	2567	29.38125	26.38125	352.57500	7.914375
005	1510P1	345	2066	841	22.98750	19.98750	275.85000	5.996250
007	1234P2	165	1001	2567	29.38125	26.38125	352.57500	7.914375
008	1498P1	345	2066	841	22.98750	19.98750	275.85000	5.996250
009	1222P1	165	1001	2567	29.38125	26.38125	352.57500	7.914375
010	1486P1	345	2067	841	23.00625	20.00625	276.07500	6.001875
011	1210P1	165	1001	2567	29.38125	26.38125	352.57500	7.914375
013	1198P1	165	1001	2567	29.38125	26.38125	352.57500	7.914375
014	1474P1	345	2067	841	23.00625	20.00625	276.07500	6.001875
016	1462P1	345	2067	1518	10.31250	10.31250	123.75000	3.093750
016	1462P1	345	1517	841	12.69375	9.69375	152.32500	2.908125
017	1186P1	165	1001	2567	29.38125	26.38125	352.57500	7.914375
019	1174P1	165	1001	2567	29.38125	26.38125	352.57500	7.914375
020	1450P1	345	1676	841	15.67500	12.67500	188.10000	3.802500
020	1450P1	345	2067	1677	7.33125	7.33125	87.97500	2.199375
021	1162P1	165	1001	2567	29.38125	26.38125	352.57500	7.914375
022	1438P1	345	2067	841	23.00625	20.00625	276.07500	6.001875
023	1150P1	165	1001	2567	29.38125	26.38125	352.57500	7.914375
024	1426P1	345	958	841	2.21250	0.00000	26.55000	0.000000
024	1426P1	345	2067	959	20.79375	20.00625	249.52500	6.001875
025	1138P1	165	1001	2567	29.38125	26.38125	352.57500	7.914375
027	1126P1	165	1001	2567	29.38125	26.38125	352.57500	7.914375
028	1414P1	345	2067	943	21.09375	20.00625	253.12500	6.001875
028	1414P1	345	942	841	1.91250	0.00000	22.95000	0.000000
030	1402P1	345	2067	841	23.00625	20.00625	276.07500	6.001875
031	1114P1	165	1001	2567	29.38125	26.38125	352.57500	7.914375
032	1390P1	345	2067	841	23.00625	20.00625	276.07500	6.001875
033	1102P1	165	1001	2567	29.38125	26.38125	352.57500	7.914375
034	1378P1	345	2068	841	23.02500	20.02500	276.30000	6.007500
035	1266P1	345	2068	841	23.02500	20.02500	276.30000	6.007500
037	1354P1	345	2068	841	23.02500	20.02500	276.30000	6.007500
038	1090P1	165	1001	2567	29.38125	26.38125	352.57500	7.914375
039	1342P1	345	2068	841	23.02500	20.02500	276.30000	6.007500
040	1078P1	165	1001	2567	29.38125	26.38125	352.57500	7.914375
043	1330P1	345	2068	841	23.02500	20.02500	276.30000	6.007500

Seq	Line	Dir	FCSP	LCSP	KM	KMFF	CMP	SQKMFF
044	1066P1	165	1001	1010	0.18750	0.18750	2.25000	0.056250
044	1066P1	165	1011	2567	29.19375	26.19375	350.32500	7.858125
045	1318P1	345	2407	841	29.38125	26.38125	352.57500	7.914375
046	1054P1	165	1001	2567	29.38125	26.38125	352.57500	7.914375
047	1306P1	345	2407	841	29.38125	26.38125	352.57500	7.914375
048	1042P1	165	1001	1086	1.61250	1.61250	19.35000	0.483750
048	1042P1	165	1087	2567	27.76875	24.76875	333.22500	7.430625
049	1294P1	345	2407	841	29.38125	26.38125	352.57500	7.914375
053	1006P1	345	2407	841	29.38125	26.38125	352.57500	7.914375
062	1018P1	345	2407	841	29.38125	26.38125	352.57500	7.914375
063	1270P1	165	1001	2567	29.38125	26.38125	352.57500	7.914375
064	1030P1	345	2407	841	29.38125	26.38125	352.57500	7.914375
066	1522R1	345	2066	1721	6.48750	6.48750	77.85000	1.946250
068	1282P1	165	1001	2567	29.38125	26.38125	352.57500	7.914375

Infill Production between 2nd and 29th Jan 2008

Seq	Line	Dir	FCSP	LCSP	KM	KMFF	CMP	SQKMFF
012	1486F1	345	1200	841	6.75000	3.75000	81.00000	1.125000
012	1486F1	345	2067	1201	16.25625	16.25625	195.07500	4.876875
015	1198F1	165	1001	2567	29.38125	26.38125	352.57500	7.914375
018	1462F1	345	2067	841	23.00625	20.00625	276.07500	6.001875
026	1426F1	345	2067	841	23.00625	20.00625	276.07500	6.001875
029	1126F1	165	1001	2567	29.38125	26.38125	352.57500	7.914375
036	1102F1	165	1001	2567	29.38125	26.38125	352.57500	7.914375
041	1342F1	345	2068	841	23.02500	20.02500	276.30000	6.007500
042	1078F1	165	1001	2567	29.38125	26.38125	352.57500	7.914375
050	1090F1	165	1001	2567	29.38125	26.38125	352.57500	7.914375
051	1438F1	345	2067	841	23.00625	20.00625	276.07500	6.001875
052	1234F1	165	1001	1119	2.23125	2.23125	26.77500	0.669375
052	1234F1	165	1120	2447	24.90000	24.15000	298.80000	7.245000
054	1138F1	165	1001	1881	16.51875	16.51875	198.22500	4.955625
056	1138F2	165	1882	2527	12.11250	9.86250	145.35000	2.958750
057	1498F2	345	1986	1931	1.05000	1.05000	12.60000	0.315000
057	1498F2	345	1930	881	19.68750	17.43750	236.25000	5.231250
060	1510F2	345	2066	1100	18.13125	18.13125	217.57500	5.439375
061	1246F1	165	1580	2527	17.77500	15.52500	213.30000	4.657500
065	1174R1	165	1518	1765	4.65000	4.65000	55.80000	1.395000
065	1174R1	165	1910	2005	1.80000	1.80000	21.60000	0.540000
066	1522R1	345	1625	881	13.96875	11.71875	167.62500	3.515625
067	1126F3	165	1081	2527	27.13125	24.88125	325.57500	7.464375
069	1522F1	345	2066	1455	11.47500	11.47500	137.70000	3.442500

Seq	Line	Dir	FCSP	LCSP	KM	KMFF	CMP	SQKMFF
070	1066R1	165	1680	2567	16.65000	13.65000	199.80000	4.095000
071	1294F1	345	2407	841	29.38125	26.38125	352.57500	7.914375
072	1210F1	165	1081	2567	27.88125	24.88125	334.57500	7.464375
073	1030F1	345	2407	841	29.38125	26.38125	352.57500	7.914375
075	1030F2	345	2407	1310	20.58750	20.58750	247.05000	6.176250
077	1162F1	345	1780	841	17.62500	14.62500	211.50000	4.387500
078	1282F3	165	1001	2567	29.38125	26.38125	352.57500	7.914375
079	1294F2	345	2140	930	22.70625	21.37500	272.47500	6.412500

2.3 PRODUCTION TOTALS

Prime Production between 2nd and 29th Jan 2008

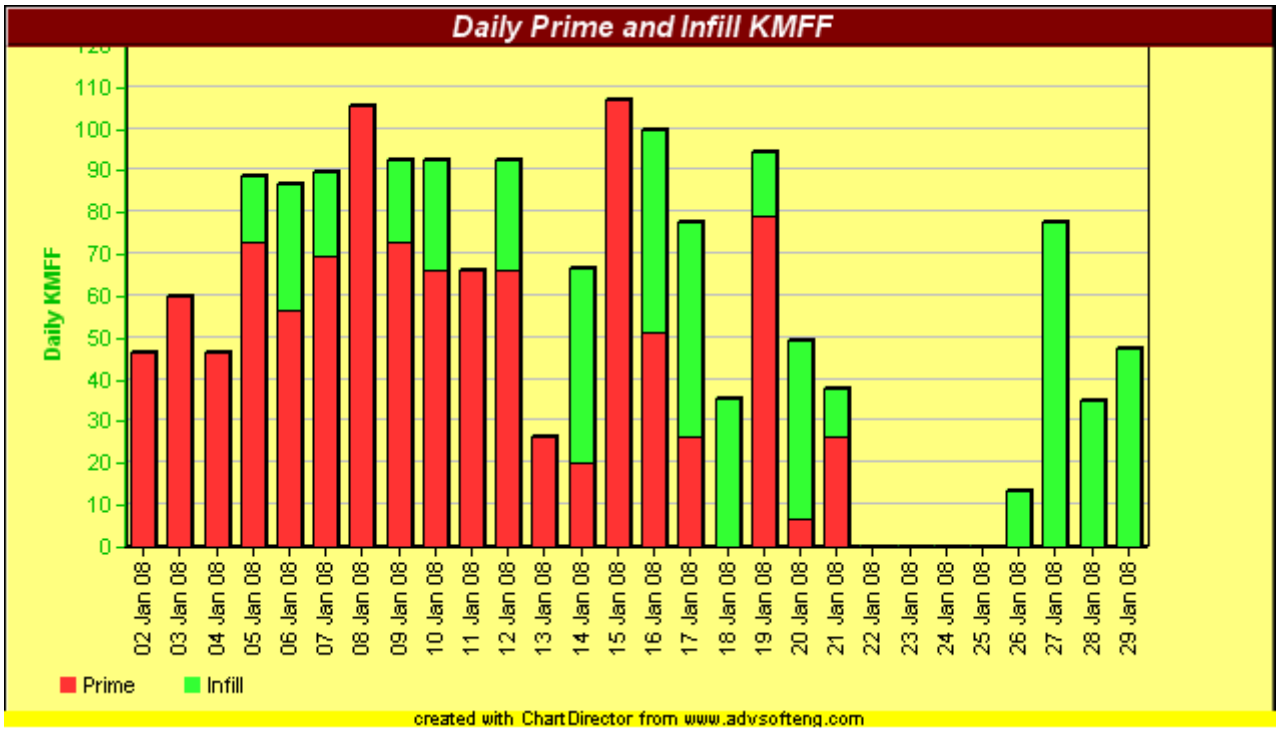
KM	KMFF	CMP	SQKMFF
1207.42500	1072.42500	14489.10000	321.727500

Infill Production between 2nd and 29th Jan 2008

KM	KMFF	CMP	SQKMFF
626.98125	565.65000	7523.77500	169.695000

Percent Infill = 51.927% by KM
Percent Infill = 52.745% by KMFF
Percent Infill = 51.927% by CMP
Percent Infill = 52.745% by SQKMFF

2.4 DAILY PRIME AND INFILL PRODUCTION GRAPH



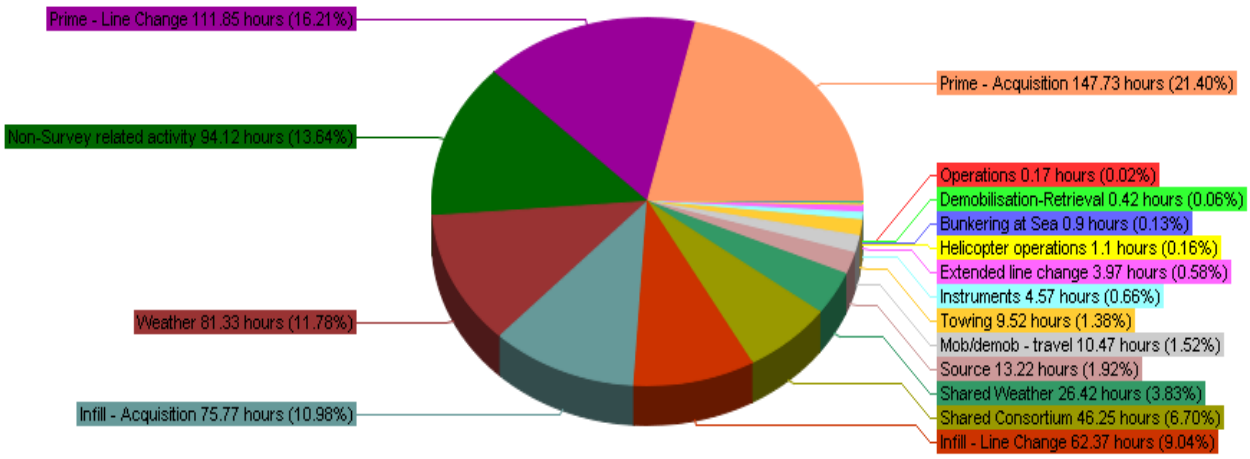
2.5 SURVEY TOTAL TIMING

Timing between 2nd and 30th Jan 2008

Code	Description	Duration
01	Prime - Acquisition	147.73
02	Prime - Line Change	111.85
03	Infill - Acquisition	75.77
04	Infill - Line Change	62.37
07	Shared Weather	26.42
08	Shared Consortium	46.25
10	Weather	81.33
20	Extended line change	3.97
30	Source	13.22
35	Instruments	4.57
38	Towing	9.52
41	Helicopter operations	1.10
42	Bunkering at Sea	0.90
51	Mob/demob - travel	10.47
53	Demobilisation-Retrieval	0.42
98	Operations	0.17
99	Non-Survey related activity	94.12

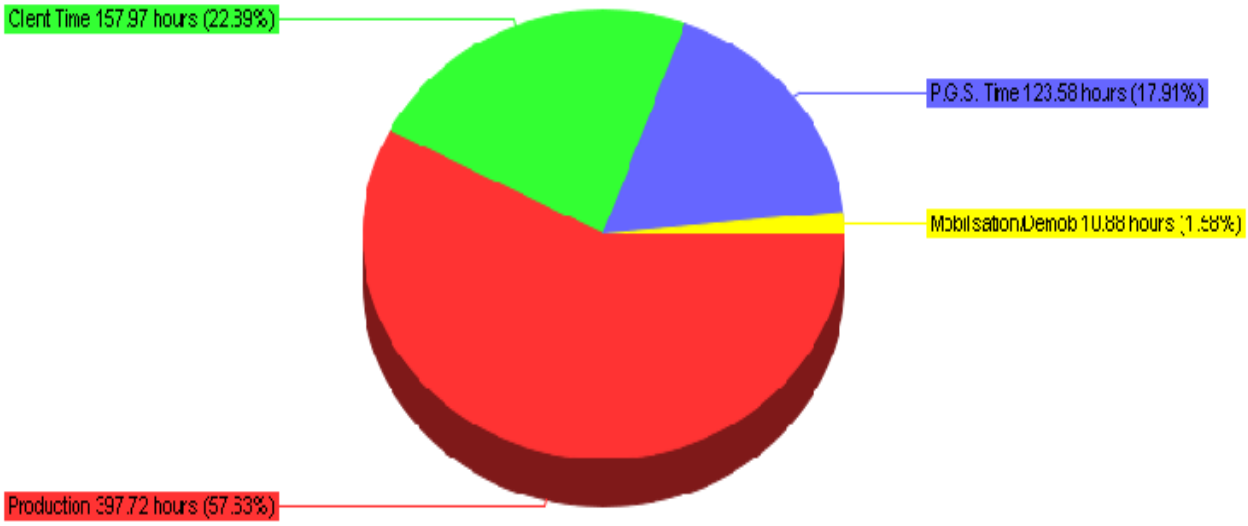
Total Time = 690.150 Hours

Silvereye 3D - Timing Breakdown



2.6 SURVEY TIMING BY CATEGORY

Silvereye 3D - Category Timing between 02 Jan 08 and 30 Jan 08 (Total = 690.15 hours)



2.7 TECHNICAL SUMMARY

The following is a brief description of individual equipment performance throughout the survey:

2.7.1 Recording Instruments and QC System

The PGS Acquisition Quality Control system includes a set of standard products for online QC, general seismic data QC processing, investigations and data archiving. These standard QC products are the first and highest priority of the QC processing effort.

PGS standard acquisition QC sequence

Seismic QC is performed using PGS' gAS and Viper systems.

Software

The geophysical Acquisition System (gAS) is the recording system and produces a number of automated online QC displays. The Viper system performs the offline QC. Both packages use a common source code and the interaction between gAS and Viper provides a seamless system. The intention with these systems is to automate as many functions and displays as appropriate, use interactive display facilities rather than rely on paper plots, and to investigate / display upon exceptions. The Viper system has a number of ported geophysical modules from PGS' proprietary processing software Cube Manager such as swell noise attenuation (SINK) that can be used for QC purposes.

Hardware

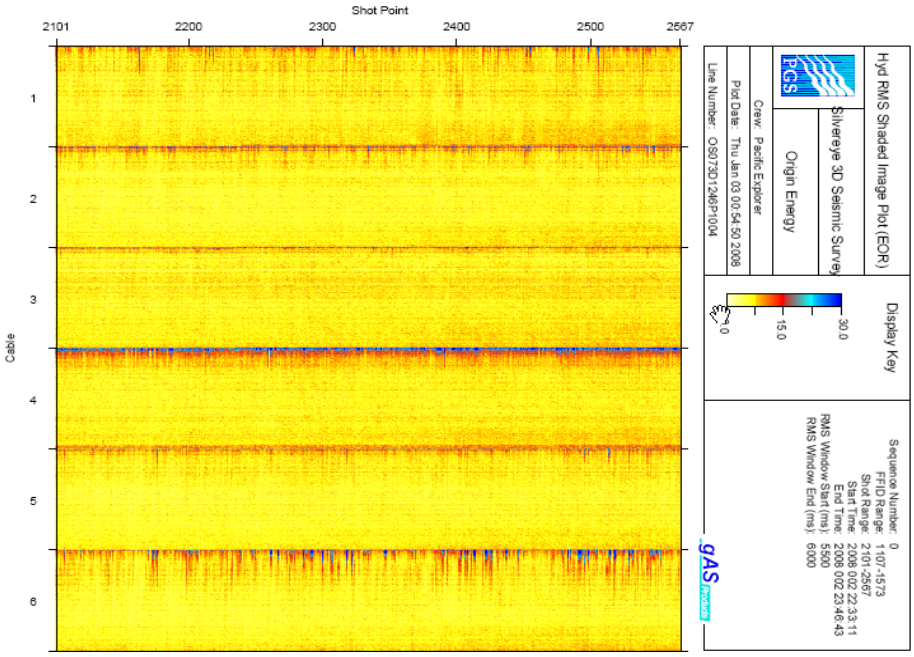
The gAS and Viper systems run on generic PC's and IBM Xenon X335 PCs, respectively and use Redhat Linux as the operating system.

2.7.2 Streamers

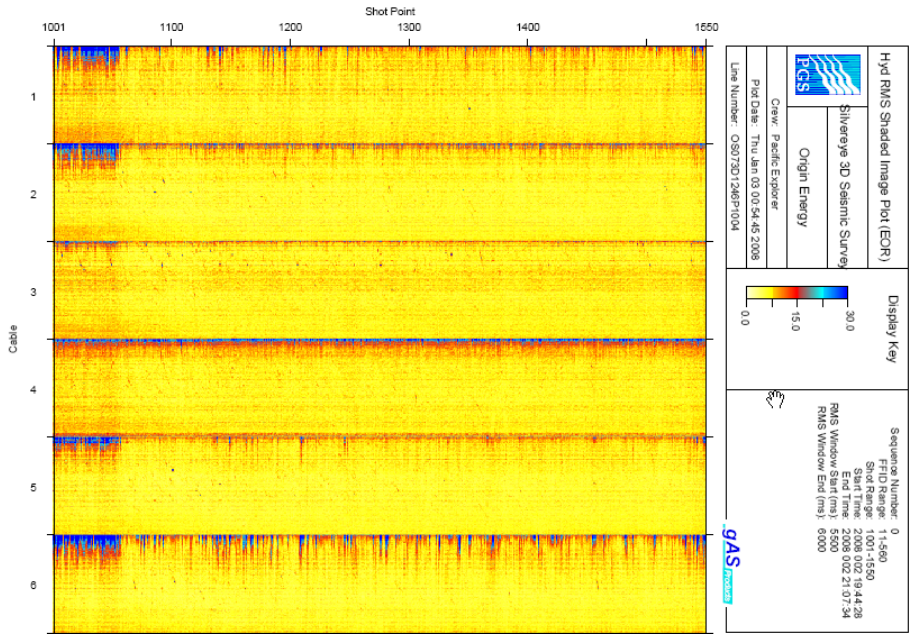
Hydroscience's gel-filled streamers were used on this project. The streamers proved to be a great improvement from the old fluid filled streamers with regard to noise levels in marginal sea conditions. This, coupled with better processing techniques meant that the deciding factor for shutting down in poor weather conditions was no longer streamer noise but was due to noisy compass data. The streamers do have their own noise signature which translates as coherent noise. The moveout of the said noise is vastly different than that of data and can be safely removed by an F-K type filter. It is also effectively removed by the P.G.S. SINK filter.

The affects of barnacle growth on the streamers became more apparent as the survey progressed. There was a gradual change in the length of the streamers as the extra weight [of the barnacles] increased the drag through the water. This, in turn, started to affect the streamer separations with a noticeable decrease in separations down to a mean of 90 metres. It became necessary to start 'cleaning' the streamers using a special barnacle-removal tool and ropes to scrape the barnacles off. The operation was conducted during line changes only as the streamers needed to be on the surface. The barnacle removal was completed when the streamers were retrieved to go to Burnie for the January port call.

A noticeable amount of front-end noise on streamers 1, 2, 4 and 6 was experienced from the beginning of the survey. An example is displayed in the gAS RMS display below. The level of noise increased whenever the sea state deteriorated.



The display below illustrates the effect of the front-end noise reduction across all streamers whenever the vessel speed was reduced online.

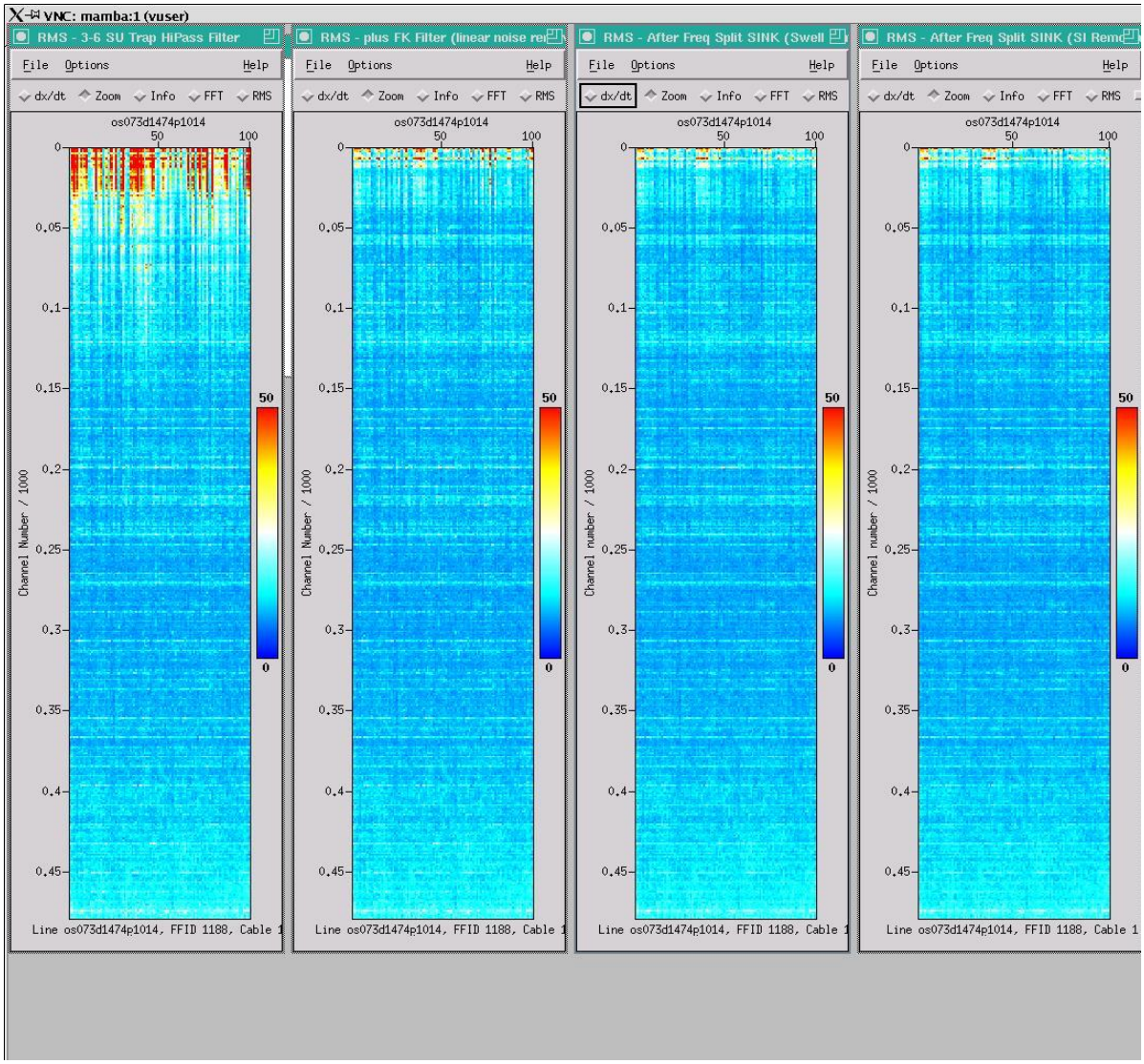


The following QC displays shows the effect of applying FK filters and SINK to raw data affected by front-end streamer noise.

The four processes are:

- 3-6 Hz low cut filter applied.
- FK filter applied to remove linear noise.
- First pass of SINK parameterized to remove swell noise.
- Second pass of SINK parameterized to remove seismic interference.

After the crew change in Burnie, the equipment was redeployed. From this point the separation between streamers 3, 4 was high. The front ends were retrieved after sequence 70 as the separation rope appeared tangled. On redeployment, the separation was till high though improved on that of sequence 70. This was observed closely during production and no loss of coverage was noted.



2.7.3 Energy Source

Apart from the occasional individual element failure, the sources functioned well throughout the survey period.

The following sequences incurred edits or were terminated early due to source element failures: 054, 055.

2.7.4 GCS-90 Gun Controller

No problems were encountered with the GCS-90.

2.7.5 Recording System

Edits occurred during the following sequences due to the gAS seismic recording system failure: 003, 021, 044.

2.8 VESSEL AND CREW

Australians replaced the regular PGS ship's crew prior to the vessel coming into Australian waters. Some key members of the PGS crew retained in an advisory capacity. These were Bridge and Engineering Officers, including the Captain and Chief Engineer.

The over all performance of the seismic crew was good, the level of expertise of the senior seismic crewmembers was above average.

2.9 HSE SUMMARY

Emergency procedures are laid down and prominently displayed about the vessel. Vessel plans showing emergency escape routes along with the location of all emergency equipment are also prominently displayed. Drills are performed on a weekly basis. There is rotation between Abandon Ship (normally first after crew change), Emergency Response, Fire, Man Over Board (MOB), Safety Of Life At Sea (SOLAS), Oil spill and ISPS (International Shipping and Port Security). Current policy, hazards, near misses and topics arising are dealt with during the HSE meetings held for all crew twice a trip.

Procedures for handling trailing gear during deployment and recovery were clearly laid down and followed closely. Procedures are under constant review as both the equipment and therefore the handling techniques change. Procedures are also in place for helicopter operations and at-sea personnel transfers. Safety 'toolbox' meetings were held with all personnel involved prior to any operation. A Permit to Work system was in place for all hot work (burning, welding, and cutting), confined space entry, work aloft, work on high-pressure systems and electrical systems.

Comprehensive first aid and medical supplies are carried onboard. A Medic was onboard and medical advice was on hand through Frontier Medical.

All personnel have completed an offshore survival course, which covers survival at sea; fire fighting, first aid and helicopter underwater escape training. The Master, Chief Officer and some senior seismic personnel have undertaken advanced first aid and HSE management courses. There was also a fully qualified paramedic onboard.

The waste management system in place onboard separated burnable from non-burnable materials. That which was burnable was put in the incinerator and reduced to ashes, then transported ashore. The non-burnable materials were further separated for recycling, with particular safety measurements in place for batteries and aerosol cans.

The standard of accommodation and general housekeeping was good.

There are full crew QHSE meetings performed at the start and end of each rotation. These meetings are used to inform personnel of all QHSE aspects pertaining to this vessel's operation. The meetings are normally chaired by the Party Chief.

An injured seaman was airlifted ashore by Origin helicopter early on the 07th of January. The seaman sustained a back injury two days earlier whilst performing regular duties on deck. The injured seaman was accompanied ashore by one of the seismic crew, who would return to the vessel the following day on the chase boat.

HSE Statistics for Survey

Incidents/Accidents		Exposure Hours	
Type	**Cumulative**	**Group**	**Cumulative**
Fatality	0	Client	2304
Lost Time Incident	0	Maritime	15264
Medical Treatment Case	1	Seismic	13128
First Aid Case	1	3rd Party	3384
Restricted Work Case	0		
Material Loss or Damage	0		
Environmental Incident/Damage	0		
Near Miss	0		
Hazard	15		
Unsafe Act	0		
Total Incidents	**17**	**Total Hours**	**34080**
		Total Man Days	**1420**

Activity	Cumulative
Safety Drills	6
Safety Meetings	2
Boat Launches	19
Boat Transfers	5
Toolbox Meetings	30
Helicopter Landings	2
Safety Audit - Internal	0
Safety Audit - External	0

Comments

Date	Comments
05 Jan 08	1 helicopter operation (personnel transfer). 2 work boat operations.
06 Jan 08	One maritime crew member given medical treatment for back injury sustained whilst working.
07 Jan 08	Helicopter personnel transfer. Fire drill and MOB drill (FRC launched). Work boat launched for streamer maintenance.
08 Jan 08	Work boat launched to collect crew from chase boat. Work boat launched to transfer stores from chase boat.
09 Jan 08	Transfer fuel bunkers from chase boat. Work boat deployed for streamer maintenance. Work boat transferred 1 seismic crew member to chase boat.
12 Jan 08	Work boat deployed a.m. and p.m. for streamer maintenance and transfer supplies from chase boat.
14 Jan 08	Fuel bunkers transferred from chase boat. Work boat used to transfer 1 person to chase boat for transfer ashore.
15 Jan 08	Fire drill (simulated helicopter crash). Work boat launched twice for streamer maintenance and barnacle cleaning.
16 Jan 08	Work boat used to transfer 1 new seismic crew member from the chase boat. Incident report 423/08/MA INJURY-PAC issued.
17 Jan 08	Safety committee meeting.
19 Jan 08	Work boat deployed for streamer maintenance. Abandon ship drill. Manual handling presentations.
21 Jan 08	Work boat performing streamer maintenance.
23 Jan 08	The vessel was re-fueling and re-supplying alongside the dock in Burnie.
24 Jan 08	The vessel left the dock at 06:23. Streamer deployment from 08:35.
25 Jan 08	An abandon ship muster was held at 12:45. On completion, the personnel new to the vessel, were given instruction on the lifeboats.
26 Jan 08	The workboat was sent out from 08:13-10:33 to replace 4 birds and 1 acoustic.
28 Jan 08	No events.
27 Jan 08	A full safety meeting chaired by the PC was held at 13:00 in the messroom.
29 Jan 08	There was a toolbox meeting to discuss the streamer recovery operations.
30 Jan 08	A fire drill was held at 12:45.A fire in the laundry room was simulated. Fire teams were dispatched to put the fire out. A toolbox meeting was held for deployment.

2.10 CONTRACT VARIATIONS

23rd December 2007

Instructions received from Neil Millar, via e-mail (see Client Mails folder), to include the sequence number in the line naming convention.

31st December 2007

E-mail received from Neil Millar (see Client Mails folder) informing all parties of Origin's decision to opt for the turnkey full-fold kilometer rate for billing the Silvereye 3D survey.

07th January 2008

E-mail received from Neil Millar (see Client Mails folder) informing all parties of Origin's decision to accept tapered [flexed] binning. The following new flexing will be used:

Near offsets 50%
Far offsets 150%

15th January 2008

E-mail received from Neil Millar (see Client Mails folder) suggesting that we steer the far mids for optimal coverage for that particular offset. This will be implemented from sequence 047. Permission was also granted to traverse infill lines in the opposite direction to the prime heading if it meant that a more efficient shooting plan could be created.

21st January 2008

E-mail from Frank Renton (Enquest) outlining the charging accountability for the port call crew change in Burnie.

2.11 RECOMMENDATIONS & CONCLUSIONS

For this particular survey the fuel bunker capacity of the chase boat was insufficient. Their maximum storage for fuel was only enough for six days operation of the Pacific Explorer. This meant that re-fuelling had to be performed every week or so, which significantly increased the exposure hours for boat-to-boat transfers at sea. On a typical marine seismic survey re-fuelling at sea would only occur every month or so. Another downside to this is that the chase boat spent most of its time in transit between port and the survey area when one of its main functions is to remain with the Pacific Explorer on picket duty and as a safety precaution whenever small boat work is performed.

It was necessary to reduce the online vessel speed during the survey in order to reduce the amount of 'jerking' noise generated by the front of streamer one. Reducing the speed means that the survey takes longer to complete, which impacts on the following points:

- The client ends up paying more for the data when production is charged for by time. Therefore it is highly recommended that future contracts be charged for by distance, i.e. kilometres recorded.
- The survey takes longer to complete therefore increasing the chances of exposure to extra weather standby etc.
- Reducing vessel speed directly effects the towing configuration and overall control of the streamers and feathering. Whenever the Pacific Explorer had to reduce speed online there was a [detrimental] change in some streamer and source sub-array separations.

Depending on the location of the survey barnacle growth on the streamers has to be monitored and, if necessary, a pro-active approach in clearing the growth off the streamers needs to be implemented. Excessive barnacle growth increases drag on the streamers, which in turn, affects streamer length and separations.

3 NAVIGATION

3.1 OVERVIEW

The positioning objectives were to navigate the vessel safely, steer the defined point, the near common midpoint (CMP), or common depth point (CDP), depending on the terminology requirements and determine all receiver group coordinates within the required tolerances, correctly co-register these coordinates with seismic records and to achieve the required coverage criteria for the 3D marine seismic survey.

3.2 METHODOLOGY

Positioning for the vessel and trailing equipment was coordinated through the Concept Systems Spectra Integrated Navigation System (INS).

Primary navigation of the vessel was a combination of positioning from the Fugro Starfix HP and Skyfix XP Differential Global Positioning Systems (dGPS). Source sub-array and streamer tailbuoy positioning was achieved with Relative Global Positioning System (rGPS) utilising Seatrack units. Streamer tracking was achieved using DigiCourse compasses and 3 acoustic networks at the head, mid and tail areas of the streamers.

Navigation processing has been mainly achieved using the Concept systems NRT (Near Real-time) system, which is an automated process designed to speed up processing and dispense with dedicated processors. It was sometimes necessary to re-process lines due to anomalies which the NRT system was unable to handle, particularly the noisy compass data on this prospect.

The navigation processing QC was performed by Fast Geophysical Positioning Solutions (FGPS) software. Every line was parallel processed and a direct comparison made to establish consistency.

3.3 SOURCE AND STREAMER GEOMETRY

Except for the following outages the source, and streamer geometry was considered consistent.

Until Sequence 69mthe streamer lengths were gradually increasing, reflecting the growth of barnacles along the streamers. This also affected the streamer 3 to 4 separation, with 100m becoming impossible to attain prior to the crew change of the 23rd January 2008. Following the crew change barnacles were removed, and the streamers returned to a more normal length, with greater ship speed available. From sequence 71 to 79 inclusive the mean separation streamer 3 to 4 varied between 107.7, and 114.4m. Sequence 70 the mean separation recorded was 117.7m. It was decided to continue with the larger than normal separation as the coverage was not affected.

From sequence 044 to 051 there were problems with the Chinese finger slipping on streamer 3 when the inline distance for this streamer varied from 106 to 126m. The worst cases were on sequence 045 when it was at 106m, and sequence 047 when it was at 126m (previously averaging at 117m). This is a rope device used to hold the streamer in a fixed position, rather than towing directly from a reel.

A similar occurrence on streamer 5 for sequences 063 & 064, with an offset increase of approximately 5m.
The seismic offset quoted in this report was computed from the mean inline distance for each line from each array to each of the six streamers. The mean for the survey was 115.9m.

If computed only from the inline distance streamers 3, and 4 the figure is 116m, with an increase of approximately 4m from sequence 69 to 79.

A summary of results is presented in the table below.

Source Separation			
Source Separation	*Mean*	*Min*	*Max*
Source 1 to 2	50.4	46.5	54.4
Sub-array Separation	*Mean*	*Min*	Max
1 o 2	9.8	8.7	11.2
2 to 3	9.9	9.2	10.5
4 to 5	9.6	8.9	10.3
5 to 6	10.2	8.6	11.2
Streamer Separation			
Near Group	*Mean*	*Min*	*Max*
Streamer 1 to 2	102.0	99.5	103.4
Streamer 2 to 3	99.9	97.3	103.0
Streamer 3 to 4	95.4	81.8	127.2
Streamer 4 to 5	99.8	96.0	102.3
Streamer 5 to 6	103.8	101.2	105.2
Streamer 1 to 6	500.2	487.0	529.8
Mid Group	*Mean*	*Min*	*Max*
Streamer 1 to 2	95.7	64.6	128.9
Streamer 2 to 3	91.8	57.5	131.6
Streamer 3 to 4	104.2	64.2	155.6
Streamer 4 to 5	98.1	66.6	128.3
Streamer 5 to 6	97.1	61.5	116.2
Streamer 1 to 6	486.3	430.7	526.1
Far Group	*Mean*	*Min*	*Max*
Streamer 1 to 2	97.7	26.4	166.9
Streamer 2 to 3	85.9	15.7	146.2
Streamer 3 to 4	108.3	43.1	198.2
Streamer 4 to 5	98.6	20.5	174.4
Streamer 5 to 6	96.2	32.0	155.4
Streamer 1 to 6	486.2	363.1	581.6

P190 Comparisons				
	Mean	*Min*	*Max*	
Vessel Comparison	0.22	0	2.2	
Streamer Comparison	*Near*	*N.Mid*	*F Mid*	*Far*
Streamer 1	2.1	2.2	1.9	0.9
Streamer 2	2.0	2.1	1.7	0.7
Streamer 3	1.9	2.2	1.6	0.7
Streamer 4	1.9	1.8	2.0	2.0
Streamer 5	1.7	1.8	1.6	0.7
Streamer 6	1.7	2.0	1.7	0.8
Source	*Mean*	*Min*	*Max*	
Starboard Array	1.2	0.0	4.3	
Port Array	1.2	0.0	5.0	
Tailbuoy Rotation	*Strm 1*	*Strm 2*	*Strm 3*	
Mean from Spectra	-0.17	-0.13	-0.19	
Tailbuoy Rotation	*Strm 4*	*Strm 5*	*Strm 6*	
Mean from Spectra	-0.16	-0.18	-0.18	
Near to Far Group	*Strm 1*	*Strm 2*	*Strm 3*	
Mean P190	5984.6	5980.4	5983.9	
Near to Far Group	*Strm 4*	*Strm 5*	*Strm 6*	
Mean P190	5986.4	5981.7	5979.9	
dGPS	*Mean*	*Mean*	*Max*	*Max*
mts	*dE*	*dN*	*dE*	*dN*
dGPS Position Diff.	0.0	0.0	0.8	0.6
Inline Mean Offsets	*Mean*	*Min*	*Max*	
Source to CNG	115.9	111.9	119.3	
Vessel to Source	331.3	329.8	332.7	
Velocity of Sound m-s	*Mean*	*Min*	Max	
Streamer Sensors	1517.6	1515.2	1520.5	
T/S Dip 7m	1515.5	1513.9	1517.2	
Water Column	1512.7	1509.6	1516.0	

3.4 BINNING AND COVERAGE

Binning Software: Census

Census is still being used by PGS, despite being a rather old, unsupported system. There is better software available with a more flexibility.

Census operates with an online or real-time database, with an offline display built from P1/90 data. While shooting the prime lines, the navigators followed the PGS convention of displaying unflexed coverage. Census does not have the capability of switching on the flexed displays while online, although these can be generated later.

Bird depth edits were generated automatically by Spectra, but these were not entered into Census unless they were likely to necessitate an infill pass.

Coverage

The coverage parameters were allocated as below.

Offset groups	Coverage (%)	Minimum Fold (nominal 20)
0-1500m Nears	80%	16
1501-3000m NearMids	75%	15
3001-4500m FarMids	70%	14
4501-6000m Fars	65%	13

Flex binning was initially set up in Census according to the Project Plan:

Offset groups	% Flex	Bin Width
Nears	50%	1.50 x 25m
NearMids	75%	1.75 x 25m
FarMids	100%	2.00 x 25m
Fars	200%	3.00 x 25m

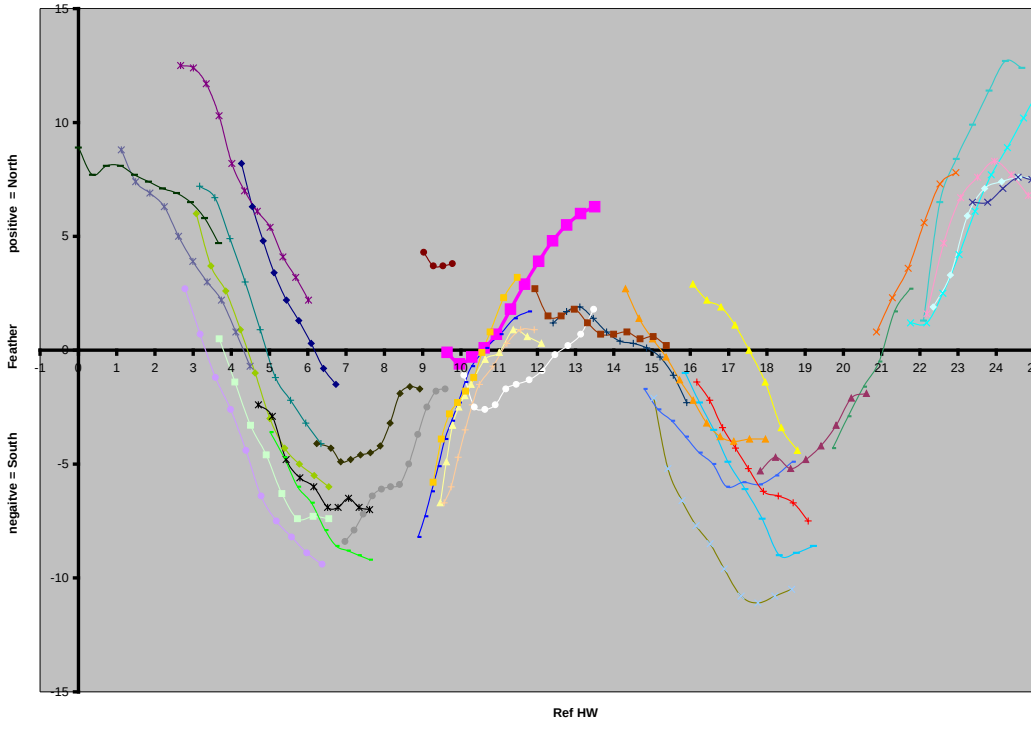
Due to a limitation in Census, the traditional “Alls” display cannot show this stepped flex, so a display was made to show a taper from 50% at the front to 150% at the tail. This was later modified to show 50% to 200%.

Changing the flex parameters such as taper from 150% to 200% has minimal effect on the true holes in the coverage. It will make a colourful column turn green, but will not rescue a few blank columns. For steering purposes, it is more useful to have a guideline of how many empty columns are acceptable. If this is zero, so be it.

Feather

Large feathers were experienced from the beginning of the survey, and some big mismatches following a period of bad weather. The navigators came up with a proposal to match the tidal cycle but it would necessitate dividing the prospect up with another swath.

Inspection of the feather acquired showed that while a diurnal cycle was obvious, the variations in magnitude of feather for the same point in the cycle would make it impossible to reliably predict feather for a line.



This chart shows the first week of feather data, all relative to the highest high tide. It can be seen that the magnitude of feather varies a lot for the same time relative to high water, meaning that even if line change was extended, a match was not guaranteed.

It also demonstrates the large and rapid feather swings experienced throughout the job, presumably due to consistently marginal weather.

It was decided that the prospect was too small to reap the benefits of a feather-matching scheme. The gains in coverage would be lost to extended linechanges, and any delay for gun work or weather would spoil the scheme.

High levels of infill were identified in order to complete the survey.

3.5 CALIBRATIONS AND VERIFICATIONS

GPS Positioning

An independent static verification of the positioning equipment was carried out by Swift Survey Pte Ltd, in Singapore at Loyang Jetty on 8th September 2007.

Three DGPS systems, five tailbuoys and three heading sensors were calibrated, and all were verified to be well within normal tolerances.

A further static verification of the GPS was completed alongside Burnie on the 23rd January 2008, with satisfactory results.

Echosounder

The Simrad EA500 Echosounder was checked in Port Kembla, Australia on the 09th of November 2007, just after bunkering. This used the traditional method of lowering a leadline over each side of the vessel and comparing the measurements with the Echosounder readings.

Suitably small C-O values were obtained:

Echosounder Check	C-O values
38kHz transducer	0.29m
200kHz transducer	0.19m

During the survey, the 200KHz transducer of the echo sounder was selected, with 1500 m/s speed of sound. Water depths were measured from the transducer head, and therefore not corrected for the vessels draught. Tidal corrections were not applied

Heave compensation was derived from the Seatex unit.

Magnetic Declination

The magnetic declination applied for the survey period was derived from the IGRF 2005 model for position 39°52'35.550"S 145°05'25.500"E on 01 January 2008.

As can be seen in this extract from the P2/94 header, the value applied was 12.43°.

```
C0001 THE IGRF-10 2005 MODEL IS USED FOR MAGNETIC VARIATION CALCULATION.
H0100 20080101 0001 0 IGRF 2005 Model
H0101 0001 0395235.550S 1450525.500E 12.430 0.0000
```

The Internet site http://www.ngdc.noaa.gov/seg/geomag/jsp/struts/calcDeclination can be used to obtain the magnetic declination value for any position. Below is a screen capture:

The average streamer rotation (angular misclosure) was less than 0.5°, which confirms that the correct magnetic declination was applied.

3.6 PERFORMANCE APPRAISAL

Differential GPS (dGPS)

Fugro Skyfix XP, and Starfix HP both performed well, although the Fugro Skyfix XP system dropped out on occasion, taking approximately forty minutes to converge.

The mean radial distance between the systems for each line excluding dropouts was less than 1.0 metre. The maximum Horizontal Dilution of Precision (HDOP) for the Starfix and Skyfix XP was less than 2.5.

Relative GPS (rGPS)

Each of the tailbuoys and source gun strings were fitted with an rGPS unit, with two independent systems on board running Starfix MRdGPS. The primary system performed well throughout the survey.

The tailbuoys are all fitted with solar panels, which provide charging for the batteries while online. Offline the streamer power was usually switched on for battery charging. Historically the flashing light mounted on the tailbuoy when batteries are charged through the streamer has been shown at times to be the cause of spiking seen on the seismic data.

Tailbuoy 1 was off air soon after the commencement of sequence 003, as were the acoustics to the node. The situation continued until sequence 8 when after battery charging, and a small weather window it was functional until sequence 11 when it was again off air. On several occasions the crew were ready to change the combi-box (battery), however the constant swell or large seas made it unsafe to attempt, until just before the start of sequence 027.

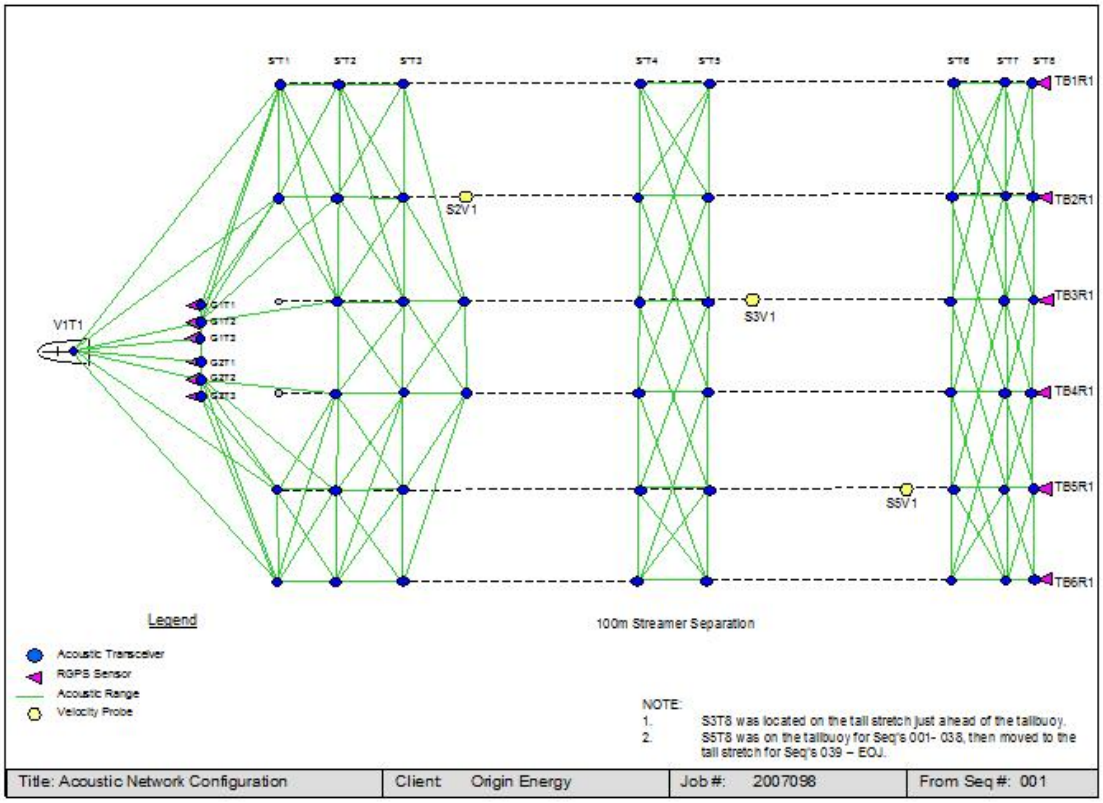
Sequence 39 Tailbuoy 1 was again off air. The intention was to replace the solar panel on the tailbuoy with a larger one, as poor battery charge characteristics had been experienced. The workboat was deployed, out but was unable to perform the operation. The combi-box was changed to provide a new battery for sequence 041. Sequence 045 and 046 the tailbuoy was again off air. The battery was replaced, but stopped responding from 066 to 069 after which the gear was recovered for crew change.

Following the crew change all rGPs source, and tailbuoys were operational, sequence 70 t0 79.

Tailbuoy 2 became intermittent during sequence 040 but was good after that.

DigiRange Acoustics

The survey was acquired with three acoustic networks as displayed below.



Discussion was entered into about moving to a full acoustic network to alleviate problems with noisy compasses, however this does have other implications:

- A lot more equipment in the water and more spares required onboard – a further 6x8 units, which PGS did not have access to anyway.
- Longer time to process additional ranges
- The longer ranges could suffer from bottom reflections, or be lost in poor weather, and the advantage would be then lost.
- Navigators need to be very vigilant about DigiCourse gate settings.
- In poor weather the front and tail networks become noisier and weaker so the overall network quality is reduced.

Mid-streamer positioning would be improved with a full streamer network.

PGS onboard personnel have experienced similar marginal sea conditions in other regions of the world, and have found that by use of a full acoustic net less downtime was attributed to the streamer positioning.

The T8 acoustic unit is mounted directly on the tailbuoy, which makes it shallower than the rest of the units, leading to data loss in rough weather or in heavy rain squalls. It is also difficult to work on from the workboat.

When power problems were experienced with tailbuoy 1 shortly after starting the job, the acoustic unit was set to receive in an attempt to reduce the power consumption.

The pinger transducer normally mounted on tailbuoy 3 was missing. An acoustic unit replacement mounted on the tail of the stretch section, 2.8m forward of the tailbuoy pinger position. This was knocked out of position during rough weather on the 11th of January, but was replaced the next day.

On the 12th of January, S3T8 was found to have slipped back under the tailbuoy, and was replaced. Pingers mounted so close to the tailbuoy often shake loose in rough weather, and is why the fixed units were introduced. Unfortunately this pinger died on sequence 041.

S5T8 was unreliable for sometime before sequence 039. A pinger was mounted on the tailbuoy stretch, as with tailbuoy 3. This again moved the offset toward the vessel by 2.8 metres.

Hull pinger ranges to the port side streamers were unusable for most of the survey although no reason was given. A cause could be the orientation of the transducer head.

The acoustic ranges between the front of the centre two streamers were good for most of the survey. The loss of some acoustic data due to turbulence from the gun bubble and the vessel wash experienced in the past was not of such a high level.

Some acoustic reflections were experienced, but only on a few ranges so no problems caused for the overall network.

DigiCourse Compasses

PGS's switch from fluid to gel in the RDH streamer sections appears to be very successful, with depth keeping much improved, and the resistance to swell noise impressive. The weak link in poor sea conditions is the compass birds. (RDH is Reduced Diameter Hydro-streamer).

The noise on the compasses was monitored on the run-in to each line, and the unit variance used as an indicator for whether the compass data was too noisy for acceptance. On many occasions, setting the streamers to 8m or 9m was enough to bring the network quality indicators back to a usable level.

In post processing, dynamic bias checks are performed on the compass data, and any with a bias of more than 0.7 degrees can be manually rejected. If the bias remains for further lines, the bird was replaced.

Streamer 5 had some intermittent compasses on many lines. There seems to be a weakness in the bird/pinger line on the streamer, as some acoustics also drop out at times. The positions of problem units was checked from the workboat, and some moved to be more precisely located over the sensor coils in the section, but this did not alleviate the problem.

Valeport TS-Dip probe

The chase vessel was instructed to take velocity profile each week (weather permitting). Results were sent by a datalink to the Pacific Explorer. The navigators use DataLog (v 1.64) software, running Chen & Millero's formula, to generate a report.

The mean velocity of sound was computed for the total water column, and at the 7m-streamer depth.

It was planned to obtain a velocity profile prior at project commencement, however the chase vessel was away from the survey area. When it returned, it was necessary to send the Chief Navigator across to instruct the new crew on how to take the profile, and how to send the data/results to the Pacific Explorer.

From the commencement of the project until profile number 01 the values obtained from the previous survey, profile 00 was used. See table below Velocity of sound results.

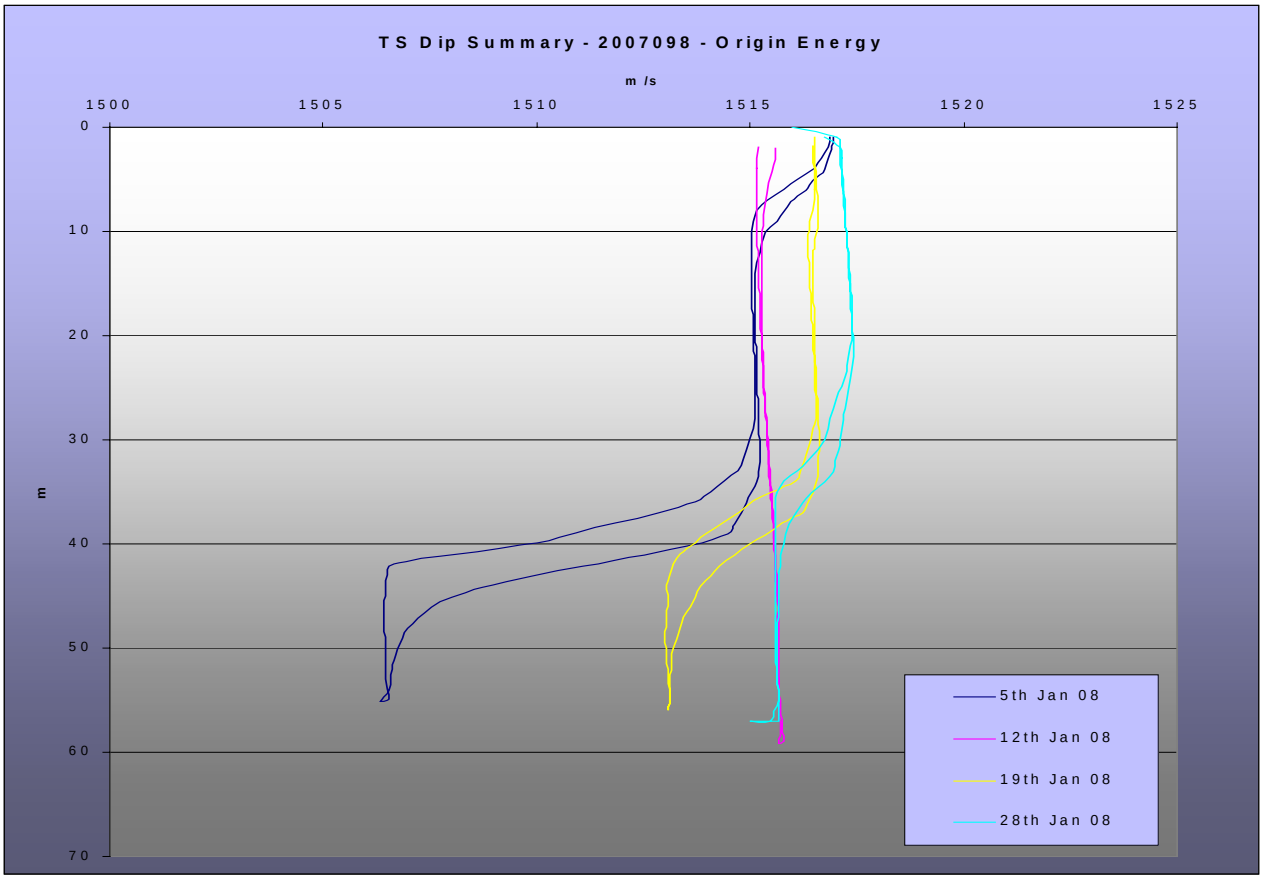
A Valeport probe calibration certificate was viewed onboard the vessel.

Certificate No.18757. Instrument 13829. Last calibrated 16th March 2007.

No problems were reported with the instruments

No	Date	Position		Maximum Depth	Speed of Sound	
		Latitude	Longitude		At Stmr Depth	Water Column
0	28 Dec 07	39º38.0'S	145º33.0'E	77 m	1513.93 m/s	1509.61 m/s
1	05 Jan 08	39º54.4'S	145º04.5'E	55 m	1515.69 m/s	1511.21 m/s
2	12 Jan 08	39º47.0'S	145º04.7'E	59 m	1515.27 m/s	1514.83 m/s
3	19 Jan 08	39º48.5'S	145º03.2'E	56 m	1516.53 m/s	1513.81 m/s
4	28 Jan 08	39º55.0'S	145º90.2'E	57 m	1517.20 m/s	1515.97 m/s

Velocity of sound results summary



Streamer Velocimeters

A velocimeter unit was located on each of streamers 2, 3, and 5, with the nearest acoustic units S2T3, S3T4, and S5T6 respectively (refer to acoustic network diagram).

S5V1 was intermittent on some lines, perhaps related to the weakness in the bird/pinger lines on that streamer. After sequence 039 it was removed from the streamer. The unit was again installed during the deployment following the Burnie port call/crew change.

Dynamic speed of sound is computed and applied to the DigiRange acoustic range times in real time. The results were compared with the weekly Valeport observation/result at the 7m streamer depth.

Spectra Integrated Navigation System

This well established navigation system performed well throughout the survey especially with experienced operators. No down time was attributed to the Spectra system.

A changes log was maintained to track any changes made within Spectra such as a bird or pinger swap, or a new sound velocity reading.

Processing: NRT

The Near Real Time (NRT) software delivers final processed navigation positions ten minutes after the end of line.

Concept Systems Ltd state that:

NRT qualifies each line and assesses the quality of the output positions as

Optimal	*The data will not benefit from navigation post-processing.*
Caveats	*The data will not benefit from navigation post-processing, however, some data are highlighted for further QC analysis.*
Reprocess	*The data may benefit from navigation post-processing.*

A suite of quality control reports is produced for each line, to enable assessment of the data. NRT is somewhat of a “black box” in that the navigators have little control over the processes, however it performed well on this prospect in good weather.

At the end of each line, various statistics are generated from Spectra. The Network Quality figures represent the Unit Variance, which was fairly constant as can be seen below, with the spikes representing noisy data in poor weather.

The NRT does struggle with any poor quality inputs such as noisy compass data, as experienced during marginal weather on this survey. The majority of lines were flagged with *Caveats* due to noisy compass data, although reprocessing with Sprint did not change the data significantly.

Unit Variance indicates the quality of the network adjustment in processing and should generally be less than 1. Concept, the producers of the NRT, and Sprint processing system, say that for QC purposes one should look for a consistent value throughout the period of the survey, and this was achieved for the most part. The unit variance is not the only criteria for assessing compass data. When the three processing systems (NRT, Sprint, and FGPS) give high magnitude differences of position when P190 results are compared this is an indication that the position on the earths surface is in doubt, caused by rough sea conditions with resulting erratic, highly dynamic compass data. An example of this was sequence 74 when the highest sea state of the project was recorded online, 4.5 metres. The line was NTBP as the Sprint operator had difficulty processing the line, the NRT had rejected 20% of the compass data, and the final P190 comparisons showed differences of over 20 metres at times. The seismic target was small, and with the large unknowns in the final receiver groups position the line in agreement with all onboard parties was not accepted. If the FGPS unit variance had been the only criteria the line would have been accepted.

Processing: Sprint

Sprint 3D post processing was used as a regular check of the NRT product. A comparison was run on every tenth line, or if NRT flagged a line as *Reprocess*. System features were thorough, comprehensive, and fulfilled the off-line QC processing tasks.

When the weather was good, most lines were flagged as *Optimal*. A few lines were flagged for *Reprocess* although the navigators could not find any reason for this. On one occasion it was suspected that the system did not handle a sudden reduction in vessel speed. The line was processed with Sprint, and a query was sent to Concept about the problem.

NRT failed to produce a P1/90 at the end of sequence 018, so it was necessary to produce a Sprint solution.

Processing: FGPS

The Navigation Representative was provided with the SeisPos navigation processing, and P1Tools P1/90 utility software supplied by Fast Geophysical Processing Solutions (FGPS) Ltd. Descriptions of this software can be seen at www.fgps.com.

Raw data files in UKOOA P2/94 format and processed data files in UKOOA P1/90 format were copied over the network to the client computer.

The independent processing and QC consisted of the following procedures for the lines acquired.

SeisPos

The P2/94 header was compared with that of the last line in order to verify any changes.
The P2/94 file was processed using SeisPos, which produced a processed data file in UKOOA P1/90 format.

P1 Tools

P1Tools was used to QC the geometrical relations between positions in the contractor's P1/90 by computing and plotting the offsets between the positions. The positions used were.

- Vessel
- Sources
- Near groups
- Mid groups
- Far groups
- Streamer Length

P1Tools was also used to verify the format compliance and record integrity of the contractor's P1/90. This included verifying the correct source firing sequence, shot point range and missing shot points.

The P1/90 produced by the contractor, and client SeisPos software was compared using the P1Tools. A report showed the position difference at the following locations.

- Vessel
- Sources
- Near Mid groups
- Near groups
- Far Mis groups
- Mid groups
- Far groups

Results

The P1/90 comparisons provide a useful measure of the final positioning accuracy. During calm weather the differences between positions (FGPS, NRT, and Sprint) were small in magnitude.

The effects of rough weather caused these differences to increase. This a result of the differences in filtering and data rejection, and occasional spike (normally across line) not clipped in processing. The greatest differences seen were near mids, and far mids where compass data is not constricted by an acoustic net. Because both processing methods employ conventional recognised filtering and network adjustment techniques both results are to be considered valid and their difference is therefore a good indication on the final positioning precision.

The use of independent processing enabled an independent appraisal of the raw data quality and the accuracy and precision of the final positions.

Independent assessment of the raw data quality, and subsequent processing of each line proved invaluable, especially in marginal weather where noisy compass data often determined the acceptance of a line. Comparisons were made between the PGS P1/90 data and that produced with SeisPos to ensure consistency in processing, especially important when NRT produces the file without intervention from a navigator/processor.

Reporting

The navigation department is still using a handwritten logbook for daily comments. This is a decree from PGS management and perhaps this should now be reviewed. An electronic log is more easily accessed by everyone who requires the information. Similarly there is a good argument for a single log to cover all departments. The argument against an electronic log is that is can be edited at a later date, which is a fair comment.

Vessel

Steering into more than 40 knots is almost impossible on this vessel. This affected some line-change decisions when marginal weather conditions prevailed. With frequent high winds in the Bass Strait, the bridge crew often used the autopilot as the usual steering control through RobTrack was unable to cope with the large crab angles.

For most lines, the vessel speed was reduced to 4.5 knots or less to alleviate the problems with strumming on streamer 6. This made steering more difficult in poor weather, and affected the towing geometry.

35 shotpoints before the end of sequence 008, the navigation network showed that the vessel had altered course. The navigators stated the bridge crew had gone into manual control before being instructed. They were asked to wait in the future for instructions from the navigators.

3.7 CONCLUSIONS AND RECOMMENDATIONS

The following recommendations are made for the client's consideration and possible incorporation into specifications for future projects should the *Pacific Explorer* be chartered in the future for a similar survey:

The Navigation team conducted the positioning acquisition, and processing functions of the survey in a safe, professional, and efficient manner. Assistance and information was provided whenever requested. Satisfactory standards with respect to utilization and maintenance of resources were reflected in the incidence of downtime attributable to navigation technical failures.

The quality control tools available to the navigators were sufficient to alert the operator to potentially damaging effects of degraded systems performance in real-time and post-processing. Positioning objectives were adhered to with minor but acceptable exception.

Good standards of acquisition were adopted on the vessel ensuring satisfactory and reliable generation of final deliverable products. All the final processed positioning data was accepted onboard the vessel.

When periods of inclement weather were experienced the sea state limited work boat operations for maintenance of in-sea positioning devices. The crew took every opportunity to maximise use of the limited weather windows.

Some contractors provide a full Spectra (or other navigation system) display in the client office, and often many other displays direct from the instrument room. This enables more constant monitoring of the vessel status, and should be considered by PGS. The numerical display provided is inadequate.

The navigation department logbook for daily comments is handwritten. This is a decree from PGS management. An electronic log could be easily accessed by other parties who are required to view the content. Similarly there is a good argument for a single log to cover all departments.

A valid argument put forward against the above is a handwritten log cannot be edited at a later date.

Before commencement of production the crew require to be fully aware of the coverage objectives. Mainly with respect to the number of blank or non-green columns that are “acceptable”. Probably due to the poor weather, there were very large feather swings and inconsistencies throughout the job, so on the understanding that the seismic target was within the near-mids, production was mainly concentrated on the near-mids group. Perhaps more emphasis should have been put on the far-mids, although moving the vessel over to obtain them, will just shift the infill rather than reduce it.

Changing the flex parameters such as taper from 150% to 200% has minimal effect on the true holes in the coverage. It will make a colourful column turn green, but will not rescue a few blank columns. For steering purposes, it is more useful to have a guideline of how many empty columns are acceptable. If this is zero, so be it.

Feather matching was discussed early in the survey, but the majority opinion was that it would not be effective enough to justify extending line changes. The infill percentage is rather high for the job, but this is an unfortunate result of marginal weather for most of the period.

When infill is being chosen for the completion of the job, it is important to remember that operational considerations such as linechanges and line directions may mean that filling the largest holes first is not the most efficient approach. The navigators need to have a list of all of the required infill sections, so they can plan accordingly.

The Census Binning System is no longer supported by the manufacturer, and is limited in flexibility of use. The contractor should consider an upgrade of the binning system.

The contractor’s policy with respect to provision of the final bathymetry data set is to have this produced on shore after survey completion. It is suggested a final set be produced on the vessel to ensure the final P1/90 data used in the navigation-seismic merge is fully corrected

The insea maintenance of positioning systems is dependent on the work boat, which in turn requires a sea state that allows safe working conditions. On deployment if it is known the lithium battery of a DigiRange acoustic pod is near its life end then it should be replaced, and not wait until it finally fails in water.

The vessel is equipped with a pitch, heave and roll sensor. The data is logged to P2/94, and the heave component applied to the echo sounder, To eliminate the motion of the GPS antenna in

particular when the sea is on the beam the data from the sensors be incorporated in the GPS processing procedures.

PGS have accepted the NRT software (Near Real Time) produced P1/90 as the final product. Unfortunately when in poor areas of acquisition, or marginal weather conditions there is normally a need to revert to the Sprint system to compare/confirm the NRT product. When these conditions are met the need for an experienced processor is vital. If this is the future it is strongly recommended that Sprint is used alongside the NRT for the first twenty lines of a project to allow the processor to "get a feel" for the data, and therefore can be more judgemental if, when called on later in the survey.

It is recommended that the client continue to support the provision of the independent Fast Geophysical Positioning Solutions (FGPS) Limited QC software. The software allows an independent and comprehensive QC audit of raw data quality, and subsequent post-processed archives by the client's navigation representative.

3.8 POSITIONING QC CHARTS

Various QC and Trend charts were maintained by the Clients Nav QC to ensure specifications were met and to highlight any deviation from the required or expected norms.

The data for the charts was extracted from two sources.

- The Spectra EOL QC report.
- The final P190 computations by the FGPS (SeisPos, and P1-Tools).

Vessel Speed

An average bottom speed of 4.4 knots and an average water speed of 4.4 knots were maintained throughout the survey.

Strumming problems on streamer 6 often meant the vessel speed was reduced, which had an effect on all the separations, with array 1-2 becoming less stable, and the centre separation between streamers 3-4 reducing on some lines.

Front Streamer Separations

Streamer separation was very stable throughout the job, until the speed reductions prior to the Burnie crew change. Following the crew change separation streamer 3 to 4 increased beyond the normal tolerance of +_ 10%.

Source Separation

Overall source separation was very stable, only lowering slightly when the speed reduced.

Sub-array Separations

Very stable when normal shooting speed was maintained.

DGPS Positioning Systems Comparison

The difference in Easting and Northing between V1G1 and V1G2, reflecting the distance between the different antennae used for the two Multifix systems.

HDOP, Number of Satellites, Height

Normal QC statistics for GPS systems showed no major problems throughout the survey

Streamer Rotation

Spectra rotates the compass derived streamer end position to the tailbuoy position, giving a figure for rotation directly, and then X & Y measurements for misclosure. Rotation angles should normally be less than 0.3 deg. If above this threshold it usually indicates the wrong magnetic declination has been chosen, or the front end has a positioning problem. There are small variations for all lines due to the change in the magnetic declination across the prospect. Larger errors are sometimes caused by dynamic streamers when local currents are encountered. Short lines can also produce larger rotation values due to the method of streamer positioning.

P190 Offsets and Separations Charts

The PGS P190 was used by P1-Tools to compute the Offsets, and Streamer/Source Separations.

P190 Comparisons.

The effects of rough weather caused differences between systems to increase. This a result of the differences in filtering, data rejection, but the main cause an occasional spike in the compass data (across line) not clipped in the FGPS processing. When a spike occurred it did not reflect the low magnitude comparison difference for the whole line.

4 ENVIRONMENT

4.1 WEATHER

The weather conditions encountered on prospect were generally moderate to poor. Due to the characteristics of the gell filled streamers, the swell noise was not a factor in shutting the vessel down for weather. The degraded compass data resulting from poor weather conditions was always the deciding factor.

4.2 TIDES, CURRENT AND FEATHER

There was a positive correlation between tide and streamer feathering. However, the rate of change of streamer feathering over the course of each line was quite dramatic, with some changes exceeding 10°. Trying to match feathers would be nigh on impossible and therefore the 'racetrack' method is the best strategy.

There is a 50-metre depth contour running perpendicular through the centre of the survey area. This sudden change in depth could have contributed to [localized] excessive currents experienced throughout the survey period.

The average tidal range in the survey area was less than one metre. Spring Tides occurred around the 10th and 21st of January.

4.3 NAVIGATION HAZARDS

No navigation hazards or obstructions were experienced during the course of the survey.

4.4 FISHING

No fishing activity was encountered in, or close, to the survey area.

5 INSTRUMENT TESTS

Recently onboard the vessel (September 2007), a comprehensive technical audit was performed by Colin Morris of Verif-I. Results were favourable and are have been submitted on a separate report. The summary is as follows:-

Conclusion and Recommendations

The equipment is in an acceptable condition for use on this survey. The equipment can be classified as follows:

Instrumentation:	***Fair***
Streamers:	***Good***
Airgun Arrays:	***Fair***
Airgun Controller:	***Fair***

For clarification, Verif-i operates a four tier grading process. Equipment is defined as 'Good' if the auditor cannot find any faults or any areas of reduced performance; equipment is defined as 'Fair' if it requires only minor adjustments or modifications to be classified as 'Good'. 'Acceptable' means meeting basic industry and contract specifications and

'Unacceptable' is defined as not meeting those same specifications.

The main findings of the audit, with recommendations where appropriate, were as follows:

Central Instrument

Central clock, headers and parameters all correct.

System timing correct, but diagram should be updated to reflect start of digital record being 58 milliseconds before aimpoint.

Recommend that quality control checks on second set of data Tapes be instigated. Either check every tenth Tape from the second set or processing to use Tapes from alternate sets.

Instrument test suite 'do QC' either doesn't report or doesn't apply low cut filter to internal noise test. Crew to report this to Hydroscience Technologies. Crew to use 'One button QC' instrument test suite which does correctly apply and report filter settings.

Instrument test specifications considered as less than rigorous, although channel performance well inside these limits.

Auxiliary box initially showed severe leakage across several traces. Wiring for external signals repaired and signal quality much improved.

Streamers

Larger than expected number of new modules failed pre-audit checks. Failures to be sent for investigation and repair or replacement.

Larger than expected number of compass birds failed pre -audit tests and during deployment. More rigorous maintenance regime recommended.

Fairing on cross-tag lines considered good, fairing on lead-ins no more than adequate.

At start of survey, all channels passed instrument tests. One channel failed relative sensitivity specification due to spiking within the module. Module was replaced at first opportunity.

Sensitivity results good. One other channel showing slight noise at streamer 3, channel 268.

Crew does not hold information on low cut filter effects of the hydrophone network in each channel. This information would be useful in assessing complete filter effects on the recorded data.

Airgun arrays

Only two depth transducers on each gun string. Recommend a minimum of three per string.

Only one GPS pod on each gun string. Recommend two per string.

Initially only one acoustic unit on each array. This was being increased to one unit per sub-array at the first opportunity. String 3 remains to be fitted with acoustic unit.

Two guns failed initial click tests due to seized solenoids. Increased maintenance necessary after extended period of inactivity with these strings.

After deployment significant leakage apparent on several firing lines on string 2. Leakage

apparently due to water ingress in reel connector. This was resolved quickly by the mechanics.

One near field hydrophone channel showed leakage worse than 1 megohm. Channel addressed by the crew prior to start of production.

After first four lines all significant leakage had been removed from the gun arrays. Mechanics to check and repair traces of leakage as part of regular maintenance.

Two near field hydrophones remain with degraded signal. Hydrophones 5-5 and 6-7 should be addressed at first opportunity. Additionally, hydrophone 5-6 has failed overnight on the 25th.

One depth indicator outside specification in tests before deployment. This was replaced. One other failed at deployment. String recovered and transducer replaced.

All depth indicators in use accurate to within 0.1 metres at target depth at start of survey.

All in-water pressure transducers calibrated to analogue gauges before production.

Pressure control during testing and early production good.

Minor air leaks on strings 1 and 2, both within contract specifications, were apparent on drop test after sequence 4. These to be investigated and repaired by the mechanics.

Drop-out specifications were calculated using digital filters from the NTRS modules although the wrong high cut filter slope was used. Although the specifications will not change significantly, it would be preferable to use the full system filter effects including the analogue low cut filter effects of the hydrophone network and the correct high cut slope.

Calibrated manometer should be sent for recalibration annually. Second manometer should be held on the vessel for use in the interim.

Source Bubble tests were conducted on 20th December to verify chamber volume sizes. The tests confirmed the correct volume of all elements.

Airgun Controller

PGS should consider long-term replacement of the GCS-90 with a more modern system.

Manifold pressure gauge giving wildly fluctuating readings. A spare has been ordered and this should be replaced at first opportunity.

Health, Safety and the Environment

"A strong attitude towards HSE was evident throughout the audit. The seismic crew were active throughout the deployment in ensuring procedures were followed and in the use of PPE. Trainees and relatively inexperienced personnel were supervised effectively by the senior members of staff. An induction tour was given on the 19th, but the standard was not considered good enough and the tour was repeated in more detail in the afternoon. Emergency drills were carried out on the 19th and the 23rd. "

Written by Colin Morris Verif-i Ltd 26th September 2007

The instruments were also tested on a daily basis according to the manufacturer's specifications and guidelines.

6 DIARY

2nd January 2008

Completed lines 1534P1001 and 1258P1002. During the transit from the previous SEBOA Consortium survey maintenance work was performed on the front-end of streamer 1, which had been exhibiting excessive 'jerking' noise during the previous survey. Test lines were recorded prior to commencing production to ensure that all recording systems were functioning correctly. Wind and sea conditions deteriorated throughout the afternoon.

3rd January 2008

Completed lines 1246P1004 and 1510P1005. The start of line 1522P1003 was delayed between SPs 2066-1721 due to a recording system failure. An 8 SP edit (SPs 1754-1761) occurred during line 1246P1004 due to system synchronization errors. Line 1234P1006 was terminated shortly after starting due to noisy compass and acoustic data. Sea conditions deteriorating and forecast to continue doing so throughout the night. Vessel will head to fair seas on a NNE heading until conditions improve.

4th January 2008

Completed lines 1234P2007 and 1498P1008. Production re-commenced early p.m. after a delay caused by adverse wind and sea conditions. Positioning Comments: Large feathers have been experienced already on this job. The navigators will monitor the situation in case it becomes advantageous to shoot in a tidal cycle. The line length would be about right to do this, without too much waiting. On sequence 007, a large feather swing saw the far coverage overlapping at the start of line, and then a large hole was left in the fars and far mids towards the end of line. Coverage was maintained for the nears and near mid groups, and the hole will be infill at a later date. Sequence 008 started with a 7.6Âº Easterly feather, which did not match at all well with the 12.4Âº Westerly feather on the adjacent line. A DC of â€“450m was required, to butt up to the previous coverage with the near mids. Another large hole has been left in the fars. The reason for both of these mismatches is the weather downtime period that pushed the line start times into a different period of the tidal cycle. If we were to try and obtain full coverage in the fars, we would not be achieving anything in the nears, and a huge DC would be required, of at least another 400m. From past experience it is better to leave the hole in the fars to be infilled later, rather than making an extreme vessel track.

5th January 2008

Completed lines 1222P1009, 1486P1010 and 1210P1011. Continuing line 1486F1012 at midnight. The line change between sequences 008 and 009 was extended by 1 hour in order to perform maintenance on the sources. A personnel change was conducted by helicopter late a.m. Two Processors disembarked and one Origin employee arrived onboard. The operation was conducted without incident. The work boat was launched early p.m. to perform streamer maintenance. It was launched a second time, during the afternoon, to transfer the Chief Navigator to the chase boat in order to give instructions on how to perform a T-S Dip. Fuel bunkers were transferred from the Pacific Crest during the day.

6th January 2008

Completed lines 1486F1012, 1198P1013, 1474P1014 and 1198F1015. Continuing line 1462P1016 at midnight. Infill lines 1486F1012 and 1198F1015 required as butt-up infill due to earlier feather mismatches. The Captain and Medic informed the client reps that one of the marine crew had injured his back during yesterday's re-fueling operation. The Captain expressed his concern about transferring the injured person ashore for further treatment. Origin was contacted about the

situation and the request for helicopter transport was made. An [Origin] helicopter will be available Monday a.m. for the vessel's use. The Captain will make the necessary arrangements directly with Jayrow. An Incident Report number [107/08/MA INJURY - PAC] has been assigned to the back injury sustained by the maritime crew member who will be transferred ashore tomorrow.

7th January 2008

Completed lines 1462P1016, 1186P1017, 1462F1018, 1174P1019. Continuing line 1450P1020 at midnight. Personnel transfer by helicopter conducted mid-morning without incident. One injured seaman was accompanied ashore by one of the Observers. The Observer will return to the vessel by chase boat later this evening. A fire drill was conducted late a.m. for the fire teams only. A MOB drill was conducted early p.m. The line change following sequence 017 was extended 66 minutes (non-chargeable to client) due to vessel altering course at helicopter pilot's request. Infill line 1462F1018 required to butt up to existing data. Edit shotpoints 1492-1507 during line 1174P1019 due to parity errors.

8th January 2008

Completed lines 1450P1020, 1438P1022 and 1150P1023. Continuing line 1426P1024 at midnight. An edit occurred during line 1162P1021 between shotpoints 2016-2039 due to recording system parity errors. The work boat was launched late a.m. to collect three [joining] seismic crew members arriving on the chase boat. The work boat was launched again early p.m. to transfer stores from the chase boat.

9th January 2008

Completed lines 1426P1024, 1138P1025, 1426F1026 and 1126P1027. Continuing line 1414P1028 at midnight. Fuel bunkers were transferred from the Pacific Crest during the morning. The work boat was launched early p.m. to perform streamer maintenance. The Chief Gun Mechanic was then transferred to the chase boat for passage ashore[non-medical reasons]. Infill line 1426F1026 was required as butt-up infill due to earlier feather mismatches.

10th January 2008

Completed lines 1414P1028, 1126F1029, 1402P1030, 1114P1031 and 1390P1032. Wind and sea conditions excellent for production throughout most of the day.

11th January 2008

Completed lines 1102P1033, 1378P1034 and 1366P1035. All survival suits and life-jackets onboard checked for integrity. Wind and sea conditions deteriorated rapidly towards midday. The wind was recorded at a steady 40 knots, gusting to 50 knots, which was considerably more than the forecast. The vessel was unable to maintain a steady course during the run-in to sequence 035 and so the decision was made to abandon the line and head south. The wind is forecast to start easing later in the day, which is when the next line attempt will be made. Production re-commenced mid-evening with sequence 035.

12th January 2008

Completed lines 1102F1036, 1354P1037, 1090P1038 and 1342P1039. Work boat launched a.m. and p.m. to perform streamer maintenance and transfer stores from the chase boat. Infill line 1102F1036 required as butt-up infill due to earlier feather mismatches.

13th January 2008

Completed line 1078P1040. Wind and sea conditions deteriorated early a.m. as they had been forecast to do. The vessel had difficulty maintaining heading during the line change following sequence 040 and the decision was taken to temporarily halt the survey for weather standby. The vessel will head to the west until conditions start easing. Attempted line 1066P1041 mid-evening but the swell noise and noise compass data was unacceptable. The vessel will head to the southern end of the block and attempt a line heading north.

14th January 2008

Completed lines 1342F1041, 1078F1042 and 1330P1043. Continuing line 1066P1044 at midnight. Infill lines 1342F1041 and 1078F1042 required as butt-up infill due to earlier feather mismatches. Fuel bunkers were transferred from the Pacific Crest during the day. Personnel transfer to the chase boat during the afternoon. One Origin employee to be transferred ashore.

15th January 2008

Completed lines 1318P1045, 1054P1046 and 1306P1047. Continuing line 1042P1048 at midnight. Line 1066P1044 incomplete due to a recording system lock-up between shotpoints 1517-1547. Throughout line 1318P1045 streamer 3 was retrieved 10m in order to repair the 'Chinese finger' (lead-in tow point). Commenced program to remove barnacles from the streamers, using the work boat, following the completion of sequence 045. A fire drill was conducted early p.m. The work boat was launched again mid-afternoon for streamer maintenance and barnacle clearing.

16th January 2008

Completed lines 1042P1048, 1294P1049, 1090F1050 and 1438F1051. Continuing line 1234F1052 at midnight. One personnel transfer (replacement PC for next rotation) from the chase boat early a.m. Infill line 1090F1050 required for far mid offsets. Incident report number 423/08/MA INJURY-PAC assigned following a slip/trip/fall injury to one of the IRs (Integrated Rating - seaman). The report will be issued once categorized by PGS. Infill line 1438F1051 required for far mid offsets.

17th January 2008

Completed lines 1234F1052, 1006P1053 and 1138F2056. Continuing line 1498F2057 at midnight. Incomplete line 1138F1054. NTBP line 1498F1055. Infill lines 1234F1052, 1138F1054 and 1138F2056 required for far mid offsets. Line 1006P1053 is the first of a new swathe heading 345 degrees. Infill line 1138F1054 terminated early due to gun element auto fire. The vessel continued south whilst the offending gun was retrieved. A safety committee meeting was conducted early p.m. An audio hook-up with the Origin office was established so that the shore side clients could participate in the meeting. Infill line 1498F1055 not to be processed due to an air leak.

18th January 2008

Completed lines 1498F2057, 1126F2058 and 1510F2060. NTBP lines 1126F2058, 1510F1059 Infill lines 1498F2057 and 1510F2060 required for far mid offsets. The data from lines 1126F2058 and 1510F1059 was rejected post-line due to excessive swell noise and noisy compass/acoustic data. Aborted line 1246F1060 (165 degrees) on run-in early p.m. due to excessive swell noise. Production re-commenced late p.m.

19th January 2008

Completed lines 1246F1061, 1018P1062, 1270P1063 and 1030P1064. Infill line 1246F1061 required for far mid offsets. The line change following sequence 064 was extended due to the failure of a steering winch whilst trying to deploy source sub-array 1. The work boat was deployed mid-morning to perform streamer maintenance. Abandon ship drill conducted late a.m., which

included partial launch of the starboard life boat. Manual handling presentations given by the medic.

20th January 2008

Completed lines 1174R1065, 1522R1066 and 1126F3067. Line 1174R1065 recorded in five parts (re-shoot/infill/line change/infill/re-shoot). This line completes re-shoots of seq. 019 (recording instruments) and seq. 021 (recording instruments). Line 1522R1066 recorded in three parts (re-shoot/transit/infill). This line completes re-shoot of seq. 003 (gAS failure). Infill lines 1174R1065, 1522R1066 and 1126F3067 required for far mid offsets. The run-in to line 1522F1068 was aborted due to excessive swell noise on the streamers. The vessel will head to fair seas, on a northerly heading, until conditions improve.

21st January 2008

Completed lines 1282P1068 and 1522F1069. Production re-commenced mid-afternoon. Line 1282P1068 is the final full-length prime of the survey. Line 1282P1068 gun 4-3 off entire line, no spare. New port volume 3030 cu. in. Line 1522F1069 gun 4-3 off entire line, no spare. New port volume 3030 cu. in. Infill line 1522F1069 required for near mid and far mid offsets. The work boat was launched early evening to perform streamer maintenance. Following the completion of sequence 069 the vessel headed into the direction of the swell in order to retrieve all trailing equipment prior to transit to Burnie (Tasmania) for crew change.

22nd January 2008

Most of the day was spent retrieving, and cleaning, the streamers in preparation for a transit to Burnie (Tasmania) for crew change. Following the nominal line change after the last sequence (069) the timing will be accountable to Woodside Petroleum until the vessel is alongside in port.

23rd January 2008

The vessel was alongside the dock at 07:00. Time to this point is allocated to Woodside and the remainder will be in the shared category. This latter code is split in two for the purpose of the databases. 07:00-18:41 is allocated to the Origin database, 18:41-06:23 (24th) is allocated to the Woodside database.

24th January 2008

The vessel left the dock at 06:23. Streamer deployment from 08:35. Streamer 6 is fully deployed out wide. Working on streamers 1, 5 at midnight. Code 99 in this database used to designate time allocated to Woodside has been changed from a standby code to a downtime code in this database as there is no charge to Origin for these periods.

25th January 2008

The entire day was spent deploying streamers and towing equipment. This was all charged to Woodside. A discrepancy in the production totals was found. The first shot of the day on 10/01/08 (sequence 28) matched that of the last shot of the previous day. This was flagged due to a difference in the totals with the PC logs and was corrected in the Origin database.

26th January 2008

The vessel continued to deploy and head for line on Woodside's account until 10:36 when it was decided to pick up sub-arrays 5, 6, both of which had airleaks. The line would have started at 11:30 so this is where the downtime starts. This delayed the start of line till 16:22. The first line was part

reshoot, part infill. It was noted on this line that the separation between streamers 3, 4 was too large and required adjustment. Due to the nature of the infill and by applying speed adjustments, it was possible to shoot sequence 70 in an acceptable manner. After completion of the line it was deemed necessary to make the necessary towing adjustments. The spread rope was found to be tangled in the leadin ballast rods, prohibiting it from getting to the correct position on the streamers.

27th January 2008

Production continued for most of the day with the weather conditions deteriorating. At the end of the day the vessel was on sequence 74 which was too poor to accept. The conditions were more severe than have been predicted in recent forecasts. Sequence 73 had he streamers at 8m and was accepted. Sequence 74 had the streamers at 9m and was rejected.

28th January 2008

Much of the day lost to weather. Sequence 74 was rejected then sequence 75 accepted with the streamers at 8m. Sequence 76 was rejected due to poor compass data which was caused by the swell conditions. Although the weather had improved, the swell was till too large. Sequence 77 was accepted with the streamer depth at 9m. Positioning Comments: Completed P190 comparisons up to & including Seq. 077. With the exception of three compasses all in-sea positioning equipment operational. Sequence 074 had the highest recorded sea state online 4.5m, which resulted in very poor quality streamer compass data, and the rejection of the line. A combination of a 3m swell with a long wave period, and the line azimuth again resulted in poor quality compass data, and the rejection of Seq. 76.

29th January 2008

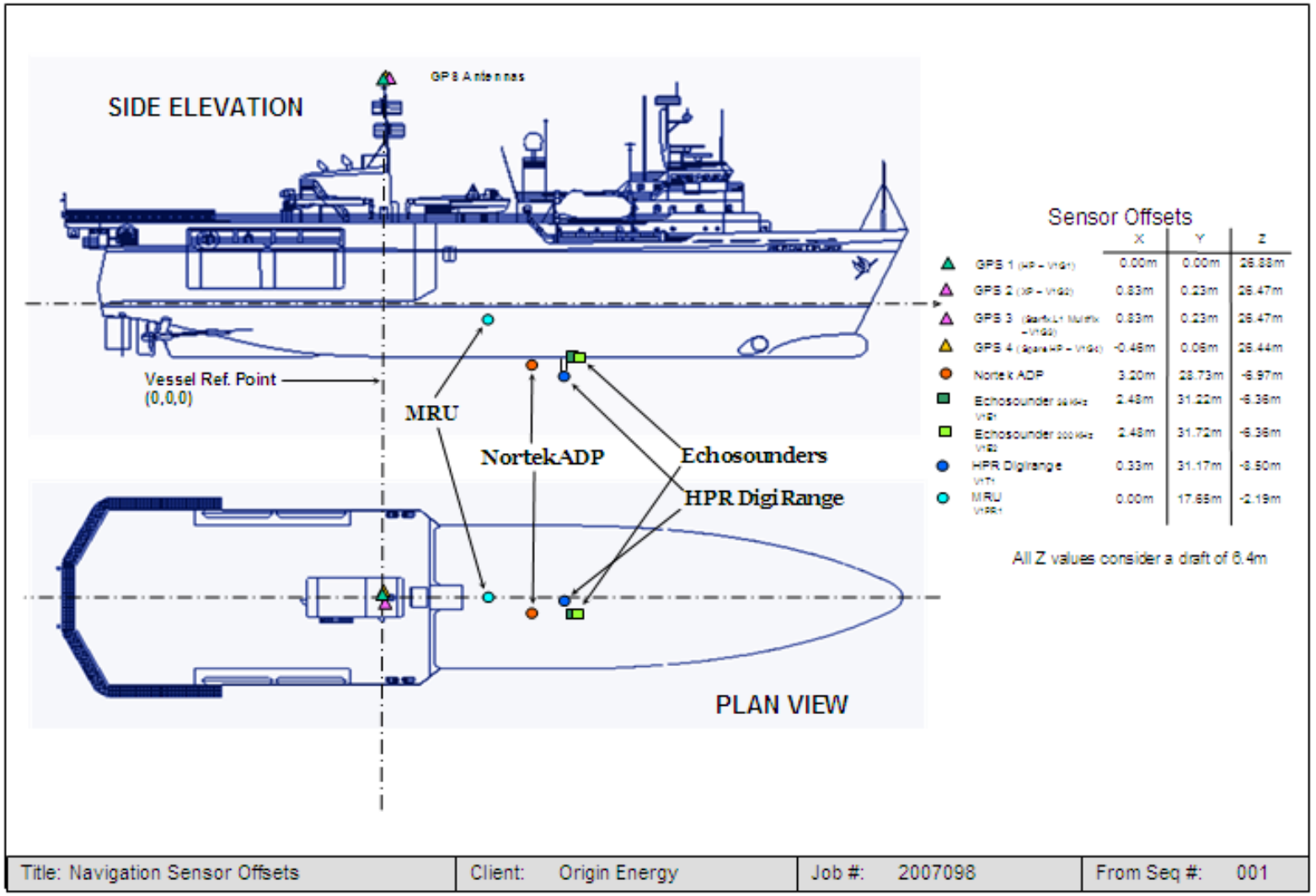
The project was considered complete at the end of sequence 79. Approval from Origin was received shortly afterwards. Positioning Comments: P190 comparisons were completed on the two final sequences 078, & 079, and were accepted. Sequence 078 compass data was noisy but acceptable. All acoustics, and rGPS units were operational throughout the period.

30th January 2008

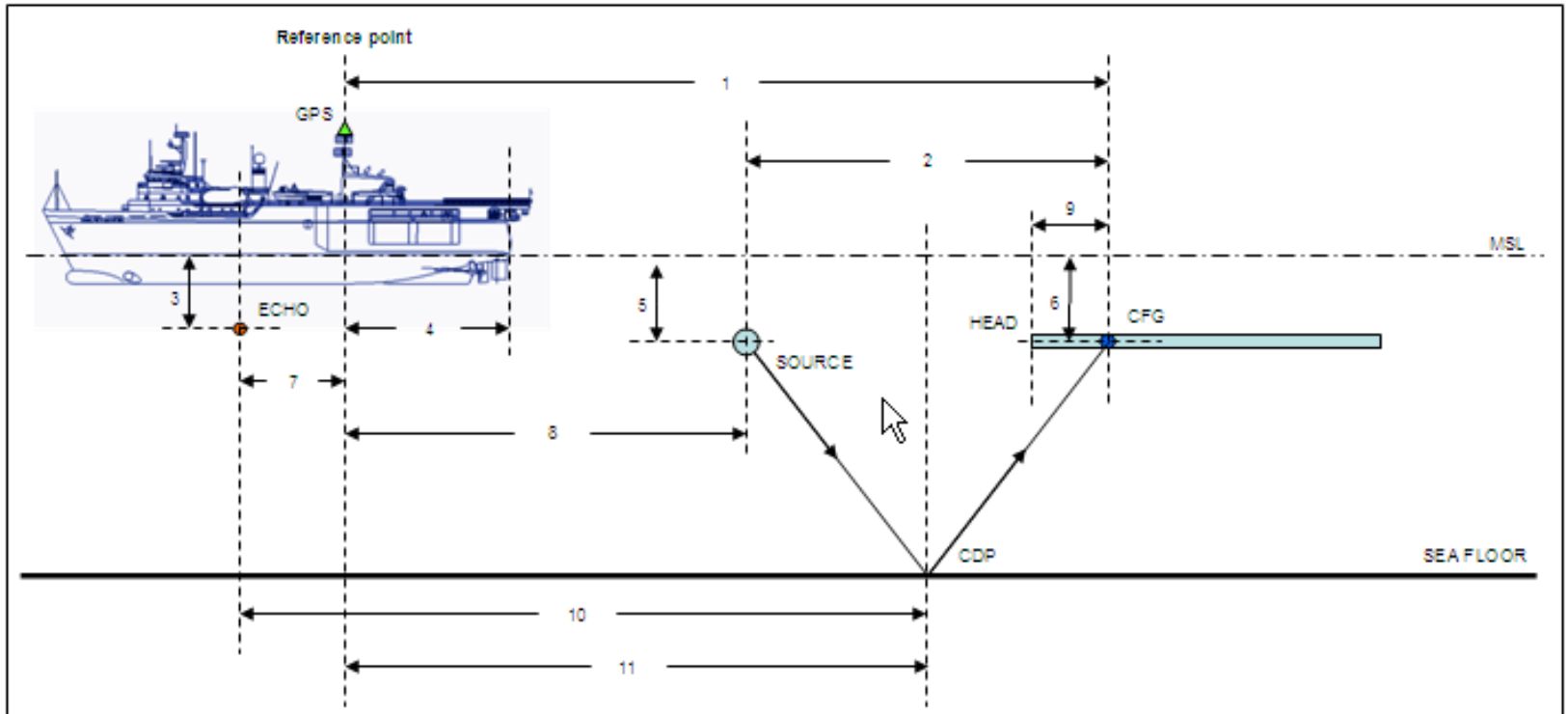
Equipment retrieval was completed and the vessel headed to the next prospect. The contractual rules say that the vessel is transferred from Origin to Woodside at the geographical midpoint between the surveys. This point was calculated as 39 Deg 10 min 56 sec S, 144 Deg 00 min 00 sec E and was reached at 18:09 local time.

7 MEASUREMENTS

7.1 GPS ANTENNAE POSITIONS

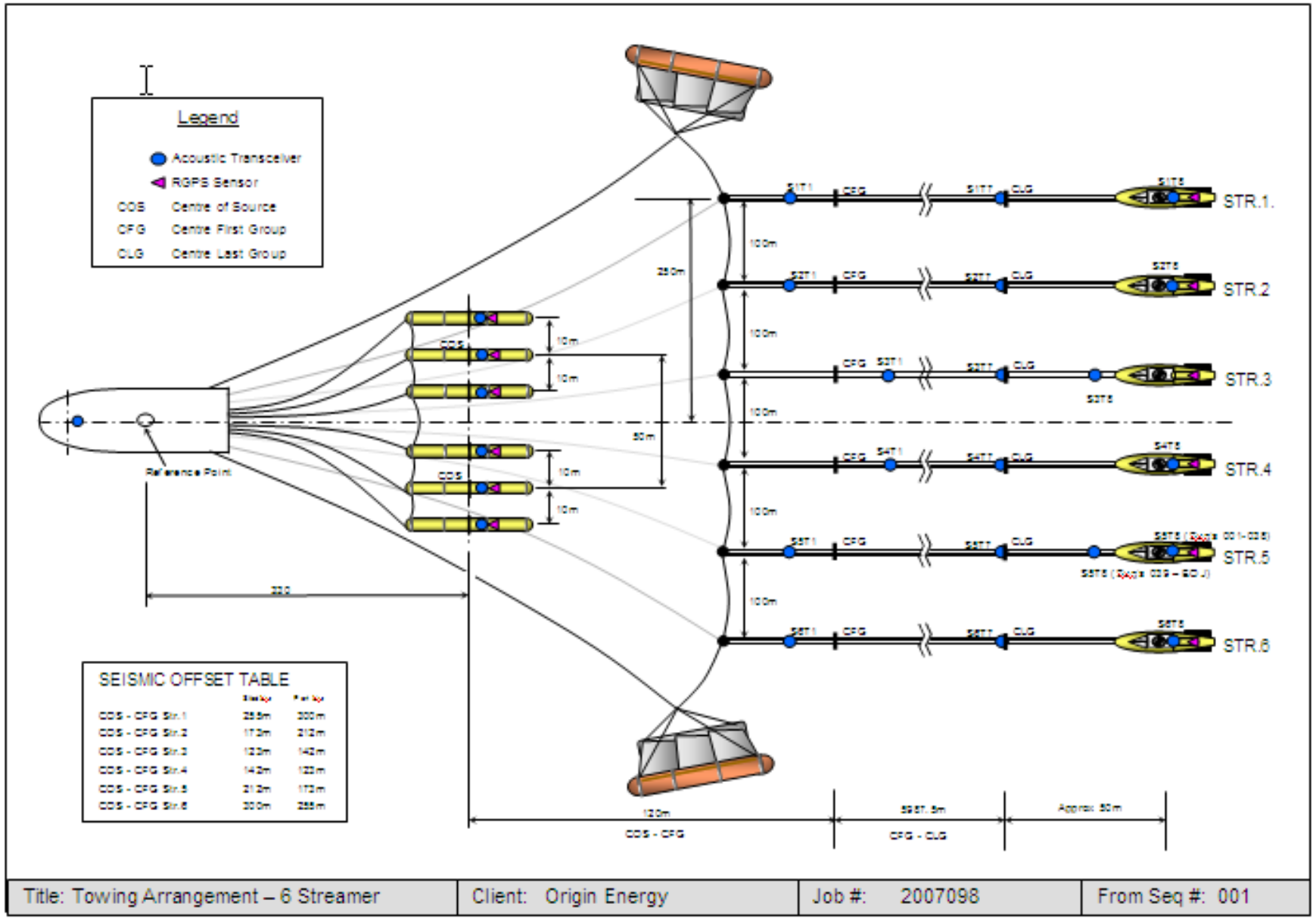


7.2 OFFSET DIAGRAM & TOWING DIMENSIONS

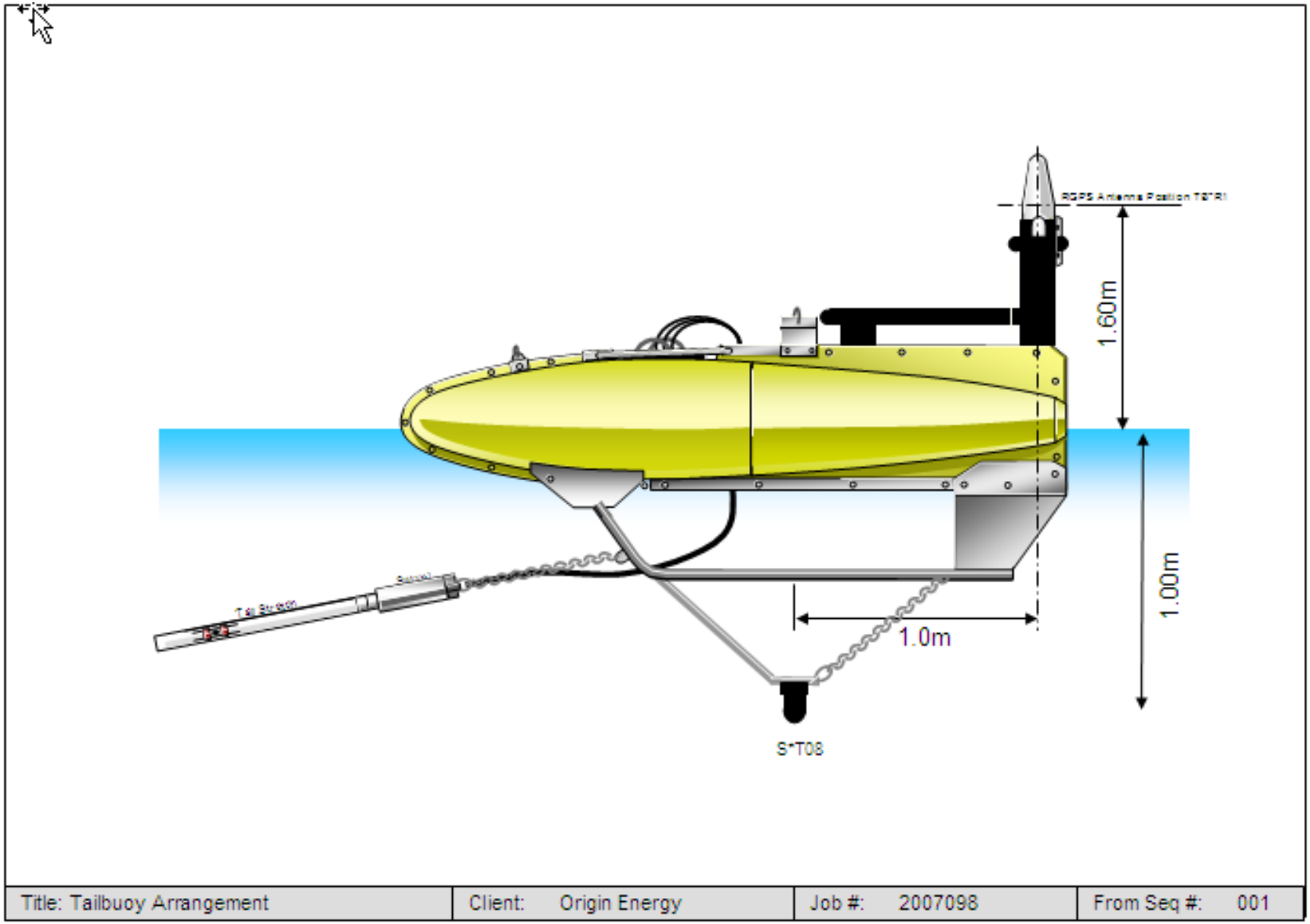


Key	Range	Distance (m)	Key	Range	Distance (m)
1	Streamer inline offset	450	7	Echo-sounder inline offset	31.47
2	Seismic offset	120	8	Source inline offset	330
	Nominal seismic offset input SCN / Census	*120*	9	Streamer head to Centre first group	6.25
3	Echo-sounder depth	6.36	10	Echo-sounder to CDP	421.47
4	Reference to Stern	32	11	Layback	390
5	Source depth	6		*Nominal layback input SCN*	*-390*
6	Streamer depth	7			

Title: Side View Offsets	Client: Origin Energy	Job #: 2007098	From Seq #: 001


Legend
Acoustic Transceiver
RGPS Sensor
COS Centre of Source
CFG Centre First Group
CLG Centre Last Group
Reference Point
STR.1.
STR.2
STR.3
STR.4
STR.5
STR.6
100m
250m
50m
10m
SEISMIC OFFSET TABLE
COS - CFG Str.1 25.5m 300m
COS - CFG Str.2 17.3m 212m
COS - CFG Str.3 12.3m 142m
COS - CFG Str.4 14.2m 122m
COS - CFG Str.5 21.2m 172m
COS - CFG Str.6 30.0m 255m
120m
COS - CFG
CFG - CLG
Approx. 50m
Title: Towing Arrangement – 6 Streamer
Client: Origin Energy
Job #: 2007098
From Seq #: 001

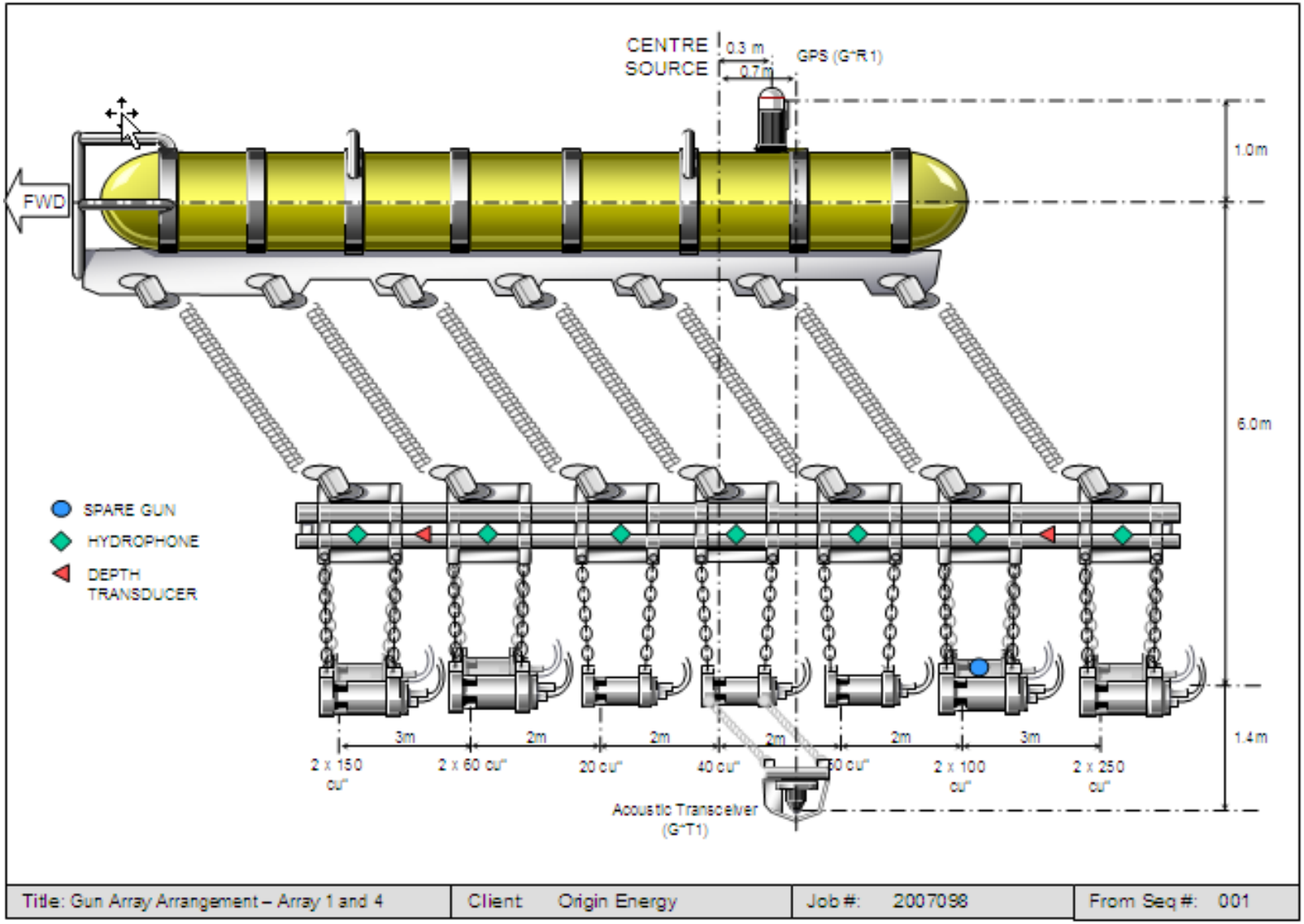
Tailbuoy Arrangement



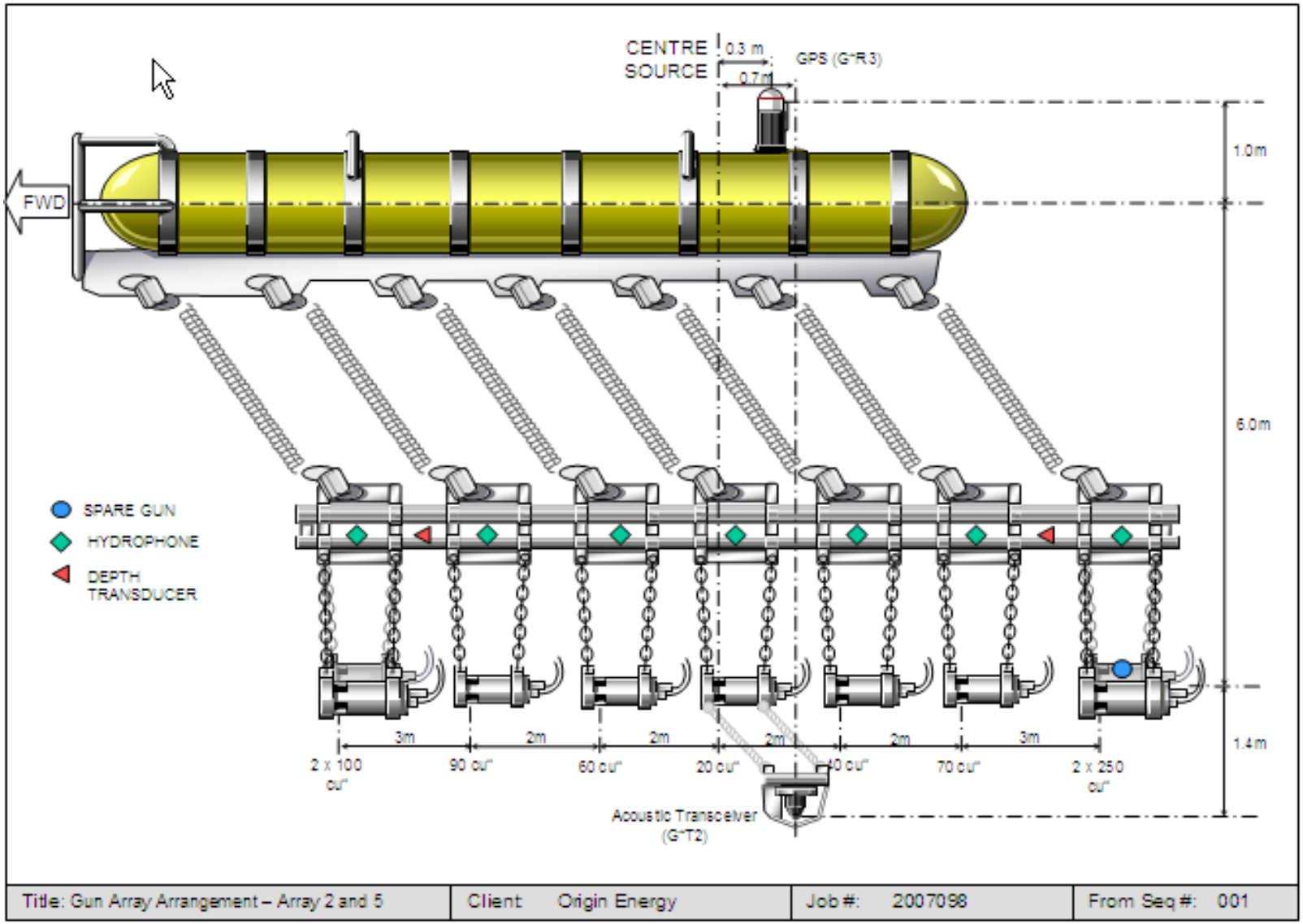
Title: Tailbuoy Arrangement	Client: Origin Energy	Job #: 2007098	From Seq #: 001

7.3 ARRAY TOWING SYSTEM & CONFIGURATION

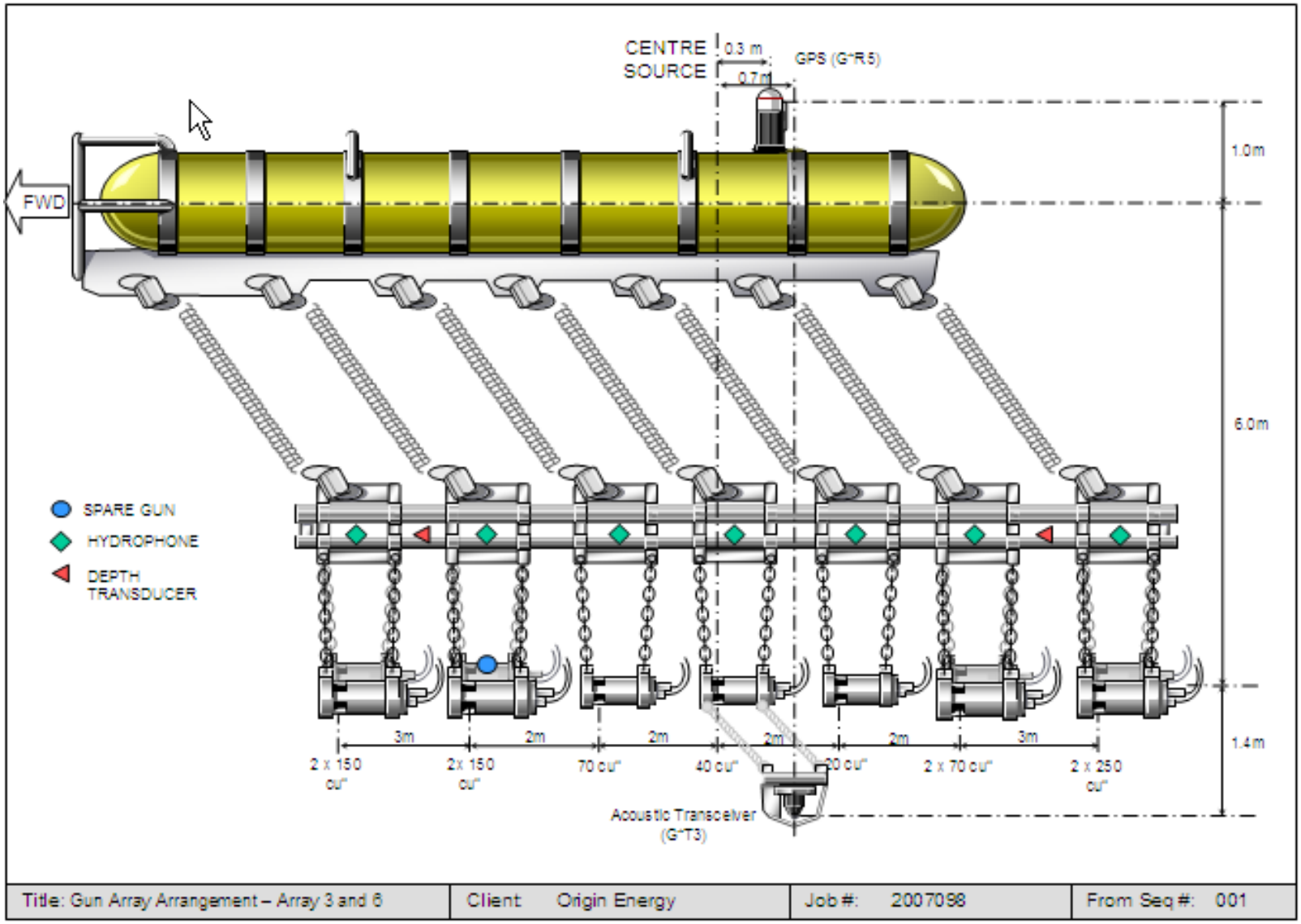
Sub-Arrays 1, 4



Sub-arrays 2, 5

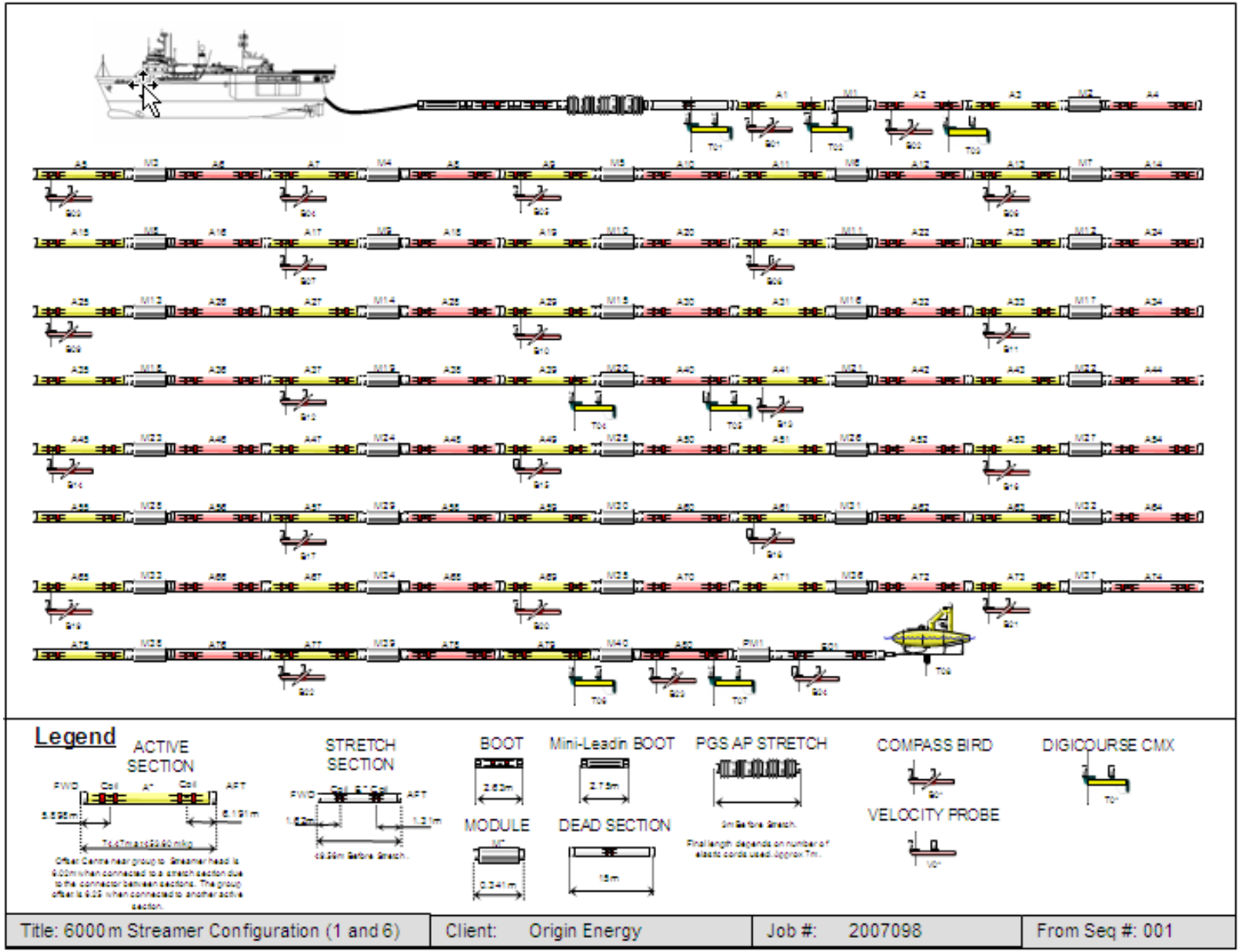


Sub-arrays 3, 6

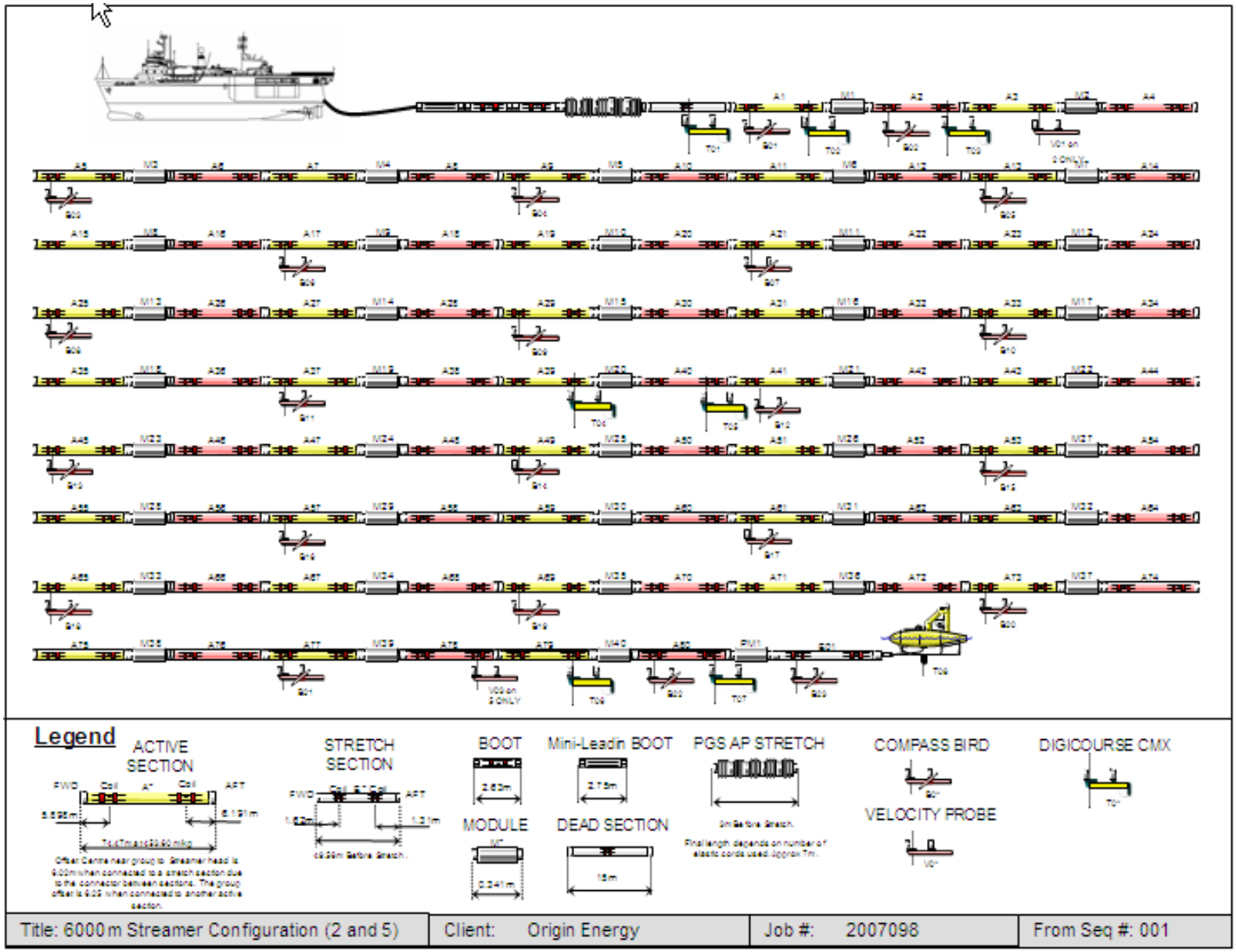


7.4 STREAMER CONFIGURATION DIAGRAM

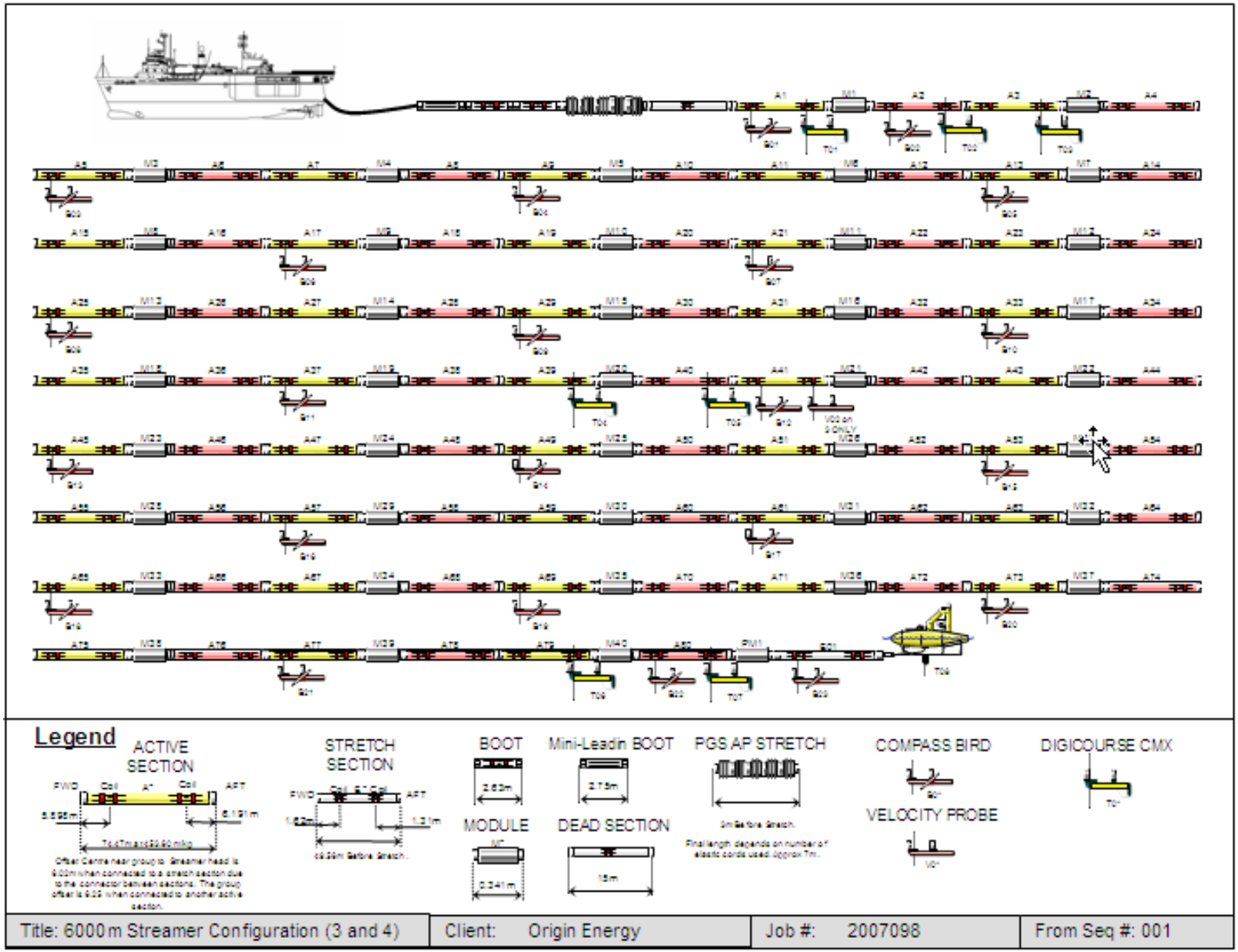
Streamers 1, 6



Streamers 2, 5



Streamers 3, 4



8 APPENDICES

8.1 CONVENTIONS AND TERMINOLOGY

Glossary:

Active : Active streamer section

BCU : Binary Coded Unit, Digicourse series depth / compass unit

DGPS : Differential Global Positioning System. Satellite navigation systems

DNP : Do Not Process. Data acquired but not accepted

FGPS : Fast Geophysical Positioning Solutions. Remote navigation processing QC.

FRC : Fast Rescue Craft

gAS : Seismic recording system (generic Acquisition System)

GCS-90 : Digital energy source timing system

Inmarsat : Telecom satellite communication system

MOB boat : Man overboard boat. A fast rescue craft designed for emergencies

Module : Streamer electronics module

Norsat : Norwegian satellite communications system

NRT : Near Real Time navigation processing

P1/90 : Processed navigation data format

P2/94 : Raw navigation data format

rGPS : Relative GPS system used for positioning source and tailbuoys

Spectra : Real Time navigation system

Sprint : Navigation processing system

UKOOA : United Kingdom Offshore Operator's Association

Viper : Seismic QC processing system

8.2 LINE AND SHOT POINT NUMBER CONVENTION

Each sail line has a unique number. The sail line numbering convention used was:

AAAAAAXXXXBYZZZ where

AAAAAA **:** survey identifier, in this case **OS073D**
XXXX **:** four digit line number
B **:** type of line, P for Prime, F for infill, R for Reshoot
Y : pass number
ZZZ **:** sequence number

The number **OS073D1246R2025** indicates that it is the second pass on sail line 1246 and it is a reshoot with unique sequence number 25.

Columns covered by a specific sail line will be from (line number -5) to (line number +6)
Example: sail line 1246 covers CMP columns 1241 to 1252

Shot Point numbers : Incremented 144.6° and Decremented 344.6°

8.3 DESCRIPTION OF LINE LOG CONTENTS

The following provides details of the data recorded for each line in the Observers line logs. All items appear on the individual line logs found on the CD accompanying this report.

Line Statistics

Seq.	: Sequence number of line (order in which lines were recorded)
Sail Line	: Client specified line number
Date	: Date on which line was started
Dir.	: Nominal line heading
Start Time	: Time of start of line, local time
End Time	: Time of end of line, local time
SOL	: Start of line column heading
EOL	: End of line column heading
FSP	: First Shotpoint
LSP	: Last Shotpoint
FGSP	: First Good Shotpoint
LGSP	: Last Good Shotpoint
KM	: Total kilometres recorded
KMFF	: Total kilometres full fold
CMP	: Common mid point
SQKMFF	: Square Kilometres Full Fold
Vessel Speed	: Vessels speed in knots (over ground)

Environment

Wind Speed	: Average wind speed in knots
Wind Dir.	: Average direction of wind
Water Depth	: Water depth below the transducer at the start and end of line
Swell	: Average swell height at the Start and End of line
Sea State	: Sea conditions i.e. slight, moderate or rough at BOL/EOL

Streamers

SOL Noise	: Ambient RMS streamer noise calculated at start of line

EOL Noise : Ambient RMS streamer noise calculated at end of line
Bad Channels : The number of defective channels on the streamer. These can be classed as bad for several reasons, dead, noisy, spiking, leaking etc.
Feather : The angle the streamer deviates off the line heading, negative numbers indicate port, positive numbers indicate starboard

Summary

Status : Whether line is complete or incomplete
Comments : General summary of line quality and any particular aspect of the line which may require special attention
Bad Records : The number of bad shots or records on the line

8.4 SOURCE DROPOUT MATRIX