AHP9701064-WST

524002

T/25P

BASS BASIN, TASMANIA

1996 HUMMOCK MARINE SEISMIC SURVEY

FINAL REPORT

PART A - DATA ACQUISITION AND PROCESSING

Compiled By:

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Boral Energy Resources Ltd
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OR-0427

524003

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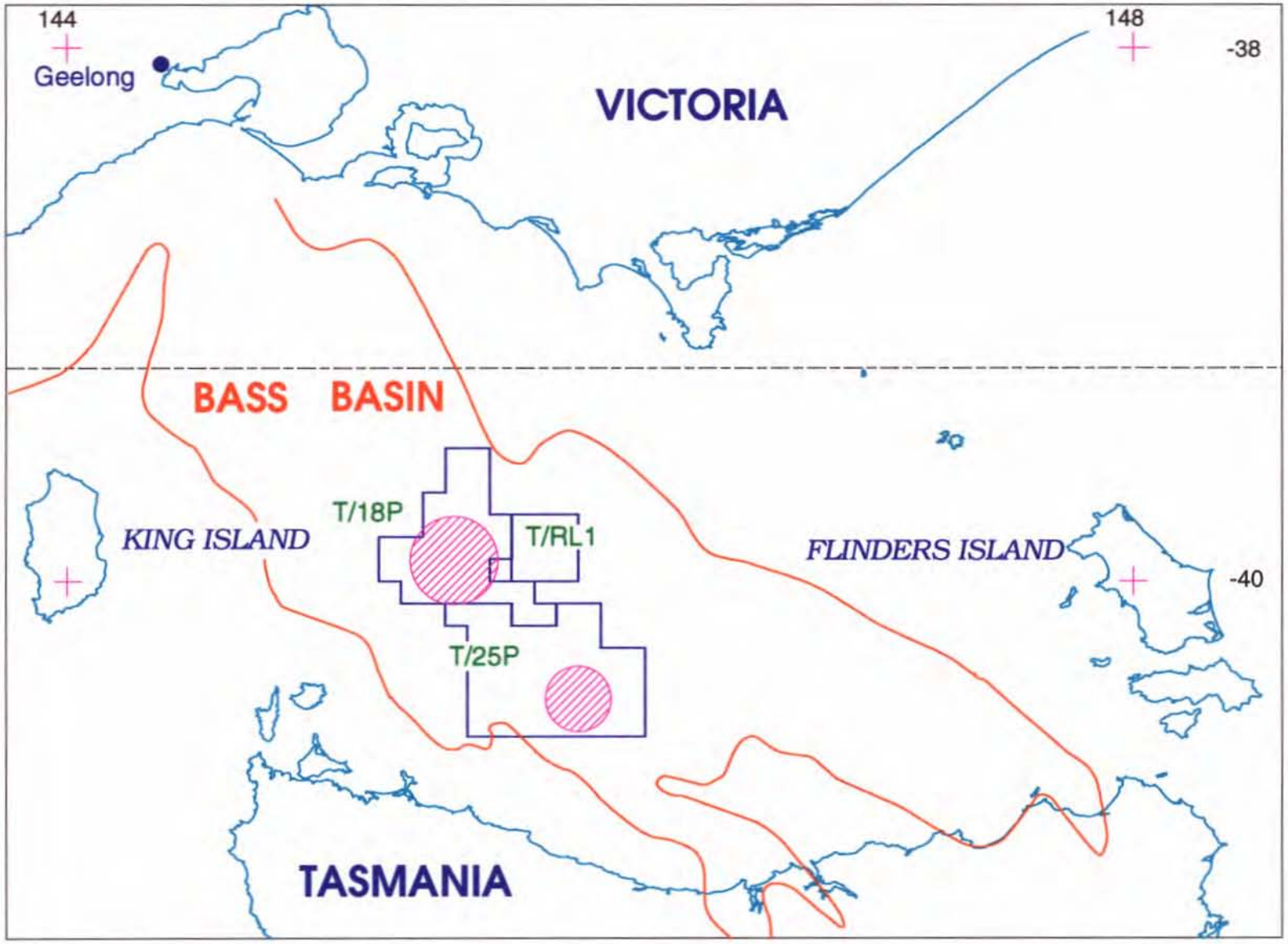
HUMMOCK SEISMIC SURVEY - LOCATION MAP
BASS BASIN - TASMANIA

BORAL ENERGY



5 cm

Outline of Survey

Kilometres

0 20 40 60 80 100

13609.1095 Fig. 1

1 INTRODUCTION

The Hummock Marine Seismic Survey consisted of two separate grids in the Bass Basin Offshore Tasmania, one in T/18P and the other in T/25P. This report concentrates on the activity in T/25P. The acquisition in this permit took place between 17 January and 27 January 1996 recording a total of 665.8206 kms of 2D data. PGS Exploration were engaged to carry out the acquisition and the data were processed by Western Geophysical, Melbourne

The T/25P Joint Venture is operated by Boral Energy Resource Limited. The participants at the time of the survey are listed in Table 1.

Table 1

T/25P Participating Interests

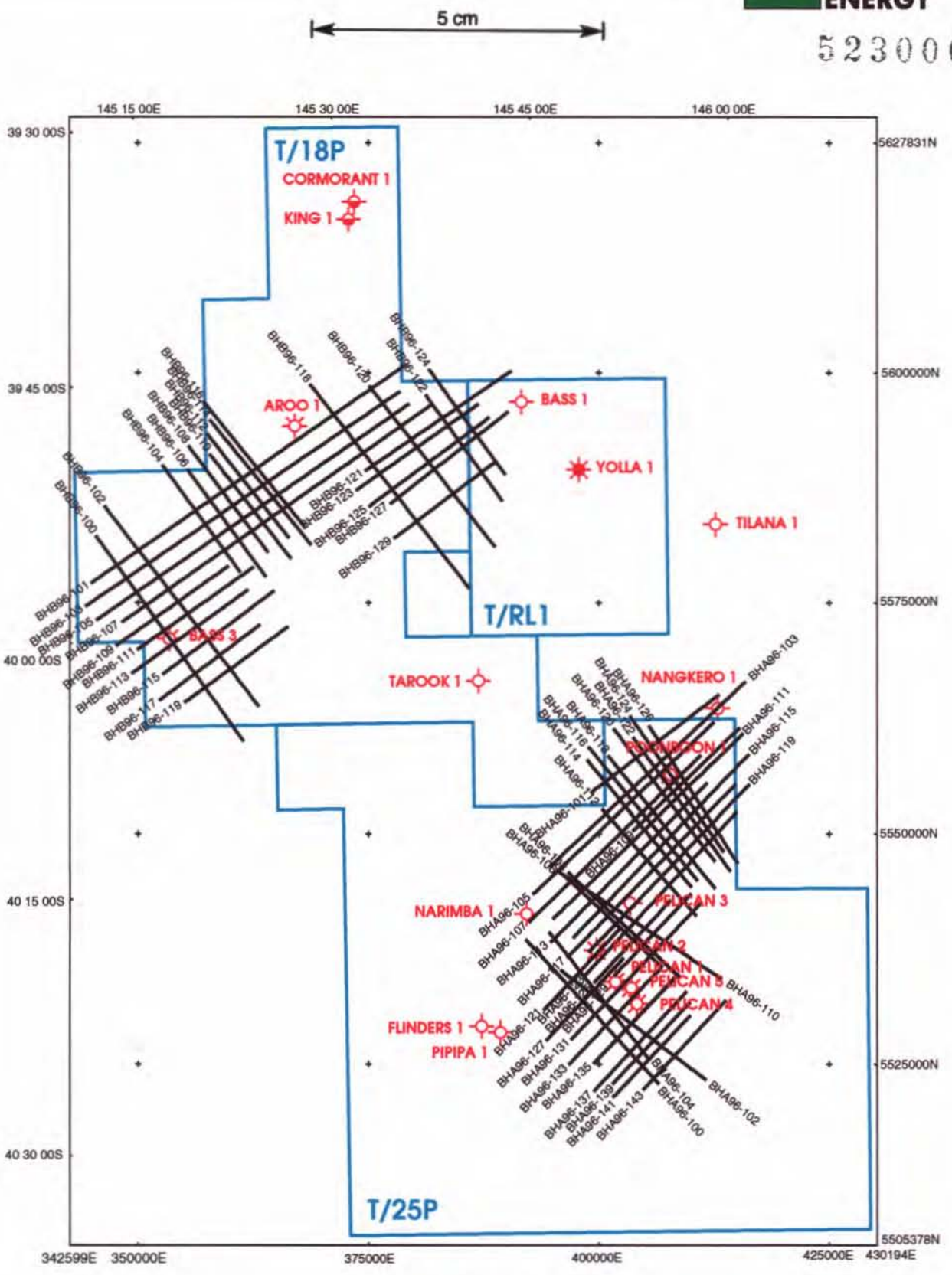
Boral Energy Resources Limited	67.273%
Basin Oil NL	12.5%
Cultus Timor Sea Pty Ltd	20.227%

The object of the Hummock Marine Seismic Survey in T/25P was to detail the Veridian lead, the Grindstone, Eddystone and Tourville prospects. All these structures were to be upgraded to drillable status by the survey which would enable more rigorous economic analysis to be achieved prior to undertaking the final year of the secondary work program which includes a well commitment.

The Hummock Survey fulfils the Joint Venture's obligations for the fifth year of the work program for the T/25P permit.

BORAL ENERGY

523006



BASS BASIN TASMANIA

1996 HUMMOCK MARINE SEISMIC SURVEY LINE LOCATION MAP

14498.0896 Fig. 2

2 ACQUISITION

The Hummock Marine Seismic Survey totalled 665.8206 kilometres of surface seismic line coverage (Figure 1) using the PGS Exploration vessel MV Odin Explorer. The acquisition parameters of the survey are summarised in Table 2, and are fully listed in the PGS Exploration Limited Report (Appendix 3).

Austral Geophysical Consultants Pty Ltd were contracted by Boral Energy Resources to supervise and report on the data acquisition operations performed by the MV Odin Explorer. The Hummock Seismic Survey Field Supervision Report by Frank Renton (Appendix 2) should be referred to in conjunction with the PGS Exploration report.

The seismic data and positioning data were independently monitored and quality controlled by using the QSEIS on-line QC system. A Fugro Starfix DGPS was used as the primary navigation system.

2.1 Magnetic Tapes

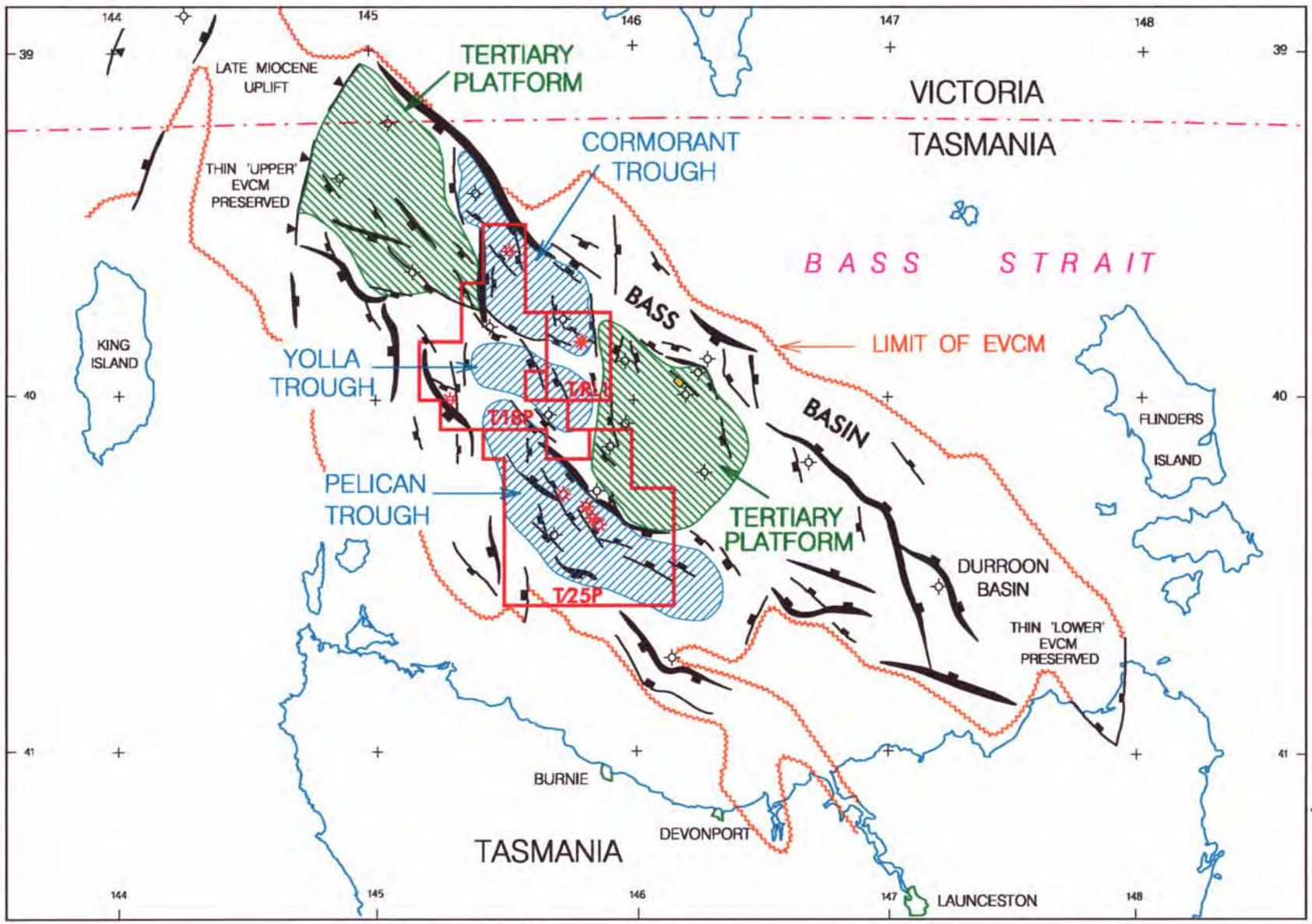
A concise listing of field tapes is contained in Appendix 1.

2.2 Summary

The acquisition contractor performed well with an average production rate of 67.9 kilometres per day in spite of bad weather. The survey was completed with 6.667 hours of down time recorded and 61.265 hours of weather time. There were no lost time injuries or environmental incidents experienced during the survey.

Table 2

Hummock Marine Seismic Survey Acquisition Parameters	
Vessel	MV Odin Explorer
Streamer Type	Teledyne/Shell Digital
Number of Groups	252
Group Interval	15.24 m
Active Streamer Length	3840 m
Shot Point Interval	22.86 m
Fold	80
Sample Rate	2 milliseconds
Record Length	6 seconds
High Cut Filter	218 hz/484 dB per octave
Low Cut Filter	out
Cable Depth	6 m
Cable Offset	107.5 m
Airgun Array Volume	2660 cubic inches
Airgun Array Depth	6 m
Streamer Tracking	16 compasses


5 cm
BORAL ENERGY
523008
144
145
146
147
148
39
40
41
LATE MIOCENE UPLIFT
TERTIARY PLATFORM
VICTORIA
TASMANIA
CORMORANT TROUGH
THIN 'UPPER' EVCM PRESERVED
BASS STRAIT
BASS
LIMIT OF EVCM
KING ISLAND
YOLLA TROUGH
T/18P
T/19P
BASIN
FLINDERS ISLAND
PELICAN TROUGH
TERTIARY PLATFORM
DURROON BASIN
T/25P
THIN 'LOWER' EVCM PRESERVED
0 20 40 60
Kilometres
BURNIE
DEVONPORT
TASMANIA
LAUNCESTON
BASS BASIN – TASMANIA
TECTONIC ELEMENTS MAP
No: 10821.0794 FIG. 3

3 PROCESSING

3.1 Hummock Processing and Results

The data processing of the Hummock Seismic Survey was performed by Western Geophysical's Melbourne Centre between February and April 1996. It was supervised there by Dee Connolly. Data tapes were shipped by Western to their Houston facility.

Rapid turnaround was an essential consideration for Hummock processing, especially for the T/25P portion of the survey. Although on-board processing with PGS was fully investigated, it was concluded that a survey which took only two weeks to acquire would require too much follow up processing for the day-rates involved for a dedicated processing facility.

Western in Melbourne were chosen for offering good turnaround and it was decided to determine as many parameters as possible with **trial processing** on Line SB94A-151 - prior to the delivery of the Hummock Survey data.

Hummock was recorded a little differently to the earlier vintages in the Bass Basin. The main difference was higher fold achieved by popping at an 18.75 metre interval into a 240 channel cable set up with 12.5 metre group interval. This **data geometry** allows for processing in two main ways, each with its own merits and disadvantages:

I. 3:1 trace summation after velocity filtering to give 46m group interval and a 23 m shot interval, resulting in 82 fold **23m CMP's** with a stack array offset distribution.

II. trace summation after velocity filtering to give 30m group interval and a 23 m shot interval, resulting in an 82 fold denser **15m CMP** interval without a stack array offset distribution.

While Line SB94A-151 was not recorded with this geometry it was possible to simulate the effect of stack array noise reduction with the 'wrong' binning due to the very low dips on reflections. 3:1 summation was clearly advantageous.

An unusually large **time correction** appeared necessary for correct start-of-data. The timing diagram supplied with the field data was ambiguous and it was difficult to get definitive information from PGS. From enlarged plots of direct arrivals and auxiliary traces a -81ms shift was measured.

A full list of processing **tests** performed can be found in the contractor's report included as an appendix. During production processing most attention was given to turnaround - with some testing of NMO on shot FK filter, receiver FK filter, designature phase / phase conversion style, demultiple type, DMO dips and post-stack signal enhancement. The latter was not necessary due to the cleanness of the data.

The final processing **sequence** can be summarised as follows:

- -81ms start-of-data correction
- Spherical Divergence Correction
- Shot Domain Velocity Filtering with NMO
- 3:1 Adjacent Trace Summation
- Designature to zero phase

- Two km Velocity Analysis
- FK Demultiple
- DBS
- Kirchhoff DMO
- One km Velocity Analysis
- Modified Residual Migration
- Time Variant Filter and Scaling

Interpolation of the section back to a 12.5m trace interval was done in testing to allow a better comparison of trace summation schemes. Interpolation was not applied in the final sequence, though it could easily be done in the future if an interpreter required sections with comparable trace intervals.

Boral Energy monitored the processing results at intermediate stages and reviewed all the first pass paper velocity interpretation. Second pass velocities were reviewed from screen plots of digital data received. It should be noted that Western's IVP velocity picking and QC system was not used here because of turnaround impact that would have been caused by waiting for shipment of velocity gather tapes from the Houston facility. Apparently paper plot files could come down the line more quickly.

AVO analysis was performed on two Hummock lines by Robertson Research in Perth. The particular areas of interest were:

I. BHB96-100 SP 1300 - 1450 at 1650ms, SP 1650 - 1750 at1650ms
II. BHB96-108 SP 1188 - 1338 at 2150-2500ms, SP 1380 - 1560 at 2000-2080ms for comparison - though likely to be igneous

Encouraging hydrocarbon indicators were observed.

Phase comparison with the Bass-3 well was carried out as part of the AVO project and results were a pleasingly close match with SEG -VE polarity.

The shot point reference for section annotations is source position. The navigation data in also processed to source position.

Note that some ripples were noticed on navigation plots of shot lines. PGS were asked to investigate this. They concluded that ripples were due to heavy weather affecting boat path and that navigation data was reliable. It should be noted that sub-surface bin positions would not affected in the same way as surface points.

3.2 Digital Archives

Data were archived on exabyte tapes at 5Gb density in a SEGY format at the following stages:

- Final stack - raw
- Final stack - filtered and scaled
- Migration - raw
- Migration - filtered and scaled
- DMO gathers were archived for two lines BHB96-100, 108 and forwarded to Robertson Research in Perth for AVO analysis.

3.3 Contractor Performance

Western completed the processing with diligence and timely delivery. The

operator recognises approximately a week delay introduced by initial data problems and testing. An effective turnaround of 7 weeks was achieved for the 666km of T/25P data (BHA96- lines) which consequently attracted a 10% bonus for the contactor. T/18P data was completed in effectively 9 weeks which did not attract a bonus but was a solid performance. Western were cooperative and supportive of the operator's objectives.

The operator would recommend the processing contractor for future work.

APPENDIX 1

FIELD TAPE LISTING

This appendix comprises a listing of seismic line, field tape and shotpoint ranges.

HUMMOCK SEISMIC SURVEY T/25P FIELD TAPE LIST

LINE	SP	SP	TAPE	COMMENT
BHA96100	1828	1750	1740	SOL
	1749	1659	1741	
	1651	1561	1742	
	1560	1470	1743	
	1469	1379	1744	
	1378	1288	1745	
	1287	1197	1746	
	1196	1106	1747	
	1105	1015	1748	
	1014	924	1749	
	923	908	1750	EOL
BHA96101	991	1080	1905	SOL
	1081	1173	1906	
	1174	1264	1907	
	1265	1348	1908	LGSP, loss of streamer control
	1218	1306	1910	restart line
	1307	1397	1911	
	1398	1488	1912	
	1490	1580	1914	
	1581	1671	1915	
	1672	1755	1916	EOL
BHA96102	1000	1088	1751	SOL
	1189	1179	1752	
	1180	1270	1753	
	1271	1361	1754	
	1362	1452	1755	
	1453	1543	1756	
	1544	1634	1757	
	1635	1725	1758	
	1726	1816	1759	
	1817	1880	1760	EOL
BHA96103	991	1079	1889	SOL
	1080	1170	1890	
	1171	1261	1891	
	1262	1352	1892	
	1353	1444	1893	
	1445	1535	1894	
	1536	1626	1895	
	1627	1717	1896	LCSP misstiming
	1718	1755	1897	no data
	1634	1721	1898	FCSP
	1722	1812	1899	
	1813	1903	1900	
	1904	1994	1901	
	1995	2085	1902	
	2086	2176	1903	
	2177	2265	1904	EOL
BHA96104	1690	1602	1761	SOL
	1601	1511	1762	
	1510	1420	1763	
	1419	1329	1764	
	1328	1238	1765	

LINE	SP	SP	TAPE	COMMENT
	1237	1147	1766	
	1146	1056	1767	
	1055	965	1768	
	964	917	1769	EOL
BHA96105	2100	2012	1874	SOL
	2011	1921	1875	
	1920	1830	1876	
	1829		1877	
	1828	1738	1878	
	1737	1647	1879	
	1646	1556	1880	
	1555	1465	1881	
	1464	1374	1882	
	1373	1283	1883	
	1282	1192	1884	
	1191	1101	1885	
	1100	1010	1886	
	1009	919	1887	
	918	917	1888	EOL
BHA96106	1562	1474	1857	SOL
	1473	1383	1858	
	1382	1292	1859	
	1291	1201	1860	
	1200	1110	1861	
	1109	1019	1862	
	1018	928	1863	
	927	917	1864	EOL
BHA96107	2050	1962	1917	SOL
	1961	1871	1918	
	1870	1780	1919	
	1779		1920	
	1778	1687	1921	
	1686	1596	1922	
	1595	1505	1923	
	1504	1414	1924	
	1413	1323	1925	
	1322	1232	1926	
	1231	1141	1927	
	1140	1050	1928	
	1049	959	1929	
	958	917	1930	EOL
BHA96108	991	1079	1849	SOL
	1080	1170	1850	
	1171	1261	1851	
	1262	1352	1852	
	1353	1443	1853	
	1444	1534	1854	
	1535	1625	1855	
	1626	1713	1856	EOL
BHA96109	991	1079	1865	SOL
	1080	1170	1866	
	1171	1261	1867	
	1262		1868	lost data
	1263	1353	1869	

LINE	SP	SP	TAPE	COMMENT
	1354	1444	1870	
	1445	1535	1871	
	1536	1626	1872	
	1627	1693	1873	EOL
BHA96110	1554	1456	1836	SOL
	1445	1365	1837	
	1364	1274	1838	
	1273		1839	lost data
	1272	1182	1840	
	1181	1091	1841	
	1090	999	1842	
	998	908	1843	
	907	817	1844	
	816	726	1845	
	725	635	1846	
	634		1847	lost data
	633	606	1848	EOL
BHA96111	991	1079	1931	SOL
	1080	1170	1932	
	1171	1262	1933	
	1263	1353	1934	
	1354	1444	1935	
	1445	1535	1936	
	1536	1626	1937	
	1627	1717	1938	
	1718	1808	1939	
	1809	1899	1940	
	1900	1990	1941	
	1991	2081	1942	
	2082	2172	1943	
	2173	2248	1944	EOL
BHA96112	991	1079	1994	SOL
	1080	1170	1995	
	1171	1261	1996	
	1262	1352	1997	
	1353	1443	1998	
	1444	1534	1999	
	1535	1625	2000	
	1626	1665	2001	EOL
BHA96113	1975	1887	1945	SOL
	1886	1796	1946	
	1795	1705	1947	
	1704	1614	1948	
	1613	1523	1949	
	1522	1432	1950	
	1431	1341	1951	
	1340		1952	data lost
	1339	1249	1953	
	1248	1158	1954	
	1157	1067	1955	
	1066	976	1956	
	975	917	1957	EOL
BHA96114	1694	1606	1985	SOL
	1605	1515	1986	

LINE	SP	SP	TAPE	COMMENT
	1514	1424	1987	
	1423	1333	1988	
	1332	1242	1989	
	1241	1151	1990	
	1150	1060	1991	
	1059	969	1992	
	968	917	1993	EOL
BHA96115	991	1080	1958	SOL
	1080	1171	1959	
	1172	1262	1960	
	1263	1353	1961	
	1354	1444	1962	
	1445	1535	1963	
	1536	1626	1964	
	1627	1717	1965	
	1718	1808	1966	
	1809	1899	1967	
	1900	1990	1968	
	1991	2081	1969	
	2082	2172	1970	
	2173	2194	1971	EOL
BHA96116	1723	1644	2002	SOL
	1634	1553	2003	
	1552	1462	2004	
	1461	1371	2005	
	1370	1280	2006	
	1279	1189	2007	
	1188	1098	2008	
	1097	1007	2009	
	1009	916	2010	EOL
	915		2011	
BHA96117	2065	1977	1972	SOL
	1976	1886	1973	
	1885	1795	1974	
	1794	1704	1975	
	1703	1613	1976	
	1612	1522	1977	
	1521	1431	1978	
	1430	1340	1979	
	1339	1249	1980	
	1248	1158	1981	
	1157	1067	1982	
	1066	976	1983	
	975	917	1984	EOL
BHA96118	991	1079	2012	SOL
	1080	1170	2013	
	1171	1261	2014	
	1262	1352	2015	
	1353	1443	2016	
	1444	1534	2017	
	1535	1625	2018	
	1626	1716	2019	
	1717	1798	2020	EOL
BHA96119	991	1079	2076	SOL

LINE	SP	SP	TAPE	COMMENT
	1080	1170	2077	
	1171	1261	2078	
	1262	1352	2079	
	1353	1452	2080	
	1453	1543	2081	
	1544	1634	2082	
	1635	1725	2083	
	1726	1816	2084	
	1817	1907	2085	
	1908	1998	2086	
	1999	2089	2087	
	2090	2093	2087	EOL
BHA96120	1707	1619	2021	SOL
	1618	1528	2022	
	1527	1437	2023	
	1436	1346	2024	
	1345	1255	2025	
	1254	1164	2026	
	1163	1073	2027	
	1072	982	2028	
	981	917	2029	
BHA96121	991	1079	1770	SOL
	1080	170	1771	
	1171	1261	1772	
	1262	1352	1773	
	1353	1443	1774	
	1444	1522	1775	EOL
BHA96122	1021	1079	2030	SOL
	1080	1170	2031	
	1171	1261	2032	
	1262	1352	2033	
	1353	1443	2034	
	1444	1534	2035	
	1535	1625	2036	
	1626	1716	2037	
	1717	1773	2038	EOL
BHA96123	1969	1881	2089	SOL
	1880	1790	2090	
	1789	1699	2091	
	1698	1608	2092	
	1607	1517	2093	
	1516	1426	2094	
	1425	1335	2095	
	1334	1244	2096	
	1243	1153	2097	
	1152	1062	2098	
	1061	971	2099	
	970	917	2100	EOL
BHA96124	1695	1607	2039	SOL
	1606	1516	2040	
	1515	1425	2041	
	1424	1334	2042	
	1333	1243	2043	
	1242	1152	2044	

LINE	SP	SP	TAPE	COMMENT
	1151	1061	2045	
	1060	970	2046	
	969	917	2047	EOL
BHA96125	1449	1361	2070	SOL
	1360	1270	2071	
	1269	1179	2072	
	1178	1088	2073	
	1087	997	2074	
	996	917	2075	EOL
BHA96126	991	1079	2048	SOL
	1080	1170	2049	
	1171	1261	2050	
	1262	1352	2051	
	1353	1443	2052	
	144	1534	2053	
	1535	1625	2054	
	1626	1717	2055	
	1718	1764	2056	EOL
BHA96127	1451	1363	1776	SOL
	1362	1272	1777	
	1271	1181	1778	
	1180	1085	1779	no data 1166-1162
	1084	994	1780	
	993	917	1781	EOL
BHA96129	991	1079	2064	SOL
	1080	1170	2065	
	1171	1264	2066	
	1265	1356	2067	
	1357	1447	2068	
	1448	1523	2069	EOL
BHA96131	991	1079	1782	SOL
	1080	1170	1783	
	1171	1261	1784	
	1262	1352	1785	
	1353	1443	1786	
	1444	1542	1787	
	1543	1633	1788	
	1634	1724	1789	
	1725	1815	1790	
	1816	1885	1791	EOL
BHA96133	1549	1456	1792	SOL
	1455	1363	1793	
	1362	1274	1794	
	1273	1185	1795	
	1184	1096	1796	
	1095	1007	1797	
	1006	918	1798	
	917		1799	EOL
BHA96135	991	1078	1800	line reshot
	1079	1167	1801	line reshot
	1168	1264	1802	line reshot
	1265	1353	1803	line reshot
	1354	1442	1804	line reshot
	1443	1531	1805	line reshot

LINE	SP	SP	TAPE	COMMENT
	1532	1558	1806	line reshot
BHA96935	991	1079	2057	SOL
	1080	1170	2058	
	1171	1261	2059	
	1262	1352	2060	
	1353	1443	2061	
	144	1536	2062	
	1537	1557	2063	EOL
BHA96137	1561	1474	1807	SOL
	1473	1385	1808	
	1384	1296	1809	
	1295	1207	1810	
	1206	1118	1811	
	1117	1029	1812	
	1028	940	1813	
	939	917	1814	EOL
BHA96139	991	1077	1815	SOL
	1078	1166	1816	
	1167	1255	1817	
	1256	1344	1818	
	1345	1433	1819	
	1434	1522	1820	
	1523		1821	EOL
BHA96141	1449	1363	1822	SOL
	1362	1274	1823	
	1273	1185	1824	
	1184	1295	1825	
	1094	1006	1826	
	1005	917	1827	
	916		1828	EOL
BHA96143	991	1077	1829	SOL
	1078	1166	1830	
	1167	1255	1831	
	1256	1344	1832	
	1345	1433	1833	
	1434	1522	1834	
	1523	1568	1835	EOL

APPENDIX 2

FIELD SUPERVISION REPORT

This appendix comprises the Consultant's field supervision report.

FINAL ACQUISITION REPORT

for the

1996 HUMMOCK 2D MARINE SEISMIC SURVEY

conducted by

BORAL ENERGY RESOURCES LTD

in exploration permit areas

T/25P and T/18P BASS BASIN AUSTRALIA

REPORT PREPARED BY FRANK RENTON

8th of FEBRUARY 1996

AUSTRAL GEOPHYSICAL CONSULTANTS PTY. LTD.

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1 INTRODUCTION

SURVEY SYNOPSIS

The subject of this report is the 1996 HUMMOCK 2D Marine Seismic Survey, conducted by BORAL ENERGY RESOURCES LIMITED. The survey was conducted in the offshore Petroleum Exploration Permit areas T/18P, T/25P and T/RL1 located in the Tasmanian portion of the Bass Basin. The approximate location of the survey is shown in figure 1 of this report.

The survey consisted of 2 separate grids of lines. One grid covered a portion of block T/25P and the second covered portions of both T/18P and T/RL1. The planned survey consisted of 64 lines which totalled some 1110 kilometres of full fold sub-surface coverage. With the necessary additional run outs acquired on each line the final total for surface coverage was 1234.6913 kilometres. Two diagrams, showing the survey line lengths and orientations are shown on Figures 2 and 3 of this report. The scale of both these diagrams is approximately 1:25000.

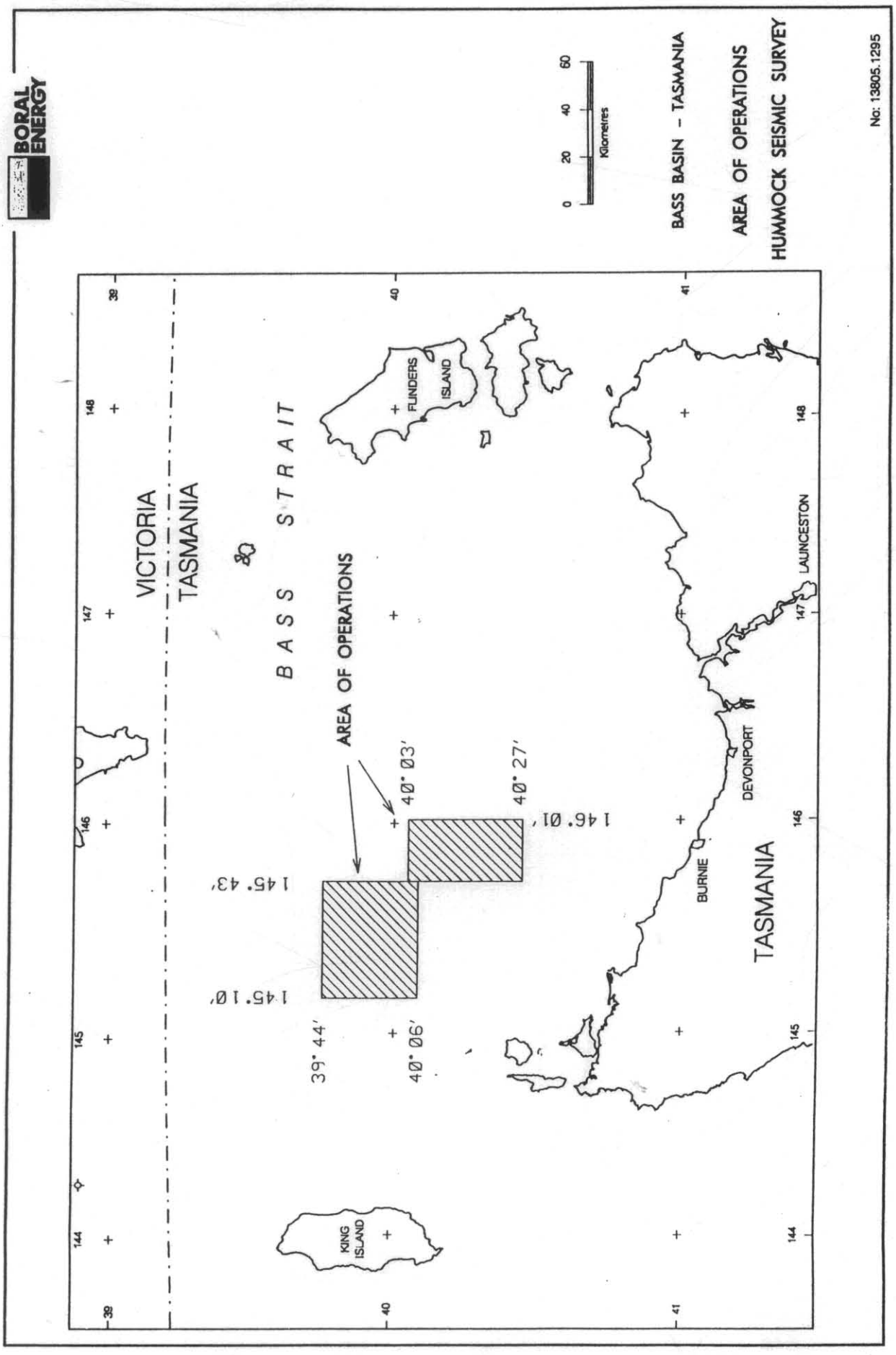
The survey started on the 16th of January 1996, when the vessel departed Devonport for the survey area, and was completed on the 4th of February 1996 when the vessel returned to Devonport. For compatibility with the contractor's standard procedures, the times used in this report are UTC, or local time minus 11 hours. Hence all daily reports were made from 11 am to 11 am local time.

Boral Energy Resources had selected PGS Exploration A.S. as the data acquisition contractor using the survey vessel Odin Explorer. The vessel is registered in Norway and operated with an Australian marine crew for the duration of this survey. Two representatives of the ship owners were also on board during the survey. The seismic crew was predominantly Norwegian with some Canadian and British nationals also.

The recording configuration selected for the survey was that of a 252 trace, 3840 metre streamer cable and a 2660 cubic inch capacity array of Sleeve guns. Both source and streamer were towed at a depth of 6 metres. The shot interval was set at 22.86 metres to yield 84 fold coverage. Fugro Survey supplied the Seafix system to the seismic contractor to provide continuous real time positioning. Fugro maintained all of the shore bases functions required and PGS navigation personnel operated the on board systems.

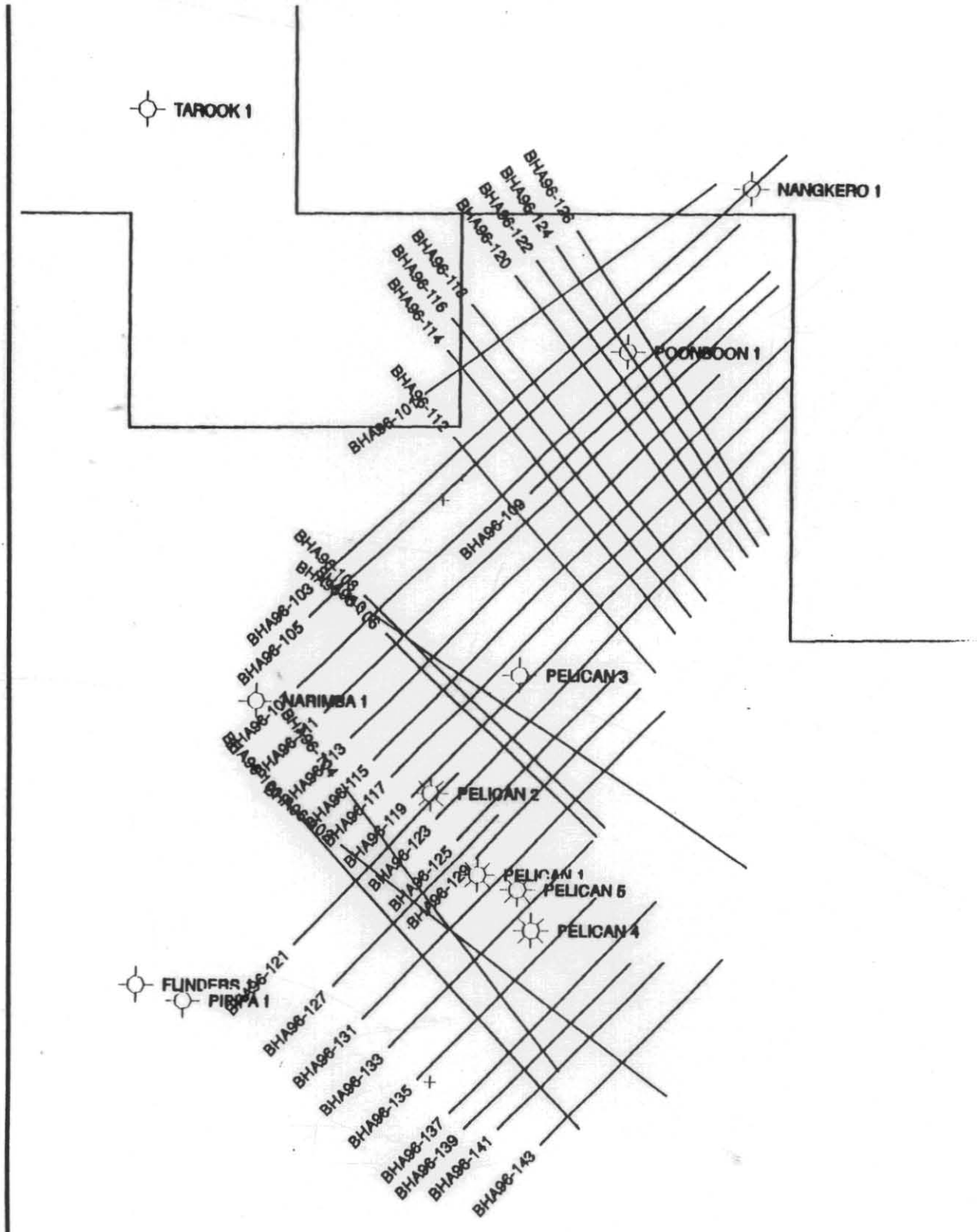
The recorded data was forwarded in two shipments, on the 24th of January and on the 5th of February, to the Western Geophysical processing facility in Melbourne where the data was to be processed.

Austral Geophysical Consultants Pty. Ltd. were selected by Boral Energy Resources, to supervise both the quality of the data acquired and the acquisition operations, as well as provide interim and final operations reports. Frank Renton from Austral Geophysical Consultants was present on board the vessel for the duration of the survey.


BORAL ENERGY
HUMMOCK SEISMIC SURVEY
AREA OF OPERATIONS
BASS BASIN - TASMANIA
No: 13805.1295
0 20 40 60
Kilometres
VICTORIA
TASMANIA
BASS STRAIT
AREA OF OPERATIONS
FLINDERS ISLAND
KING ISLAND
LAUNCESTON
DEVONPORT
BURNIE
TASMANIA
39° 44'
40° 06'
40° 03'
40° 27'
145° 43'
145° 10'
146° 01'
38
39
40
41
144
145
146
147
148

5 cm

Figure 1



T/25P

5 cm

Figure 2

DATA ACQUISITION PARAMETERS

Survey Type	Marine 2D Seismic
Number of Streamers	1
Number of Sources	1
Streamer Type	Continuous Tow, Digital
Streamer, Active Length	3840 metres
Number of Receiver Groups	252
Group Interval	15.24 metres
Group Length	15.09 metres
Group Sensitivity	27 volts/bar
Streamer Running Depth	6 metres
Number of Compasses on Streamer	16
Number of Depth Controllers	16
Instrument Type	SYNTRAK 480
Sample Rate	2 milliseconds
Record Length	6 seconds
Hi-Cut Filter	250 Hz. 72 dB/octave
Lo-Cut Filter	OUT, 3 Hz. 6 dB/octave
Recording Media	½" Tape Cartridge
Recorded Data Format	SEG D 8015, 2.5 Byte
Source Type	Tuned Sleeve Gun Array
Array Volume	2660 cubic inches
Array Depth	6 metres
Source Operating Pressure	2000 psi
Shotpoint Interval	22.86 metres
Nominal Fold	84
Offset	107 metres
Navigation System	Fugro Seafix DGPS

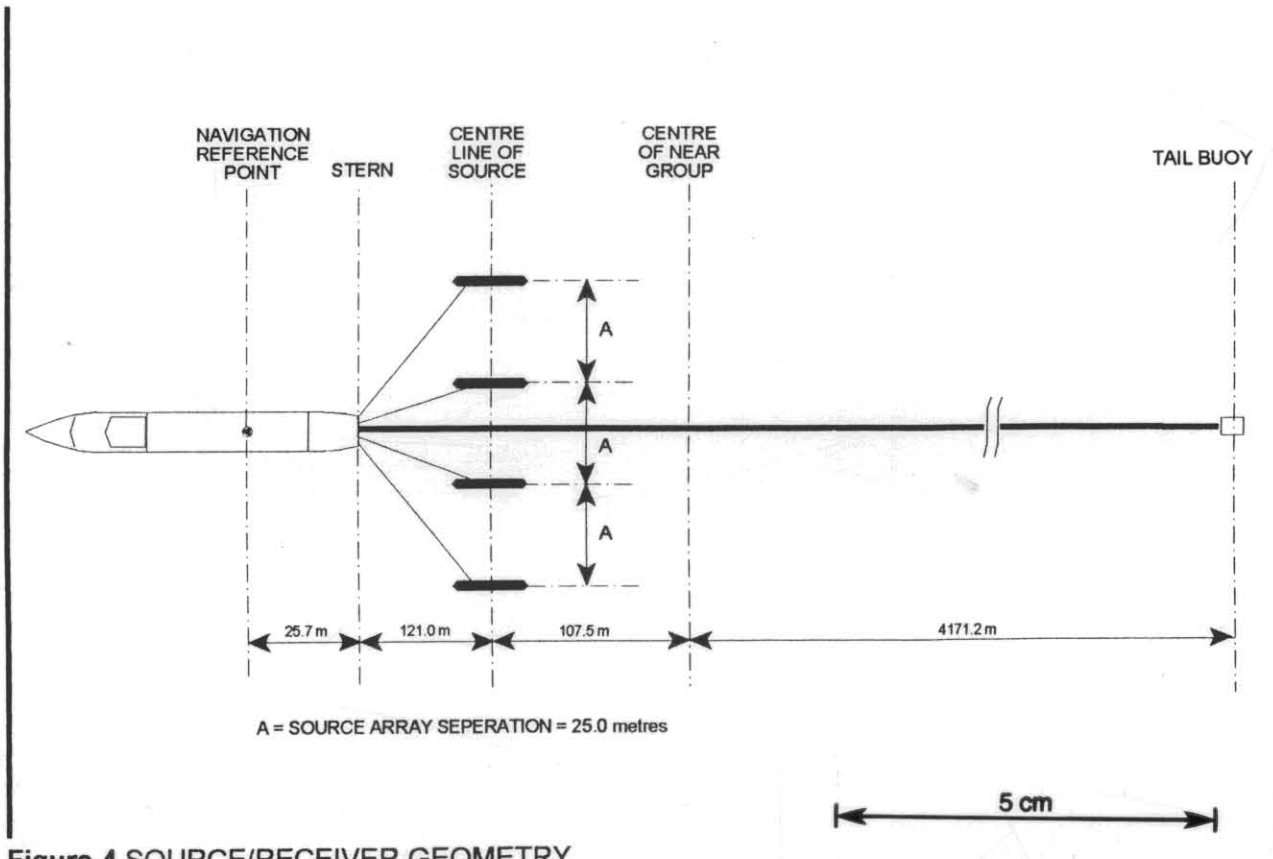
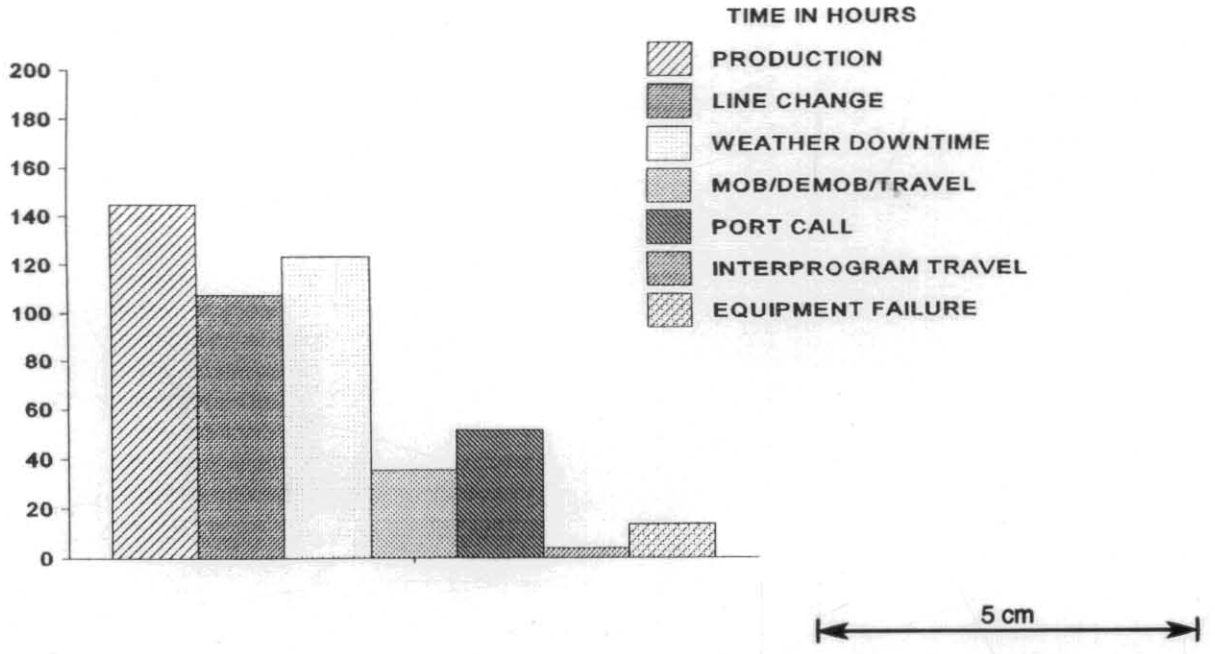


Figure 4 SOURCE/RECEIVER GEOMETRY

SURVEY STATISTICS

ACTIVITY DESCRIPTION	HOURS	SURVEY %
RECORDING LINE	144.684	30.14%
LINE CHANGE	107.450	22.39%
TRAVEL	16.117	3.36%
WEATHER DOWNTIME	123.582	25.75%
PORT CALL FOR RESUPPLY/CREW CHANGE/DATA DROP	51.400	10.71%
STREAMER DEPLOYMENT, NON CHARGEABLE	16.500	3.44%
SOURCE RECOVERY, NON CHARGEABLE	0.700	0.15%
STREAMER RECOVERY, NON CHARGEABLE	2.017	0.42%
DOWNTIME, PRIMARY NAVIGATION SYSTEM FAILURE	5.883	1.23%
INTER PROGRAM TRAVEL	3.950	0.82%
DOWNTIME, COMPRESSOR FAILURE	0.784	0.16%
DOWNTIME, NAVIGATION COMPUTER SYSTEM FAILURE	2.983	0.62%
DOWNTIME, VESSEL EQUIPMENT FAILURE	3.950	0.82%
TOTAL	480.000	

TOTAL KM RECORDED	= 1278.3081
TOTAL PROCESSABLE KM	= 1257.0254
TOTAL CHARGEABLE KM	= 1234.6913
TOTAL SURFACE KM	= 1257.0254
AVERAGE PROCESSABLE KM/DAY	= 62.8513
TOTAL CHARGEABLE HRS	= 127.532
TOTAL WEATHER HOURS	= 123.582
TOTAL RECORDED BHA KM	= 694.0069
TOTAL PROCESSABLE BHA KM	= 677.7077
TOTAL CHARGEABLE BHA KM	= 665.8206
TOTAL COMPLETED BHA LINES	= 36
TOTAL RECORDED BHB KM	= 584.3012
TOTAL PROCESSABLE BHB KM	= 579.3177
TOTAL CHARGEABLE BHB KM	= 568.8707
TOTAL COMPLETED BHB LINES	= 28



2 DAILY DIARY

16 January 1996
00:00 TRAVEL
Vessel en route from New Zealand to Devonport, Tasmania.
04:00 PORT CALL FOR RESUPPLY/CREW CHANGE/DATA DROP
Vessel alongside in Devonport to change marine crews and mobilise for the BORAL 1996 HUMMOCK survey.
10:12 TRAVEL
Vessel departs from Devonport for streamer laying point.
11:30 STREAMER DEPLOYMENT, NON CHARGEABLE
Start to deploy the streamer. Weather conditions ideal with little or no sea, light winds and good visibility.

17 January 1996
00:00 STREAMER DEPLOYMENT, NON CHARGEABLE
Adjusting the balance on the streamer and investigating noisy sections.
02:00 Muster held for all available members of the crew. Fairly confused to say the least, but not atypical for a first drill with new marine crew.
04:00 DEPLOYING SOURCE AND RUNNING TO LINE
05:07 RECORDING LINE BHA96-100
07:37 LINE CHANGE
09:30 RECORDING LINE BHA96-102
12:05 LINE CHANGE
13:49 RECORDING LINE BHA96-104
15:54 LINE CHANGE
19:00 RECORDING LINE BHA96-121
19:24 CIRCLE AFTER NAVIGATION SYSTEM FAILURE
21:59 RECORDING LINE BHA96-121
23:25 LINE CHANGE

18 January 1996
00:00 LINE CHANGE
00:47 RECORDING LINE BHA96-127
02:17 LINE CHANGE
03:45 RECORDING LINE BHA96-131
06:19 LINE CHANGE
08:07 RECORDING LINE BHA96-133
09:53 LINE CHANGE
11:23 RECORDING LINE BHA96-135
12:56 LINE CHANGE
14:35 RECORDING LINE BHA96-137
16:22 LINE CHANGE
17:56 RECORDING LINE BHA96-139
19:24 LINE CHANGE
20:58 RECORDING LINE BHA96-141
22:25 LINE CHANGE

19 January 1996
00:00 LINE CHANGE
00:05 RECORDING LINE BHA96-143
01:42 LINE CHANGE
03:26 RECORDING LINE BHA96-110
Shotpoint numbers in error throughout the line as result of finger problem with line input.
06:07 LINE CHANGE
07:36 RECORDING LINE BHA96-108
09:39 LINE CHANGE
11:27 RECORDING LINE BHA96-106
13:16 LINE CHANGE
14:41 RECORDING LINE BHA96-109

16:37 LINE CHANGE
18:09 RECORDING LINE BHA96-105
21:25 LINE CHANGE
23:17 RECORDING LINE BHA96-103

20 January 1996
00:00 RECORDING LINE BHA96-103
01:18 CIRCLE TO RESUME LINE
Line terminated after poor differential signal quality resulted in a loss of unacceptable number os shot records.
03:55 RECORDING OVERLAP TO LINE BHA96-103
04:09 RECORDING LINE BHA96-903
05:40 LINE CHANGE
07:24 WEATHER DOWNTIME
Unable to start line 101, streamer will not run level in sea and swell conditions, and is being picked up and drawn to the surface.
08:45 Weather continues to deteriorate, recovering all gun strings to avoid unnecessary damage. Weather conditions are now worsening with swells building to 4-5 metres.
14:15 Attempts to run side seas still resulting in the streamer being brought up to the surface. Turning into the seas again.
17:20 Noise and swell bursts on line heading 140° improved, start to move back to survey lines.
19:40 Weather continues to improve, starting to redeploy the gun strings in preparation to resume the survey.
21:32 RECORDING LINE BHA96-101
Streamer lowered to 8 metres in an attempt to reduce the noise levels from sea and swell conditions.
22:21 CIRCLE AFTER STREAMER ROSE TO SURFACE
Line terminated and circling to resume line. Streamer caught in strong swell and lifted to the surface. Unable to maintain depths despite all attempts.

21 January 1996
00:00 CIRCLING TO RESUME LINE, WEATHER DOWNTIME
01:02 RECORDING OVERLAP TO LINE BHA96-101
01:15 RECORDING LINE BHA96-901
02:31 LINE CHANGE
04:04 RECORDING LINE BHA96-107
07:20 LINE CHANGE
09:28 RECORDING LINE BHA96-111
13:05 LINE CHANGE
14:27 RECORDING LINE BHA96-113
Streamer raised to 7 metres as the sea conditions slowly improve.
17:25 LINE CHANGE
18:48 RECORDING LINE BHA96-115
22:02 LINE CHANGE
23:24 RECORDING LINE BHA96-117

22 January 1996
00:00 RECORDING LINE BHA96-117
02:36 LINE CHANGE
04:08 RECORDING LINE BHA96-117
04:37 TERMINATED STREAMER ON SURFACE, RUN TO LINE 114
Line 119 was terminated after the streamer rose to the surface for a time. Strong following sea and low speed through the water both contributing to the problem.
06:45 RECORDING LINE BHA96-114
Differential stations reduced to Melbourne only.
08:51 LINE CHANGE
09:58 RECORDING LINE BHA96-112
11:50 LINE CHANGE
13:03 RECORDING LINE BHA96-116
15:18 LINE CHANGE

16:48 RECORDING LINE BHA96-118
19:01 LINE CHANGE
20:24 RECORDING LINE BHA96-120
22:34 LINE CHANGE

23 January 1996
00:00 LINE CHANGE
00:21 RECORDING LINE BHA96-122
02:30 LINE CHANGE
03:58 RECORDING LINE BHA96-124
Suddenly started to receive differentials from Adelaide and Bathurst.
06:07 LINE CHANGE
07:40 RECORDING LINE BHA96-126
09:48 RECOVER ALL TRAILING EQUIPMENT FOR PORT CALL
12:25 TRAVEL TO DEVONPORT FOR PORT CALL
19:30 PORT CALL FOR RESUPPLY/CREW CHANGE/DATA DROP

24 January 1996
00:00 PORT CALL FOR RESUPPLY/CREW CHANGE/DATA DROP
07:10 DEPART DEVONPORT FOR SURVEY AREA AGAIN
10:00 STANDBY FOR WEATHER BEFORE REDEPLOYING STREAMER
Weather forecast is for force 8-9 winds with 4-5 metre swell. Standing by for a few hours for improved forecast.
19:26 REDEPLOYING STREAMER
Weather conditions and forecast improved, start to deploy streamer and repair the faults evident during the first days of production.
22:45 Streamer deployment delayed for repairs to the hydraulic system driving the reel. Failure in the cooling system being rectified.

25 January 1996
00:00 REDEPLOYING STREAMER
03:26 STANDING BY, WAITING FOR SEA CONDITIONS TO IMPROVE
14:16 DOWNTIME, PRIMARY NAVIGATION SYSTEM FAILURE
Running to line BHA96-135 to reshoot because of navigation failures on the original line.
15:43 RECORDING LINE BHA96-935
17:18 LINE CHANGE
20:18 RECORDING LINE BHA96-129
21:46 LINE CHANGE
23:31 AWAITING REPAIRS TO FOURTH COMPRESSOR

26 January 1996
00:00 DELAYS IN LINE CHANGE FOR COMPRESSOR WORK
00:18 RECORDING LINE BHA96-125
01:50 LINE CHANGE
03:33 RECOVERED AIRGUNS WAITING ON WEATHER
Weather conditions now worsened again and safety of equipment and personnel on the back deck when retreiving and deploying source, is jepordised.
19:16 REDEPLOYED AIRGUNS AND RUNNING TO LINE
Weather and forecast improved, starting to deploy the airguns again in preparations for resuming the survey.
20:25 All gunstrings redeployed.
21:55 RECORDING LINE BHA96-119

27 January 1996
00:00 RECORDING LINE BHA96-119
Lost a number of shots on this line due to inmarsat fax interfering with GPS incoming signals.
00:38 LINE CHANGE
02:01 RECORDING LINE BHA96-123
05:00 LINE CHANGE

06:45 INTER PROGRAM TRAVEL
10:42 RECORDING LINE BHB96-102
13:30 LINE CHANGE
14:54 RECORDING LINE BHB96-100
Streamer raised to 6 metres again in improving sea conditions.
17:46 LINE CHANGE
19:49 RECORDING LINE BHB96-119
21:16 LINE CHANGE
22:35 RECORDING LINE BHB96-117
23:56 LINE CHANGE

28 January 1996
00:00 LINE CHANGE
01:00 Line change extended for repairs to source arrays.
02:48 RECORDING LINE BHB96-115
04:19 LINE CHANGE
06:32 RECORDING LINE BHB96-113
08:12 LINE CHANGE
09:39 RECORDING LINE BHB96-111
11:20 LINE CHANGE
12:58 RECORDING LINE BHB96-104
14:27 LINE CHANGE
15:49 RECORDING LINE BHB96-106
17:19 LINE CHANGE
18:41 RECORDING LINE BHB96-108
20:12 LINE CHANGE
21:40 RECORDING LINE BHB96-110
23:13 LINE CHANGE

29 January 1996
00:00 LINE CHANGE
00:40 RECORDING LINE BHB96-112
02:09 LINE CHANGE
03:58 RECORDING LINE BHB96-114
05:46 LINE CHANGE
07:22 RECORDING LINE BHB96-116
09:17 LINE CHANGE, extended for source maintenance.
11:24 RECORDING LINE BHB96-118
14:31 LINE CHANGE
16:09 RECORDING LINE BHB96-120
18:35 LINE CHANGE
20:34 RECORDING LINE BHB96-122
22:03 LINE CHANGE
23:22 RECORDING LINE BHB96-124

30 January 1996
00:00 RECORDING LINE BHB96-124
00:46 LINE CHANGE
02:17 RECORDING LINE BHB96-105
06:39 LINE CHANGE
Line change extended to allow support buoy to be attached to the head of the streamer.
09:05 RECORDING LINE BHB96-101
No QC log entered for this line until promax stack produced.
13:29 DOWNTIME, VESSEL EQUIPMENT FAILURE
Line terminated after failure of engine cooling system results in loss of speed and streamer depth control. Weather remains poor and data quality poor as result.
14:45 All airguns recovered and on deck.
17:14 WEATHER DOWNTIME
18:13 Start to redeploy airguns.
20:10 Airguns redeployed, ship speed still limited by cooling problem in the engine room.

21:20 RECORDING LINE BHB96-129.
Ship speed reduced as a result of problems with the main engine cooling system.
23:15 LINE CHANGE

31 January 1996
00:00 LINE CHANGE
01:01 RECORDING LINE BHB96-127
02:56 LINE CHANGE
04:37 RECORDING LINE BHB96-123
06:33 LINE CHANGE
08:09 RECORDING LINE BHB96-121
09:35 WEATHER DOWNTIME. Line terminated after streamer depth control lost. Will recover the source arrays and standby for weather. Forecast is such that a number of hours of standby can be expected. Wind from west at 25-30 knots, sea/swell 3-4 metres and rising.
11:01 All gun strings are recovered and on board.
13:00 Wind at 35-45 knots from north west with very rough seas, 4-5 metre swell still building.
17:00 Wind at 30 to 40 knots from the west, very rough seas with 5-6 metre swell consolidating.
21:00 Wind at 30 to 40 knots with rough seas and 5-6 metre swell. Swell now consolidated.

1 February 1996
00:00 WEATHER DOWNTIME
01:00 Wind at 30 to 40 knots with very rough seas and 5-6 metre swell.
05:00 Wind at 35 to 40 knots from the west still, seas very rough with 5-6 metre swell.
09:00 Winds at 25 to 30 knots from the west southwest, with rough seas on a 5-6 metre swell.
13:00 Winds from the west at 35 to 40 knots with very rough seas on a 5-6 metre swell.
17:00 Westerly wind at 35 to 40 knots, sea conditions rough to very rough, on 5 metres swell.
21:00 Wind from the west at 30 knots, rough sea on a 5 metre swell.

2 February 1996
00:00 WEATHER DOWNTIME
01:00 Winds from the west 30-40 knots. Seas rough with 4-5 metre swell. Barometer rising still.
05:00 West south west winds at 30 to 35 knots. Seas continue rough with swell decreasing.
09:00 West south west winds at 20 knots, rough seas on a 3-4 metre swell.
13:00 Westerly winds at 30 knots, seas continue rough on 3 to 4 metre swell.
17:00 Westerly winds at 30 knots, seas rough, decreasing 3 to 4 metre swell.
21:00 South westerly winds at 18 to 20 knots. Seas moderating, swell diminished to 2-3 metres.
21:18 All gun arrays redeployed and turning to go on line.
22:35 RECORDING OVERLAP ON LINE BHB96-101
22:47 RECORDING LINE BHB96-901
23:54 LINE CHANGE

3 February 1996
00:00 LINE CHANGE
01:24 RECORDING LINE BHB96-103
05:45 LINE CHANGE
07:18 RECORDING LINE BHB96-107
11:50 LINE CHANGE
14:15 RECORDING OVERLAP ON LINE BHB96-121. Line originally terminated for weather.
14:27 RECORDING LINE BHB96-921
15:09 LINE CHANGE
16:20 RECORDING LINE BHB96-125
18:01 LINE CHANGE
19:50 RECORDING LINE BHB96-109
21:28 SURVEY COMPLETE, RECOVERING SOURCE
22:10 STREAMER RECOVERY

4 February 1996
00:00 STREAMER RECOVERY
00:11 TRAVEL
11:00 PORT CALL FOR RESUPPLY/CREW CHANGE/DATA DROP

completed. As additional information, and on the premise that a picture is worth a thousand words, the weather pictures for that period are included as pages 129-132 in APPENDIX B of this report.

STREAMER & INSTRUMENTS

For the majority of the survey there were a number of faulty traces in the streamer. Trace 109 was distorted and weak and should be edited for the entire data set. Trace 136 was noisy but should provide some data to the stack. Trace 167 consistently failed the leakage test but showed no signs of any weakness or phase shift in the field records. Traces 18 to 24 showed consistently higher noise levels than adjacent traces despite adjustments to the quantity of oil in the section. There was also noticeable levels of reflected ships noise near the head of the streamer, especially at the start of the BHA block of the survey. In every instance all problems relating to streamer trace problems were noted on the line logs.

The cable was streamed at depths between 6 and 9 metres. The primary factor influencing the depth setting was the effect of the swell on the streamer depths rather than the ambient noise levels. In all instances wherever the streamer was set, the tolerance was maintained to ± 1 metre. This contractor provides a very well balanced streamer.

The instruments had no major problems with the majority of lost records being caused by the navigation to instrument interface. There was however one transport which had a continuing problem. This resulted in one bad record being recorded at the start of the tape before it was dumped offline. In all instances, and especially with the QC process using the Promax system, the bad/missed/incorrectly identified records were noted on the observer's logs.

NAVIGATION

A DGPS calibration check was conducted prior to the vessel departing Devonport at the start of the survey on the 16th of January. The contractor's standard procedure for such a check is to mount a DGPS antenna over an established survey marker on the dock, apply conversion factors to the navigation system if necessary, and collect and display the result of one to two hours of observations.

This procedure was followed using a point identified as Marker 102 on the dock in Devonport. The grid coordinates supplied for the point were referenced to the AGD66 and this position was then transformed to WGS84 then back to AGD84 as follows.

Initial Grid Coordinates	102446480.53 E	54401825.28 N
converted to AGD66	41°11'16.002"S	146°21'42.560"E
converted to WGS84	41°11'10.602"S	146°21'47.406"E
converted to AGD84	41°11'15.995"S	146°21'42.480"E
Observed Antenna Position (AGD84)	41°11'15.975"S	146°21'42.520"E
Computed - Observed	1.12 metres at 236°	

On the 18th of January the GPS input from the Trimble 4000 receiver to the navigation system was removed. It was believed to be the cause of an intermittent system fault, which had been occurring with undesirable regularity. Although only responsible for around 6 lost records per occurrence the fault had an detrimental effect on the survey quality. The removal of this input appeared to permanently correct the fault. A measure of QC was still available with the raw GPS position still being input to the QC system for comparison purposes. The DGPS calibration procedures were repeated during the mid-survey port call in Devonport on the 24th of January, the results were as follows.

Initial Grid Coordinates	446480.53 E	54401825.28 N
converted to AGD66	41°11'16.002"S	146°21'42.560"E
converted to WGS84	41°11'10.602"S	146°21'47.406"E
converted to AGD84	41°11'15.995"S	146°21'42.480"E
Observed Antenna Position (AGD84)	41°11'15.982"S	146°21'42.530"E
Computed - Observed	1.04 metres at 247°	

On line BHA96-129 on the 25th of January, the navigation system suffered an undefined fault and caused the vessel position to diverge from the true position. Prompt action in notifying the helmsman not to adjust course to compensate and resetting the system resulted in only 4 records being missed. The cause of this was determined to be inmarsat transmissions hitting the GPS antenna and blocking reception of satellite data. In this case it was an incoming fax. Unfortunately the Pacific Ocean satellite is the only one available in this area and on the heading of line BHA96-129 the inmarsat antenna was pointing directly through the GPS antenna which has no ground plane. For the remainder of the survey every attempt was made to restrict and minimise the use of the Saturn inmarsat system while the vessel was on headings around 045°.

HEALTH, SAFETY AND ENVIRONMENTAL

The most difficult area for the survey ship's personnel was taking on board the contractual requirement for no smoking in enclosed areas. Neither the contractor, PGS, or the subcontracting company, Tidewater Port Jackson Marine, providing the marine crew personnel, had any statements in their OHSE documents relevant to this issue. As such lip service was paid to this requirement, and on many occasions there was evidence (in the form of the smell of tobacco smoke) suggesting that it was blatantly being ignored by some members of the crew. It was even more unfortunate that any smoking in enclosed areas was being done in cabins.

There was on instance when this author witnessed alcohol being consumed on board the vessel just after the port call on the 24th of January. Upon reporting this to the PGS party chief and the captain of the vessel, the captain arranged for the person responsible to be replaced at the next crew change.

There was no evidence of any pertinent education ever being provided by PGS to its own personnel, or any evidence of the subcontractor ever being notified of the no smoking requirements in advance. It is virtually impossible to "police" such a condition without a current and continuing parallel policy being in place with the contractor. This is the only way to have on board line management take some responsibility to ensure the policy is carried out.

Only one safety meeting took place during the course of the survey, despite ample opportunity in extended periods of weather downtime. The minutes of the meeting are reproduced in Section 5 of this report and show what appears to be an inordinately high number of pending items. The fact that a drydocking for the vessel was imminent, appeared to be convenient bucket into which a large number of items were dumped. It would be interesting to attend the first safety meeting held after the vessel returns to work following the drydocking, to see how may of the pending items are actually dealt with.

There was only one incident reported during the course of the survey. This took place on the 21st of January, when the IR working in the engine room used a grinding machine without using the hot work permitting system. The smoke from the work performed triggered the fire detection system and this in turn triggered the general alarm. The follow up incident investigation and for that matter, the history of incident reporting and investigation on board, showed very little interest in identifying the real cause and improving management systems to ensure no repeats. It was almost self evident that the root cause of this incident was the fact that the oncoming marine crew on the 16th of January had not been given a complete and thorough introduction to the PGS hot work procedures.

There were a number of other minor indicators of what seemed to be a somewhat relaxed approach to safety matters. Visitors allowed to walk through many hazardous areas of the vessel without safety footwear, the MOB raft on the stern did not meet contractual requirements, personnel jumping from vessel to dock without using the gangway, very rusty 44 gallon drums stored on deck with no clear indication of contents, poor radio procedures for small boat operations all served to take some gloss from what appeared on paper to be a very professional safety management system.

4 PERSONNEL

CREW LIST

From 16/1/96 to 24/1/96

POSITION	NAME	NATIONALITY
Marine Crew		
Captain	Ruben Nordblom	Australian
Chief Officer	James Young	Australian
Second Officer	Ian McClarron	Australian
I.R.	Brendan McKean	Australian
I.R.	Michael Shaw	Australian
I.R.	Steve Gentles	Australian
I.R.	Vincent B. McVeigh	Australian
Chief Engineer	Charles Robertson	Australian
Second Engineer	Pete J. Lambourne	New Zealand
Trainee Engineer	David Shearer	Australian
Chief Cook	Christopher Daly	Australian
Cook	William Worrad	Australian
Chief Steward	Frank James Fordyce	British
Owner's Representative	Bjarne Klokk	Norwegian
Electrician	Per Helge Sandtorv	Norwegian
Seismic Crew		
Party Chief	Jan Einar Ask	Norwegian
Chief Observer	André Tørring	Norwegian
Senior Observer	Endre Fidje	Norwegian
Observer	Harald Hauge	Norwegian
Observer	Ole K. Fostad	Norwegian
Chief Navigator	Håkon Øvergård	Norwegian
Navigator	Antony Warner	British
Chief Mechanic	Daniel F. MacDow	Canadian
Senior Mechanic	Odd Sigve Våge	Norwegian
Mechanic	Odd G.T. Østerholt	Norwegian
Mechanic	Ole J. Hollund	Norwegian
Processor	Kenneth Hall	British
Client Representative	Frank Renton	Australian
FRC Instructor	Tony Boyce	Australian

From 24/1/96 to 4/2/96

Marine Crew

Captain	Ruben Nordblom	Australian
Chief Officer	James Young	Australian
Second Officer	Ian McClarron	Australian
I.R.	Brendan McKean	Australian
I.R.	Michael Shaw	Australian
I.R.	Steve Gentles	Australian
I.R.	Vincent B. McVeigh	Australian
Chief Engineer	Charles Robertson	Australian
Second Engineer	Pete J. Lambourne	New Zealand
Third Engineer	David Shearer	Australian
Chief Cook	Christopher Daly	Australian
Cook	William Worrad	Australian
Chief Steward	Frank James Fordyce	British
Owner's Representative	Egil Arne Lund	Norwegian
Owner's Representative	Nils Leknessund	Norwegian

Seismic Crew

Party Chief	Gunnar Brastein	Norwegian
Chief Observer	Runar Wiersdalen	Norwegian
Senior Observer	Richard Power	British
Observer	Tore Bull	Norwegian
Observer	Harald Hauge	Norwegian
Chief Navigator	Fred Gosse	Canadian
Senior Navigator	Allen G. Hatchard	Canadian
Chief Mechanic	Bjorn Thonhaugen	Norwegian
Senior Mechanic	Per Bjarne Vadseth	Norwegian
Gun Mechanic	Finn Wichstrom	Norwegian
Gun Mechanic	Alf Johannessen	Norwegian
Processor	Ken Hall	British
Client's Representative	Frank Renton	Australian

5 VESSEL AND SAFETY

VESSEL SPECIFICATIONS

Name	M/V Odin Explorer
Owner	Shipman a.s. Austevoll, Norway
Registry	Norwegian
Home Port	Bergen, Norway
Class	Germanischer Lloyd +100 A 4EF Research Vessel +MC CS +NCCS
Built	1967, Rickmers, Bremerhaven, Germany
Converted	1981, Kiel, Germany
Refitted	1990, Skagen, Denmark
Call Sign	LAGQ4
Gross Tonnage	1544 (1901 - 1969 convention)
Net Tonnage	464 (1140 - 1969 convention)
Length	74.30 metres
Beam	10.83 metres
Draft	5.80 metre
Main Engines	2 x Deutz 1320 bhp
Propellers	Single Variable Pitch Escher-Wyss
Generators	2 x Shaft 480 Kw, 380/220 volt, 50 Hertz 1 Auxiliary, 400 Kw, 380/220V 50 Hertz
Bow Thruster	Brunvold - 350 Kw (475 hp)
Radars	Atlas 6500 ARPA, 10 cm Kelvin Hughes Nucleus 6000A ARPA, 3 cm
GPS	Magnavox MX200
Gyrocompass	Anschultz 110-301/1
Autopilot	Anschultz
Fathometer	Knejio Denki KC 110 Colour, 30 Khz
Weatherfax	Furuno Navtex NX500/Fax Receiver 210
Weather Station	AANDENRAA 3400 Wind Monitoring System
Water Maker	Atlas AFGU3 (10 m^3/day)
Cranes	MTT SWL 2T 12 MTR
Incinerator	Atlas ASNI-402A
Fuel Capacity	500 m^3
Potable Water	100 m^3
Endurance	40 days surveying 55 days cruising
Accommodation	11 single and 11 double cabins
Total Marine Crew	11
Total Seismic Crew	13

Communications		
Inmarsat System	JRC-JUE-45A Mark-I	SATURN 3S90
Telephone Number	1312261	1315731
Facsimile Number	1312262	1315732
MF radios	Skanti TRP 7000, Sait 5000i	
Watchkeeper	Skanti WR, 2182 Khz	
VHF Radios	3 x Sailor RT2048 C-908, simplex 1 x Sailor RT146C-403, duplex 1 x Furuno FM55, portable 2 x ICOM IC M5, portable + 2 x ICOM IC M15	
UHF Radios	3 x Motorola MX1000 2 x Motorola GP300	

VESSEL SAFETY

Lifeboat	1 x Harding 22' MCM 35 persons
Life Rafts	3 x Viking 25 person
	1 x Viking 20 person
Rescue Boat	Alusafe MOB 700, 130 BHP,
	equipped with VHF and Radar Transponder
Emergency Radios	Radio Holland TR4750 Life Boat Radio
	Jotron TRON 30 S Mk II EPIRB
	Radar Transponder TRON sart 9 GHz
Life Boat Radios	Radio Holland 4750 lifeboat Radio
	Radar Transponder McMurdo sart 9 GHz
Fire Pump	80 m^3/min
Emergency Fire Pump	80 m^3/min
Fire Extinguishers (portable)	18 Hand Held Powder
	2 x 75 Kg Trolley
	1 x 50 Kg Trolley
	14 Hand Held CO_2
	1 Graphite (for Lithium batteries)
Fire Extinguishers (fixed)	
Halon	Instrument Room, Compressor Room, Engine Room, Paint Store, Incinerator Room.
Foam Deluge	Streamer Reel Deck
	Portable foam hose available also
Fire Suits	2 x Drager PA 80/1800-1
Smoke Hoods	30 x Drager Parat Mask c (traveller)
Line Thrower	4 x Paines-Wessex Speedline
Survival Suits	27 x FCO OBAN MK 90
	19 x Helly Hansen E 305-7
Life vests	38 x T-Vesten, Mod 87
	19 x Seamaster
Life rings	2 with light/smoke
	4 with light
	2 with line only
Work Vests	25 x Crewsaver Seafire
Gas Monitor	Exotox 40 - portable
Resuscitator	1 located in hospital
Medicines	Certified to ships medicine No 5
First Aid Boxes	Galley, Engine Room, Bridge
Personal Protective E uipment	Safety Shoes, Glasses, Ear Defenders, Hard Hats all supplied

On Board Safety Training	
Fire Drill	Every Two Weeks
Lifeboat Drill	Every Two Weeks
MOB Drill	Two times per 5 week swing
Equipment Testing	In Accordance with Drills
Testing of Radios	In Accordance with Drills
Safety Meetings	Twice Each Shift
First Aid Instruction	In Accordance with Drills

MUSTERS AND SAFETY MEETINGS

MUSTER DRILL 02:00 hours (13:00 Local) 17th January, 1996

A muster drill was held on what was basically the first day at sea for the new Australian marine crew. Not unexpectedly this was somewhat of a shambles due to the marine crew's lack of familiarity with procedures particular to the vessel.
Fire parties were defined and other crew members' duties defined. It is still unfortunate that life preservers are all being kept in deck containers that are not float free yet. There will obviously be a very steep learning curve before the entire crew is completely up to speed in safety drills and safety equipment handling.

The drill was ended at 13:15 hrs local time.

SAFETY MEETING NO: 01MOD96 22nd January, 1996

Agenda

1. Committee members present.
2. Minutes from last meeting.
3. Pending cases.
4. New cases / safety audit cases
5. Completed cases.
6. Alarms.
7. Drills.
8. Accident/Near misses reports /Internal Audits.
9. Statistics.

The meeting opened at : 12:35

1. COMMITTEE MEMBERS PRESENT.

Capt.	Ruben Nordblom	Chairman
1st.off.	J.Young	Safety Officer
Ch.Eng.	C. Robertson	Committee member
I.R.	B.McKean	Committee member
I.R.	S. Gentles	Committee member
Party Ch.	Jan Ask	Committee member
Gun Ch.	Daniel MacDow	Committee member
Nav Ch.	Håkon Øvergård	Committee member
Ch. Obs.	André Tørring	Committee member
Obs.	Endre Fidje	Committee member
Owners Rep.	B.Klokk	Committee member

Frank Renton also attended the meeting. Håkon Øvergård didn't attend this meeting, he was on duty in the instrument room.

2. MINUTES FROM LAST MEETING.
Status on cases from 21MOD95 was checked.

3. PENDING CASES.

04MOD95-09	Intercom problems remain
Responsible for action:	Shipman / Kaare Ask
Status:	On shipyard list.
05MOD95-02	Fix steering gear leakage
Responsible for action:	Ch. Eng.
Status:	On shipyard list.

06MOD95-03	New Foam/ Water cannon on the upper deck. Ref. Telephone conv. with Crew-1.
Responsible for action:	PGS/Andy C.
Status:	On shipyard list
06MOD95-05	New bunkers hose of sufficient length. point 04MOD95-10. Ordered by fax 6th of March 1995.
Responsible for action:	Shipman/ Kaare Ask.
Status:	No answer on this from shipman. Looks like it will not be ordered.
06MOD95-06	Duffle coats for fire squads. Ordered by fax 8 of March 1995
Responsible for action:	Shipman/ Kaare Ask
Status:	Confirmed on the way to the ship. Where are they now ??
14MOD95-03	Order water-tight box with small hand held flares for the MOB boat and also a VHF radio that will float if lost overboard. We had one earlier that was supposed to float but it sank when lost from the MOB. There has been no reply from the office about it.
Responsible for action:	PGS / Andy C.
Status:	Box for flares received A new VHF has been ordered.
15MOD95-01	Pallet lifter to be tested and marked with SWL, if found to be worn out, we have to order a new one.
Responsible for action:	Shipman/Kaare Ask/ Tidewater
Status:	One received in NZ. It was to big. Returned to supplier.
17MOD95-02	Zone 6 on the fire alarm system doesn't work properly. The alarm goes off if port guns are picked up or deployed.
Responsible for action:	Electrician.
Status:	Shipyard
17MOD95-03	The intercom system in the compressor room is not satisfactory.
Responsible for action:	Electrician.
Status:	Shipyard
19MOD95-01	Need updated stability data on the ship.
Responsible for action:	Shipman
Status:	Shipman has been notified of this. No response from them so far !
19MOD95-03	Put handrails around the machinery in the aux. engine room.
Responsible for action:	Ch. Eng.
Status:	To be looked into.
19MOD95-04	Rust in original ship pipes. Put water filter in the galley water line.
Responsible for action:	Ch. Eng.
Status:	To be checked
20MOD95-01	Look into getting the diesel injection parts for high temp. burning of food scraps in the incinerator. Suggestion from Ch.Eng : Put in food mincer and "dump" it in the sewage tank.
Responsible for action:	Ch. Eng.
Status:	To be looked into
20MOD95-02	Test self righting on the FRC
Responsible for action:	Ch. Off.
Status:	Tested. A leak found in the system. Is it fixed ?
20MOD95-04	Unmarked containers on deck, mark container with the contents.
Responsible for action:	Ch. Off.
Status:	Being done

21MOD95-02 The door into the freezer storage in the galley needs to be fixed
Responsible for action: Ch.Eng
Status: To be done.

21MOD95-03 Dispersant for oil spills on deck to be ordered
Responsible for action: Ch.Off
Status: To be looked into.

ACTION ITEMS FORM INTERNAL SAFETY AUDIT

SAFETY TRAINING
G-2 Provide advanced first aid training for at least two crew members on each shift.
Responsible for action: PGS/Shipman AS
Status: Company contacted

FIREFIGHTING EQUIPMENT
K-1 Replace foam hydrant with a foam monitor clear of the spare streamer sections.
Responsible for action: Shipyard
Status: Shipyard

K-6 Replace total protection suits with Bristol type jackets and leggings.
Responsible for action: Chief Officer
Status: Confirmed on the way.

THE OPEN DECKS
N-5 Colour code and label all deck filling, sounding and vent pipes.
Responsible for action: Chief Officer
Status: Tape on order.

N-6 Display pictorial hazard warning signs on emergency battery box.
Responsible for action: Chief Officer
Status: On order

MACHINERY SPACES
R-2 Colour code pipe work in machinery spaces
Responsible for action: Chief Engineer
Status: Tape on order

R-3 Display pictorial hazard warning signs on battery boxes
Responsible for action: Chief Engineer
Status: On order

R-4 Store oily rags etc. in non-combustible bins with lids.
Responsible for action: Chief Engineer
Status: On order

MACHINERY SPACE STORES AND WORKSHOPS
S-2 Replace perspex guards on bench grinders
Responsible for action: Chief Engineer
Status: On order ?

S-3 Fit chuck guard to the drill press
Responsible for action: Chief Engineer
Status: On order ?

BURNING AND WELDING
U-1 Review storage of the oxygen and acetylene bottles
Responsible for action: Safety committee
Status Canvas cover will be fitted.

U-2 Consider hard piping the hoses from the cylinders to the back deck
Responsible for action: Shipyard
Status: Refit

POLLUTION CONTROL
V-1 Fit spill containment around fuel filling and vent pipes.
Responsible for action: Shipyard
Status: Refit

V-2 Consider ordering fuel spill containment kits
Responsible for action: Captain/Ch. Eng
Status: Ordered

MISCELLANEOUS - SIGNS & LABELS ETC.:
Z-2 Replace monkey fists with rubber weights.
Responsible for action: Chief Officer
Status: On order

4. NEW CASES.

01MOD96-01 Put lifejackets in Engine room.
Responsible for action: Ch.Off
Status: To be done.

01MOD96-02 Make sure that personnel who perform work classified as "Hot work" fill out the hot work permits.
Responsible for action: Ch.Off
Status: To be done.

01MOD96-03 Make sure that all signs around the ship has got English translation fitted next to them if they're originally written in Norwegian / another language.
Responsible for action: Ch.Off
Status: To be done

01MOD96-04 Lead based paint needs to be replaced / stored somewhere while in Australia. Safety harnesses must be moved from paint locker on main deck.
Responsible for action: Ch.Off / Owners Rep.
Status: To be done.

01MOD96-05 Grease points on davit for lifeboat are inaccessible d/t Hydraulic pipes layout.
Responsible for action: Ch.Off / Owners Rep.
Status: To be checked

01MOD96-06 Rudder for lifeboat will be hard to fit on in rough weather. Look into and find a better set-up.
Responsible for action: Ch.Off / Owners Rep.
Status: To be checked

5.COMPLETED CASES.
04MOD95-11 More training for FRC operators
Responsible for action: Shipman / Kaare Ask, Maritime crew
Responsible for action: Charles Jeffery, Seismic crew
Status: Done

04MOD95-12 Stern lights
Responsible for action: Electrician/Ch.Eng.
Status: Done

14MOD95-04	Two smokediver sets / fireman suits to be purchased, local if possible. Ref point K5. in internal safety audit list.
Responsible for action:	Party Ch. & PGS / Andy C.
Status:	Two smokediver sets received.
20MOD95-03	Float free fittings to be installed on lifejacket boxes.
Responsible for action:	Ch. Off.
Status:	Done.
21MOD95-01	MOB boat needs a full service/ overhaul
Responsible for action:	Ch.Eng
Status:	Done in NZ.

COMPLETED ACTION ITEMS FROM INTERNAL SAFETY AUDIT

SAFETY MANAGEMENT

B-1	Introduce an unsafe act auditing system
Responsible for action:	HSE Department
Status:	Done

SAFETY TRAINING

G-1	Provide FRC training for MOB boat crew
Responsible for action:	HSE Department
Status:	Done

FIREFIGHTING EQUIPMENT

K-5	Order 2 more fireman's outfits and SCBA sets to comply with HSE manual requirements.
Responsible for action:	Chief Officer
Status:	2 SCBA sets received

LIFESAVING APPLIANCES

M-1	Fit retroflective tape on port for'd main deck lifebuoy
Responsible for action:	Chief Officer
Status:	Done

6. ALARMS.

24.12.95 Fire alarm set off by smoke coming form the galley.
21.01.96 Fire alarm set off by welding in the engine room.

7. DRILLS.

23.12.95 Fire drill. Smoke diving equipment put on two people from the seismic department in order to involve this department more in the firefighting.

23.12.95 Lifeboat drill. Survival suits shown to the crew. Everyone was familiar with them.

02.01.96 Fire drill. There was a simulated fire in the engine room. One person missing. Two smokedivers were sent down to rescue the missing person. After the drill there was a meeting in the dayroom. A few points were raised during the meeting.

1. The boots for the smokedivers are a bit small. It was suggested to order new and bigger ones.
2. Ordering a new mask on a long air hose that can clip on to the BA sets was suggested.. This mask would enable the smoke diver to get through tight/narrow spaces if required
3. Get a paramedic kit in a small rucksack that's ready to go with the first aid team.
4. Set up lists of tasks to be done in various emergency cases.

08.01.96 MOB drill. A dummy was thrown overboard and picked up by the FRC.

17.01.96 Fire drill at sea. Crew mustered behind the wheelhouse.

8. ACCIDENTS / INCIDENTS/ NEAR MISSES REPORTS/INTERNAL AUDITS.

Cross dep. audit	02/01	MOB boat launch, Audit complete
Internal Audit	15/01	General conditions, Audit complete

9. STATISTICS.

	Since 21MOD95	Cumulative 1996	Total 1995
Alarms	2	1	9
Fire drills	3	2	23
Lifeboat drills	1	0	14
MOB drills	1	1	7
Accidents	0	0	1
Near misses	1	0	1
Safety meetings	2	1	24
Safety audits external/PGS	0	0	2
Cross departmental audits	2	2	7

Meeting adjourned at : 14:00

ODIN EXPLORER - SAFETY TRAINING SUMMARY

POSITION	NAME	TRAINING
Captain Ruben Nordblom	BOS, ROF, FA, HUET	
Chief Officer	James Young	HUET, FA, AFF, HLO
Second Officer	Ian McClarron	BOS, AFF, FA, FRC
I.R.	Brendan McKean	BOS, ROF, FA, HUET, HLO, FRC
I.R.	Michael Shaw	BOS, ROF, FA, FRC
I.R.	Steve Gentles	BOS, ROF, FA, FRC, R-S
I.R.	Vincent McVeigh	BOS, ROF, FA, FRC
Chief Engineer	Charles Robertson	BOS, AFF, CPR, FA, HUET, SAM
Second Engineer	Pete J. Lambourne	BOS, HUET (prior to 24/1)
Second Engineer	Colin Edgeworth	HUET (after 24/1)
Third Engineer	David Shearer	BOS
Chief Cook	Christopher Daly	BOS (1983)
Cook	William Worrad	BOS, HUET (1983)
Chief Steward	Frank J. Fordyce	BOS
Party Chief	Jan Einar Ask	BOS, ROF, HUET, FRC
Chief Observer	André Tørring	BOS, ROF, HUET, FRC
Senior Observer	Endre Fidje	BOS, ROF, FRC
Observer	Harald Hauge	BOS, HUET, FRC-3
Observer	Ole K. Fostad	BOS, ROF, HUET, FRC
Chief Navigator	Håkon Øvergård	BOS, ROF, FRC
Navigator	Antony Warner	BOS, FRC
Chief Mechanic	Daniel F. MacDow	BOS, ROF, FRC
Senior Mechanic	Odd Sigve Våge	BOS, ROF, FRC
Mechanic	Odd G.T. Østerholt	BOS, ROF, HUET
Mechanic	Ole J. Hollund	
Processor	Kenneth Hall	BOS, FA, HUET
Client Representative	Frank Renton	BOS, HUET
FRC Instructor	Tony Boyce	FRC, HUET, CPA, AFF, MPS, BOS
Owner's Representative	Bjarne Klokk	BOS, FA, HUET
Electrician	Per Helge Sandtorv	BOS, FA, AFF, ROF
Replacement crew members after 24/1/96		
Party Chief	Gunnar Brastein	BOS, ROF, HUET, FRC-2
Chief Observer	Runar Wiersdalen	BOS, ROF, FA, FRC-3
Senior Observer	Richard Power	BOS, ROF, HUET, FRC-3
Observer	Tore Bull	BOS, ROF, HUET, FRC-2
Chief Navigator	Fred Gosse	BOS, ROF, FA, HUET, FRC-2
Senior Navigator	Allan Hatchard	BOS, ROF, HUET, FRC-3
Chief Mechanic	Bjorn Thonhaugen	BOS, aff, FA, HUET, FRC-3
Senior Mechanic	Per Bjarne Vadseth	BOS, ROF, FA, HUET, FRC-3, R-S
Gun Mechanic	Finn Wichstrom	BOS, AFF, FA, HUET
Gun Mechanic	Alf Johannessen	BOS, AFF, FA, FRC-2
Owner's Representative	Egil Arne Lund	BOS, AFF, FA, HUET, FRC
Owner's Representative	Nils Leknessund	BOS, ROF, FA

Abbreviations Used

AFF	Advanced Fire Fighting	BOS	Basic Offshore Survival
CPR	Cardiopulmonary Resuscitation	EMT	Emergency Medical Training
FA	First Aid	HUET	Helicopter Underwater Escape Training
HLO	Helicopter Landing Officer	R-S	Cranedriver
MPS	Maritime Personal Safety	OEA	Offshore Emergency Abandonment
FRC-3	Fast Rescue Craft, coxswain	FRC	Fast Rescue Craft, crew
ROF	Reduced Offshore Fire		
SAM	Safety Awareness/Management	SOS	Emergency First Care at Sea

6 STREAMER

GENERAL SPECIFICATIONS

Active streamer length	3840 m nominal (Max 6000 m)
Stretch sections	1 @ 70 metres head, 1 @ 67 metres tail
Channels, total	252 (400)
Channel numbering	252 head, 1 tail (400 head, 1 tail)
Streamer Type	Digital
Manufacturer	Teledyne/Shell
Group length	15.09 metres
Group Interval	15.24 metres
Operating depth,nominal	6 metres +/- 1 m

Note: The vessel can on a reasonable notice be configured to a dual streamer operation 2 x 3000m.

ACTIVE SECTIONS

The digital streamer cable section used has a fixed group length of 15.09 metres. There are 2 types of 300 feet active sections with Syntron streamer modules at every 2nd section. There are 6 channels in each section with overlapping groups at both ends of each of the active section. The actual configuration for each section is three quarters of a group at the head of each section followed by five full groups and then a quarter of a group.

Hydrophone type	LRS-2510, Model WMI-018
Group per section	6
Hydrophones per group	24
Group sensitivity	27 V/B +/-5%
Active section length	91 metre (300ft)
Active section thickens	76 mm

ELECTRONIC MODULES

The electronic modules are capable of sampling 12 hydrophone channels at 1 msec sample rate with NO sample skew. Quality control diagnostics are controlled from the on board telemetry system. The modules also contain strain gauge type of depth transducers, accurate to ± 1.5 feet. Every module contains an automatic equalisation filter to compensate for random variations in line attenuation.

Seismic channels per module	12
Sample Rate	1 msec
Preamplifier gain	12 dB
Input noise	≤ 0.2 µbars RMS
Dynamic Range	110 dB
Distortion	< 0.02%

The acquisition modules employ surface mount technology for reliability and shock/vibration immunity. The module housing is manufactured from titanium alloy for strength, light weight and corrosion resistance. The inside of the acquisition module is filled with 40 PSI of dry nitrogen, to avoid deterioration of sensitive circuitry by moisture.

The acquisition modules samples the seismic data at 1 msec interval. However the on board system uses several floating point digital signal processors to re-sample the data any way the customer requires. Due to the 63 point FIR filter used, the theoretical high-cut filter slope is better than 480 dB pr octave. Besides the 250 Hz/72 dB anti-alias filter, the in-sea unit contains an 8 Hz/18 dB low cut filter, to avoid limiting the dynamic range of the system with large unwanted low frequencies. The low-cut filter can be disabled by operator command, which would reduce the low frequency cut-off of the system to 3 Hz/6 dB. The acquisition system uses a 16 bit A/D converter, which in conjunction with other circuitry results in a dynamic range of better than 110 dB.

The acquisition modules contain a calibration oscillator, to verify the integrity of each acquisition channel. The test/calibration routines can be invoked by the operator by software command. The on board system will analyse the data and will inform the observer about channels which might not conform to manufacturers specifications. A hard copy of the test data is provided as well. The acquisition module contains a very unique test circuitry to measure the electrical parameters of the hydrophone array. This test incorporates leakage, wire continuity and capacitance measurement. The hydrophone array is charged with a pulse of known amplitude and duration via a calibrated resistor. The shape of the charge as well as discharge curve across the hydrophone is measured and compared with the signature of a good hydrophone array. This test goes far beyond the measurements possible with conventional analogue streamer/test systems.

ELASTIC SECTIONS

	Front Stretches	Tail Stretches
Unstretched Length	70.1 metres	67 metres
Diameter	90 mm	50 mm

AUXILIARY SECTIONS

Function	Contain active hydrophones connected to first (nearest) channel
Length	12.19 metres

STREAMER POSITIONING

Offset is determined by measuring the distance from the geometrical centre of the source to the centre of first the group. Using a single Gun, this is done by measuring the time from when the gun fires, using the Gun Sensor, to when the pulse reaches the streamer first group. Taking into account the distance from the near-field hydrophone to the Gun, the hydrophone might be used instead of the Gun Sensor. The propagation velocity of sound through water is measured using propagation time between group xx and group yy.

Tailbuoy positioning (feathering angle) is achieved using a combination of ship's Arpa radar and evaluation of data from cable mounted compass birds. An active tailbuoy using the Seadiff DGPS system can also used if required.

Streamer retrievers were also deployed on the streamer to minimise the risk of streamer loss. The specification for these units are as follows

Manufacturer	Concord Technologies, Inc., Houston; USA
Model	SRD-300 recovery device
Release depth	30 metre

STREAMER DEPTH CONTROL SYSTEM

Manufacturer	Digicourse Inc., USA
DAU, model	293A
System controller	IBM compatible 386/16 Mhz PC
Monitor	VGA, Colour
Software Version	Digiscan Graphic package, V2.73A
Modem, Model	293-1, PROM version 4.9
Cable Unit model	5010 Leveller, Depth, (Temp)
5011 Bird Leveller, Depth, Compass, (Temp)	
No of Units (5010)	16
No of Units (5011)	20

The Digicourse controller is polled by QSEIS. Serial RS232 is output to both the QSEIS system and SYNTRAK external header port.

Specifications - 5010 Depth Controllers, 5011 Compass/Depth Controllers

Manufacturer	Digicourse Inc.	U.S.A.
Mechanical	Weight	6.1 pounds or 2.8 Kg in sea water
	Length	48.2 inches (1.2 metres)
	Mounting	2.9 " bird collars
Battery	Type	4 Lithium D cells
	Life	6-8 weeks
Communication	Type	Serial FSK
	Frequency	27 Mhz
	Data Rate	2400 Bits/sec
Diving plane	Lift	35 pounds (15.9 Kg) at 5 knots
	Airfoil	NACA 651-012 airfoil section
	Aspect ratio	2.0
	Wing Span	19 inches (48 cm)
	Surface area	140 sq inches (903 sq.cm)
Depth Sensor	Range	to 400 feet (122 m)
	Accuracy	+/- 0.5 feet (0.15 m)
	Resolution	+/- 0.1 feet (0.03 m)
Compass	Resolution	0.3 degrees
	Accuracy	+/- 0.5 degrees
	Sampling	0.3 to 6 seconds, selectable
	Averaging	0,3,7,15,31 samples selectable

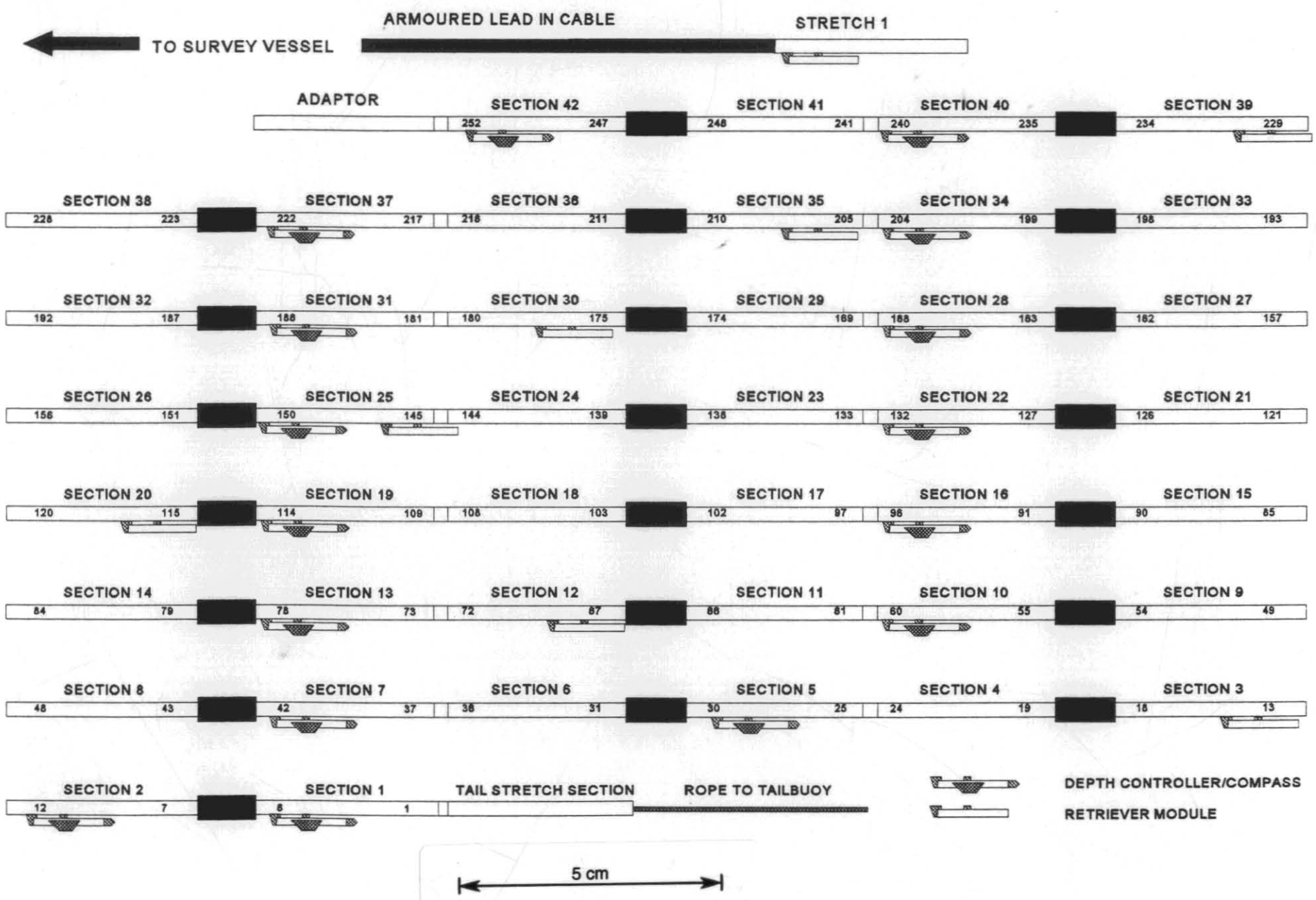


Figure 6

AUSTRAL GEOPHYSICAL CONSULTANTS PTY. LTD.

7 SEISMIC INSTRUMENTATION ON BOARD

SYNTRAK 480 DATA ACQUISITION SYSTEM

The SYNTRAK-480 is a digital seismic acquisition system supplied by an independent equipment manufacturer. The SYNTRAK-480 is used by many Seismic contractors today, who have not developed their own systems. The system is capable of acquiring seismic data sampled at 2 msec. with 8 streamer of 480 ch. each. The system comprises the on board recording system and the in-sea data acquisition modules, which are connected in between streamer sections at regular intervals.

The data transmission of the SYNTRAK MSTP system uses digital serial transmission with repeaters in each module adaptive equalisation between the acquisition modules, to allow a modest amount of electrical leakage on the transmission line, without damaging the integrity of the data transmitted. The on board unit contains a complex error detection circuitry, which will inform the observer of any possible transmission errors. In case of a transmission error, the questionable sample will be set equal to the previous sample, rather than being zeroed. This will cause the least amount of damage to the data in a real time system.

The operator can constantly view the data acquired in various different ways. A "wiggle" trace display, similar to the oscilloscope display of previous systems. This display allows the operator to determine seismic interference, vessel propeller or towing noise as well as electrical leakage spikes on the hydrophone array. A cross-hair cursor allows to determine the channel number of a faulty trace. Another display allows to view the data in a "frozen" form similar to a conventional trace plotter however for several hundred channels at the same time. A thermal plotter provides a hard copy of all channels at regular intervals. After a seismic line has been completed, a single trace plot can be requested. Again the quality of this plot is far superior than plots produced by the older carbonised paper plotters.

All seismic data is written to STK 4280 cartridge drives. Four tape transports are constantly on line. The rather high redundancy is required to avoid data loss in case of a tape transport or magnetic tape malfunction.

The in sea electronic is powered by 140 Volt DC. To avoid potential electrocution hazard when the power cables are severed, the power supply contains a very fast ground fault interrupter. This circuit disconnects the power from the streamer as soon as the current in the positive wire is unequal the current in the negative wire.

BASIC SYSTEM SPECIFICATIONS

Manufacturer	Syntron Inc., USA
Type	Syntrak MSTP 480
Maximum streamers	6
Maximum channels/streamer	480
Auxiliary channels	12 (or 0)
Acquisition Module channels	12
Preamplifier gain	12 dB
Sample rate	1 ms in the streamer module.
Lo-cut Filter type	Butterworth
Cut-off	Out 3 Hz 6 dB/Octave. In 8 Hz 18 dB/Octave
Hi-Cut Filter Type	Butterworth Thompson
Cut-off	250 Hz, 72 dB/Octave
Digital filter type	Standard 63-point Finite Impulse Response.

Digital filter and re-sampling applied for 2 and 4 ms operation.
Standard alias filters for 2 ms and 4 ms, linear phase.
-12 db @ 220 Hz for 2 ms sample rate
-12 dB @ 101 Hz for 4 ms sample rate
480 dB per octave filter slope

On-line QC	Wiggle display, Shot display, Observer log, Single trace plot, Shot-plot, Trace RMS noise.
Off-line QC	Instrument test, Trace-plot, Shot-plot, Header-dump.

The sample rate in the streamer electronic module is 1 ms for 2 or 4 ms recording, on-board digital filtering is applied before sample-rate reduction. Due to digital filtering, Time-break from source controller is delayed 31 ms by the recording system.

STORAGE SYSTEM

All seismic data is written to STK 4280 cartridge drives. Four tape transports are constantly on line. The rather high redundancy is required to avoid data loss in case of a tape transport or magnetic tape malfunction.

Tape System Specifications

Manufacturer	Storage Technology, USA
Model	2 x dual STK-4280 Cartridge drives.
Recording method	ANSI/IBM 3480
Recording Media	1/2 inch IBM-3480 Cartridges
Recording density	37871 cpi.
Number of tracks	18 parallel
Tape Capacity	Unformatted 246 MB 25 KB records 218 MB
Error management systems	Parity, CRC, DRC, VRC
Tape Speeds	
- Read/write	2.0 metres/second
- Rewind/Search	4.0 metres/second
- Rewind time	55 seconds, maximum
- Data transfer rate	2.982 MB/second
Connectivity	SCSI, STK, FIPS
Recording Format	SEG-D, 2.5 byte, Demultiplexed 8015.

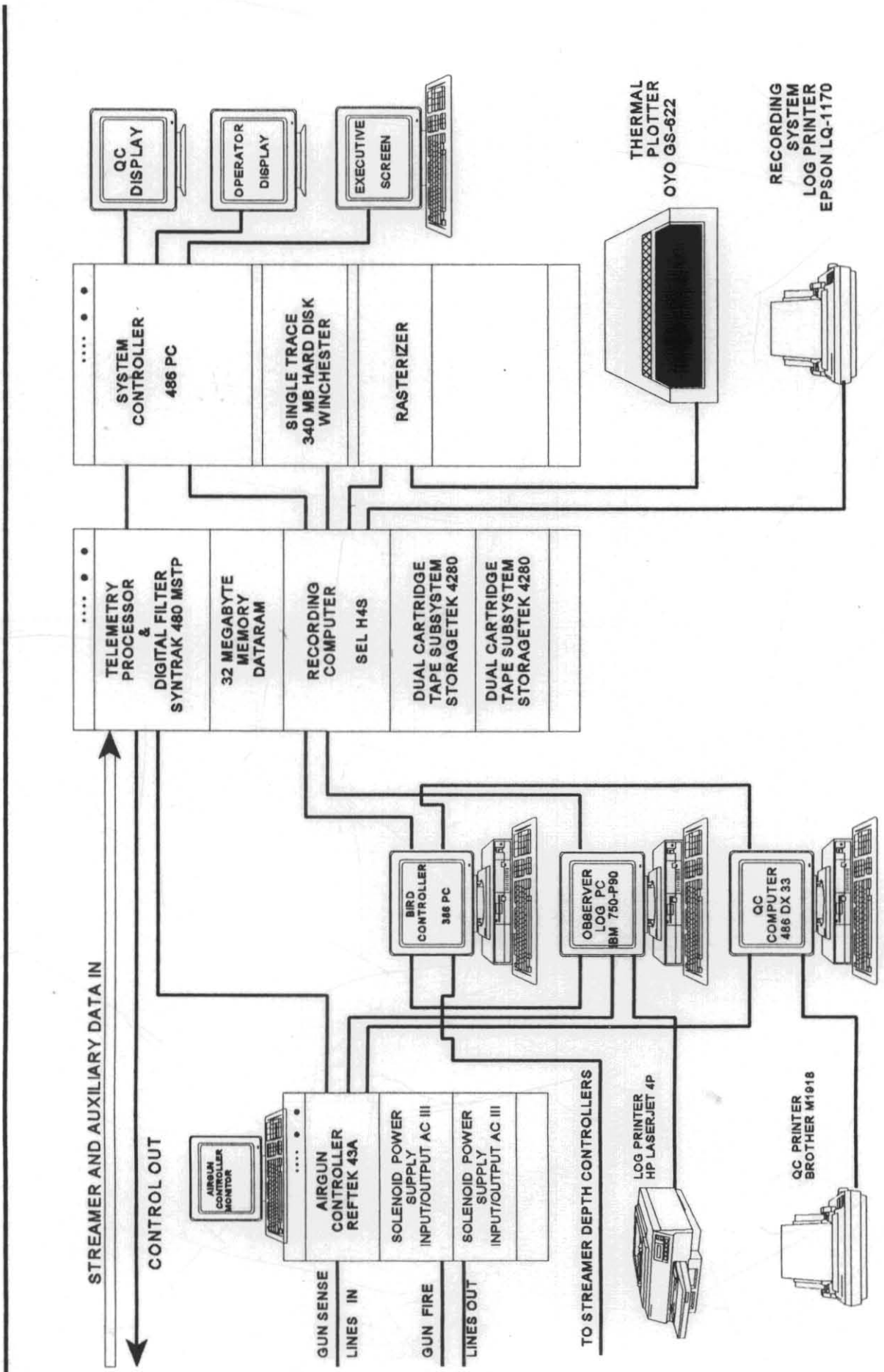

QC DISPLAY
OPERATOR DISPLAY
EXECUTIVE SCREEN
THERMAL PLOTTER OYO GS-622
RECORDING SYSTEM LOG PRINTER EPSON LQ-1170
SYSTEM CONTROLLER 486 PC
SINGLE TRACE 340 MB HARD DISK WINCHESTER
RASTERIZER
TELEMETRY PROCESSOR & DIGITAL FILTER SYNTRAK 480 MSTP
32 MEGABYTE MEMORY DATARAM
RECORDING COMPUTER SEL H4S
DUAL CARTRIDGE TAPE SUBSYSTEM STORAGETEK 4280
DUAL CARTRIDGE TAPE SUBSYSTEM STORAGETEK 4280
BIRD CONTROLLER 386 PC
OBSERVER LOG PC IBM 750-P90
QC COMPUTER 486 DX 33
STREAMER AND AUXILIARY DATA IN
CONTROL OUT
AIRGUN CONTROLLER MONITOR
AIRGUN CONTROLLER REFTEK 43A
SOLENOID POWER SUPPLY INPUT/OUTPUT AC III
SOLENOID POWER SUPPLY INPUT/OUTPUT AC III
GUN SENSE LINES IN
GUN FIRE
LINES OUT
TO STREAMER DEPTH CONTROLLERS
LOG PRINTER HP LASERJET 4P
QC PRINTER BROTHER M1918

Figure 7

SEG D FORMAT 8015/HEADER

The Syntrak External header size is maximum 3168 bytes. The data to the external header is transferred over two serial communication ports. Data from port 2 is added to data from port 1. The actual length will vary according to configuration, but will be in multiples of 32 bytes, i.e. (Number of bytes from port 1 plus number of bytes from port 2) rounded up to next multiple of 32. The actual number of 32 byte blocks in External Header is specified in byte 32 in general header.

External data from the Navigation system is transferred over communication port 1. (J1) The length of the data string is user configurable and recorded to SEG D External Header. In single vessel operations, the Navipac port sending data to the Syntrak is called "CSO". In multi vessel operations, the GIN III port sending data to the Syntrak on the slave vessel is called Syntrak "link connection with an external computer"

External data from the Digicourse-controller is transferred over communication port 2. (J6)

SEG-D TAPE FORMAT

General Header Bytes 1 - 32

Byte 1,2	= File number
Byte 3,4	= Format code (8015)
Byte 26,27	= Record length
Byte 29	= Channel sets (2)
Byte 31	= Number of extended header blocks (9)
Byte 32	= Number of 32 byte block for External header (10)

The size of Extended and External header may vary.

Channel Set Header
Channel Set Header Size = Bytes 32 * Channel sets (2)
Set 1 described briefly, Set 2 description start on byte 65.

Bytes 33 - 64 (Set 2, 65 - 96)

Byte 33	= Scan Type (1)
Byte 34	= Set Number (1)
Byte 35,36	= Start Time (0 ms), unless water delay activated
Byte 37,38	= End Time (ms)
Byte 40	= MP (HEX 8C for 12 dB Preamp)
Byte 41,42	= Number of Aux. traces
Byte 44	= Gain Mode (09)

Extended Header (Host Recording System Status)
Bytes 97 - 383 (Size in multiples of 32 bytes, Size may vary with configuration) Contain user defined information such as Client, Project, Line number etc.

Byte 99,100	= Number of channels
Byte 112	= Number of streamers
Byte 128,135	= Line identification (streamer 1)
Byte 136,143	= Line identification (streamer 2)etc.

External Header
Bytes 385- 704 (Size in multiples of 32 bytes, size may vary with configuration)
Bytes 385- 475 Navigation string (Time/Shotpoint/Posn. in Northing,Easting etc)
Bytes 476- 704 Digicourse string (Time, Cable depths, Compass data)
Bytes 705-1251 Acquisition module descriptions.

ON LINE SYSTEM QC AND AUXILIARY FUNCTIONS

TRACE PLOTS

Single trace recorder:	Syntrak / OYO GS 622
Trace displayed:	Selectable
Trace plots:	OYO GS 622 Thermal Plotter

AUTOMATIC OBSERVER LOG

The system is Autolog v.304 running on an IBM compatible PC and using a laser printer for reports. A label printer, TLP 2044, is also interfaced to the PC to print labels for every tape change, single trace labels, box labels etc.

The automatic observer log system allows the log to be edited, and additional comments added. It provides an on line display of digi birds and generates an end-of-line statistics report on the controller depths.

INTERFACES

Syntrak serial port, to extract shotpoint number, file number, system errors etc.
Digicourse to recover streamer depth data
Navigation System for event coordinates.

OFF LINE QC, PROCESSING AND INSTRUMENT TESTS

General specifications
The vessel is equipped with a mini off-line QC and processing system - LookOut. LookOut is running on a Compaq/486 PC hardware platform. The main features are:

- Noise analysis, filtering, brut stack.
- Shot-plot, Trace RMS noise, Header dump.
- Tape checks.
- Tape copying.

PGS ACQUISITION QA/QC SEQUENCE - 2D

The following notes outline the systems and structure of the Acquisition QA/QC typically carried out on PGS 2D vessels. Clearly if a project involves a final 2D processing, then a different action should be taken.

Generalised System set-up

Processor	One IBM RS6000 system
Local Memory (RAM)	128Mb
Disk storage	28Gb.
Tape Drives	8mm Exabyte Drive. Storagetek 4280 Cartridge Drive w/Stacker
Thermal plotter	OYO Geospace - GS636, 36".
Operating System	IBM UNIX AIX 3.2.5
Application	ProMax version 5.1

QC processing sequence

Processing is aimed in general, not at attenuating noise, but in showing the data either as recorded or as it would be presented to a shore or vessel based processing centre.

31 ms static for digital filter delay
Adjacent trace summation with differential NMO if recording with 12.5 metre groups

Gain recovery
Pre decon mute
DBS
NMO. Velocities should be picked on a grid no coarser than 2km
Mute
Stack
Gun & cable static correction
TVF
Amplitude balancing
Display

QC displays, routine production of the following:

one shot every km
near trace plots
NMO corrected gathers or supergathers as dictated by fold stack section, all with appropriate scaling. N.B. AGC is not appropriate

In addition to this, the QC system is available for detailed investigation of specific data areas.

RMS Values

Computation of rms windows on one or more window per trace. These are suggested to be the last 500 ms of the trace for a "noise" estimate and any client specified signal window. In cases where the water is deep enough a measure of true ambient noise is taken from the water column. The data will be plotted on a trace by trace basis in ProMax.

Data Archiving

1 A "ProMAX Line Archive" is taken for each line processed. This should include decimated shots (if created), various stack files and the near traces. Velocity and flow data are automatically captured by this method. The value of these datasets is for reloading on the vessel during the course of subsequent acquisition, and they have little long term value as a general archive.

2 Stacks, SEG Y archive tape containing the raw stacks for each line.

3 A velocity tape containing the derived information for each line.

4 ProMAX archive of master flows.

INSTRUMENT TESTS

As is common with virtually all the recent digital streamer systems the SYNTRAK 480 SYSTEM provides the capability of recording and analysing instrument tests as well as displaying the results in a graphical and readily comprehensible form.

Amplifier Noise and DC Offset

This examines RMS noise and DC offset in the amplifier system. The instrument specifications for these parameters is as follows (for 1024 samples @ 1 millisecond sample rate)

With a 12dB Preamplifier Gain		
RMS Noise	4.5 µvolts typical	7.0 µvolts maximum
DC Offset	6.0 µvolts typical	10.0 µvolts maximum
With a 24dB Preamplifier Gain		
RMS Noise	1.2 µvolts typical	1.7 µvolts maximum
DC Offset	1.7 µvolts typical	2.5 µvolts maximum

Amplifier Impulse Response

This test checks the system's amplitude impulse response. The instrument specifications for these parameters is as follows (for 1024 samples @ 1 millisecond sample rate)

Frequency	Amplitude
Low Cut Out = 3.90625 Hz.	-2.0 dB ± 0.50 dB
Low Cut In = 7.81250 Hz.	-4.0 dB ± 0.50 dB
Midband = 31.25000 Hz.	0.0 dB ± 0.08 dB
High Cut = 125.00000 Hz.	-12.0 dB ± 1.00 dB
High Cut = 250.00000 Hz.	-12.0 dB ± 1.00 dB

Channel Gain Accuracy

This test looks at the channel to channel gain accuracy. The typical RMS amplitude error is ±0.2%. The maximum allowable error is 0.5%.

Amplifier Harmonic Distortion/Dynamic Resolution

This test records a series of range of amplitudes, from 0 dB to -90 dB, and displays for each channel the fundamental frequency, the second and third harmonics and the noise relative to the fundamental. The instrument specifications for these parameters is as follows (for 1024 samples @ 1 millisecond sample rate)

For amplitudes of 0 to -40 dB (0 to -60 dB for 24 dB preamp) the distortion should be less than 0.02% or -74 dB.

For amplitudes less than -40 dB (less than -60 dB for 24 dB preamp) the distortion should not be greater than 18 dB above the mean noise level.

Hydrophone Array Leakage

This test measures and displays the leakage on an operator specified channel set. The results are presented on a "Pass" or "Fail" basis for each channel. The instrument specifications for leakage limits are as follows

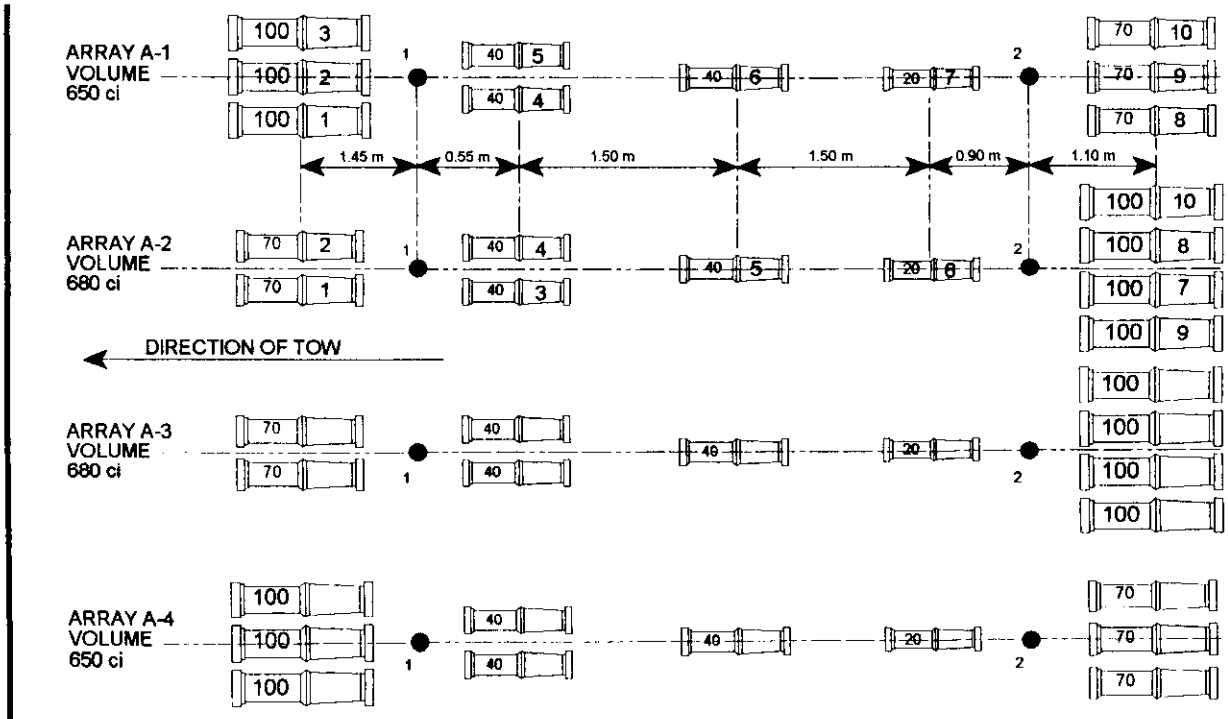
15.24 metre group length	1 megohm > R > 225 kilohm

8 ENERGY SOURCE

ENERGY SOURCE SPECIFICATIONS

No. of Arrays	1, optional 2 (flip-flop)
Array Type	Seres Point Source
No. Sub Arrays	4
Sub Array Configuration	10 Gun precision cluster
Gun Type	HGS Sleeve Gun I/II
Airgun sizes	100, 70, 40, 20
Operating Volume	2660 in^3
Peak to Peak Output	109.2 bar metres
Primary to Bubble Ratio	34.3
Total Available Airguns	40
Airguns per Active Array	40
Airguns Spare for Array	0
Stern to Array Centre Distance	121 metres
Operating Pressure	2000 psi
Gun Depth, nominal	6 - 7,5 m
Towing width, nominal	Inner array = 25m, Outer array = 75m.
Depth Monitors	None
Near Field Hydrophones	2 per Sub Array
Timing Control Unit	RefTek 43A
Manufacturer	Refraction Technology
Firing Delay	50 millisecond
Compressors	4 x LMF VGd 2610 W14
Primary Drive	2 x Electric Motor AEG 355R M4 2 x Diesel Engine Detroit 12V-71
Delivery Rate	2 x 550 cfm (Electric) 2 x 480 cfm (Diesel)
Gun Timing Specification	± 1.0 millisecond

ENERGY SOURCE DESCRIPTION



TOTAL SOURCE VOLUME IS 2660 CUBIC INCHES

Figure 8

The energy source deployed by the contractor consisted of a tuned sleeve gun array with an operational volume of 2660 cubic inches. The source is shown in the figure on the previous page. The array is constructed using the HGS sleeve gun as the active element. These are deployed as individual guns and as clusters of 2, 3 and 4 guns. The array consists of four sub-arrays A1 through A4, numbered from starboard to port. The two outer arrays, A1 and A4, are identical, each with an operational volume of 650 cubic inches. The two inner arrays, A2 and A3 are also identical but have an operational volume of 680 cubic inches. Each sub-array has a total of 10 guns. There are no spare guns included in the sub-arrays. The sub-arrays are 7 metres long which is quite compact for a source array of this type.

The 10 air guns on each sub-array are suspended on a steel frame from a PVC floating paravane. Separation between each array is achieved by adjusting the number of links on the chain which is connected between the floating paravane and the main towing harness. The individual airguns are paired such that each individual air line supplies 2 guns. This of course results in the loss of two guns rather than one, each time an air leak occurs. All guns are suspended horizontally and the cluster guns are in vertical stacks.

Any loss of volume up to 15% (or 400 cubic inches) can be tolerated and the array will still maintain the source characteristics. The following exceptions and conditions have to be applied however.

- only one of the 400 cubic inch clusters can be out
- only one of the 300 cubic inch clusters can be out
- only one of the 210 cubic inch clusters can be out
- only three of the 80 cubic inch clusters can be out
- if one 100 cubic inch gun in a 400 cubic inch cluster is dropped, a second has to be dropped to avoid creating another 300 cubic inch cluster.
- only two 40 and two 20 cubic inch single guns can be out at the same time.
- maximum of six guns only can be dropped.

For what could typically be considered the worst case ie when the volume is reduced to 2260 cubic inches, the resultant peak to peak output is still 96.8 barmetres with the peak to bubble ratio maintained at 33.7. The ability to maintain such a high peak to bubble ratio is one of the major advantages in using sleeve gun arrays.

The Odin Explorer has four LMF compressors installed on the vessel. These units were installed midships below the main deck. These units were capable of supplying air at the rate of 2060 cubic feet per minute at 2000 psi. During the survey however only three of the compressors had to run on line to maintain pressure, giving a possible maximum supply rate of approximately 1500 cubic feet per second.

ENERGY SOURCE TIMING

The source timing is initiated from the navigation system. In the first instance a digital TTL pulse is converted to a closure and sent to the Syntrak 480 recording system. The recording instruments in turn generate a TTL pulse which initiates the REFTEK RT43 gun synchroniser to fire the airguns. A Time break signal is returned to the recording instruments and the guns are fired after a 50 milliseconds delay.

The individual gun timing is controlled using a REFTEK 43A gun controller system interfaced to an Input/Output AC III Solenoid Power Supply. The gun controller system is built a Texas Instruments TM 990/101 microprocessor and uses standard interface and memory cards to provide a 48 channel controller. Using basic ring counter theory each individual gun delay is sensed and integrated into the firing delay used for the next cycle. In this way all the guns are synchronised to fire 50 milliseconds after the unit receives a fire command.

GUN CONTROLLER SPECIFICATIONS

Manufacturer	Refraction Technology, USA
Model	REFTEK RT-43
No of guns	48

Input gain	Programmable
Parameter Back-up	Non-volatile RAM
Colour Data Monitor	Colortrend, Hi-res 720 x 442 pixels
Synchronisation model	Automatic Individual
Synchronisation	Typical +/- 1.50 msec
Resolution	0.25 msec
Timing method	Zero Crossing
Solenoid Power supply	AIRCON III, I/O Inc., USA For SV-2 & SV-3
Solenoid Power supply	REF TEK For SV-2 only

The components of the source controller and their functions are further illustrated in the block diagram for the recording instrumentation in section 6.

ENERGY SOURCE QUALITY CONTROL

The QSEIS is a ON-LINE QC system developed by Geoteam running on a PC/486. An intelligent serial port card is used for interfacing to the gun controller REFTEK RT-43 external serial , streamer controller and navigation computer. After each line there is a print out of the gun performance statistics to complement the reporting of individual misfires produced on line. The primary functions are:

Source	Reading gun timing for every shot and immediately report gun firing out of the selected time window, misfire or any changes in volume. At operator selected intervals, print timing distribution for every gun in a table with 1/4 msec resolution and present a graphic representation for every gun standard deviation.
Streamer	Reading depth, compass and fin angle from Digicourse. At operator selected intervals reports sensors out of specification and computing feather angle.
Navigation	Reading shot point, time and position from navigation and file no. from gun controller for printout together with Digicourse data.
Weather	A weather station for wind monitoring is installed, and will be interfaced early 1996.

QSEIS SPECIFICATIONS

Manufacturer	Geoteam a.s
Software	QSEIS version 2.1, 11 Nov 92, QC Package On screen Graphics & Hardcopy
Computer	486 33 Mhz PC, VGA Colour screen
Intelligent serial card	Digiboard 8 channel
Hardcopy	Brother, 24 pin Printer
Auxiliary Screen	Video splitter, with extra VGA Colour screen located in the shooting shack
Recording Media	3.5" 1.44 Mb Floppy Diskettes (IBM-PC format, ASCII)
Wind monitor	AANDENRAA 3400

Printer output - on line,
At intervals defined by the operator
- Streamer depth, time, position, water depth, feathering, SP, file (RT-file)
- Gun standard deviation.
- Independent of the interval: Gun errors

Printer output - at End Of Line, (End of line statistics)
- Gun summary table
- Gun standard deviation for every gun for the whole line.
- Error Calculations in %

- Streamer statistics:
  Minimum, mean, maximum and average fin angle for every Digibird sensor.
  Percentage of readings and shots within the depth tolerance.
  Feather statistics, minimum and maximum feather angle.

Data printed on a printer is also logged to the hard disc. Ancillary functions include graphical presentation of Gun timing for on-line monitoring and summary log files for Gun timing and streamer depth to hard disc.

The components of the QSEIS source quality control and their functions are further illustrated in the block diagram for the recording instrumentation in section 6.

Source positioning is achieved by firing guns on each array and measuring the time from when the gun fires to when the pulse reaches the hydrophones on the other sub arrays. By doing this on all arrays both the spread of the array and the in-line skew can be measured. To determine the distance of the source behind the vessel, the gun umbilicals are physically measured. This will give the distance from reference antenna to centre source.

ENERGY SOURCE DEPTH MONITORING

The source was not equipped with any method of measuring or monitoring the depths at which the airgun arrays were running.

9 POSITIONING SYSTEMS

MAPPING PARAMETERS

The survey was drawn up on Australian Map Grid, a UTM projection on the AGD84 spheroid. Line end data was supplied to the contractor in the form of AMG values. The contractor could operate on the AMG in real time. The line end co-ordinates on the AMG were therefore used as input for the real time navigation system.

GEODETIC SYSTEMS DEFINITIONS

The real time navigation system was operated on the AMG. The relevant parameters of the AGD84 and the WGS84 datum, as well as the datum shift values, are shown below:

	AGD84	WGS84
Semi-Major Axis:	6378160.000m	6378137.000m
Semi Minor Axis:	6356774.719m	6356752.314m
Inverse Flattening:	298.25	298.257224

Datum Shift from AGD84 to WGS84:

dX: -116.00m	dY: -50.47m	dZ: +141.69m
rX: -0.230	rY: -0.390	rZ: -0.344
	Scale: 0.0983 ppm	

UTM Grid Zone 55

True Origin	0°N 147°E	
Coordinates	500000 m E	10000000 m N
Scale Factor at CM	0.9996	

NAVIGATION SYSTEM

EIVA - REAL TIME INTEGRATED NAVIGATION SYSTEM

GENERAL

Type	2D Integrated Nav. system
Model	EIVA NAVIPAC 300
Manufacturer	EIVA a.s., Denmark
Program Version	Navipac 61
IGPS Receiver	2 x Trimble 4000DL II
Gyro Compass	Arma Brown MK.10 (Interface - Lehmkuhl repeater)
Speed Log	Sal-Imcor-2 Doppler Log (Interfaced via DGH timer)
Echosounder	Simrad EA300P, range = 0-1500 meters, with Canon PJ-1080 Colour Printer, 38 Khz transducer and draft correction (Nominal 5,2m when topped with fuel)
Shot Interval	30,48m
Line mode	Grid or Rhumb lines or simulated Great Circle
Projection	Selectable between UTM and TM.
Working Spheroid	Selectable

EIVA EQUIPMENT LIST

Computer	1 - H.P. 9920U Computer, w/33 MHz turbo
Expander	1 - H.P. 9888A I.O.
Dual Disc Drive	1 - H.P. 9122C 3.5" 1,44 Mb
Mass storage unit	1 - IEM, 320 Mb Hard disc
Helmsman display	1 - H.P. RGB Colour Monitor
	5 - NEC Multisync Colour Monitor

Console	1 - H.P. 35731B Monochrome Monitor
Monitor amplifier/splitter	1 - BARCO
Printer	1 - H.P. 2225A Thinkjet Printer
Interface	To all common Navigation systems
Helmsman displays at	Navigator/Observer/Gun Shack/Bridge/Party Chief/Client rep.

NAVIPAC ON-LINE STORAGE SYSTEM

Disc Drive	H.P. 9122C
Recording medium	3.5", 1.44 MB floppy disc
Floppy format	Hewlett Packard - LIF
Raw data file format	EIVA Recdata

GPS

All data are filtered and smoothed and de-skewed to shot time before they are used in position fix calculations. The filtering window can be set by the navigator. The smoothing is done by a straight line approximation through the last 5 readings, and the value being used in the fix is a weighted average of the reading and the predicted value from the straight line approximation. The filtering and smoothing is applied to GPS positions directly.

DEAD RECKONING SYSTEM

Gyro Compass	Arma Brown, Model : Mark 10
Converter/repeater	Lehmkuhl LR60C, Gyro compass repeater.
Speed Log	Consilium Marine, Model Sal-Imcor-2
Speed log interface	DGH timer

The Dead Reckoning can be used to steady the Differential GPS when the DOP's are high and a secondary navigation system is not available for whatever reason. The EIVA system provides real time error correction through an alpha-beta filter. The amount of correction the Dead Reckoning applies to the navigation position is controlled by the operator.

REAL TIME DISPLAYS IN EIVA/NAVIPAC

Radio Navigation Systems	Standard deviation, Error Ellipse
For each LOP	Radionav channel configuration, Raw value, Residual, Variance over 5 points of difference between raw and smoothed values.
GPS	Raw position (Lat/Long), DGPS position, Difference in position (delta-easting and delta northing) between Radio navigation (if used) and GPS
Digibird Compass Data	Recording raw compass data from Digicourse only.
Tailbouy	GPS tracking with Seadiff. (Optional)

PRINTER OUTPUT (On Line) EIVA/Navipac

Dead Reckoning at operator defined intervals	Date/Time Lat/Long Northings/Eastings in chosen projection Gyro compass bearing Course made good Distance off line Speed from primary navigation system Log speed Record number on floppy disc Water depth Operator defined offset positions ie when using active tailbouy position, range & bearing.

Radio Navigation when used	Radio navigation configuration and channel numbers Raw radio readings
GPS	PDOP value Raw position (Latitude and Longitude) Difference in position (delta-easting and delta-northing) between Radio navigation and GPS Trimble 4000 string as recorded from Seadiff
Tailbouy	Tailbouy position UTM N,E + Lat,Lon

PRINTER OUTPUT AT END OF LINE

Line Statistics	Distance off line Histogram Standard deviation of radionav fixes Histogram Shot point interval distance, Histogram Time between shots Number of satellites.

OUTPUT ON SERIAL LINE - CUSTOMER SPECIFIED OUTPUT "CSO"

Output at START OF LINE	Start of line + Line name
Output on EVERY SHOT	Time, Event No., Easting, Northing, Water depth, Gyro, SMG, CMG, CVG
Output at END OF LINE	End of line + Line name

Output is on an RS 232 line (9600,N,8,2). The message is 90 characters long, and formatted as ASCII text, except for SOL and EOL which are 28 characters.

The "CSO" setup, can within reasonable limits, be altered by the operator on board. The CSO is interfaced to SYNTRAK recording system and QSEIS.

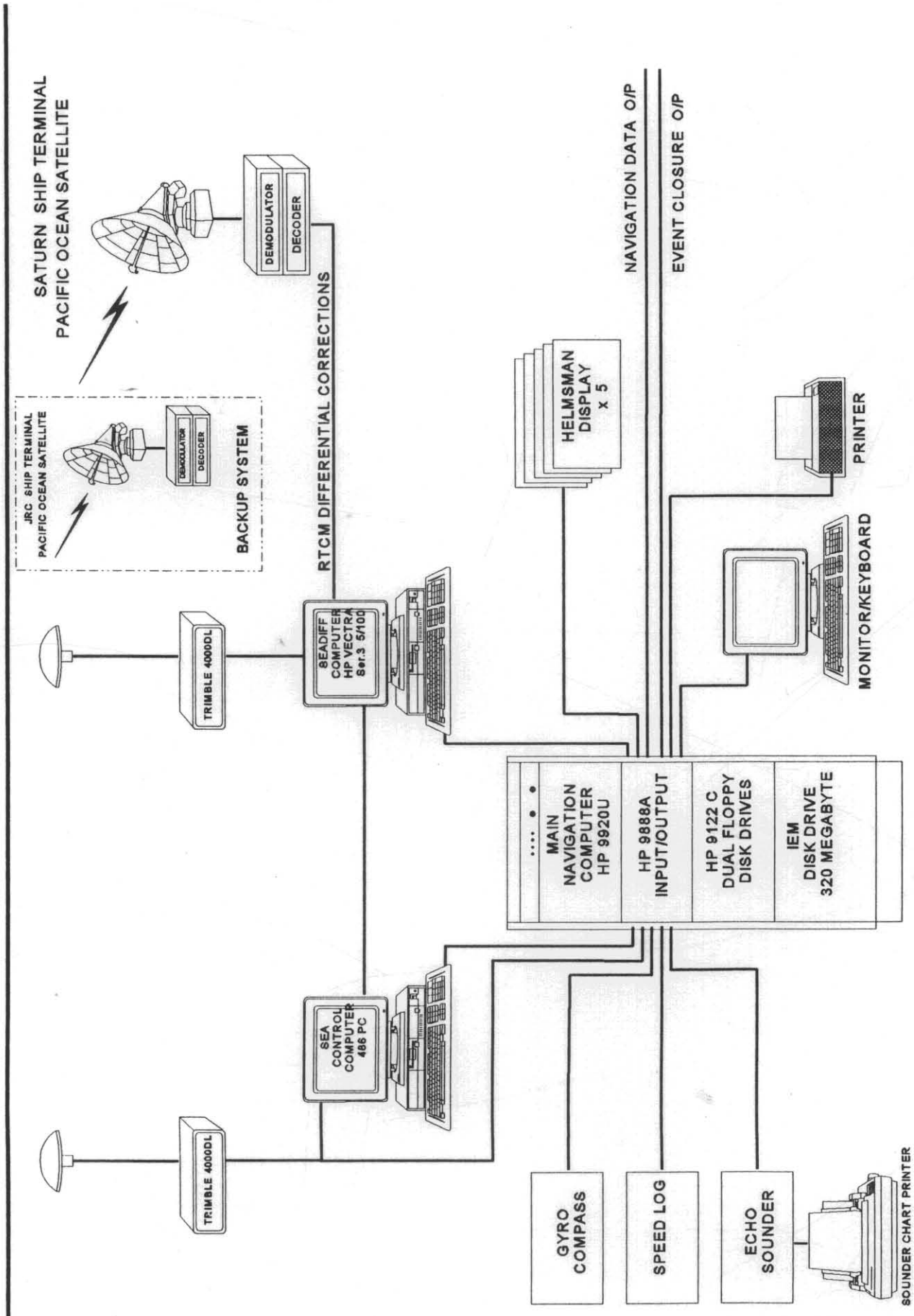

SATURN SHIP TERMINAL
PACIFIC OCEAN SATELLITE
DEMODULATOR
DECODER
JRC SHIP TERMINAL
PACIFIC OCEAN SATELLITE
DEMODULATOR
DECODER
BACKUP SYSTEM
RTCM DIFFERENTIAL CORRECTIONS
NAVIGATION DATA O/P
EVENT CLOSURE O/P
HELMSMAN DISPLAY x 5
PRINTER
MONITOR/KEYBOARD
TRIMBLE 4000DL
SEADIFF COMPUTER HP VECTRA Ser.3 5/100
MAIN NAVIGATION COMPUTER HP 9920U
HP 9888A INPUT/OUTPUT
HP 9122 C DUAL FLOPPY DISK DRIVES
IEM DISK DRIVE 320 MEGABYTE
TRIMBLE 4000DL
SEA CONTROL COMPUTER 486 PC
GYRO COMPASS
SPEED LOG
ECHO SOUNDER
SOUNDER CHART PRINTER

Figure 9

DIFFERENTIAL GPS NAVIGATION SYSTEM

GENERAL SPECIFICATIONS

FUGRO STARFIX is provides differential GPS corrections from multiple GPS reference stations via the Inmarsat satellite communication system.

INMARSAT DIFFERENTIAL LINK HARDWARE

Manufacturer	FUGRO Singapore
Satellite Demodulator	JRC 45 MK
Translator	JECCA

INTERFACE SOFTWARE, SEADIFF

SEADIFF is a software package for real-time differential GPS processing. It can handle 9 GPS satellites simultaneously. SEADIFF is outputting corrected Latitude/Longitude to NAVIPAC. (SEADIFF can also be interfaced to a wide range of other radio navigation systems). The Seadiff also includes quality control of the performance of the reference station network and the on board equipment in real time. This includes display of Standard Deviation of Residuals when an over determined solution is available and comparing multiple reference stations.

Manufacturer	Seatex a.s., Trondheim, Norway
Version	Seadiff Version 6.0
Datum	Selectable
Computer	HP Vectra Pentium/100MHz PC
Monitor	SVGA Colour
Serial interface	8 Channel Digiboard

GPS RECEIVERS

Manufacturer	Trimble Navigation
Type	GPS Satellite Receiver
Model	4000 DL II
Software Versions	Nav. Ver. 5.41 - 28 Feb. 1991 Sig. Ver. 1.18 - 12 Nov. 1991 Boot Ver. 3.27 - 16 Aug. 1991

DIFFERENTIAL STATIONS

The system can in the present configuration receive differential GPS corrections from up to 12 reference stations with an update rate of less than five seconds. It can monitor the difference of derived positions from a maximum of 6 individual stations.

GPS REFERENCE STATION COORDINATES (WGS 84)

TOWNSVILLE	0004	Latitude Longitude	19° 15' 52.645" S 146° 42' 44.108" E	Height 73.13 m.
MELBOURNE	0006	Latitude Longitude	38° 27' 53.371" S 144° 54' 46.906" E	Height 144.90 m.
ADELAIDE	0007	Latitiude Longitude	34° 56' 31.530" S 138° 30' 25.400" E	Height 52.41 m.
BATHURST	0018	Latitude Longitude	33° 25' 46.900" S 149° 34' 01.960" E	Height 756.80 m.

NEW PLYMOUTH	0021	Latitude Longitude	39° 03' 27.185" S 174° 04' 49.232" E	Height 56.07 m.
AUCKLAND	0022	Latitude Longitude	36° 47' 33.490" S 174° 45' 50.208" E	Height 74.40 m.

ANTENNA LAYBACK

The system positions are referred to the Transit Satellite antenna.
Positions to Starboard and Fore get a positive sign.

Distance of Primary GPS Nav. Ant. Forward	+0.1 m	
Distance of Primary GPS Nav. Ant. Port		-1.6 m
Distance of Secondary GPS Nav. Ant. Forward	+0.1 m	
Distance of Secondary GPS Nav. Ant. Starboard		+1.6 m

INMARSAT SATELLITES

Data from the reference stations are transmitted through dedicated telephone lines to the Inmarsat uplink station in the area. At the uplink station, the datastreams are combined into one, and transmitted through the Inmar satellite used in the area.. On board the vessel, the data are received using a JRC ship station

SEACONTROL NAVIGATION QC PACKAGE

GENERAL

SEACONTROL is a stand alone data logging and quality control system for marine survey navigation. The program is designed to run on a IBM compatible PC/AT computer under MS-DOS. This system is used on Master Odin as an aid to the navigator to ensure good quality navigation. It is interfaced to the raw navigation system(s) separately and produces it's own position, and also receive the Navipac position. It then compares all interfaced systems to give a good, independent quality control check on-line.

Manufacturer	SEATEX a.s., Trondheim, Norway
Program Version	Seacontrol 1. 651, 08 Apr. 1994
Datum Shift	Selectable
Interfaced To	FUGRO Starfix Raw GPS Navipac Hard Closure + To all common navigation systems
Projections	UTM and TM
Computer	486 DX 33 Mz PC
Intelligent Interface	8 Channel Serial Board - Digiboard
RAM	1.9 Mb total
Hard-disc	40 Mb
Floppy-disc	1.44 Mb 3.5"
Monitor	Hitachi VGA Colour
Printer	Star LC-10
Real time displays	Difference in positions, Geographical & Grid Coordinates, SD's, SMG, CMG, Gyro, Error ellipse for radio navigation LOP's.
Printout at EOL	Timeseries statistics for Radio Navigation (if used)
Data logging	UKOOA P2/86, ASCII Positions

NAVIGATION ON BOARD 2D OFF-LINE QC-TOOL.

NAVIMAP is a off-line Nav. QC tool for Navipac Recdata. NAVIMAP is designed to run on the series 300 Hewlett Packard computers. The main features are the systems ability to

1 Convert Recdata to EIVA-Processed file format.
2 List Raw data
3 Print sp-intervals, out of operator entered specifications.
4 Produce Postplots from Navipac Recdata discs. (Multi plots)
5 Runline plot. (Track plot)
6 Depth smoothing and editing.
7 Bathy Charts. (w/tide corrections), line by line - not contour charts.
8 GPS Scatter plots (in harbor).

Specifications

Manufacturer	EIVA a.s., Denmark
Program version	Navimap 039C
Processor	HP 9000/300 Computer
Monitor	HP 82913A, Monochrome
Plotter	HP 7595B, Draftmaster SX, Plot sizes A3, A1 and A0
Printer	HP 2225AY, Thinkjet
Data storage	HP 9122C 3.5" Dual Disc Drive
	IEM 3018, Mass Storage Unit, 180 Mb Winchester hard-disc.

CYCLE CONTROLLER (CLOSURE BOX)

The cycle controller sends trigger signal to the recording system. It has two inputs (0 and 1) and eight outputs (0 to 7). Output 0-3 is TTL, output 4-7 is a choice between TTL and contact closure. When off-line, the FESTO is programmable from an IBM-PC with FST (Festo Software Tool).

Manufacturer	FESTO Electronic, Germany.
Model	FESTO FPC-404, Programmable controller.
Type	PLS
Input	Navigation, TTL
Output	RefTek Gun Controller, TTL
	Syntrak, TTL
	QSEIS, Contact closure
	Gravity

BATHYMETRY

ECHO SOUNDER

The echo sounder installed on the survey vessel was a SIMRAD EA300. This is a relatively compact digital sounding system designed for hydrographic survey work at depths to 1500 metres. Navigation data or annotaion messages can be fed to the sounder and will appear on the lower part of the recording paper. The sounder also supports a manual marker function. A complete system consists of an EA300 echo sounder, a display unit, a colour printer and transducer.

TECHNICAL SPECIFICATIONS

Size	31 x 21 x 40 centimetres
Supply Voltage	220 V AC 50/60 Hz.
Power Consumption	75-125 watts with printer
Transducer Frequency	38 kilohertz
Output Power	1 kilowatt
Pulse Lengths	0.3 and 1 millisecond
Ranges	10, 25, 50, 100, 250, 500 metres

10 SURVEY LOGS

DAILY ACTIVITY SUMMARIES

TIME	ACTIVITY	HOURS CHG
** Date: 16/01/96		
00:00	TRAVEL	4.000
04:00	PORT CALL FOR RESUPPLY/CREW CHANGE/DATA DROP	6.200
10:12	TRAVEL	1.300
11:30	STREAMER DEPLOYMENT, NON CHARGEABLE	12.500
** Subtotal **		24.000
** Date: 17/01/96		
00:00	STREAMER DEPLOYMENT, NON CHARGEABLE	4.000
04:00	DEPLOYING SOURCE AND RUNNING TO LINE	1.117
05:07	RECORDING LINE BHA96-100	2.500
07:37	LINE CHANGE	1.883
09:30	RECORDING LINE BHA96-102	2.583
12:05	LINE CHANGE	1.733
13:49	RECORDING LINE BHA96-104	2.083
15:54	LINE CHANGE	3.100
19:00	RECORDING LINE BHA96-121	0.400
19:24	CIRCLE AFTER NAVIGATION SYSTEM FAILURE	2.583
21:59	RECORDING LINE BHA96-121	1.433
23:25	LINE CHANGE	0.585
** Subtotal **		24.000
** Date: 18/01/96		
00:00	LINE CHANGE	0.783
00:47	RECORDING LINE BHA96-127	1.500
02:17	LINE CHANGE	1.467
03:45	RECORDING LINE BHA96-131	2.567
06:19	LINE CHANGE	1.800
08:07	RECORDING LINE BHA96-133	1.767
09:53	LINE CHANGE	1.500
11:23	RECORDING LINE BHA96-135	1.550
12:56	LINE CHANGE	1.650
14:35	RECORDING LINE BHA96-137	1.783
16:22	LINE CHANGE	1.567
17:56	RECORDING LINE BHA96-139	1.467
19:24	LINE CHANGE	1.567
20:58	RECORDING LINE BHA96-141	1.450
22:25	LINE CHANGE	1.582
** Subtotal **		24.000
** Date: 19/01/96		
00:00	LINE CHANGE	0.083
00:05	RECORDING LINE BHA96-143	1.617
01:42	LINE CHANGE	1.733
03:26	RECORDING LINE BHA96-110	2.683
06:07	LINE CHANGE	1.483
07:36	RECORDING LINE BHA96-108	2.050
09:39	LINE CHANGE	1.800
11:27	RECORDING LINE BHA96-106	1.817
13:16	LINE CHANGE	1.417
14:41	RECORDING LINE BHA96-109	1.933
16:37	LINE CHANGE	1.533
18:09	RECORDING LINE BHA96-105	3.267
21:25	LINE CHANGE	1.867
23:17	RECORDING LINE BHA96-103	0.717
** Subtotal **		24.000

TIME	ACTIVITY	HOURS	CHG
** Date: 20/01/96			
00:00	RECORDING LINE BHA96-103	1.300	
01:18	CIRCLE TO RESUME LINE	2.617	
03:55	RECORDING OVERLAP TO LINE BHA96-103	0.233	
04:09	RECORDING LINE BHA96-903	1.517	
05:40	LINE CHANGE	1.733	
07:24	WEATHER DOWNTIME	14.133	Y
21:32	RECORDING LINE BHA96-101	0.817	
22:21	CIRCLE AFTER STREAMER ROSE TO SURFACE	1.650	Y
** Subtotal **			
		24.000	
** Date: 21/01/96			
00:00	CIRCLING TO RESUME LINE, WEATHER DOWNTIME	1.033	Y
01:02	RECORDING OVERLAP TO LINE BHA96-101	0.217	Y
01:15	RECORDING LINE BHA96-901	1.267	
02:31	LINE CHANGE	1.550	
04:04	RECORDING LINE BHA96-107	3.267	
07:20	LINE CHANGE	2.133	
09:28	RECORDING LINE BHA96-111	3.617	
13:05	LINE CHANGE	1.367	
14:27	RECORDING LINE BHA96-113	2.967	
17:25	LINE CHANGE	1.383	
18:48	RECORDING LINE BHA96-115	3.233	
22:02	LINE CHANGE	1.367	
23:24	RECORDING LINE BHA96-117	0.599	
** Subtotal **			
		24.000	
** Date: 22/01/96			
00:00	RECORDING LINE BHA96-117	2.600	
02:36	LINE CHANGE	1.533	
04:08	RECORDING LINE BHA96-117	0.483	Y
04:37	TERMINATED STREAMER ON SURFACE, RUN TO LINE 114	2.133	Y
06:45	RECORDING LINE BHA96-114	2.100	
08:51	LINE CHANGE	1.117	
09:58	RECORDING LINE BHA96-112	1.867	
11:50	LINE CHANGE	1.217	
13:03	RECORDING LINE BHA96-116	2.250	
15:18	LINE CHANGE	1.500	
16:48	RECORDING LINE BHA96-118	2.217	
19:01	LINE CHANGE	1.383	
20:24	RECORDING LINE BHA96-120	2.167	
22:34	LINE CHANGE	1.433	
** Subtotal **			
		24.000	
** Date: 23/01/96			
00:00	LINE CHANGE	0.350	
00:21	RECORDING LINE BHA96-122	2.150	
02:30	LINE CHANGE	1.467	
03:58	RECORDING LINE BHA96-124	2.150	
06:07	LINE CHANGE	1.550	
07:40	RECORDING LINE BHA96-126	2.133	
09:48	RECOVER ALL TRAILING EQUIPMENT FOR PORT CALL	2.617	
12:25	TRAVEL TO DEVONPORT FOR PORT CALL	7.083	
19:30	PORT CALL FOR RESUPPLY/CREW CHANGE/DATA DROP	4.500	
** Subtotal **			
		24.000	

TIME	ACTIVITY	HOURS	CHG
** Date: 24/01/96			
00:00	PORT CALL FOR RESUPPLY/CREW CHANGE/DATA DROP	7.167	
07:10	DEPART DEVONPORT FOR SURVEY AREA AGAIN	2.833	
10:00	STANDBY FOR WEATHER BEFORE REDEPLOYING STREAMER	9.433	Y
19:26	REDEPLOYING STREAMER	4.567	
** Subtotal **			
		24.000	
** Date: 25/01/96			
00:00	REDEPLOYING STREAMER	3.433	
03:26	STANDING BY, WAITING FOR SEA CONDITIONS TO IMPROVE	10.833	Y
14:16	DOWNTIME, PRIMARY NAVIGATION SYSTEM FAILURE	1.450	
15:43	RECORDING LINE BHA96-935	1.583	
17:18	LINE CHANGE	3.000	
20:18	RECORDING LINE BHA96-129	1.467	
21:46	LINE CHANGE	1.750	
23:31	AWAITING REPAIRS TO FOURTH COMPRESSOR	0.484	
** Subtotal **			
		24.000	
** Date: 26/01/96			
00:00	DELAYS IN LINE CHANGE FOR COMPRESSOR WORK	0.300	
00:18	RECORDING LINE BHA96-125	1.533	
01:50	LINE CHANGE	1.717	
03:33	RECOVERED AIRGUNS WAITING ON WEATHER	15.717	Y
19:16	REDEPLOYED AIRGUNS AND RUNNING TO LINE	2.650	Y
21:55	RECORDING LINE BHA96-119	2.083	
** Subtotal **			
		24.000	
** Date: 27/01/96			
00:00	RECORDING LINE BHA96-119	0.633	
00:38	LINE CHANGE	1.383	
02:01	RECORDING LINE BHA96-123	2.983	
05:00	LINE CHANGE	1.750	
06:45	INTER PROGRAM TRAVEL	3.950	Y
10:42	RECORDING LINE BHB96-102	2.800	
13:30	LINE CHANGE	1.400	
14:54	RECORDING LINE BHB96-100	2.867	
17:46	LINE CHANGE	2.050	
19:49	RECORDING LINE BHB96-119	1.450	
21:16	LINE CHANGE	1.317	
22:35	RECORDING LINE BHB96-117	1.350	
23:56	LINE CHANGE	0.067	
** Subtotal **			
		24.000	
** Date: 28/01/96			
00:00	LINE CHANGE	2.800	
02:48	RECORDING LINE BHB96-115	1.517	
04:19	LINE CHANGE	2.217	
06:32	RECORDING LINE BHB96-113	1.667	
08:12	LINE CHANGE	1.450	
09:39	RECORDING LINE BHB96-111	1.683	
11:20	LINE CHANGE	1.633	
12:58	RECORDING LINE BHB96-104	1.483	
14:27	LINE CHANGE	1.367	
15:49	RECORDING LINE BHB96-106	1.500	
17:19	LINE CHANGE	1.367	
18:41	RECORDING LINE BHB96-108	1.517	
20:12	LINE CHANGE	1.467	
21:40	RECORDING LINE BHB96-110	1.550	
23:13	LINE CHANGE	0.782	
** Subtotal **			
		24.000	

TIME	ACTIVITY	HOURS	CHG
** Date: 29/01/96			
00:00	LINE CHANGE	0.667	
00:40	RECORDING LINE BHB96-112	1.483	
02:09	LINE CHANGE	1.817	
03:58	RECORDING LINE BHB96-114	1.800	
05:46	LINE CHANGE	1.600	
07:22	RECORDING LINE BHB96-116	1.917	
09:17	LINE CHANGE	2.117	
11:24	RECORDING LINE BHB96-118	3.117	
14:31	LINE CHANGE	1.633	
16:09	RECORDING LINE BHB96-120	2.433	
18:35	LINE CHANGE	1.983	
20:34	RECORDING LINE BHB96-122	1.483	
22:03	LINE CHANGE	1.317	
23:22	RECORDING LINE BHB96-124	0.633	
** Subtotal **		24.000	
** Date: 30/01/96			
00:00	RECORDING LINE BHB96-124	0.767	
00:46	LINE CHANGE	1.517	
02:17	RECORDING LINE BHB96-105	4.367	
06:39	LINE CHANGE	2.433	
09:05	RECORDING LINE BHB96-101	4.400	
13:29	DOWNTIME, VESSEL EQUIPMENT FAILURE	3.750	
17:14	WEATHER DOWNTIME	4.100	Y
21:20	RECORDING LINE BHB96-129	1.917	
23:15	LINE CHANGE	0.749	
** Subtotal **		24.000	
** Date: 31/01/96			
00:00	LINE CHANGE	1.017	
01:01	RECORDING LINE BHB96-127	1.917	
02:56	LINE CHANGE	1.683	
04:37	RECORDING LINE BHB96-123	1.933	
06:33	LINE CHANGE	1.600	
08:09	RECORDING LINE BHB96-121	1.433	
09:35	WEATHER DOWNTIME	14.417	Y
** Subtotal **		24.000	
** Date: 01/02/96			
00:00	WEATHER DOWNTIME	24.000	Y
** Subtotal **		24.000	
** Date: 02/02/96			
00:00	WEATHER DOWNTIME	22.583	Y
22:35	RECORDING OVERLAP ON LINE BHB96-101	0.200	
22:47	RECORDING LINE BHB96-901	1.117	
23:54	LINE CHANGE	0.100	
** Subtotal **		24.000	

TIME	ACTIVITY	HOURS	CHG
** Date: 03/02/96			
00:00	LINE CHANGE	1.400	
01:24	RECORDING LINE BHB96-103	4.350	
05:45	LINE CHANGE	1.550	
07:18	RECORDING LINE BHB96-107	4.533	
11:50	LINE CHANGE	2.417	
14:15	RECORDING OVERLAP ON LINE BHB96-121	0.200	Y
14:27	RECORDING LINE BHB96-921	0.700	
15:09	LINE CHANGE	1.183	
16:20	RECORDING LINE BHB96-125	1.683	
18:01	LINE CHANGE	1.817	
19:50	RECORDING LINE BHB96-109	1.633	
21:28	SURVEY COMPLETE, RECOVERING SOURCE	0.700	
22:10	STREAMER RECOVERY	1.834	
** Subtotal **			
		24.000	
** Date: 04/02/96			
00:00	STREAMER RECOVERY	0.183	
00:11	TRAVEL	10.817	
11:00	PORT CALL FOR RESUPPLY/CREW CHANGE/DATA DROP	13.000	
** Subtotal **			
		24.000	
*** Total ***			
		480.000	

DAILY PRODUCTION DETAILS

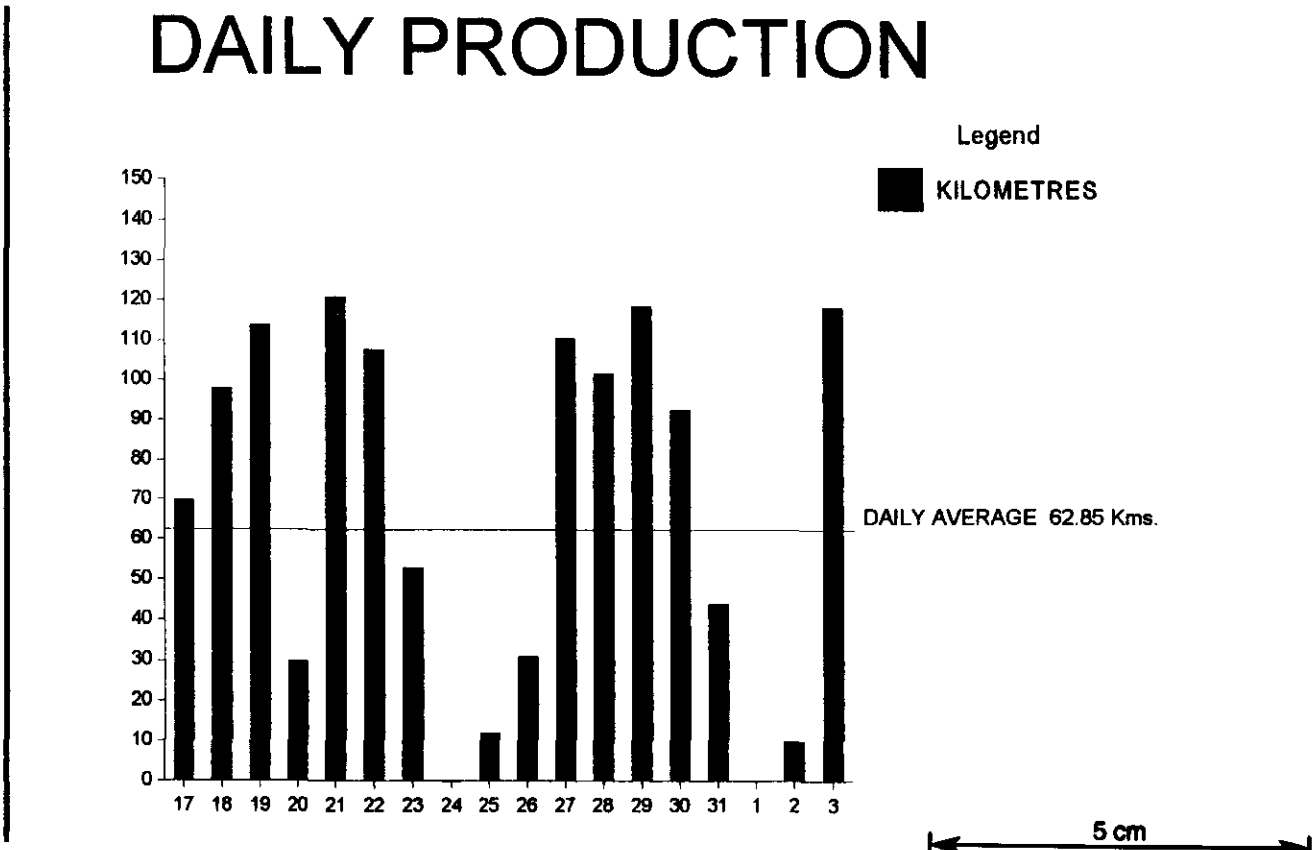


Figure 10

LINE	AZM	OVERALL SP RANGE	PROCESS SP RANGE	PROCESS KILOMETRES	CHARGE SP RANGE	CHARGE KILOMETRES	
** Date 17/01/96							
BHA96-100	318	1828-908	1828-908	21.0541	1828-908	21.0541	COM
BHA96-102	128	1010-1880	1010-1880	19.9111	1010-1862	19.4996	COM
BHA96-104	323	1690-917	1690-917	17.6936	1680-917	17.4650	COM
BHA96-121	043	1001-1146	0-0	0.0000	0-0	0.0000	TBR
BHA96-121	043	1001-1522	1001-1522	11.9329	1001-1522	11.9329	COM
** Subtotal **				70.5917		69.9516	
** Date 18/01/96							
BHA96-127	223	1451-917	1451-917	12.2301	1441-917	12.0015	COM
BHA96-131	044	991-1885	991-1885	20.4597	1001-1885	20.2311	COM
BHA96-133	224	1549-917	1549-917	14.4704	1539-917	14.2418	COM
BHA96-135	044	992-1558	0-0	0.0000	1001-1558	12.7559	TBR
BHA96-137	224	1561-917	1561-917	14.7447	1551-917	14.5161	COM
BHA96-139	044	991-1523	991-1523	12.1844	1001-1523	11.9558	COM
BHA96-141	224	1449-917	1449-917	12.1844	1439-917	11.9558	COM
** Subtotal **				86.2737		97.6580	
** Date 19/01/96							
BHA96-143	044	991-1568	991-1568	13.2131	1001-1568	12.9845	COM
BHA96-110	304	1544-606	1544-606	21.4655	1534-606	21.2369	COM
BHA96-108	134	991-1713	991-1713	16.5278	1001-1713	16.2992	COM
BHA96-106	314	1562-917	1562-917	14.7676	1552-917	14.5390	COM
BHA96-109	047	991-1693	991-1693	16.0706	1001-1693	15.8420	COM
BHA96-105	227	2100-917	2100-917	27.0662	2090-917	26.8376	COM
BHA96-103	048	991-1256	991-1256	6.0808	1001-1256	5.8522	MSP
** Subtotal **				115.1916		113.5914	

LINE	AZM	OVERALL SP RANGE	PROCESS SP RANGE	PROCESS KILOMETRES	CHARGE SP RANGE	CHARGE KILOMETRES	
** Date 20/01/96							
BHA96-103	323	1257-1717	1257-1717	10.5385	1257-1717	10.5385	TBC
BHA96-903	047	1634-2265	1634-2265	14.4475	1718-2265	12.5273	COM
BHA96-101	053	991-1300	991-1300	7.0866	1001-1300	6.8580	TBC
** Subtotal **				32.0726		29.9238	
** Date 21/01/96							
BHA96-901	053	1218-1755	1218-1755	12.2987	1301-1755	10.4013	COM
BHA96-107	227	2050-917	2050-917	25.9232	2041-917	25.7175	COM
BHA96-111	046	991-2248	991-2248	28.7579	1001-2248	28.5293	COM
BHA96-113	225	1975-917	1975-917	24.2087	1965-917	23.9801	COM
BHA96-115	045	991-2194	991-2194	27.5234	1001-2194	27.2948	COM
BHA96-117	225	2065-1842	2065-1842	5.1206	2055-1842	4.8920	MSP
** Subtotal **				123.8325		120.8150	
** Date 22/01/96							
BHA96-117	225	1841-917	1841-917	21.1455	1841-917	21.1455	COM
BHA96-114	321	1694-917	1694-917	17.7851	1684-917	17.5565	COM
BHA96-112	139	991-1665	991-1665	15.4305	1001-1665	15.2019	COM
BHA96-116	139	1732-917	1732-917	18.6538	1722-917	18.4252	COM
BHA96-118	142	991-1798	991-1798	18.4709	1001-1798	18.2423	COM
BHA96-120	323	1707-917	1707-917	18.0823	1697-917	17.8537	COM
** Subtotal **				109.5681		108.4251	
** Date 23/01/96							
BHA96-122	145	991-1773	991-1773	17.8994	1001-1773	17.6708	COM
BHA96-124	326	1695-917	1695-917	17.8079	1685-917	17.5793	COM
BHA96-126	148	991-1764	991-1764	17.6936	1001-1764	17.4650	COM
** Subtotal **				53.4009		52.7151	
** Date 25/01/96							
BHA96-935	044	991-1557	991-1557	12.9616	0-0	0.0000	COM
BHA96-129	043	991-1523	991-1523	12.1844	1001-1523	11.9558	COM
** Subtotal **				25.1460		11.9558	
** Date 26/01/96							
BHA96-125	223	1449-910	1449-910	12.3444	1439-917	11.9558	COM
BHA96-119	044	991-1833	991-1833	19.2710	1001-1833	19.0424	MSP
** Subtotal **				31.6154		30.9982	
** Date 27/01/96							
BHA96-119	044	1834-2093	1834-2093	5.9436	1834-2093	5.9436	COM
BHA96-123	223	1969-917	1969-917	24.0716	1959-917	23.8430	COM
BHB96-102	322	2115-917	2115-917	27.4091	2105-917	27.1805	COM
BHB96-100	144	991-2187	991-2187	27.3634	1001-2187	27.1348	COM
BHB96-119	054	991-1598	991-1598	13.8989	1001-1598	13.6703	COM
BHB96-117	233	1513-917	1513-917	13.6474	1503-917	13.4188	COM
** Subtotal **				112.3340		111.1910	
** Date 28/01/96							
BHB96-115	053	991-1654	991-1654	15.1790	1004-1654	14.8819	COM
BHB96-113	234	1596-917	1596-917	15.5448	1586-917	15.3162	COM
BHB96-111	055	991-1666	991-1666	15.4534	1001-1666	15.2248	COM
BHB96-104	324	1545-917	1545-917	14.3789	1535-917	14.1503	COM
BHB96-106	144	991-1618	991-1618	14.3561	1001-1618	14.1275	COM
BHB96-108	323	1545-917	1545-917	14.3789	1535-917	14.1503	COM
BHB96-110	142	991-1618	991-1618	14.3561	1001-1618	14.1275	COM
** Subtotal **				103.6472		101.9785	

LINE	AZM	OVERALL SP RANGE	PROCESS SP RANGE	PROCESS KILOMETRES	CHARGE SP RANGE	CHARGE KILOMETRES	
** Date 29/01/96							
BHB96-112	322	1545-915	1545-915	14.4247	1535-917	14.1503	COM
BHB96-114	141	991-1755	991-1755	17.4879	1001-1752	17.1907	COM
BHB96-116	321	1678-917	1678-917	17.4193	1668-917	17.1907	COM
BHB96-118	142	991-2219	991-2219	28.0949	1001-2219	27.8663	COM
BHB96-120	322	1885-917	1885-917	22.1513	1875-917	21.9227	COM
BHB96-122	144	991-1610	991-1610	14.1732	1001-1610	13.9446	COM
BHB96-124	324	1533-1247	1533-1247	6.5608	1523-1247	6.3322	MSP
** Subtotal **				120.3121		118.5975	
** Date 30/01/96							
BHB96-124	324	1246-917	1246-917	7.5438	1246-917	7.5438	COM
BHB96-105	235	2720-917	2720-917	41.2394	2710-917	41.0108	COM
BHB96-101	055	991-2503	991-2370	31.5468	1001-2370	31.3182	TBC
BHB96-129	233	1520-917	1520-917	13.8074	1510-917	13.5788	COM
** Subtotal **				94.1374		93.4516	
** Date 31/01/96							
BHB96-127	052	991-1698	991-1698	16.1849	1001-1698	15.9563	COM
BHB96-123	235	1626-917	1626-917	16.2306	1616-917	16.0020	COM
BHB96-121	056	991-1619	991-1534	12.4358	1001-1534	12.2072	TBC
** Subtotal **				44.8513		44.1655	
** Date 02/02/96							
BHB96-901	055	2286-2799	2286-2799	11.7500	2371-2799	9.8069	COM
** Subtotal **				11.7500		9.8069	
** Date 03/02/96							
BHB96-103	236	2723-917	2723-917	41.3080	2713-917	41.0794	COM
BHB96-107	055	990-2792	990-2792	41.2166	1000-2792	40.9880	COM
BHB96-921	056	1451-1829	1451-1829	8.6639	1535-1829	6.7437	COM
BHB96-125	234	1625-917	1625-917	16.2077	1615-917	15.9791	COM
BHB96-109	235	1568-917	1568-917	14.9047	1558-917	14.6761	COM
** Subtotal **				122.3009		119.4663	
*** Total ***				1257.0254		1234.6913	

SURVEY LINE LOGS

Sail Line: BHA96-100 Azm: 318 Status: COM Date: 17/01/96

CMP Lines: Source #1 Edit
Streamer #1 - : 100

Total SP Range: 1828-908
Process Range : 1828-908
Charge Range : 1828-908
Total CMP Km : 21.0541
Process CMP Km: 21.0541
Charge CMP Km : 21.0541

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	05:07	1740	75.5 M	FORCE 1-2 NNW	1	< 1M	107.5 M
EOL	07:37	1750	76.5 M	FORCE 2 NW	1	< 1M	107.5 M

Streamer Noise (uB) SOL #1 4.0 Feather 3.0S
EOL #1 4.0 Feather 2.0S Ave Depth (M): 6 Qual 1:3
Bad Grps: Trace 109 low response, 226 spiking intermittently.
Comments: Traces 215-225 noisy from ships noise refelcted from the sea bed

SOL Source Vol (in3) : #1 2660 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 4

Dropouts: None
Comments: A number of minor timing errors on guns throughout.

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, 4, 21, 22 PDOP SOL 1.4 EOL 1.2 Ave 1.3

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 4
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : Lost navigation recording system from shots 1658-1652

Edited Shotpoints : 1658-1652 NDRs
Segment Edits : None

Additional Q.A. Log Comments

Sail Line: BHA96-102 Azm: 128 Status: COM Date: 17/01/96

CMP Lines: Source #1 Edit
Streamer #1 - : 102

Total SP Range: 1010-1880
Process Range : 1010-1880
Charge Range : 1010-1862
Total CMP Km : 19.9111
Process CMP Km: 19.9111
Charge CMP Km : 19.4996

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	09:30	1751	77.7 M	FORCE 1-2 NW	1	< 1M	107.5 M
EOL	12:05	1760	77.5 M	FORCE 1-2 NW	1	< 1M	107.5 M

Streamer Noise (uB) SOL #1 3.0 Feather 0.0P
EOL #1 2.0 Feather 1.0P Ave Depth (M): 6 Qual 1:3
Bad Grps: Trace 109 low response, 226 spiking intermittently.
Comments: Traces 215-225 noisy from ships noise reflected from the sea bed

SOL Source Vol (in3) : #1 2660 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 2

Dropouts: A2 7 SP1278 2560ci timing, A2 8 SP1285 2460ci cluster rule
Comments: Source timing poor in the region SP 1277-1285. 98/15% in +/- 1 ms

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, 4, 21, 22 PDOP SOL 1.5 EOL 1.3 Ave 1.4

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 4
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : Line not terminated at the corrct point by operator

Edited Shotpoints : 1277-1281 for source timing
Segment Edits : None

Additional Q.A. Log Comments

Sail Line: BHA96-103 Azm: 048 Status: TBC Date: 19/01/96

CMP Lines: Source #1 Edit
Streamer #1 - : 103

Total SP Range: 991-1717
Process Range : 991-1717
Charge Range : 1001-1717
Total CMP Km : 16.6193
Process CMP Km: 16.6193
Charge CMP Km : 16.3907

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	23:17	1889	79.2 M	FORCE 6 N	5-6	1M	107.5 M
EOL	01:15	1897	81.6 M	FORCE 6 NNW	5-6	2-3M	107.5 M

Streamer Noise (uB) SOL #1 3.0 Feather 4.0S
EOL #1 4.0 Feather 0.7P Ave Depth (M): 6 Qual 1:3
Bad Grps: 109 weak, 14, 136 & 226 spiking intermittently. 167 fails leakage test
Comments: Traces 217-227 noisy from ships noise reflected from the sea bed

SOL Source Vol (in3) : #1 2660 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 4

Dropouts: None
Comments: 99.20% in ± 1 ms

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, 4, 21, 22 PDOP SOL 1.4 EOL 1.4 Ave 1.4

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 2
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : Missed SP1389 & line termination both caused by loss of differentials

Edited Shotpoints : 1389 NDR
Segment Edits : Edit all data after SP 1717

Additional Q.A. Log Comments

Line terminated after a second extended period of differential signal problems caused an unacceptably high number of lost shots.

Sail Line: BHA96-104 Azm: 323 Status: COM Date: 17/01/96

CMP Lines: Source #1 Edit
Streamer #1 - : 104

Total SP Range: 1690-917
Process Range : 1690-917
Charge Range : 1680-917
Total CMP Km : 17.6936
Process CMP Km: 17.6936
Charge CMP Km : 17.4650

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	13:49	1761	76.5 M	FORCE 4 NW	3	< 1M	107.5 M
EOL	15:54	1769	76.2 M	FORCE 5 WNW	3	< 1M	107.5 M

Streamer Noise (uB) SOL #1 3.0 Feather 0.0P
EOL #1 3.0 Feather 1.0P Ave Depth (M): 6 Qual 1:3
Bad Grps: Trace 109 low response, 226 spiking intermittently.
Comments: Traces 215-225 noisy from ships noise reflected from the sea bed

SOL Source Vol (in3) : #1 2660 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 4

Dropouts: None
Comments: 99.87% in +/- 1 ms

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, 4, 21, 22 PDOP SOL 1.6 EOL 1.5 Ave 1.3

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 4
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments :

Edited Shotpoints : None
Segment Edits : None

Additional Q.A. Log Comments

Sail Line: BHA96-105 Azm: 227 Status: COM Date: 19/01/96

CMP Lines: Source #1 Edit
Streamer #1 - : 105

Total SP Range: 2100-917
Process Range : 2100-917
Charge Range : 2090-917
Total CMP Km : 27.0662
Process CMP Km: 27.0662
Charge CMP Km : 26.8376

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	18:09	1874	80.1 M	FORCE 4-5 NE	4	< 1M	107.5 M
EOL	21:25	1888	77.6 M	FORCE 4 NE	4	< 1M	107.5 M

Streamer Noise (uB) SOL #1 3.0 Feather 1.0P
EOL #1 3.0 Feather 7.0P Ave Depth (M): 6 Qual 1:3
Bad Grps: 109 weak, 14, 136 & 226 spiking intermittently. 167 fails leakage test
Comments: Traces 200-212 noisy from ships noise reflected from the sea bed

SOL Source Vol (in3) : #1 2660 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 4

Dropouts: nONE
Comments: 99.41% in ± 1 ms

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, 4, 21, 22 PDOP SOL 1.8 EOL 1.5 Ave 1.6

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 4
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : No missed shotpoints or NDRs due to Nav.

Edited Shotpoints : 1829 bad, only record on tape 1877 DNP
Segment Edits : None

Additional Q.A. Log Comments

Sail Line: BHA96-106 Azm: 314 Status: COM Date: 19/01/96

CMP Lines: Source #1 Edit
Streamer #1 - : 106

Total SP Range: 1562-917
Process Range : 1562-917
Charge Range : 1552-917
Total CMP Km : 14.7676
Process CMP Km: 14.7676
Charge CMP Km : 14.5390

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	11:27	1857	79.7 M	FORCE 3-4 NE	3-4	< 1M	107.5 M
EOL	13:16	1864	79.2 M	FORCE 3-4 N	3	< 1M	107.5 M

Streamer Noise (uB) SOL #1 3.0 Feather 0.0P
EOL #1 2.5 Feather 1.0S Ave Depth (M): 6 Qual 1:3
Bad Grps: 109 weak, 14, 136 & 226 spiking intermittently. 167 fails leakage test
Comments: Traces 215-225 noisy from ships noise reflected from the sea bed

SOL Source Vol (in3) : #1 2660 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 4

Dropouts: None
Comments: 99.69% in ± 1 ms

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, 4, 21, 22 PDOP SOL 1.5 EOL 1.6 Ave 1.6

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 4
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : No missed shotpoints or NDRs

Edited Shotpoints : None
Segment Edits : None

Additional Q.A. Log Comments

Sail Line: BHA96-107 Azm: 227 Status: COM Date: 21/01/96

CMP Lines: Source #1 Edit
Streamer #1 - : 107

Total SP Range: 2050-917
Process Range : 2050-917
Charge Range : 2041-917
Total CMP Km : 25.9232
Process CMP Km: 25.9232
Charge CMP Km : 25.7175

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	04:04	1917	80.6 M	FORCE 6 SW	5-6	3-4M	107.5 M
EOL	07:20	1930	77.1 M	FORCE 6 SW	5-6	4 M	107.5 M

Streamer Noise (uB) SOL #1 4.0 Feather 1.0S
EOL #1 5.0 Feather 0.5P Ave Depth (M): 8 Qual 1:3
Bad Grps: 109 weak, 14, 136 & 226 spiking intermittently. 167 fails leakage test
Comments: Very frequent sea and swell noise on records.

SOL Source Vol (in3) : #1 2660 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 4

Dropouts: None but numerous small timing errors on A1-1.
Comments: 98.06% in ± 1 ms

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, 4, 21, 22 PDOP SOL 1.4 EOL 1.2 Ave 1.3

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 4
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : No missed shots resulting from Nav. problems

Edited Shotpoints : 1779 is the only file on tape 1920 and is bad DNP tape 1920
Segment Edits : None

Additional Q.A. Log Comments

Sail Line: BHA96-108 Azm: 134 Status: COM Date: 19/01/96

CMP Lines: Source #1 Edit
Streamer #1 - : 108

Total SP Range: 991-1713
Process Range : 991-1713
Charge Range : 1001-1713
Total CMP Km : 16.5278
Process CMP Km: 16.5278
Charge CMP Km : 16.2992

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	07:36	1849	77.4 M	FORCE 3 ESE	2-3	< 1M	107.5 M
EOL	09:39	1856	78.7 M	FORCE 3 ESE	2-3	< 1M	107.5 M

Streamer Noise (uB) SOL #1 3.0 Feather 0.7S
EOL #1 3.0 Feather 1.5S Ave Depth (M): 6 Qual 1:3
Bad Grps: 109 weak, 14, 136 & 226 spiking intermittently. 167 fails leakage test
Comments: Traces 217-227 noisy from ships noise reflected from the sea bed

SOL Source Vol (in3) : #1 2460 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 3

Dropouts: A3-7 failed A3-8 off at SOL.
Comments: 98.76% in ± 1 ms

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, 4, 21, 22 PDOP SOL 1.5 EOL 2.0 Ave 1.7

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 4
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : No missed shotpoints or NDRs

Edited Shotpoints : None
Segment Edits : None

Additional Q.A. Log Comments

Sail Line: BHA96-109 Azm: 047 Status: COM Date: 19/01/96

CMP Lines: Source #1 Edit
Streamer #1 - : 109

Total SP Range: 991-1693
Process Range : 991-1693
Charge Range : 1001-1693
Total CMP Km : 16.0706
Process CMP Km: 16.0706
Charge CMP Km : 15.8420

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	14:41	1865	79.9 M	FORCE 4-5 NE	4	< 1M	107.5 M
EOL	16:37	1873	80.8 M	FORCE 5 NE	4	< 1M	107.5 M

Streamer Noise (uB) SOL #1 3.0 Feather 3.0P
EOL #1 3.0 Feather 0.0P Ave Depth (M): 6 Qual 1:3
Bad Grps: 109 weak, 14, 136 & 226 spiking intermittently. 167 fails leakage test
Comments: Traces 210-220 noisy from ships noise reflected from the sea bed

SOL Source Vol (in3) : #1 2660 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 4

Dropouts: None
Comments: 99.86% in ±1 ms

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, 4, 21, 22 PDOP SOL 1.3 EOL 1.7 Ave 1.5

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 4
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : No missed shotpoints or NDRs due to Nav.

Edited Shotpoints : 1262 file 362 is only record on tape 1868 and is bad
Segment Edits : None

Additional Q.A. Log Comments

Sail Line: BHA96-110 Azm: 304 Status: COM Date: 19/01/96

CMP Lines: Source #1 Edit
Streamer #1 - : 110

Total SP Range: 1544-606
Process Range : 1544-606
Charge Range : 1534-606
Total CMP Km : 21.4655
Process CMP Km: 21.4655
Charge CMP Km : 21.2369

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	03:26	1836	78.0 M	FORCE 3 NE	3-4	< 1M	107.5 M
EOL	06:07	1848	77.0 M	FORCE 2-3 NE	3-4	< 1M	107.5 M

Streamer Noise (uB) SOL #1 3.0 Feather 0.5P
EOL #1 3.0 Feather 0.5P Ave Depth (M): 6 Qual 1:3
Bad Grps: 109 weak, 14, 136 & 226 spiking intermittently. 167 fails leakage test
Comments: Traces 197-217 noisy from ships noise reflected from the sea bed

SOL Source Vol (in3) : #1 2660 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 3

Dropouts: A3-1 SP756 poor timing, volume 2590 ci
Comments: 97.12% in ± 1 ms

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, 4, 21, 22 PDOP SOL 1.3 EOL 1.6 Ave 1.5

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 4
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : Shotpoints incorrectly numbered due to finger fault.

Edited Shotpoints : 1273, 1036, 634 all NDRs first and last for tape failures.
Segment Edits : None

Additional Q.A. Log Comments

Sail Line: BHA96-111 Azm: 046 Status: COM Date: 21/01/96

CMP Lines: Source #1 Edit
Streamer #1 - : 111

Total SP Range: 991-2248
Process Range : 991-2248
Charge Range : 1001-2248
Total CMP Km : 28.7579
Process CMP Km: 28.7579
Charge CMP Km : 28.5293

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	09:28	1931	75.6 M	FORCE 5 W	5-6	3-4M	107.5 M
EOL	13:05	1944	81.5 M	FORCE 4-5 SW	5	3 M	107.5 M

Streamer Noise (uB) SOL #1 4.0 Feather 3.0S
EOL #1 3.5 Feather 1.7S Ave Depth (M): 8 Qual 1:3
Bad Grps: 109 weak, 14, 136 & 226 spiking intermittently. 167 fails leakage test
Comments: Frequent sea and swell noise on records.

SOL Source Vol (in3) : #1 2660 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 4

Dropouts: None
Comments: 99.60% in ± 1 ms

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, 4, 21, 22 PDOP SOL 2.0 EOL 1.6 Ave 1.8

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 4
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : SP 1204 NDR, shooting to fast.

Edited Shotpoints : 1204 NDR, 1205 is wrongly identified as 1204 in header
Segment Edits : None

Additional Q.A. Log Comments

Sail Line: BHA96-112 Azm: 139 Status: COM Date: 22/01/96

CMP Lines: Source #1 Edit
Streamer #1 - : 112

Total SP Range: 991-1665
Process Range : 991-1665
Charge Range : 1001-1665
Total CMP Km : 15.4305
Process CMP Km: 15.4305
Charge CMP Km : 15.2019

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	09:58	1994	78.3 M	FORCE 2-3 W	2-3	1-2M	107.5 M
EOL	11:50	2001	79.3 M	FORCE 3 SW	2-3	1-2M	107.5 M

Streamer Noise (uB) SOL #1 4.0 Feather 2.0P
EOL #1 3.0 Feather 2.2S Ave Depth (M): 7 Qual 1:3
Bad Grps: 109 weak, 14, 136 & 226 spiking intermittently. 167 fails leakage test
Comments: Some swell noise still evident. Reflected ship noise on 213-223

SOL Source Vol (in3) : #1 2660 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 4

Dropouts: None
Comments: 99.26% in ± 1 ms

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, all others N/A PDOP SOL 1.6 EOL 1.3 Ave 1.5

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 4
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : No Shotpoints missed by navigation system

Edited Shotpoints : 1355, 1356, 1357 ITBs to allow pressure to recover at speed
Segment Edits : None

Additional Q.A. Log Comments

Sail Line: BHA96-113 Azm: 225 Status: COM Date: 21/01/96

CMP Lines: Source #1 Edit
Streamer #1 - : 113

Total SP Range: 1975-917
Process Range : 1975-917
Charge Range : 1965-917
Total CMP Km : 24.2087
Process CMP Km: 24.2087
Charge CMP Km : 23.9801

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	14:27	1945	81.4 M	FORCE 5 SW	4-5	2-3 M	107.5 M
EOL	17:25	1957	77.9 M	FORCE 4-5 W	4	2 M	107.5 M

Streamer Noise (uB) SOL #1 5.0 Feather 0.0P
EOL #1 3.0 Feather 0.0P Ave Depth (M): 7 Qual 1:3
Bad Grps: 109 weak, 14, 136 & 226 spiking intermittently. 167 fails leakage test
Comments: Sea and swell noise still evident.

SOL Source Vol (in3) : #1 2660 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 4

Dropouts: None
Comments: 99.81% in ± 1 ms

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, 4, 21, 22 PDOP SOL 1.3 EOL 1.2 Ave 1.3

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 4
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : No shotpoints missed due to navigation problems

Edited Shotpoints : 1340 is a single bad record on tape 1952 DNP
Segment Edits : None

Additional Q.A. Log Comments

Sail Line: BHA96-114 Azm: 321 Status: COM Date: 22/01/96

CMP Lines: Source #1 Edit
Streamer #1 - : 114

Total SP Range: 1694-917
Process Range : 1694-917
Charge Range : 1684-917
Total CMP Km : 17.7851
Process CMP Km: 17.7851
Charge CMP Km : 17.5565

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	06:43	1985	79.1 M	FORCE 4-5 SW	3-4	2 M	107.5 M
EOL	08:51	1993	78.0 M	FORCE 3-4 W	2-3	1-2M	107.5 M

Streamer Noise (uB) SOL #1 5.0 Feather 1.0S
EOL #1 3.0 Feather 0.4S Ave Depth (M): 7 Qual 1:3
Bad Grps: 109 weak, 14, 136 & 226 spiking intermittently. 167 fails leakage test
Comments: Sea and swell noise still evident. Reflected ship noise on 205-210

SOL Source Vol (in3) : #1 2660 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 4

Dropouts: None
Comments: 99.48% in ± 1 ms

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, all others N/A PDOP SOL 1.5 EOL 1.5 Ave 1.5

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 4
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : No Shotpoints missed by navigation system

Edited Shotpoints : 1642, 1641, 1640, 1559, 1558 all ITBs to keep pressure up
Segment Edits : None

Additional Q.A. Log Comments

At the start of the line the seas and current were such that the streamer depth of 7 metres could not be maintained without loosing pressure. A compromise of dropping the streamer depth back to 8 metres and decreasing the speed was taken at SP 1525.

Sail Line: BHA96-115 Azm: 045 Status: COM Date: 21/01/96

CMP Lines: Source #1 Edit
Streamer #1 - : 115

Total SP Range: 991-2194
Process Range : 991-2194
Charge Range : 1001-2194
Total CMP Km : 27.5234
Process CMP Km: 27.5234
Charge CMP Km : 27.2948

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	18:48	1958	76.0 M	FORCE 4-5 W	3-4	2-3 M	107.5 M
EOL	22:02	1971	79.7 M	FORCE 5 SW	4	2 M	107.5 M

Streamer Noise (uB) SOL #1 3.0 Feather 0.0S
EOL #1 3.0 Feather 4.0S Ave Depth (M): 7 Qual 1:3
Bad Grps: 109 weak, 14, 136 & 226 spiking intermittently. 167 fails leakage test
Comments: Sea and swell noise still evident. Reflected ship noise on 219-229.

SOL Source Vol (in3) : #1 2660 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 4

Dropouts: A2-9 & A2-10 SP1112, timing. 2460 ci
Comments: 98.59% in ± 1 ms

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, 4, 21, 22 PDOP SOL 1.6 EOL 2.2 Ave 1.9

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 4
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : SP 1042 NDR no clusure issued by navigation system

Edited Shotpoints : 1042 NDR
Segment Edits : None

Additional Q.A. Log Comments

Sail Line: BHA96-116 Azm: 139 Status: COM Date: 22/01/96

CMP Lines: Source #1 Edit
Streamer #1 - : 116

Total SP Range: 1732-917
Process Range : 1732-917
Charge Range : 1722-917
Total CMP Km : 18.6538
Process CMP Km: 18.6538
Charge CMP Km : 18.4252

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	13:03	2002	80.1 M	FORCE 4 SW	3	1M	107.5 M
EOL	15:18	2011	81.1 M	FORCE 3 VAR.	2-3	1M	107.5 M

Streamer Noise (uB) SOL #1 3.0 Feather 2.0P
EOL #1 3.0 Feather 2.0P Ave Depth (M): 7 Qual 1:3
Bad Grps: 109 weak, 14, 136 & 226 spiking intermittently. 167 fails leakage test
Comments: Slight swell noise still evident. Some reflected ship noise 205-215

SOL Source Vol (in3) : #1 2660 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 4

Dropouts: None
Comments: 98.53% in ± 1 ms. Some minor timing errors mainly A2-9

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, all others N/A PDOP SOL 1.6 EOL 1.3 Ave 1.5

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 4
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : No Shotpoints missed by navigation system

Edited Shotpoints : None
Segment Edits : None

Additional Q.A. Log Comments

Sail Line: BHA96-117 Azm: 225 Status: COM Date: 21/01/96

CMP Lines: Source #1 Edit
Streamer #1 - : 117

Total SP Range: 2065-917
Process Range : 2065-917
Charge Range : 2055-917
Total CMP Km : 26.2661
Process CMP Km: 26.2661
Charge CMP Km : 26.0375

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	23:24	1972	80.2 M	FORCE 5-6 SW	3-4	2 M	107.5 M
EOL	02:36	1984	78.1 M	FORCE 4-5 SE	3-4	2 M	107.5 M

Streamer Noise (uB) SOL #1 4.0 Feather 4.0P
EOL #1 3.0 Feather 3.4S Ave Depth (M): 7 Qual 1:3
Bad Grps: 109 weak, 14, 136 & 226 spiking intermittently. 167 fails leakage test
Comments: Sea and swell noise still evident. Reflected ship noise on 195-215

SOL Source Vol (in3) : #1 2660 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 4

Dropouts: None
Comments: 99.48% in ± 1 ms

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, 4, 21, 22 PDOP SOL 1.4 EOL 1.3 Ave 1.4

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 4
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : No Shotpoints missed by navigation system

Edited Shotpoints : None
Segment Edits : None

Additional Q.A. Log Comments

Sail Line: BHA96-118 Azm: 142 Status: COM Date: 22/01/96

CMP Lines: Source #1 Edit
Streamer #1 - : 118

Total SP Range: 991-1798
Process Range : 991-1798
Charge Range : 1001-1798
Total CMP Km : 18.4709
Process CMP Km: 18.4709
Charge CMP Km : 18.2423

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	16:48	2012	81.5 M	FORCE 2 VAR.	2	< 1M	107.5 M
EOL	19:01	2020	80.0 M	FORCE 1 VAR.	2-3	< 1M	107.5 M

Streamer Noise (uB) SOL #1 3.0 Feather 0.0P
EOL #1 2.5 Feather 1.0P Ave Depth (M): 7 Qual 1:3
Bad Grps: 109 weak, 14, 136 & 226 spiking intermittently. 167 fails leakage test
Comments: Slight swell noise still evident. Some reflected ship noise 195-220

SOL Source Vol (in3) : #1 2660 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 4

Dropouts: None
Comments: 99.75% in ± 1 ms

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, all others N/A PDOP SOL 1.5 EOL 1.4 Ave 1.5

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 4
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : No Shotpoints missed by navigation system

Edited Shotpoints : None
Segment Edits : None

Additional Q.A. Log Comments

Sail Line: BHA96-119 Azm: 044 Status: COM Date: 26/01/96

CMP Lines: Source #1 Edit
Streamer #1 - : 119

Total SP Range: 991-2093
Process Range : 991-2093
Charge Range : 1001-2093
Total CMP Km : 25.2146
Process CMP Km: 25.2146
Charge CMP Km : 24.9860

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	21:55	2076	78.4 M	FORCE 5-6 NW	4-5	3-4M	107.5 M
EOL	00:38	2088	79.3 M	FORCE 5-6 NW	5	3-4M	107.5 M

Streamer Noise (uB) SOL #1 3.5 Feather 2.1P
EOL #1 4.0 Feather 0.4S Ave Depth (M): 8 Qual 1:3
Bad Grps: 136 consistently noisy. 167 fails leakage test. 18-24 = 5 μbar +
Comments: Reflected ship noise on traces 218-227

SOL Source Vol (in3) : #1 2660 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 4

Dropouts: None
Comments: 99.54% in ± 1 ms

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, 7, 18 PDOP SOL 1.4 EOL 1.4 Ave 1.4

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 3
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : Jamming of GPS signals by incoming fax caused 9 lost records.

Edited Shotpoints : See Below
Segment Edits : None

Additional Q.A. Log Comments

SP	Time	Actual	SP	Time	Actual
1360	22:49:02	1360	1373	22:50:59	NDR
1361	22:49:11	NDR	1374	22:51:08	1374
1362	22:49:20	1361	1375	22:51:17	1376
1363	22:49:29	NDR	1376	22:51:26	1377
1364	22:49:38	1362	1377	22:51:35	1378
1365	22:49:47	NDR	1378	22:51:44	NDR
1366	22:49:56	1363	1379	22:51:53	1379
1367	22:50:05	1365	1380	22:52:02	1380
1368	22:50:14	NDR	1381	22:52:11	1381
1369	22:50:23	NDR	1382	22:52:20	NDR
1370	22:50:32	1366	1383	22:52:29	1383
1371	22:50:41	NDR	1384	22:52:38	1384
1372	22:50:50	1370	1385	22:52:47	1385

9 MISSED SHOTS IN 22 SHOTPOINTS.

Sail Line: BHA96-120 Azm: 323 Status: COM Date: 22/01/96

CMP Lines: Source #1 Edit
Streamer #1 - : 120

Total SP Range: 1707-917
Process Range : 1707-917
Charge Range : 1697-917
Total CMP Km : 18.0823
Process CMP Km: 18.0823
Charge CMP Km : 17.8537

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	20:24	2021	79.7 M	FORCE 1 VAR.	1-2	< 1M	107.5 M
EOL	22:34	2029	79.4 M	FORCE 3 NE	2	< 1M	107.5 M

Streamer Noise (uB) SOL #1 2.5 Feather 2.0S
EOL #1 2.5 Feather 0.0S Ave Depth (M): 7 Qual 1:3
Bad Grps: 109 weak, 14, 136 & 226 spiking intermittently. 167 fails leakage test
Comments: Streamer head deep (9 m.) holed stretch? Reflected ship noise 205-215

SOL Source Vol (in3) : #1 2660 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 4

Dropouts: None
Comments: 99.87% in ± 1 ms

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, all others N/A PDOP SOL 1.5 EOL 1.5 Ave 1.5

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 4
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : No Shotpoints missed by navigation system

Edited Shotpoints : 1408 & 1407 ITBs guncontroller fault
Segment Edits : None

Additional Q.A. Log Comments

Sail Line: BHA96-121 Azm: 043 Status: COM Date: 17/01/96

CMP Lines: Source #1 Edit
Streamer #1 - : 121

Total SP Range: 1001-1522
Process Range : 1001-1522
Charge Range : 1001-1522
Total CMP Km : 15.2705
Process CMP Km: 11.9329
Charge CMP Km : 11.9329

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	19:00	1770	76.1 M	FORCE 5 WSW	3-4	< 1M	107.5 M
EOL	23:25	1775	79.2 M	FORCE 4 WSW	3	< 1M	107.5 M

Streamer Noise (uB) SOL #1 3.0 Feather 0.0P
EOL #1 3.0 Feather 6.0P Ave Depth (M): 6 Qual 1:3
Bad Grps: Trace 109 low response, 14 & 136 spiking intermittently.
Comments: Traces 221-229 noisy from ships noise reflected from the sea bed

SOL Source Vol (in3) : #1 2660 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 4

Dropouts: None
Comments: 99.25% in ± 1 msec

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, 4, 21, 22 PDOP SOL 1.6 EOL 1.4 Ave 1.5

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 4
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments :

Edited Shotpoints : None
Segment Edits : None

Additional Q.A. Log Comments

Sail Line: BHA96-122 Azm: 145 Status: COM Date: 23/01/96

CMP Lines: Source #1 Edit
Streamer #1 - : 122

Total SP Range: 991-1773
Process Range : 991-1773
Charge Range : 1001-1773
Total CMP Km : 17.8994
Process CMP Km: 17.8994
Charge CMP Km : 17.6708

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	00:21	2030	80.3 M	FORCE 3 WNW	3	< 1M	107.5 M
EOL	02:30	2038	81.5 M	FORCE 4-5 NE	3	< 1M	107.5 M

Streamer Noise (uB) SOL #1 3.0 Feather 3.0S
EOL #1 3.0 Feather 5.4S Ave Depth (M): 7 Qual 1:3
Bad Grps: 109 weak, 14, 136 & 226 spiking intermittently. 167 fails leakage test
Comments: Streamer head deep (9 m.) holed stretch? Reflected ship noise 195-220

SOL Source Vol (in3) : #1 2660 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 4

Dropouts: None
Comments: 99.11% in ± 1 ms

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6 all others N/A PDOP SOL 1.8 EOL 1.3 Ave 1.5

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 4
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : No Shotpoints missed by navigation system

Edited Shotpoints : None
Segment Edits : None

Additional Q.A. Log Comments

Sail Line: BHA96-123 Azm: 223 Status: COM Date: 27/01/96

CMP Lines: Source #1 Edit
Streamer #1 - : 123

Total SP Range: 1969-917
Process Range : 1969-917
Charge Range : 1959-917
Total CMP Km : 24.0716
Process CMP Km: 24.0716
Charge CMP Km : 23.8430

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	02:01	2089	79.4 M	FORCE 5-6 NW	4-5	3-4M	107.5 M
EOL	05:00	2100	76.0 M	FORCE 5 NW	4-5	3-4M	107.5 M

Streamer Noise (uB) SOL #1 4.0 Feather 3.8P
EOL #1 4.0 Feather 8.6P Ave Depth (M): 8 Qual 1:3
Bad Grps: 136 consistently noisy. 167 fails leakage test. 18-24 = 5 μbar +
Comments: Reflected ship noise on traces 210-220. Feather peaked at 9° port

SOL Source Vol (in3) : #1 2660 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 3

Dropouts: None. SPs 1104, 1101, 1096, 1088 all ITBs, compressor failure.
Comments: 99.33% in ± 1 ms. Compressor offline at SP 1100 back on at SP 1070

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, 7, 18 PDOP SOL 1.3 EOL 1.2 Ave 1.3

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 3
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : No navigation system problems noted on this line

Edited Shotpoints : 1104, 1101, 1096, 1088
Segment Edits : None

Additional Q.A. Log Comments

Sail Line: BHA96-124 Azm: 326 Status: COM Date: 23/01/96

CMP Lines: Source #1 Edit
Streamer #1 - : 124

Total SP Range: 1695-917
Process Range : 1695-917
Charge Range : 1685-917
Total CMP Km : 17.8079
Process CMP Km: 17.8079
Charge CMP Km : 17.5793

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	03:58	2039	82.2 M	FORCE 4-5 NE	4-5	1-2M	107.5 M
EOL	06:07	2047	81.3 M	FORCE 4-5 NE	4-5	2M	107.5 M

Streamer Noise (uB) SOL #1 3.0 Feather 5.0P
EOL #1 3.0 Feather 5.1P Ave Depth (M): 7 Qual 1:3
Bad Grps: 109 weak, 14, 136 & 226 spiking intermittently. 167 fails leakage test
Comments: Streamer head deep (9 m.) holed stretch? Reflected ship noise 203-213

SOL Source Vol (in3) : #1 2660 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 3

Dropouts: A4-1 & A4-2 SP1016, air leak, 2460 ci
Comments: 99.10 in ± 1 ms

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, 7, 18 PDOP SOL 1.4 EOL 1.5 Ave 1.5

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 4
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : No Shotpoints missed by navigation system

Edited Shotpoints : None
Segment Edits : None

Additional Q.A. Log Comments

Sail Line: BHA96-125 Azm: 223 Status: COM Date: 26/01/96

CMP Lines: Source #1 Edit
Streamer #1 - : 125

Total SP Range: 1449-910
Process Range : 1449-910
Charge Range : 1439-917
Total CMP Km : 12.3444
Process CMP Km: 12.3444
Charge CMP Km : 11.9558

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	00:18	2070	80.3 M	FORCE 5-6 NW	5-6	4M	107.5 M
EOL	01:50	2075	78.0 M	FORCE 5-6 NW	6	4-5M	107.5 M

Streamer Noise (uB) SOL #1 4.0 Feather 1.2P
EOL #1 5.0 Feather 3.3P Ave Depth (M): 8 Qual 1:3
Bad Grps: 136 consistently noisy. 167 fails leakage test. 18-24 = 5 μbar +
Comments: Reflected ship noise on traces 205-215

SOL Source Vol (in3) : #1 2570 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 3

Dropouts: A4-7 & A4-8 off at SOL airleak, 2570 ci
Comments: 99.81% in ± 1 ms

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, 7, 18 PDOP SOL 1.4 EOL 1.4 Ave 1.4

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 3
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : Offline distances lrger because of steering in very heavy water.

Edited Shotpoints : None
Segment Edits : None

Additional Q.A. Log Comments

Sail Line: BHA96-126 Azm: 148 Status: COM Date: 23/01/96

CMP Lines: Source #1 Edit
Streamer #1 - : 126

Total SP Range: 991-1764
Process Range : 991-1764
Charge Range : 1001-1764
Total CMP Km : 17.6936
Process CMP Km: 17.6936
Charge CMP Km : 17.4650

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	07:40	2048	80.1 M	FORCE 4-5 NE	5	1-2M	107.5 M
EOL	09:48	2056	79.6 M	FORCE 5 W	5	2M	107.5 M

Streamer Noise (uB) SOL #1 3.0 Feather 3.0S
EOL #1 3.0 Feather 0.7S Ave Depth (M): 7 Qual 1:3
Bad Grps: 109 weak, 14, 136 & 226 spiking intermittently. 167 fails leakage test
Comments: Streamer head deep (9 m.) holed stretch? Reflected ship noise 203-213

SOL Source Vol (in3) : #1 2660 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 3

Dropouts: None
Comments: 99.74% in ± 1 ms

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, 7, 18 PDOP SOL 1.3 EOL 1.6 Ave 1.5

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 4
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : No Shotpoints missed by navigation system

Edited Shotpoints : 1259, 1260, 1661 ITBs 1702 and 1755 NDRs
Segment Edits : None

Additional Q.A. Log Comments

Sail Line: BHA96-127 Azm: 223 Status: COM Date: 18/01/96

CMP Lines: Source #1 Edit
Streamer #1 - : 127

Total SP Range: 1451-917
Process Range : 1451-917
Charge Range : 1441-917
Total CMP Km : 12.2301
Process CMP Km: 12.2301
Charge CMP Km : 12.0015

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	00:47	1776	78.5 M	FORCE 3 SW	3	< 1M	107.5 M
EOL	02:17	1781	73.4 M	FORCE 4 S	3-4	< 1M	107.5 M

Streamer Noise (uB) SOL #1 4.0 Feather 7.0S
EOL #1 3.0 Feather 7.0S Ave Depth (M): 6 Qual 1:3
Bad Grps: Trace 109 low response, 14 & 136 spiking intermittently.
Comments: Traces 215-225 noisy from ships noise reflected from the sea bed

SOL Source Vol (in3) : #1 2660 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 4

Dropouts: None
Comments: 100% in ± 1 ms

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, 4, 21, 22 PDOP SOL 1.8 EOL 1.7 Ave 1.8

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 4
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : Navigation system stopped causing lost SPs from 1166-1162 incl.

Edited Shotpoints : 1166-1162 NDRs
Segment Edits : None

Additional Q.A. Log Comments

Sail Line: BHA96-129 Azm: 043 Status: COM Date: 25/01/96

CMP Lines: Source #1 Edit
Streamer #1 - : 129

Total SP Range: 991-1523
Process Range : 991-1523
Charge Range : 1001-1523
Total CMP Km : 12.1844
Process CMP Km: 12.1844
Charge CMP Km : 11.9558

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	20:18	2064	78.7 M	FORCE 5-6 NW	5-6	3-4M	107.5 M
EOL	21:46	2069	79.8 M	FORCE 5-6 NW	5-6	3-4M	107.5 M

Streamer Noise (uB) SOL #1 4.0 Feather 1.6S
EOL #1 4.0 Feather 0.3P Ave Depth (M): 8 Qual 1:3
Bad Grps: 136 consistently noisy. 167 fails leakage test. 18-24 = 5 μbar
Comments: Reflected ship noise on traces 215-225

SOL Source Vol (in3) : #1 2660 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 3

Dropouts: A4-1 off SP 1028 to 1062 to allow pressure to build, 2560 ci
Comments: 99.24% in ± 1 ms

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, 7, 18 PDOP SOL 1.4 EOL 1.8 Ave 1.6

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 3
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : Lost navigation around SP 1230, recovered at SP 1254.

Edited Shotpoints : 1236, 1238, 1242, 1290 NDRs
Segment Edits : None

Additional Q.A. Log Comments
The navigation system fault resulted in 4 NDRs. SP 1237 wrongly identified as 1236, 1239 as 1238, 1243 as 1242, 1290 as 1291 and 1293 as 1292

Sail Line: BHA96-131 Azm: 044 Status: COM Date: 18/01/96

CMP Lines: Source #1 Edit
Streamer #1 - : 131

Total SP Range: 991-1885
Process Range : 991-1885
Charge Range : 1001-1885
Total CMP Km : 20.4597
Process CMP Km: 20.4597
Charge CMP Km : 20.2311

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	03:45	1782	74.3 M	FORCE 4 S	3-4	< 1M	107.5 M
EOL	06:19	1791	78.6 M	CALM	1-2	< 1M	107.5 M

Streamer Noise (uB) SOL #1 3.0 Feather 5.6P
EOL #1 4.0 Feather 1.0S Ave Depth (M): 6 Qual 1:3
Bad Grps: Trace 109 low response, 14 & 136 spiking intermittently.
Comments: Traces 220-230 noisy from ships noise reflected from the sea bed

SOL Source Vol (in3) : #1 2660 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 4

Dropouts: None
Comments: 99.66% in ± 1 ms

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, 4, 21, 22 PDOP SOL 1.5 EOL 1.4 Ave 1.5

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 4
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : Navigation system stopped causing lost SPs from 1470-1475, 1481, 1484

Edited Shotpoints : 1470-1475, 1481, 1484 all NDRs
Segment Edits : None

Additional Q.A. Log Comments

Sail Line: BHA96-139 Azm: 044 Status: COM Date: 18/01/96

CMP Lines: Source #1 Edit
Streamer #1 - : 139

Total SP Range: 991-1523
Process Range : 991-1523
Charge Range : 1001-1523
Total CMP Km : 12.1844
Process CMP Km: 12.1844
Charge CMP Km : 11.9558

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	17:56	1815	74.8 M	FORCE 4 N	3	< 1M	107.5 M
EOL	19:24	1821	77.8 M	FORCE 4 NNW	3-4	< 1M	107.5 M

Streamer Noise (uB) SOL #1 2.5 Feather 1.0S
EOL #1 2.5 Feather 4.0S Ave Depth (M): 6 Qual 1:3
Bad Grps: 109 weak, 14, 136 & 226 spiking intermittently. 167 fails leakage test
Comments: Traces 209-215 noisy from ships noise reflected from the sea bed

SOL Source Vol (in3) : #1 2660 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 4

Dropouts: None
Comments: 99.44% in ± 1 ms

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, 4, 21, 22 PDOP SOL 1.3 EOL 1.4 Ave 1.4

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 4
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : Navigation system running well after removal of raw GPS from system

Edited Shotpoints : None
Segment Edits : None

Additional Q.A. Log Comments

Sail Line: BHA96-141 Azm: 224 Status: COM Date: 18/01/96

CMP Lines: Source #1 Edit
Streamer #1 - : 141

Total SP Range: 1449-917
Process Range : 1449-917
Charge Range : 1439-917
Total CMP Km : 12.1844
Process CMP Km: 12.1844
Charge CMP Km : 11.9558

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	20:58	1822	78.6 M	FORCE 1 VAR	1-2	< 1M	107.5 M
EOL	22:25	1828	76.4 M	FORCE 3 ENE	3-4	< 1M	107.5 M

Streamer Noise (uB) SOL #1 2.0 Feather 1.0P
EOL #1 3.0 Feather 0.0P Ave Depth (M): 6 Qual 1:3
Bad Grps: 109 weak, 14, 136 spiking intermittently. 167 fails leakage test
Comments: Traces 205-215 noisy from ships noise reflected from the sea bed

SOL Source Vol (in3) : #1 2660 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 4

Dropouts: None
Comments: 98.31% in ± 1 ms

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, 4, 21, 22 PDOP SOL 1.4 EOL 1.6 Ave 1.5

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 4
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : Navigation system running well after removal of raw GPS from system

Edited Shotpoints : 1162 NDR no closure from NAV system. 1161 labelled as 1162
Segment Edits : None

Additional Q.A. Log Comments

Sail Line: BHA96-143 Azm: 044 Status: COM Date: 19/01/96

CMP Lines: Source #1 Edit
Streamer #1 - : 143

Total SP Range: 991-1568
Process Range : 991-1568
Charge Range : 1001-1568
Total CMP Km : 13.2131
Process CMP Km: 13.2131
Charge CMP Km : 12.9845

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	00:05	1829	77.2 M	FORCE 4 ENE	3-4	< 1M	107.5 M
EOL	01:42	1835	78.9 M	FORCE 4-5 NE	3	< 1M	107.5 M

Streamer Noise (uB) SOL #1 2.5 Feather 8.0P
EOL #1 3.0 Feather 5.1P Ave Depth (M): 6 Qual 1:3
Bad Grps: 109 weak, 14, 136 & 226 spiking intermittently. 167 fails leakage test
Comments: Traces 217-227 noisy from ships noise reflected from the sea bed

SOL Source Vol (in3) : #1 2660 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 4

Dropouts: None
Comments: 98.79% in ± 1 ms

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, 4, 21, 22 PDOP SOL 1.3 EOL 1.4 Ave 1.4

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 4
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : Navigation system running well after removal of raw GPS from system

Edited Shotpoints : None
Segment Edits : None

Additional Q.A. Log Comments

Sail Line: BHA96-901 Azm: 053 Status: COM Date: 21/01/96

CMP Lines: Source #1 Edit
Streamer #1 - : 901

Total SP Range: 1218-1755
Process Range : 1218-1755
Charge Range : 1301-1755
Total CMP Km : 12.2987
Process CMP Km: 12.2987
Charge CMP Km : 10.4013

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	01:02	1910	81.1 M	FORCE 6 WSW	5	3M	107.5 M
EOL	02:31	1916	81.4 M	FORCE 6 W	5	3M	107.5 M

Streamer Noise (uB) SOL #1 5.0 Feather 0.4S
EOL #1 8.0 Feather 2.0P Ave Depth (M): 8 Qual 1:3
Bad Grps: 109 weak, 14, 136 & 226 spiking intermittently. 167 fails leakage test
Comments: Traces 210-220 noisy from ships noise reflected from the sea bed

SOL Source Vol (in3) : #1 2660 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 4

Dropouts: None
Comments: 98.53% in ± 1 ms.

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, 4, 21, 22 PDOP SOL 1.4 EOL 1.3 Ave 1.4

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 4
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : No shots missed due to Nav.

Edited Shotpoints : 1489 NDR tape unit failure, DNP tape 1913.
Segment Edits : None

Additional Q.A. Log Comments

Sail Line: BHA96-903 Azm: 047 Status: COM Date: 20/01/96

CMP Lines: Source #1 Edit
Streamer #1 - : 903

Total SP Range: 1634-2265
Process Range : 1634-2265
Charge Range : 1718-2265
Total CMP Km : 14.4475
Process CMP Km: 14.4475
Charge CMP Km : 12.5273

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	04:09	1898	79.7 M	FORCE 6 SW	5-6	3M	107.5 M
EOL	05:40	1904	79.8 M	FORCE 6 SW	6	3M	107.5 M

Streamer Noise (uB) SOL #1 4.0 Feather 0.9P
EOL #1 4.0 Feather 0.4S Ave Depth (M): 6 Qual 1:3
Bad Grps: 109 weak, 14, 136 & 226 spiking intermittently. 167 fails leakage test
Comments: Traces 217-227 noisy from ships noise reflected from the sea bed

SOL Source Vol (in3) : #1 2660 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 4

Dropouts: None
Comments: 99.05% in ± 1 ms

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, 4, 21, 22 PDOP SOL 1.4 EOL 1.5 Ave 1.5

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 4
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : No SPs missed as a result of navigation problems

Edited Shotpoints : None
Segment Edits : None

Additional Q.A. Log Comments

Sail Line: BHA96-935 Azm: 044 Status: COM Date: 25/01/96

CMP Lines: Source #1 Edit
Streamer #1 - : 935

Total SP Range: 991-1557
Process Range : 991-1557
Charge Range : Nil
Total CMP Km : 12.9616
Process CMP Km: 12.9616
Charge CMP Km : Nil

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	15:43	2057	76.1 M	FORCE 5-6 NW	5-6	2-4M	107.5 M
EOL	17:18	2063	79.6 M	FORCE 6-7 NW	6	3-4M	107.5 M

Streamer Noise (uB) SOL #1 4.0 Feather 6.2S
EOL #1 5.0 Feather 4.5S Ave Depth (M): 8 Qual 1:3
Bad Grps: 136 consistently noisy. 167 fails leakage test. 18-24 = 5 μbar
Comments: Reflected ship noise on traces 220-225

SOL Source Vol (in3) : #1 2660 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 4

Dropouts: None
Comments: 99.47% in ± 1 ms

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, 7, 18 PDOP SOL 1.3 EOL 1.8 Ave 1.6

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 4
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : Echo sounder having difficulty tracking in sea conditions.

Edited Shotpoints : 1500, 1551 both NDRs because of excessive ship speed
Segment Edits : None

Additional Q.A. Log Comments

Sail Line: BHB96-100 Azm: 144 Status: COM Date: 27/01/96

CMP Lines: Source #1 Edit
Streamer #1 - : 100

Total SP Range: 991-2187
Process Range : 991-2187
Charge Range : 1001-2187
Total CMP Km : 27.3634
Process CMP Km: 27.3634
Charge CMP Km : 27.1348

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	14:54	2116	58.6 M	FORCE 3-4 W	2-3	1-2M	107.5 M
EOL	17:46	2129	61.6 M	FORCE 3-4 W	2-3	1M	107.5 M

Streamer Noise (uB) SOL #1 4.0 Feather 6.5P
EOL #1 3.0 Feather 3.9P Ave Depth (M): 6 Qual 1:3
Bad Grps: 136 consistently noisy. 167 fails leakage test. 18-24 = 5 μbar +
Comments: Reflected ship noise on traces 220-225. Streamer raised to 6 m. again

SOL Source Vol (in3) : #1 2660 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 3

Dropouts: A2-9 & A2-10 SP1021, airleak, 2460ci. A4-9 SP1059, timing, 2390 ci
Comments: 99.00% in ± 1 ms. A4-9 timing misfires SPs 1053,1054,1055,1056,1059

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, 7, 18 PDOP SOL 1.3 EOL 1.6 Ave 1.5

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 4
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : No navigation system problems noted on this line

Edited Shotpoints : 1053, 1054, 1055, 1056, 1059 source timing misfires.
Segment Edits : None

Additional Q.A. Log Comments

Sail Line: BHB96-101 Azm: 055 Status: TBC Date: 30/01/96

CMP Lines: Source #1 Edit
Streamer #1 - : 101

Total SP Range: 991-2503
Process Range : 991-2370
Charge Range : 1001-2370
Total CMP Km : 34.5872
Process CMP Km: 31.5468
Charge CMP Km : 31.3182

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	09:05	2281	59.2 M	FORCE 6 NE	5-6	3 M	107.5 M
EOL	13:58	2297	79.0 M	FORCE 7-8 NE	6	4-5 M	107.5 M

Streamer Noise (uB) SOL #1 5.0 Feather 4.5P
EOL #1 8.0 Feather 3.2P Ave Depth (M): 6 Qual 1:3
Bad Grps: 109 distorted, 136/198 noisy. 167 fails leakage test. 18-24=5 μbar+
Comments: Streamer lowered to 8 metres at SP1080, sea noise incresing throughout

SOL Source Vol (in3) : #1 2620 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 3

Dropouts: A3-3 SOL N/F. A2-1/2 SP1311 airleak, 2480 ci. A2-1/2 on SP1421.
Comments: 98.39% in ± 1 ms

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, 7, 18 PDOP SOL 1.6 EOL 2.3 Ave 2.0

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 3
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : Multiple missed SPs, system cannot handle speed variation in head seas

Edited Shotpoints : See below.
Segment Edits : None

Additional Q.A. Log Comments

PREPLOT	ACTUAL	PREPLOT	ACTUAL	PREPLOT	ACTUAL	PREPLOT	ACTUAL
SP 1050	NDR	SP 1051	SP 1050	SP 1051	NDR	SP 1052	SP 1051
SP 1110	NDR	SP 1111	SP 1110	SP 1379	NDR	SP 1380	SP 1379
SP 1408	NDR	SP 1409	SP 1408	SP 1535	NDR	SP 1536	SP 1535
SP 1537	NDR	SP 1538	SP 1537	SP 1618	NDR	SP 1619	SP 1618
SP 1671	NDR	SP 1672	SP 1671	SP 1789	NDR	SP 1790	SP 1789
SP 1869	NDR	SP 1870	SP 1869	SP 1877	NDR	SP 1878	SP 1877
SP 1911	NDR	SP 1912	SP 1911	SP 2050	NDR	SP 2051	SP 2050
SP 2071	NDR	SP 2072	SP 2071	SP 2282	NDR	SP 2283	SP 2282
SP 2303	NDR	SP 2304	SP 2303	SP 2381	NDR	SP 2382	SP 2381
SP 2462	NDR	SP 2463	SP 2462				

Sail Line: BHB96-102 Azm: 322 Status: COM Date: 27/01/96

CMP Lines: Source #1 Edit
Streamer #1 - : 102

Total SP Range: 2115-917
Process Range : 2115-917
Charge Range : 2105-917
Total CMP Km : 27.4091
Process CMP Km: 27.4091
Charge CMP Km : 27.1805

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	10:42	2101	63.7 M	FORCE 4 W	4	2-3M	107.5 M
EOL	13:30	2115	60.3 M	FORCE 3 NW	3	1-2M	107.5 M

Streamer Noise (uB) SOL #1 4.0 Feather 0.5P
EOL #1 4.0 Feather 0.8S Ave Depth (M): 8 Qual 1:3
Bad Grps: 136 consistently noisy. 167 fails leakage test. 18-24 = 5 μbar +
Comments: Reflected ship noise on traces 221-240.

SOL Source Vol (in3) : #1 2660 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 4

Dropouts: None
Comments: 99.42% in ± 1 ms

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, 7, 18 PDOP SOL 1.6 EOL 1.4 Ave 1.5

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 3
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : No navigation system problems noted on this line

Edited Shotpoints : 1025, file 1181, was a bad single record on tape 2113 DNP
Segment Edits : None

Additional Q.A. Log Comments

Sail Line: BHB96-103 Azm: 236 Status: COM Date: 03/02/96

CMP Lines: Source #1 Edit
Streamer #1 - : 103

Total SP Range: 2723-917
Process Range : 2723-917
Charge Range : 2713-917
Total CMP Km : 41.3080
Process CMP Km: 41.3080
Charge CMP Km : 41.0794

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	01:24	2335	80.5 M	FORCE 6 SW	5	3 M	107.5 M
EOL	05:45	2356	57.8 M	FORCE 6 SW	5	3 M	107.5 M

Streamer Noise (uB) SOL #1 4.0 Feather 0.1S
EOL #1 5.0 Feather 0.7S Ave Depth (M): 8 Qual 1:3
Bad Grps: 109 distorted, 136/198 noisy. 167 fails leakage test. 18-24=5 μbar+
Comments: Streamer at 8 m. to minimise noise, and avoid being picked up by seas

SOL Source Vol (in3) : #1 2660 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 3

Dropouts: A4-9/10 SP1882 airleak, 2520 ci
Comments: 99.39% in ± 1 ms

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, 7, 18 PDOP SOL 1.2 EOL 1.5 Ave 1.4

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 4
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : No system faults noted on this line.

Edited Shotpoints : 1360, 1086 both single bad files on tapes 2350, 2354 DNP
Segment Edits : None

Additional Q.A. Log Comments

Sail Line: BHB96-104 Azm: 324 Status: COM Date: 28/01/96

CMP Lines: Source #1 Edit
Streamer #1 - : 104

Total SP Range: 1545-917
Process Range : 1545-917
Charge Range : 1535-917
Total CMP Km : 14.3789
Process CMP Km: 14.3789
Charge CMP Km : 14.1503

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	12:58	2169	67.2 M	FORCE 3-4 W	3-4	2M	107.5 M
EOL	14:27	2175	63.1 M	FORCE 3-4 W	3-4	2M	107.5 M

Streamer Noise (uB) SOL #1 4.0 Feather 1.2S
EOL #1 3.0 Feather 0.6P Ave Depth (M): 6 Qual 1:3
Bad Grps: 109 weak, 136 noisy. 167 fails leakage test. 18-24=5 μbar+
Comments: Some swell break out on streamer.

SOL Source Vol (in3) : #1 2660 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 4

Dropouts: None
Comments: 98.89% in ± 1 ms

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, 7, 18 PDOP SOL 1.5 EOL 1.7 Ave 1.6

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 4
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : No problems noted on this line

Edited Shotpoints : None
Segment Edits : None

Additional Q.A. Log Comments

Sail Line: BHB96-105 Azm: 235 Status: COM Date: 30/01/96

CMP Lines: Source #1 Edit
Streamer #1 - : 105

Total SP Range: 2720-917
Process Range : 2720-917
Charge Range : 2710-917
Total CMP Km : 41.2394
Process CMP Km: 41.2394
Charge CMP Km : 41.0108

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	02:17	2261	79.0 M	FORCE 1-2 VAR.	2-3	< 1 M	107.5 M
EOL	06:39	2280	57.8 M	FORCE 5 ENE	3-4	1 M	107.5 M

Streamer Noise (uB) SOL #1 3.5 Feather 3.0S
EOL #1 5.0 Feather 4.2P Ave Depth (M): 6 Qual 1:3
Bad Grps: 109 distorted, 136/198 noisy. 167 fails leakage test. 18-24=5 μbar+
Comments: Reflected ship's noise traces 222-228. Head of streamer running deeper

SOL Source Vol (in3) : #1 2660 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 4

Dropouts: None
Comments: 99.67% in ± 1 ms

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, 7, 18 PDOP SOL 1.3 EOL 1.4 Ave 1.4

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 4
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : No navigation system problems noted.

Edited Shotpoints : None
Segment Edits : None

Additional Q.A. Log Comments

Sail Line: BHB96-106 Azm: 144 Status: COM Date: 28/01/96

CMP Lines: Source #1 Edit
Streamer #1 - : 106

Total SP Range: 991-1618
Process Range : 991-1618
Charge Range : 1001-1618
Total CMP Km : 14.3561
Process CMP Km: 14.3561
Charge CMP Km : 14.1275

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	15:49	2176	65.1 M	FORCE 3-4 W	3	1-2 M	107.5 M
EOL	17:19	2182	71.4 M	FORCE 3-4 W	3	1-2 M	107.5 M

Streamer Noise (uB) SOL #1 3.5 Feather 3.9P
EOL #1 3.0 Feather 3.0P Ave Depth (M): 6 Qual 1:3
Bad Grps: 109 weak, 136 noisy. 167 fails leakage test. 18-24=5 μbar+
Comments: Some swell break out on streamer.

SOL Source Vol (in3) : #1 2660 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 4

Dropouts: None
Comments: 99.36% in ± 1 ms

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, 7, 18 PDOP SOL 1.4 EOL 1.3 Ave 1.4

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 4
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : No problems noted on this line

Edited Shotpoints : None
Segment Edits : None

Additional Q.A. Log Comments

Sail Line: BHB96-107 Azm: 055 Status: COM Date: 03/02/96

CMP Lines: Source #1 Edit
Streamer #1 - : 107

Total SP Range: 990-2792
Process Range : 990-2792
Charge Range : 1000-2792
Total CMP Km : 41.2166
Process CMP Km: 41.2166
Charge CMP Km : 40.9880

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	07:18	2357	56.5 M	FORCE 4 SW	4	2 M	107.5 M
EOL	11:50	2376	80.3 M	FORCE 4 SW	3	1-2 M	107.5 M

Streamer Noise (uB) SOL #1 5.5 Feather 3.0P
EOL #1 4.5 Feather 0.6S Ave Depth (M): 8 Qual 1:3
Bad Grps: 109 distorted, 136/198 noisy. 167 fails leakage test. 18-24=5 μbar+
Comments: Streamer at 8 m. to minimise noise, and avoid being picked up by seas

SOL Source Vol (in3) : #1 2660 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 3

Dropouts: A3-9/10 SP1226 airleak, 2460 ci.
Comments: 99.00% in ± 1 ms

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, 7, 18 PDOP SOL 1.5 EOL 1.6 Ave 1.6

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 4
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : Apart from initial error in SP No, no system faults noted.

Edited Shotpoints : None
Segment Edits : None

Additional Q.A. Log Comments

Sail Line: BHB96-108 Azm: 323 Status: COM Date: 28/01/96

CMP Lines: Source #1 Edit
Streamer #1 - : 108

Total SP Range: 1545-917
Process Range : 1545-917
Charge Range : 1535-917
Total CMP Km : 14.3789
Process CMP Km: 14.3789
Charge CMP Km : 14.1503

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	18:41	2183	73.5 M	FORCE 2-3 W	3	1-2 M	107.5 M
EOL	20:12	2189	66.9 M	FORCE 2-3 W	3	1-2 M	107.5 M

Streamer Noise (uB) SOL #1 3.0 Feather 2.3S
EOL #1 3.0 Feather 0.7S Ave Depth (M): 6 Qual 1:3
Bad Grps: 109 weak, 136 noisy. 167 fails leakage test. 18-24=5 μbar+
Comments: Some swell break out on streamer.

SOL Source Vol (in3) : #1 2660 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 4

Dropouts: None
Comments: 99.68% in ± 1 ms

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, 7, 18 PDOP SOL 1.4 EOL 1.4 Ave 1.4

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 4
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : No problems noted on this line

Edited Shotpoints : None
Segment Edits : None

Additional Q.A. Log Comments

Sail Line: BHB96-109 Azm: 235 Status: COM Date: 03/02/96

CMP Lines: Source #1 Edit
Streamer #1 - : 109

Total SP Range: 1568-917
Process Range : 1568-917
Charge Range : 1558-917
Total CMP Km : 14.9047
Process CMP Km: 14.9047
Charge CMP Km : 14.6761

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	19:50	2390	66.5 M	FORCE 4 W	3	1 M	107.5 M
EOL	21:28	2397	57.5 M	FORCE 4-5 W	3	1 M	107.5 M

Streamer Noise (uB) SOL #1 3.5 Feather 0.4P
EOL #1 3.0 Feather 1.8P Ave Depth (M): 6 Qual 1:3
Bad Grps: 109 distorted, 136/198 noisy. 167 fails leakage test. 18-24=5 μbar+
Comments: Streamer at 6 m. swell noise still visible throughout.

SOL Source Vol (in3) : #1 2460 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 3

Dropouts: A3-9/10 SOL bad sensor on 9.
Comments: 97.85% in ± 1 ms

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, 7, 18 PDOP SOL 1.3 EOL 1.6 Ave 1.5

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 4
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : No system faults noted during this line.

Edited Shotpoints : None
Segment Edits : None

Additional Q.A. Log Comments

Sail Line: BHB96-110 Azm: 142 Status: COM Date: 28/01/96

CMP Lines: Source #1 Edit
Streamer #1 - : 110

Total SP Range: 991-1618
Process Range : 991-1618
Charge Range : 1001-1618
Total CMP Km : 14.3561
Process CMP Km: 14.3561
Charge CMP Km : 14.1275

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	21:40	2190	69.0 M	FORCE 1-2 W	2-3	1-2 M	107.5 M
EOL	23:13	2196	74.7 M	FORCE 1-2 SW	2-3	1-2 M	107.5 M

Streamer Noise (uB) SOL #1 4.0 Feather 1.1S
EOL #1 4.0 Feather 4.0S Ave Depth (M): 6 Qual 1:3
Bad Grps: 109 weak, 136 noisy. 167 fails leakage test. 18-24=5 μbar+
Comments: Some swell break out on streamer.

SOL Source Vol (in3) : #1 2660 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 4

Dropouts: None
Comments: 99.36% in ± 1 ms

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, 7, 18 PDOP SOL 1.6 EOL 1.4 Ave 1.5

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 4
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : No problems noted on this line

Edited Shotpoints : None
Segment Edits : None

Additional Q.A. Log Comments

Sail Line: BHB96-111 Azm: 055 Status: COM Date: 28/01/96

CMP Lines: Source #1 Edit
Streamer #1 - : 111

Total SP Range: 991-1666
Process Range : 991-1666
Charge Range : 1001-1666
Total CMP Km : 15.4534
Process CMP Km: 15.4534
Charge CMP Km : 15.2248

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	09:39	2161	59.1 M	FORCE 2 S	2-3	1-2M	107.5 M
EOL	11:20	2168	70.7 M	FORCE 2 W	2-3	1M	107.5 M

Streamer Noise (uB) SOL #1 4.0 Feather 5.0P
EOL #1 4.0 Feather 4.9P Ave Depth (M): 6 Qual 1:3
Bad Grps: 109 weak, 136 noisy. 167 fails leakage test. 18-24=5 μbar+
Comments: Still some swell break out on streamer.

SOL Source Vol (in3) : #1 2660 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 4

Dropouts: None
Comments: 98.96% in ± 1 ms

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, 7, 18 PDOP SOL 2.0 EOL 1.3 Ave 1.7

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 4
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : No problems noted on this line

Edited Shotpoints : None
Segment Edits : None

Additional Q.A. Log Comments

Sail Line: BHB96-112 Azm: 322 Status: COM Date: 29/01/96

CMP Lines: Source #1 Edit
Streamer #1 - : 112

Total SP Range: 1545-915
Process Range : 1545-915
Charge Range : 1535-917
Total CMP Km : 14.4247
Process CMP Km: 14.4247
Charge CMP Km : 14.1503

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	00:40	2197	74.2 M	FORCE 1-2 SW	2-3	1-2 M	107.5 M
EOL	02:09	2203	67.4 M	FORCE 1-2 SW	2-3	1-2 M	107.5 M

Streamer Noise (uB) SOL #1 3.5 Feather 5.4P
EOL #1 3.5 Feather 4.8P Ave Depth (M): 6 Qual 1:3
Bad Grps: 109 weak, 136 noisy. 167 fails leakage test. 18-24=5 μbar+
Comments: Some swell break out on streamer.

SOL Source Vol (in3) : #1 2660 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 4

Dropouts: None
Comments: 99.84% in ± 1 ms

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, 7, 18 PDOP SOL 1.4 EOL 1.3 Ave 1.4

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 4
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : Two extra shots fired at EOL, pilot error

Edited Shotpoints : None
Segment Edits : None

Additional Q.A. Log Comments

Sail Line: BHB96-113 Azm: 234 Status: COM Date: 28/01/96

CMP Lines: Source #1 Edit
Streamer #1 - : 113

Total SP Range: 1596-917
Process Range : 1596-917
Charge Range : 1586-917
Total CMP Km : 15.5448
Process CMP Km: 15.5448
Charge CMP Km : 15.3162

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	06:32	2153	68.2 M	FORCE 0 VAR.	2	2-3M	107.5 M
EOL	08:12	2160	58.7 M	FORCE 5 SW	3	2-3M	107.5 M

Streamer Noise (uB) SOL #1 5.0 Feather 1.2S
EOL #1 4.0 Feather 1.1S Ave Depth (M): 8 Qual 1:3
Bad Grps: 109 weak, 136 noisy. 167 fails leakage test. 18-24=5 μbar+
Comments: Long low south westerly swell causing break out on streamer.

SOL Source Vol (in3) : #1 2660 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 4

Dropouts: None
Comments: 99.56% in ± 1 ms

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, 7, 18 PDOP SOL 1.5 EOL 1.6 Ave 1.6

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 4
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : No problems noted on this line

Edited Shotpoints : None
Segment Edits : None

Additional Q.A. Log Comments

Sail Line: BHB96-114 Azm: 141 Status: COM Date: 29/01/96

CMP Lines: Source #1 Edit
Streamer #1 - : 114

Total SP Range: 991-1755
Process Range : 991-1755
Charge Range : 1001-1752
Total CMP Km : 17.4879
Process CMP Km: 17.4879
Charge CMP Km : 17.1907

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	03:58	2204	68.6 M	FORCE 3-4 SW	3	2 M	107.5 M
EOL	05:46	2212	76.5 M	FORCE 4-5 SW	3-4	2 M	107.5 M

Streamer Noise (uB) SOL #1 4.0 Feather 0.4P
EOL #1 3.5 Feather 0.0P Ave Depth (M): 6 Qual 1:3
Bad Grps: 109 weak/distorted, 136 noisy. 167 fails leakage test. 18-24=5 μbar +
Comments: Reflected ship's noise on traces 221-228

SOL Source Vol (in3) : #1 2660 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 4

Dropouts: None
Comments: 99.87% in ± 1 ms

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, 7, 18 PDOP SOL 1.4 EOL 1.5 Ave 1.5

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 4
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : Three extra shots fired at EOL, pilot error

Edited Shotpoints : None
Segment Edits : None

Additional Q.A. Log Comments

Sail Line: BHB96-115 Azm: 053 Status: COM Date: 28/01/96

CMP Lines: Source #1 Edit
Streamer #1 - : 115

Total SP Range: 991-1654
Process Range : 991-1654
Charge Range : 1004-1654
Total CMP Km : 15.1790
Process CMP Km: 15.1790
Charge CMP Km : 14.8819

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	02:48	2145	56.7 M	FORCE 0 VAR.	1	1-2M	107.5 M
EOL	04:19	2152	72.0 M	FORCE 0 VAR.	1	1-2M	107.5 M

Streamer Noise (uB) SOL #1 5.0 Feather 0.5P
EOL #1 5.0 Feather 1.9S Ave Depth (M): 7 Qual 1:3
Bad Grps: 109 weak, 136 noisy. 167 fails leakage test. 18-24=5 μbar+
Comments: Long low south westerly swell causing break out on streamer.

SOL Source Vol (in3) : #1 2660 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 3

Dropouts: A4-9 SP1052, N/F 2590 ci.
Comments: 97.56% in ± 1 ms

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, 7, 18 PDOP SOL 1.3 EOL 1.4 Ave 1.4

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 4
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : Some problems on the run in to line caused delayed start

Edited Shotpoints : None
Segment Edits : None

Additional Q.A. Log Comments

Sail Line: BHB96-116 Azm: 321 Status: COM Date: 29/01/96

CMP Lines: Source #1 Edit
Streamer #1 - : 116

Total SP Range: 1678-917
Process Range : 1678-917
Charge Range : 1668-917
Total CMP Km : 17.4193
Process CMP Km: 17.4193
Charge CMP Km : 17.1907

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	07:22	2213	76.6 M	FORCE 5 SW	4-5	2 M	107.5 M
EOL	09:17	2221	70.0 M	FORCE 5 SW	4-5	2 M	107.5 M

Streamer Noise (uB) SOL #1 4.0 Feather 0.2P
EOL #1 4.0 Feather 1.0P Ave Depth (M): 6 Qual 1:3
Bad Grps: 109 weak/distorted, 136 noisy. 167 fails leakage test. 18-24=5 μbar +
Comments: Reflected ship's noise traces 222-230. Head of streamer running deep

SOL Source Vol (in3) : #1 2660 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 4

Dropouts: None
Comments: 99.74% in ± 1 ms

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, 7, 18 PDOP SOL 1.3 EOL 1.6 Ave 1.5

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 4
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : No navigation system problems noted.

Edited Shotpoints : None
Segment Edits : None

Additional Q.A. Log Comments

Sail Line: BHB96-117 Azm: 233 Status: COM Date: 27/01/96

CMP Lines: Source #1 Edit
Streamer #1 - : 117

Total SP Range: 1513-917
Process Range : 1513-917
Charge Range : 1503-917
Total CMP Km : 13.6474
Process CMP Km: 13.6474
Charge CMP Km : 13.4188

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	22:35	2138	67.7 M	FORCE 1 W	1-2	1M	107.5 M
EOL	23:56	2144	55.9 M	FORCE 1 W	1-2	1M	107.5 M

Streamer Noise (uB) SOL #1 3.0 Feather 2.0S
EOL #1 3.0 Feather 5.2S Ave Depth (M): 6 Qual 1:3
Bad Grps: 109 weak, 136 noisy. 167 fails leakage test. 18-24=5 μbar+
Comments: Reflected ship noise on traces 222-228.

SOL Source Vol (in3) : #1 2590 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 3

Dropouts: A4-9 SOL N/F
Comments: 99.33% in ± 1 ms

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, 7, 18 PDOP SOL 1.4 EOL 1.8 Ave 1.6

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 4
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : A number of NDRs & ITBs recorded when the vessel speed was too high.

Edited Shotpoints : See below
Segment Edits : None

Additional Q.A. Log Comments

SP 1468	NDR		SP 1444	NDR	
SP 1387	NDR		SP 1321	NDR	
SP 1319	ITB	DNP	SP 1314	ITB	DNP
SP 1290	ITB	DNP	SP 1278	NDR	
SP 1275	ITB	DNP	SP 1270	NDR	
SP 1269	ITB	DNP	SP 1266	NDR	
SP 1264	ITB	DNP	SP 1260	NDR	
SP 1218	ITB	DNP	SP 1216	ITB	DNP
SP 1200	ITB	DNP	SP 1141	ITB	DNP
SP 1128	NDR		SP 1119	ITB	DNP

20 BAD RECORDS IN ALL, NO SEQUENCE EXCEEDING THE LIMITS FOR BAD SHOTS

Sail Line: BHB96-118 Azm: 142 Status: COM Date: 29/01/96

CMP Lines: Source #1 Edit
Streamer #1 - : 118

Total SP Range: 991-2219
Process Range : 991-2219
Charge Range : 1001-2219
Total CMP Km : 28.0949
Process CMP Km: 28.0949
Charge CMP Km : 27.8663

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	11:24	2222	77.8 M	FORCE 5 SW	4	2 M	107.5 M
EOL	14:31	2235	79.0 M	FORCE 4 SW	3-4	1 M	107.5 M

Streamer Noise (uB) SOL #1 4.0 Feather 1.1S
EOL #1 3.0 Feather 1.1P Ave Depth (M): 6 Qual 1:3
Bad Grps: 109 weak/distorted, 136 noisy. 167 fails leakage test. 18-24=5 μbar +
Comments: Reflected ship's noise traces 218-228. Head of streamer running deep

SOL Source Vol (in3) : #1 2660 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 3

Dropouts: A2-4 SP1213 N/F, 2590 ci. A2-9, A2-10 SP1905 airleak, 2390 ci.
Comments: 98.62% in ± 1 ms

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, 7, 18 PDOP SOL 1.3 EOL 1.7 Ave 1.5

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 4
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : No navigation system problems noted.

Edited Shotpoints : None
Segment Edits : None

Additional Q.A. Log Comments

Sail Line: BHB96-119 Azm: 054 Status: COM Date: 27/01/96

CMP Lines: Source #1 Edit
Streamer #1 - : 119

Total SP Range: 991-1598
Process Range : 991-1598
Charge Range : 1001-1598
Total CMP Km : 13.8989
Process CMP Km: 13.8989
Charge CMP Km : 13.6703

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	19:49	2130	58.9 M	CALM	2	1M	107.5 M
EOL	21:16	2137	72.6 M	FORCE 1-2 W	2	1M	107.5 M

Streamer Noise (uB) SOL #1 3.0 Feather 0.7P
EOL #1 3.5 Feather 2.9P Ave Depth (M): 6 Qual 1:3
Bad Grps: 109 & 136 consistently noisy. 167 fails leakage test. 18-24 = 5 μbar +
Comments: Reflected ship noise on traces 218-224.

SOL Source Vol (in3) : #1 2590 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 3

Dropouts: A4-9 SOL N/F
Comments: 99.8% in ± 1 ms

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, 7, 18 PDOP SOL 1.5 EOL 1.6 Ave 1.5

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 4
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : No navigation system problems noted on this line

Edited Shotpoints : 1264, file 362, bad and only record on tape 2133, DNP
Segment Edits : None

Additional Q.A. Log Comments

Sail Line: BHB96-120 Azm: 322 Status: COM Date: 29/01/96

CMP Lines: Source #1 Edit
Streamer #1 - : 120

Total SP Range: 1885-917
Process Range : 1885-917
Charge Range : 1875-917
Total CMP Km : 22.1513
Process CMP Km: 22.1513
Charge CMP Km : 21.9227

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	16:09	2236	79.6 M	FORCE 3 SW	2-3	1 M	107.5 M
EOL	18:35	2246	80.0 M	FORCE 2 SW	2	< 1 M	107.5 M

Streamer Noise (uB) SOL #1 3.0 Feather 0.1P
EOL #1 3.0 Feather 0.7P Ave Depth (M): 6 Qual 1:3
Bad Grps: 109 distorted, 136 & 198 noisy. 167 fails leakage test. 18-24=5 μbar+
Comments: Reflected ship's noise traces 217-227. Head of streamer running deeper

SOL Source Vol (in3) : #1 2660 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 3

Dropouts: A4-9 SP1842 M/F, 2590 ci. A1-1 SP1783 N/F, 2520 ci.
Comments: 98.66% in ± 1 ms

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, 7, 18 PDOP SOL 1.6 EOL 1.4 Ave 1.5

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 4
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : No navigation system problems noted.

Edited Shotpoints : 4 NDRs on run in SP1885-1882
Segment Edits : None

Additional Q.A. Log Comments

Sail Line: BHB96-121 Azm: 056 Status: TBC Date: 31/01/96

CMP Lines: Source #1 Edit
Streamer #1 - : 121

Total SP Range: 991-1619
Process Range : 991-1534
Charge Range : 1001-1534
Total CMP Km : 14.3789
Process CMP Km: 13.4358
Charge CMP Km : 12.2072

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	08:09	2322	79.8 M	FORCE 5 W	5	3-4 M	107.5 M
EOL	09:49	2328	81.3 M	FORCE 8 W	6	4-5 M	107.5 M

Streamer Noise (uB) SOL #1 4.5 Feather 10.2S
EOL #1 0.0 Feather 2.1S Ave Depth (M): 8 Qual 1:3
Bad Grps: 109 distorted, 136/198 noisy. 167 fails leakage test. 18-24=5 μbar+
Comments: Streamer at 8 m. to minimise noise, and avoid being picked up by seas

SOL Source Vol (in3) : #1 2660 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 4

Dropouts: None
Comments: 98.57% in ± 1 ms

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, 7, 18 PDOP SOL 1.5 EOL 1.4 Ave 1.5

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 4
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : No system problems noted on this line.

Edited Shotpoints : None
Segment Edits : None

Additional Q.A. Log Comments

On several occasions the streamer depths were a little uneven due to the sea conditions. Eventually such variations became impossible to control and the streamer was pulled to the surface at the front end.

Sail Line: BHB96-122 Azm: 144 Status: COM Date: 29/01/96

CMP Lines: Source #1 Edit
Streamer #1 - : 122

Total SP Range: 991-1610
Process Range : 991-1610
Charge Range : 1001-1610
Total CMP Km : 14.1732
Process CMP Km: 14.1732
Charge CMP Km : 13.9446

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	20:34	2247	81.3 M	FORCE 2 W	1-2	< 1 M	107.5 M
EOL	22:03	2253	81.6 M	FORCE 1 VAR.	1-2	< 1 M	107.5 M

Streamer Noise (uB) SOL #1 4.0 Feather 2.5S
EOL #1 4.0 Feather 3.8S Ave Depth (M): 6 Qual 1:3
Bad Grps: 109 distorted, 136 & 198 noisy. 167 fails leakage test. 18-24=5 μbar+
Comments: Reflected ship's noise traces 219-227. Head of streamer running deeper

SOL Source Vol (in3) : #1 2660 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 3

Dropouts: A4-9 SP1132 timing drifting, 2590 ci.
Comments: 98.39% in ± 1 ms

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, 7, 18 PDOP SOL 1.3 EOL 1.6 Ave 1.5

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 4
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : No navigation system problems noted.

Edited Shotpoints : None
Segment Edits : None

Additional Q.A. Log Comments

Sail Line: BHB96-123 Azm: 235 Status: COM Date: 31/01/96

CMP Lines: Source #1 Edit
Streamer #1 - : 123

Total SP Range: 1626-917
Process Range : 1626-917
Charge Range : 1616-917
Total CMP Km : 16.2306
Process CMP Km: 16.2306
Charge CMP Km : 16.0020

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	04:37	2314	79.9 M	FORCE 6 W	5	3-4 M	107.5 M
EOL	06:33	2321	78.0 M	FORCE 5 W	5	3-4 M	107.5 M

Streamer Noise (uB) SOL #1 5.0 Feather 0.1P
EOL #1 5.0 Feather 2.3P Ave Depth (M): 9 Qual 1:3
Bad Grps: 109 distorted, 136/198 noisy. 167 fails leakage test. 18-24=5 μbar+
Comments: Streamer at 9 m. to minimise noise, and avoid being picked up by seas

SOL Source Vol (in3) : #1 2660 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 4

Dropouts: None
Comments: 99.15% in ± 1 ms

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, 7, 18 PDOP SOL 1.3 EOL 1.4 Ave 1.4

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 3
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : Speed variation caused loss of one shotpoint near SOL

Edited Shotpoints : 1584 is NDR, 1583 is called 1584 in header.
Segment Edits : None

Additional Q.A. Log Comments

Sail Line: BHB96-124 Azm: 324 Status: COM Date: 29/01/96

CMP Lines: Source #1 Edit
Streamer #1 - : 124

Total SP Range: 1533-917
Process Range : 1533-917
Charge Range : 1523-917
Total CMP Km : 14.1046
Process CMP Km: 14.1046
Charge CMP Km : 13.8760

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	23:22	2254	81.1 M	FORCE 1-2 VAR.	1-2	< 1 M	107.5 M
EOL	00:46	2260	80.0 M	FORCE 1 VAR.	1-2	< 1 M	107.5 M

Streamer Noise (uB) SOL #1 3.5 Feather 4.0P
EOL #1 3.5 Feather 2.9P Ave Depth (M): 6 Qual 1:3
Bad Grps: 109 distorted, 136/198 noisy. 167 fails leakage test. 18-24=5 μbar+
Comments: Reflected ship's noise traces 219-225. Head of streamer running deeper

SOL Source Vol (in3) : #1 2660 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 4

Dropouts: None
Comments: Timing errors to 2.75 and 2.25 ms at SPs 1022 and 1021 respectively

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, 7, 18 PDOP SOL 1.4 EOL 1.4 Ave 1.4

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 4
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : No navigation system problems noted.

Edited Shotpoints : None
Segment Edits : None

Additional Q.A. Log Comments

Sail Line: BHB96-125 Azm: 234 Status: COM Date: 03/02/96

CMP Lines: Source #1 Edit
Streamer #1 - : 125

Total SP Range: 1625-917
Process Range : 1625-917
Charge Range : 1615-917
Total CMP Km : 16.2077
Process CMP Km: 16.2077
Charge CMP Km : 15.9791

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	16:20	2382	80.8 M	FORCE 2-3 SW	3	1-2 M	107.5 M
EOL	18:01	2389	79.6 M	FORCE 2-3 SW	3	1-2 M	107.5 M

Streamer Noise (uB) SOL #1 3.5 Feather 1.0P
EOL #1 4.0 Feather 0.8P Ave Depth (M): 8 Qual 1:3
Bad Grps: 109 distorted, 136/198 noisy. 167 fails leakage test. 18-24=5 μbar+
Comments: Streamer at 8 m. to minimise noise.

SOL Source Vol (in3) : #1 2660 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 4

Dropouts: None
Comments: None

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, 7, 18 PDOP SOL 1.2 EOL 1.6 Ave 1.4

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 4
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : Line completed with overlaps, no system faults noted.

Edited Shotpoints : None
Segment Edits : None

Additional Q.A. Log Comments

Sail Line: BHB96-127 Azm: 052 Status: COM Date: 31/01/96

CMP Lines: Source #1 Edit
Streamer #1 - : 127

Total SP Range: 991-1698
Process Range : 991-1698
Charge Range : 1001-1698
Total CMP Km : 16.1849
Process CMP Km: 16.1849
Charge CMP Km : 15.9563

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	01:01	2305	79.5 M	FORCE 4 W	4-5	3 M	107.5 M
EOL	02:56	2313	79.3 M	FORCE W WNW	5	3-4 M	107.5 M

Streamer Noise (uB) SOL #1 5.0 Feather 7.2P
EOL #1 4.0 Feather 4.7P Ave Depth (M): 8 Qual 1:3
Bad Grps: 109 distorted, 136/198 noisy. 167 fails leakage test. 18-24=5 μbar+
Comments: Streamer at 8 to minimise sea noise, visible throughout line

SOL Source Vol (in3) : #1 2660 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 4

Dropouts: None
Comments: 99.72% in ± 1 ms

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, 7, 18 PDOP SOL 1.3 EOL 1.9 Ave 1.6

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 3
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : Speed reduced as result of main engine cooling problem.

Edited Shotpoints : 1262, file 362 is the only. bad record on tape 2308, DNP
Segment Edits : None

Additional Q.A. Log Comments

Sail Line: BHB96-129 Azm: 233 Status: COM Date: 30/01/96

CMP Lines: Source #1 Edit
Streamer #1 - : 129

Total SP Range: 1520-917
Process Range : 1520-917
Charge Range : 1510-917
Total CMP Km : 13.8074
Process CMP Km: 13.8074
Charge CMP Km : 13.5788

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	21:18	2298	82.0 M	FORCE 5 SW	4	2-3 M	107.5 M
EOL	23:15	2304	80.7 M	FORCE 5-6 SW	4-5	2-3 M	107.5 M

Streamer Noise (uB) SOL #1 4.0 Feather 2.8P
EOL #1 4.0 Feather 3.7S Ave Depth (M): 8 Qual 1:3
Bad Grps: 109 distorted, 136/198 noisy. 167 fails leakage test. 18-24=5 μbar+
Comments: Streamer at 8 to minimise sea noise, visible throughout line

SOL Source Vol (in3) : #1 2660 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 4

Dropouts: None
Comments: 99.83% in ± 1 ms

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, 7, 18 PDOP SOL 1.5 EOL 1.4 Ave 1.5

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 3
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : Speed reduced as result of main engine cooling problem.

Edited Shotpoints : None
Segment Edits : None

Additional Q.A. Log Comments

Sail Line: BHB96-901 Azm: 055 Status: COM Date: 02/02/96

CMP Lines: Source #1 Edit
Streamer #1 - : 901

Total SP Range: 2286-2799
Process Range : 2286-2799
Charge Range : 2371-2799
Total CMP Km : 11.7500
Process CMP Km: 11.7500
Charge CMP Km : 9.8069

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	22:47	2329	78.7 M	FORCE 5 WSW	5	3 M	107.5 M
EOL	23:54	2334	80.7 M	FORCE 4-5 WSW	5	2-3 M	107.5 M

Streamer Noise (uB) SOL #1 4.0 Feather 0.8S
EOL #1 4.0 Feather 1.3S Ave Depth (M): 8 Qual 1:3
Bad Grps: 109 distorted, 136/198 noisy. 167 fails leakage test. 18-24=5 μbar+
Comments: Streamer at 8 m. to minimise noise, and avoid being picked up by seas

SOL Source Vol (in3) : #1 2660 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 3

Dropouts: A3-5/6 SP2688 airleak, 2600 ci.
Comments: 99.80% in ± 1 ms

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, 7, 18 PDOP SOL 1.4 EOL 1.4 Ave 1.4

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 4
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : SP 2286 identified as 1620 on seismic header.

Edited Shotpoints : None
Segment Edits : None

Additional Q.A. Log Comments

Sail Line: BHB96-921 Azm: 056 Status: COM Date: 03/02/96

CMP Lines: Source #1 Edit
Streamer #1 - : 921

Total SP Range: 1451-1829
Process Range : 1451-1829
Charge Range : 1535-1829
Total CMP Km : 8.6639
Process CMP Km: 8.6639
Charge CMP Km : 6.7437

	Time	Tape#	W Depth	Wind Speed/Dir	Sea State	Swell	Offset
SOL	14:27	2377	81.0 M	FORCE 3-4 SW	3	1-2 M	107.5 M
EOL	15:09	2381	80.6 M	FORCE 2-3 SW	3	< 1 M	107.5 M

Streamer Noise (uB) SOL #1 3.5 Feather 0.2P
EOL #1 3.5 Feather 0.1S Ave Depth (M): 8 Qual 1:3
Bad Grps: 109 distorted, 136/198 noisy. 167 fails leakage test. 18-24=5 μbar+
Comments: Streamer at 8 m. to minimise noise, and avoid being picked up by seas

SOL Source Vol (in3) : #1 2660 Pressure (psi): 2000
Ave Source Depths (M): #1 6 Qual #1 4

Dropouts: None
Comments: 99.47% in ± 1 ms

Nav Systems - Primary: STARFIX Secondary: GPS
Stations used in fit :6, 7, 18 PDOP SOL 1.4 EOL 1.6 Ave 1.5

Active Tailbuoys - Type: None In Use: #1: N Nav Qual 4
Compasses: 16 compasses, all in solution for streamer shape
Acoustics: N/A
Comments : Line completed with overlaps, no system faults noted.

Edited Shotpoints : None
Segment Edits : None

Additional Q.A. Log Comments

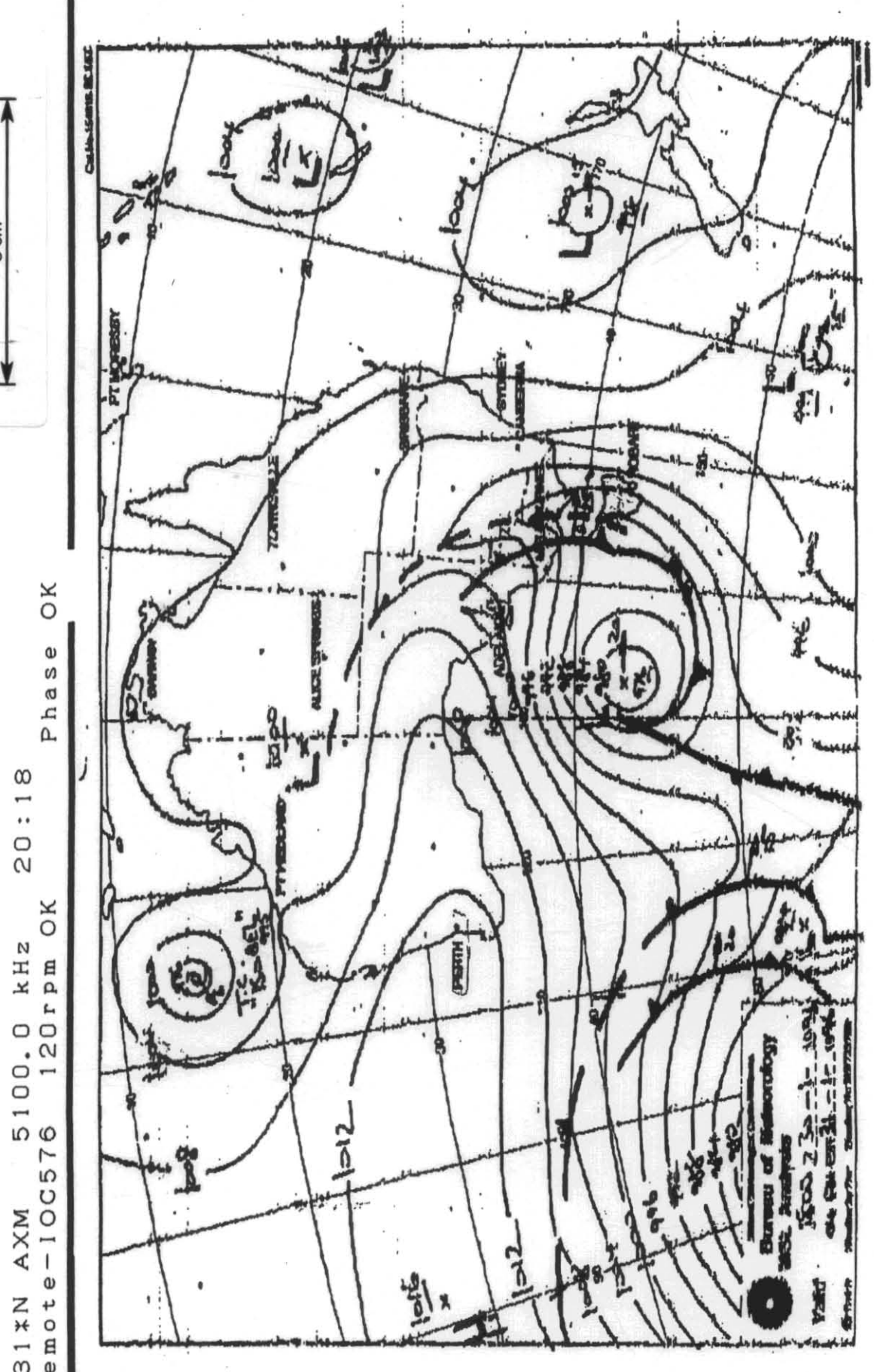
APPENDIX A - ACTUAL LINE END COORDINATES

SEQ#	LINE	SP	EASTING	NOTHING
001	BHA96100	1828	406288.00	5523078.00
		908	392035.40	5538543.20
002	BHA96102	1010	396070.60	5536003.20
		1862	411954.50	5523034.80
003	BHA96104	1680	405335.20	5525630.00
		917	394577.80	5539360.20
004	BHA96121	1001	394189.30	5531044.10
		1522	402312.50	5539753.10
005	BHA96127	1441	402472.00	5536285.90
		917	394267.70	5527558.00
006	BHA96131	1001	397154.40	5527877.20
		1885	411088.20	5542513.30
007	BHA96133	1539	406701.10	5535401.20
		917	396726.00	5524950.00
008	BHA96135	Not To Be Processed		
009	BHA96137	1551	409303.20	5532656.70
		917	399423.50	5522052.20
010	BHA96139	1001	401655.60	5523075.10
		1523	409888.10	5531713.30
011	BHA96141	1439	409701.90	5530048.00
		917	401498.00	5521373.00
012	BHA96143	1001	404963.00	5522415.80
		1568	413777.00	5531919.40
013	BHA96110	1534	413085.50	5534405.20
		606	395370.30	5546076.00
014	BHA96108	1001	396858.60	5545607.20
		1713	408734.90	5534477.30
015	BHA96106	1552	406681.60	5535695.60
		917	396074.50	5545605.80
016	BHA96109	1001	403725.20	5550332.60
		1693	415239.90	5561444.30
017	BHA96105	2090	412272.20	5561868.80
		917	392819.70	5543412.50
018	BHA96103	1001	394912.60	5546648.80
		1717	406808.90	5557891.50
019	BHA96903	1718	406826.00	5557905.80
		2265	415916.70	5566491.70
020	BHA96101	1001	399337.80	5554591.30
		1300	404763.50	5558755.10
021	BHA96901	1301	404789.80	5558758.00
		1755	413034.30	5565062.40
022	BHA96107	2041	410843.10	5558280.20
		917	392393.80	5540399.10
023	BHA96111	1001	395218.40	5540970.30
		2248	415641.10	5560858.60
024	BHA96113	1965	411549.70	5555276.30
		917	394751.30	5538195.10
025	BHA96115	1001	397385.90	5538920.40
		2194	416280.10	5558586.60
026	BHA96117	2055	414664.00	5555182.70
		917	396526.20	5536533.80

SEQ#	LINE	SP	EASTING	NOTHING
027	BHA96114	1684	409851.00	5544448.00
		917	398711.40	5557988.10
028	BHA96112	1001	400529.30	5552448.40
		1665	410571.40	5541065.70
029	BHA96116	1722	410514.00	5545148.40
		917	398866.40	5559395.20
030	BHA96118	1001	401171.00	5558224.50
		2487	412611.70	5544044.60
031	BHA96120	1697	412402.70	5547217.50
		917	401574.80	5561384.20
032	BHA96122	1001	403872.70	5560183.60
		1773	414285.50	5545935.30
033	BHA96124	1685	413357.80	5548293.30
		917	403374.50	5562735.00
034	BHA96126	1001	405572.00	5561458.60
		1764	415068.10	5546827.40
035	BHA96935	1001	399598.50	5525255.90
		1557	408338.50	5534485.00
036	BHA96129	1001	401856.40	5534789.90
		1523	410005.90	5543509.50
037	BHA96125	1439	407580.50	5542561.10
		917	399456.90	5533820.60
038	BHA96119	1001	399060.70	5537332.30
		2093	416335.60	5555352.60
039	BHA96123	1959	414747.00	5552151.78
		917	398530.67	5534703.58
040	BHB96102	2105	362925.84	5564012.16
		917	346336.20	5585514.00
041	BHB96100	1001	345586.70	5582036.90
		2187	361430.50	5560036.50
042	BHB96119	1001	355257.50	5564352.50
		1598	366273.50	5572408.50
043	BHB96117	1503	363004.60	5572450.10
		917	352301.50	5564393.70
044	BHB96115	1004	352886.30	5567406.70
		1654	364775.75	5576320.92
045	BHB96113	1586	361714.11	5576256.50
		917	349292.40	5567335.30
046	BHB96111	1001	350139.33	5570077.69
		1666	362536.96	5578875.16
047	BHB96104	1535	360919.41	5578549.34
		917	352617.77	5589980.33
048	BHB96106	1001	355523.62	5589225.29
		1618	363846.95	5577838.40
049	BHB96108	1535	363924.09	5580710.89
		917	355466.33	5592026.69
050	BHB96110	1001	357947.45	5590925.00
		1618	366596.73	5579783.57
051	BHB96112	1535	366193.60	5582284.09
		917	357455.40	5593384.90
052	BHB96114	1001	357977.70	5594622.80
		1752	368783.30	5581282.00
053	BHB96116	1668	367884.18	5583494.53
		917	357087.01	5596842.00

SEQ#	LINE	SP	EASTING	NOTHING
054	BHB96118	1001	368850.73	5598484.90
		2219	385980.17	5576534.06
055	BHB96120	1875	388556.62	5581311.24
		917	375060.73	5598558.32
056	BHB96122	1001	381363.89	5597335.28
		1610	389550.36	5586074.98
057	BHB96124	1523	389684.38	5589141.53
		917	381562.22	5600363.97
058	BHB96105	2710	379175.06	5596428.19
		917	345460.57	5573118.34
059	BHB96101	1001	345137.62	5577285.67
		2370	370834.20	5595148.30
060	BHB96129	1510	388597.58	5590169.16
		917	377769.77	5582012.55
061	BHB96127	1001	377606.23	5585927.40
		1698	390157.88	5595742.79
062	BHB96123	1616	386716.13	5596409.38
		917	373650.23	5587210.45
063	BHB96121	1001	374873.55	5589485.60
		1534	384929.40	5596363.20
064	BHB96901	2371	370852.30	5595162.60
		2799	378887.16	5600745.82
065	BHB96103	2713	378188.51	5597769.26
		917	344288.39	5574600.84
066	BHB96107	1001	348466.20	5573051.89
		2792	381980.56	5596609.21
067	BHB96921	1535	384948.40	5596375.60
		1829	390492.26	5600175.19
068	BHB96125	1615	387888.60	5594952.90
		917	375061.93	5585461.69
069	BHB96109	1558	359566.87	5578811.66
		917	347620.03	5570326.96

APPENDIX B - WEATHER CHARTS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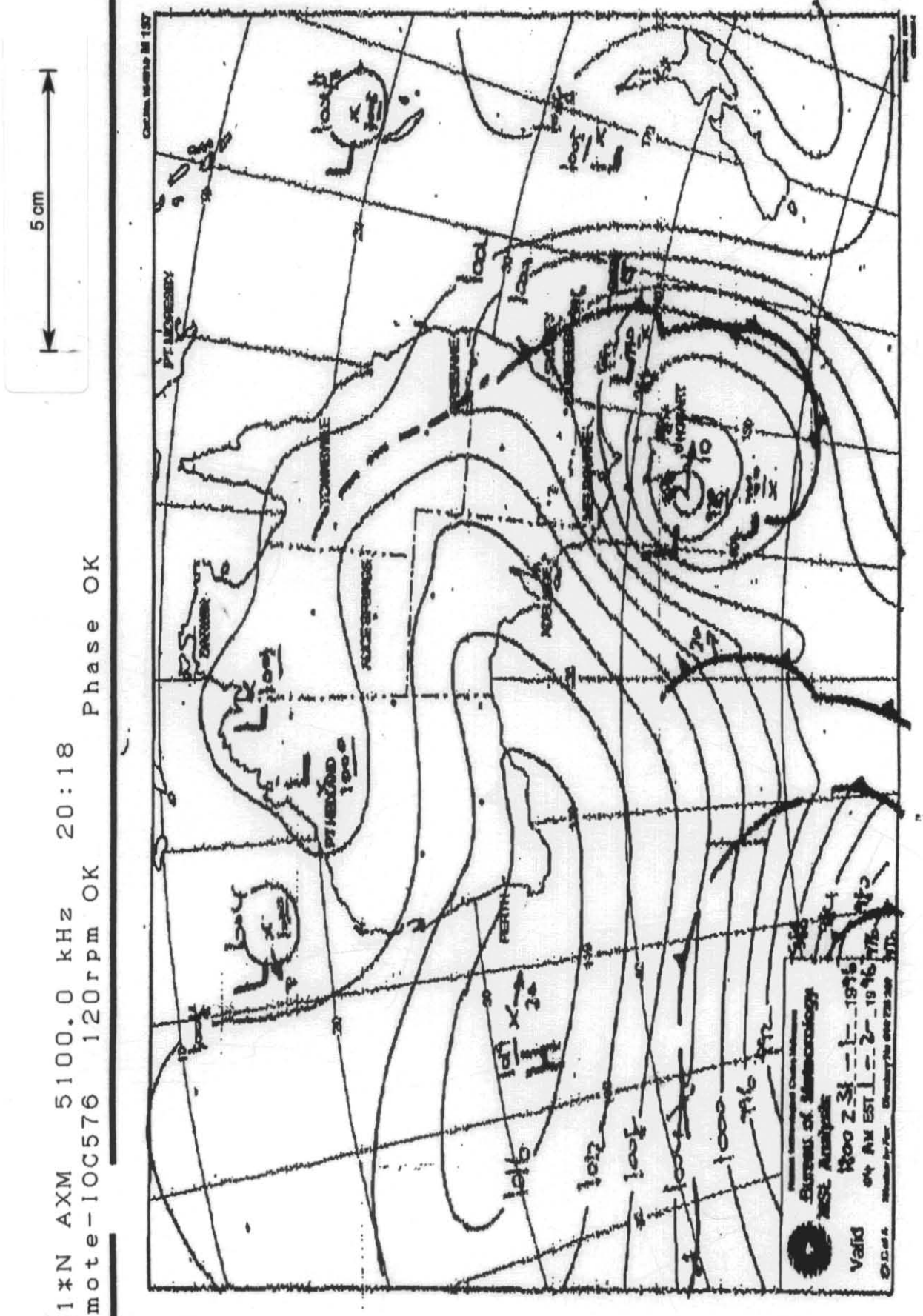
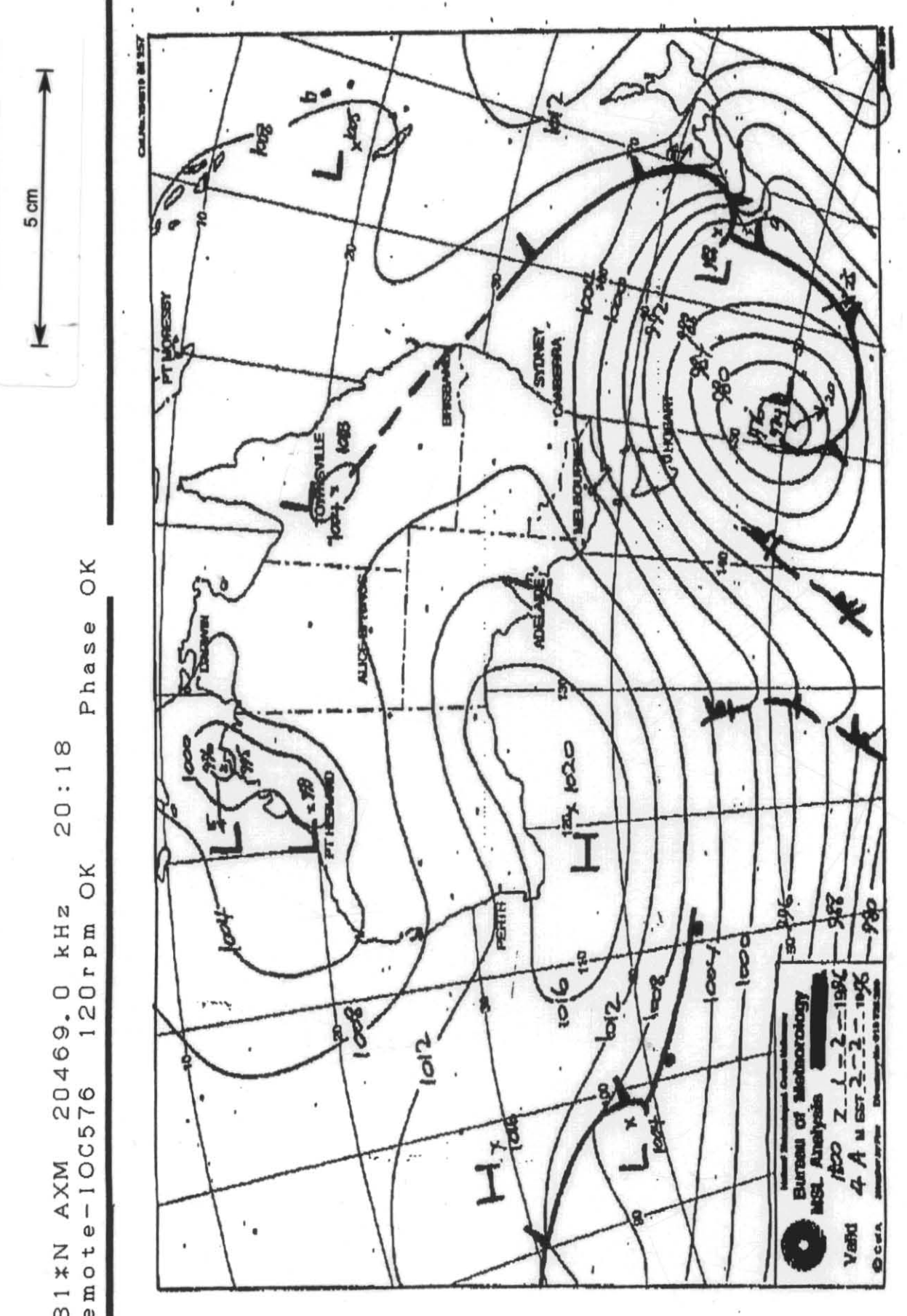
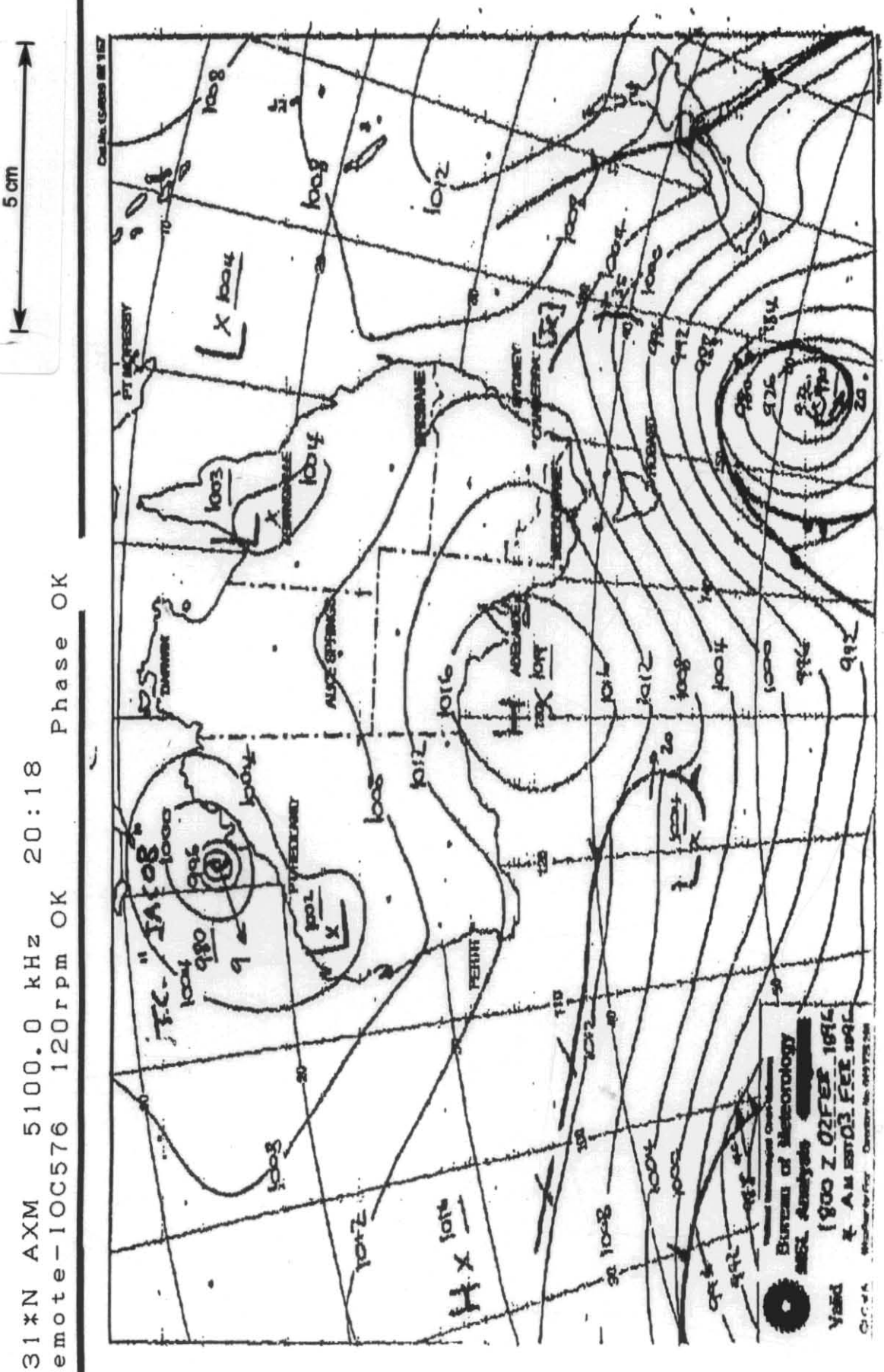
Remote-IOC576 120rpm OK
PT MOREBY
PERTH


5 cm
-31*N AXM 5100.0 kHz 20:18 Phase OK
Remote-IOC576 120rpm OK
Bureau of Meteorology
Valid


5 cm
-31*N AXM 20469.0 kHz 20:18 Phase OK
Remote-IOC576 120rpm OK
Bureau of Meteorology
MSL Analysis
Valid
PT MORESBY
BRISBANE
SYDNEY
CANBERRA
MELBOURNE
ADELAIDE
PERTH
DARWIN
TOWNSVILLE
HOBART


5 cm
-31*N AXM 5100.0 kHz 20:18 Phase OK
Remote-IOC576 120rpm OK

APPENDIX C - CONTRACTOR INCIDENT REPORT FORM

SAGASCO Holdings Limited
A.C.N. 008 181 068
GROUP OF COMPANIES

CONTRACTOR'S NAME: PGS EXPLORATION
ADDRESS: 1060 HAY STREET
WEST PERTH, WA.
CONTACT NAME: A. CUNNINGHAM
TELEPHONE: 0011 65 T35 6411

CONTRACTOR INCIDENT REPORT

Rectify the cause of the incident immediately if possible.

1. Date 21 / 10/96 Reported by CHIEF MATE Section DECK.
2. LOCATION OF THE INCIDENT: PORT SIDE ENGINE ROOM ENTRANCE
3. DESCRIBE THE INCIDENT: I.R. USING ANGLE GRINDER ON THE OUTSIDE OF THE ENGINE ROOM DOOR, TO REMOVE OBSTRUCTION IN DOOR FRAME, TO ALLOW PROPER CLOSING THE, SMOKE GENERATED WAS SUFFICIENT TO TRIGGER THE FIRE ALARM SYSTEM WHICHIN TURN TRIGGERED THE GENERAL ALARM. INVESTIGATION BY MATE THEN ESTABLISHED CAUSE
4. POSSIBLE SOLUTION (If not already rectified): ENSURE THAT OHSE POLICY AND PROCEDURES ESPECIALLY 'HOT WORK PERMIT' SYSTEM ARE FOLLOWED BY ALL CREW MEMBERS IN FUTURE.

SEND TO SAGASCO CONTRACT SUPERVISOR FOR FOLLOW-UP ACTION

5. ACTION TAKEN (To be completed by SAGASCO Contract Supervisor):

SUPERVISOR SIGNATURE: ..... Date: / /

6. FORWARD to the OH&S REPRESENTATIVE

Noted: ..... / /

7. FORWARD to the DEPARTMENT MANAGER

Noted: ..... / /

8. FORWARD to the GROUP MANAGER

Noted: ..... / /

9. FORWARD to the MANAGER, OCCUPATIONAL HEALTH AND SAFETY

Noted: ..... / /

10. COPY OF COMPLETED REPORT RETURNED TO EMPLOYEE ON / /

ORIGINAL HELD BY MANAGER OH&S

Form No. PD 2C

Appendix D

523150

PGS *Exploration*

FINAL REPORT

NAVIGATION POST PROCESSING

2D SEISMIC SURVEY

HUMMOCK

BASS STRAIT
AUSTRALIA

FOR

BORAL ENERGY RESOURCES Ltd.

PGS EXPLORATION PROJECT No. 60110

March 20, 1996

This Navigation Processing Report is

Prepared by

Jenny Glasser

Navigation Processing

Coordinator

Approved by

Esben Jettestad

Navigation Processing

Coordinator

PGS Exploration as,

Navigation Processing,

Strandveien 4,

N-1324 Lysaker,

NORWAY

Table of Contents

Not with Report

1. INTRODUCTION & SUMMARY

This report covers the post-processing of navigation data acquired during the 2D seismic survey in the Bass Strait off of Tasmania. The acquisition and the post-processing of the navigation data were conducted by PGS Exploration AS for Boral Energy Resources Ltd.

Project name:	Hummock, Bass Strait
PGS Exploration job no.:	60110

1.1. Brief Details of Acquisition Phase.

The data was acquired during the period from January 17, 1996 to February 03, 1996 by PGS Exploration's ship M/V Odin Explorer. The vessel towed a single streamer 3840 meters long, recording 252 channels for the majority of the survey (see section 1.5 for a summary), and employed a single airgun source, composed of 4 subarrays. The shotpoint interval was 22.86 meters, lines were shot in grid mode.

The survey area included two different permit areas, the total survey consisted of 69 line sequences acquired, of which sequence 08 was not accepted. A total of 1646.22 km of navigation data was processed.

1.2. Navigation Data Acquisition.

Navigation data was collected onboard the M/V Odin Explorer using EIVA 200/300 software, program versions: Navipac 61I, Navimap 039C, Navidat 18D. The field data was sent in a single shipment to PGS Exploration's office in Lysaker, Norway for post-processing and quality control checking. (See section 4.1 for details) The Primary Navigation used was DGPS, the Secondary Navigation used was raw GPS corrected by dead reckoning, however, this was not used after line sequence 009. Digicourse birds were used for azimuth and depth control of the streamer.

1.3. Brief Details of Post-Processing.

The processing software used was provided by EnSoCo Inc. of Houston, Texas. The raw data was sent from the ship in the form of HP format diskettes. The data was reformatted as ASCII files, which were read into the EnSoCo internal processing format. The data then was checked for internal consistency and for any problems with the shotpoint interval in distance and time. A check was made of the transformation parameters as used in the field. Then the primary and secondary navigation data was time de-skewed, stepped from the antenna locations to the vessel reference point, using the gyro as azimuth control. If necessary, a light filter was applied to the vessel position and/or the gyro data. In this case, a light filter was applied to the vessel position, but not the gyro. Once the vessel position was considered satisfactory, a second check of the shotpoint interval was made. Source positions were generated by stepping to the ship's stern using the gyro as azimuth control, and from the ship's stern to the nominal center of source offset using the recomputed course-made-good. Finally, headers were generated and the data was written to tape. The tapes were checked for physical readability. The source position maps were generated by PGS Exploration.

1.4. Geodetic Parameters

The geodetic datum used during acquisition was AGD84. The geodetic datum used for post-processing was AGD84. The datum transformation used for the satellite data was as follows:

WGS84 --> AGD84	DX = 116.00 m	DY = 50.47 m	DZ = -141.69 m
	RX = -0.23 sec	RY = - 0.39 sec	RZ = -0.344 sec
	Scale Factor = - 0.09830 ppm		

(Bursa Wolf convention used for rotations - see UKOOA P2/91 format description)

Spheroid :	WGS84	ANS
Semi-major axis:	6378137.00 m	6378160.00 m
Inverse Flattening:	298.25722356	298.25000000

Mapping Projection:	Transverse Mercator
Latitude of Origin:	0° S
Longitude of Origin:	147° E
False Easting :	500000.0 m
False Northing:	10000000.0 m

1.5. Compass Offsets

During the survey the magnetic declination value used was 12.0°E.

The offsets from the navigation reference point to the nearest bird (#16) and between each successive bird are as follows:

Bird#	Offset	Compass	Bird#	Offset	Compass
#1	92 m	YES	#10	273 m	YES
#2	273 m	YES	#11	275 m	YES
#3	182 m	YES	#12	273 m	YES
#4	273 m	YES	#13	275 m	YES
#5	275 m	YES	#14	273 m	YES
#6	273 m	YES	#15	182 m	YES
#7	275 m	YES	#16	260 m	YES
#8	273 m	YES			
#9	275 m	YES			

For Seq. 001, the distance to bird # 16 was incorrectly entered as 315 meters. The correct distance was 260 meters for the entire survey.

2. DESCRIPTION OF THE POSITIONING SYSTEMS

2.1. Primary Positioning System

Manufacturer	Trimble Navigation
Type	GPS Satellite Receiver
Model	4000 DS
Software Versions	Nav. Ver. 6.12 - 31 Jan 1995
	Sig. Ver. 2.12 - 18 Oct 1994
	Boot Ver. 3.33 - 26 Apr 1994
Differential. Link	Fugro Starfix
Differential Corrections via:	Inmarsat, Pacific Ocean Region

Differential. Station:	New Plymouth	(ID# 0021)	
	Auckland	(ID# 0022)	
	Melbourne	(ID#0006)	
	Townsville		(ID#0004)

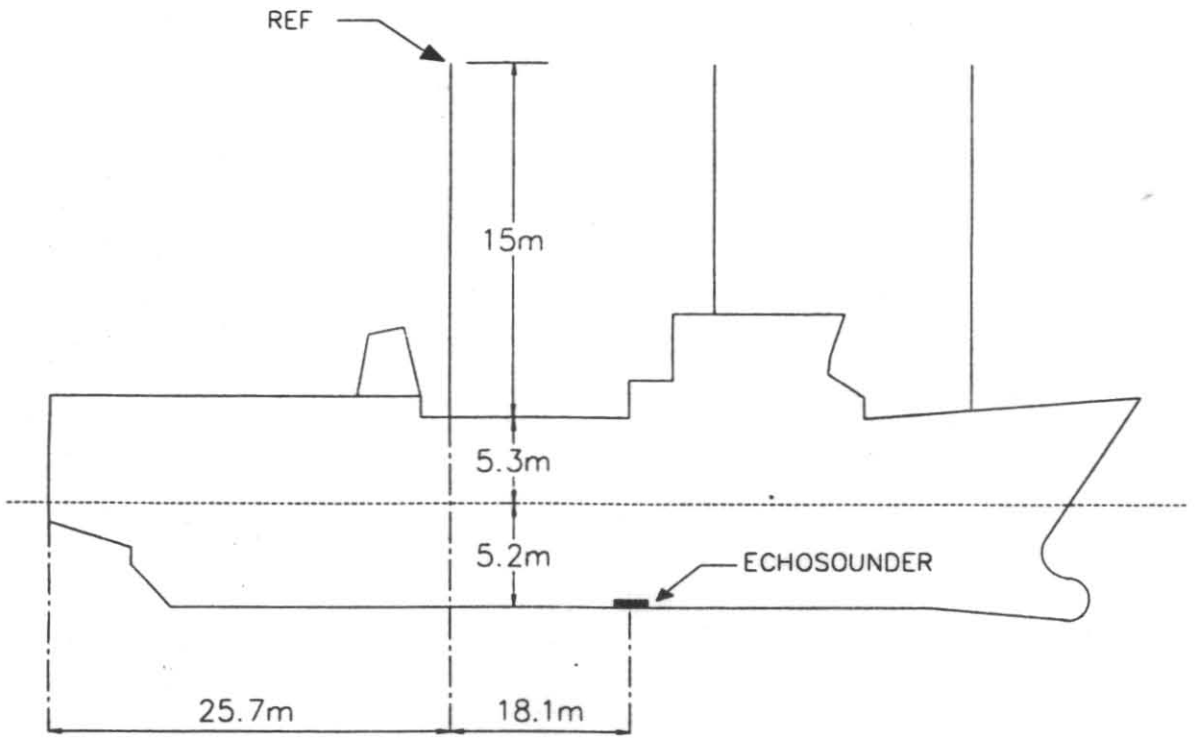
Differential. Station Coordinates in WGS84 Datum:

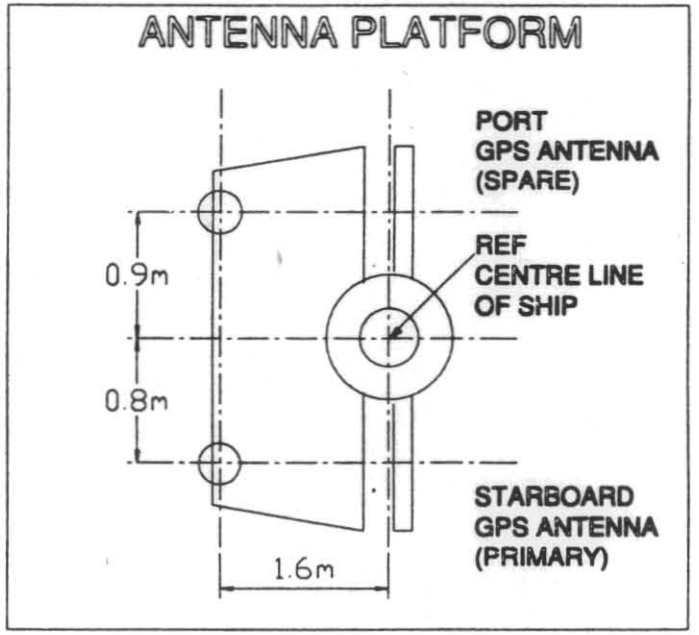
New Plymouth	39°03'27.185"S	174°04'49.232"E
Auckland	36°47'33.490"S	174°45'50.208"E
Melbourne	38°27'53.371"S	144°54'46.906"E
Townsville	19°15'52.645"S	146°48'44.108"E

After Seq # 32 these stations were used:

	Melbourne	(ID#0006)	
	Bathurst	(ID#0018)	
	Adelaide	(ID#0007)	
Coordinates (WGS-84):	38°27'53.371"S	144°54'46.906"E	(ID#0006)
	33°25'46.909"S	149°34'01.959"E	(ID#0018)
	33°56'31.529"S	138°36'25.470"E	(ID#0007)

Pages 8 and 9 missing





REF TO CENTRE OF FIRST GROUP : 254,2 m
REF TO CENTRE OF SOURCE : 146,7 m
REF TO CDP : 200,5 m

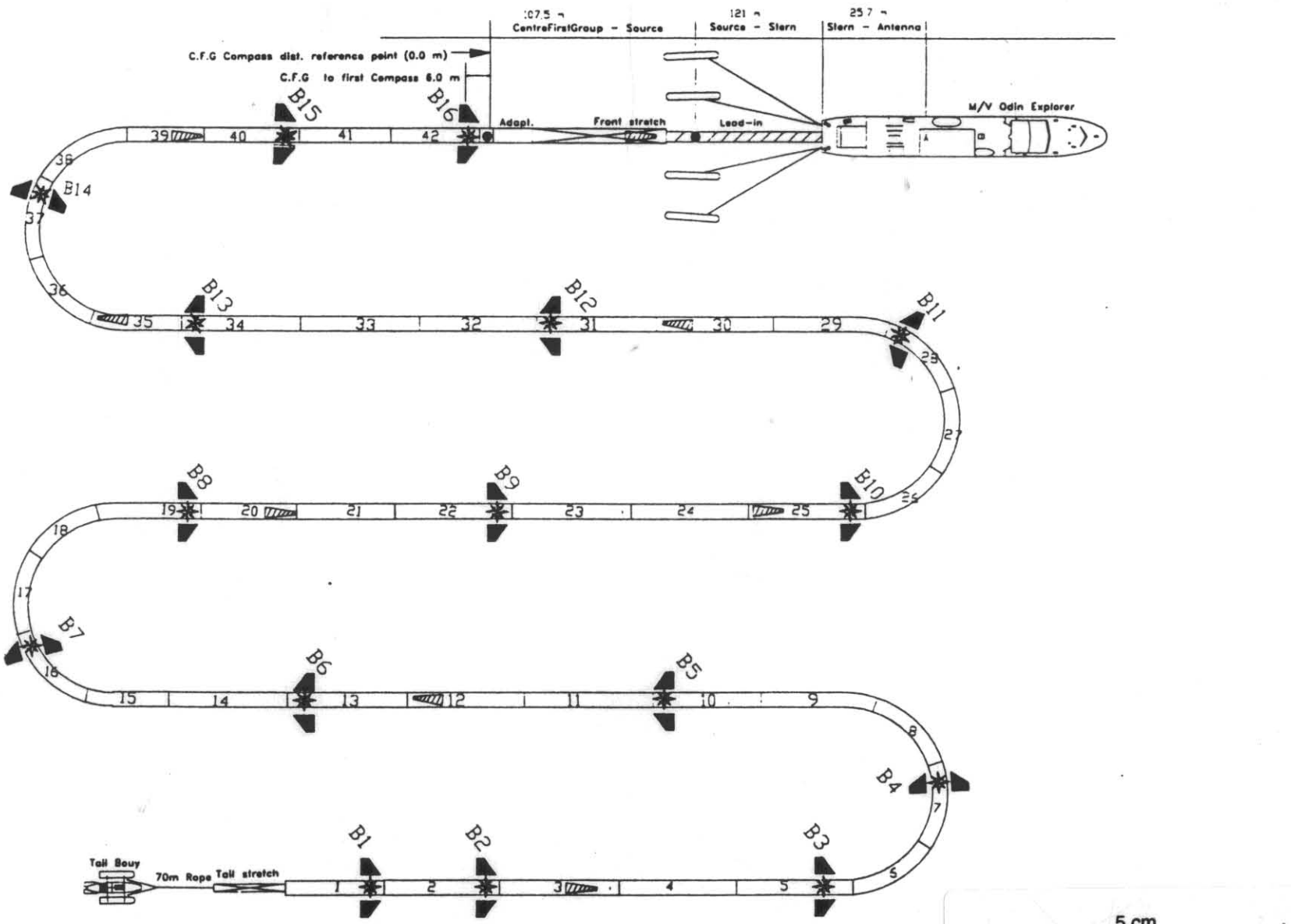
5 cm

M/V Odin Explorer Antenna Layout

Project:60110 Client:Boral Energy Area:Bass Strait

5231 51

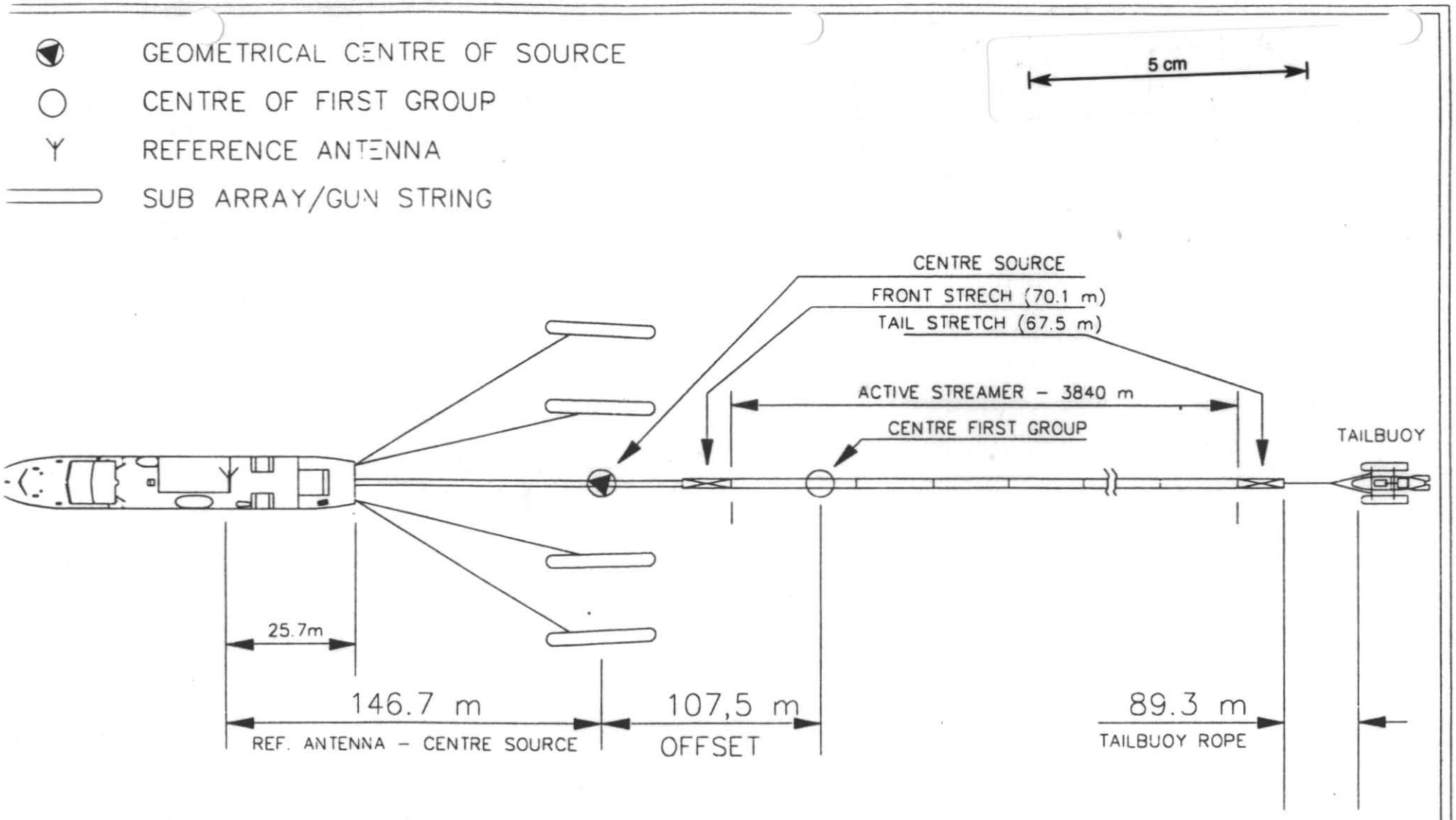
Bird #	Distance (m)	Trace #
16	6	252
15	189	240
14	463	222
13	738	204
12	1012	186
11	1286	168
10	1560	150
9	1835	132
8	2109	114
7	2383	96
6	2658	78
5	2932	60
4	3206	42
3	3389	30
2	3664	12
1	3755	6



M/V Odin Explorer, Streamer Lay-Out, Drawing No.1

Project:60110 Client:BORAL ENERGY Area:BASS STRAIT

5231558



OFFSET = Distance between centre source and centre first group.

M/V Odin Explorer – OFFSET, Drawing no. 1

Project: 60110 Client: Boral Energy Area: Bass Strait

V ODIN EXPLORER

DRAWING IS NOT TO SCALE

5231159

4. PRODUCTION INFORMATION

4.1. Final Production List & Shipping Details

M/V Odin Explorer delivered a single shipment:

SHIPMENT	DATE	LINE SEQ.	DATE RCVD
1	24 JAN 96	001 - 069	12 FEB 96

PGS Exploration's office has delivered two shipments at the time of this report:

SHIPMENT	DATE	LINE SEQ.	CONTENTS
1	04 MAR 96	001 - 069	2 copies UKOOA P1/90 on exabyte tape - P95-SRC-BH
2	05 MAR 96	001 - 069	2 copies UKOOA P1/90 on exabyte tape - P95-SRC-BH-VER2
			(An error was discovered in the P1/90 header)
			1 copy each, film, paper, source position maps at 1:50,000
3	20 MAR 96		1 copy Navigation Post-processing Report

The P1/90 and the maps treated the two permit areas, T/18P and T/25P, separately.

The data was shipped to: Boral Energy Resources Ltd.
60 Hindmarsh Square
Adelaide SA 5001
Australia
Attn: Mr Doug Roberts

4.2. Line Comments

These comments are extracted from the Chief Navigator's Trip Report.

All run-outs will be 84 shotpoints (SP's) and all lines will have 10 dummy shots prior to start-of-line (SOL) unless otherwise stated. All overlaps will also be 84 SP's unless otherwise stated. SP numbers will increment for West to East lines, and decrement for East to West lines. The First Good SP (FGSP) will be when the first common-mid-point (CMP) passes over the preplotted SOL coordinate.

Block A

Line	Comments
BHA96100	Dir 318.1° 17 January 1996, Seq#001
	SOL, FGSP 1828. SP 1658, disc failed, lost 7 SPs (SP1658-SP1652). SP 1651, restarted nav system. LGSP 908, EOL, complete. Wrong distance (315m) to Compass Bird # 1 was used, should have been 260m.
BHA96102	Dir 127.7° 17 January 1996, Seq#002
	SOL, FGSP 1010. LSP 1880.LGSP 1862, 18 SPs extra recorded, EOL, complete.
BHA96104	Dir 321.9° 17 January 1996, Seq#003
	SOL, FGSP 1680. LGSP 917, EOL, complete.
BHA96121	Dir 42.9° 17 January 1996, Seq#004
	SOL, FGSP 1001. LGSP 1522, EOL, complete
BHA96127	Dir 223.3° 18 January 1996, Seq#005
	SOL, FGSP 1441. LGSP 917, EOL, complete
BHA96131	Dir 44.3° 18 January 1996, Seq#006
	SOL, FGSP 1001. LGSP 1885, EOL, complete
BHA96133	Dir 224.4° 18 January 1996, Seq#007
	SOL, FGSP 1539. LGSP 917, EOL, complete
BHA96135	Dir 44.2° 18 January 1996, Seq#008
	NTBP
BHA96137	Dir 223.0 18 January 1996, Seq#009
	SOL, FGSP 1551. LGSP 917, EOL, complete
BHA96139	Dir 44.4° 18 January 1996, Seq#010
	SOL, FGSP 1001. LGSP 1523, EOL, complete
BHA96141	Dir 224.0° 18 January 1996, Seq#011

Line	Comments
BHA96143	Dir 43.6° 19 January 1996, Seq#012 FGSP 1001. LGSP 1568, EOL, complete.
BHA96110	Dir 304.0° 19 January 1996, Seq#013 FGSP 1534. Incorrect FGSP. According to SP# convention, FGSP should be 1845. LGSP 1568, EOL, complete.
BHA96108	Dir 133.9° 19 January 1996, Seq#014 FGSP 1001. LGSP 1713, EOL, complete.
BHA96106	Dir 313.1° 19 January 1996, Seq#015 FGSP 1552. LGSP 917, EOL, complete.
BHA96109	Dir 46.8° 19 January 1996, Seq#016 FGSP 1001. LGSP 1693, EOL, complete.
BHA96105	Dir 227.1° 20 January 1996, Seq#017 FGSP 2090. LGSP 917, EOL, complete.
BHA96103	Dir 47.5° 19/20 January 1996, Seq#018 FGSP 1001. LGSP 1717. LSP 1725, aborted line due to weather jamming differential corr.s.
BHA96903	Dir 47.5° 20 January 1996, Seq#019 FSP O/L 1634. FGSP 1718. LSGP 2265. EOL, complete.
BHA96101	Dir 53.4° 20 January 1996, Seq#020 FGSP 1001. LGSP 1300, aborted due to loss of streamer control.
BHA96901	Dir 53.4° 21 January 1996, Seq#021 Reshoot of seq 20. 1st overlap, SP 1218. FGSP 1301. LGSP 1755, EOL, complete.
BHA96107	Dir 226.6° 21 January 1996, Seq#022 FGSP 2041. LGSP 917, EOL, complete.
BHA96111	Dir 46.6° 21, January 1996, Seq#023 FGSP 1001. LGSP 2248. EOL, complete.
BHA96113	Dir 225.1° 21 January 1996, Seq#024 FGSP 1965. LGSP 917, EOL, complete.
BHA96115	Dir 44.7° 21 January 1996, Seq#025 FGSP 1001. LGSP 2194. EOL, complete.

Line	Comments
BHA96117	Dir 224.8° 21/22 January 1996, Seq#026 FGSP 2055. LGSP 917, EOL, complete.
BHA96114	Dir 321.3° 22 January 1996, Seq#027 FGSP 1684. LGSP 917, EOL, complete.
BHA96112	Dir 139.3° 22 January 1996, Seq#028 FGSP 917. LGSP 1665, EOL, complete.
BHA96116	Dir 320.7° 22 January 1996, Seq#029 FGSP 1722. LGSP 917, EOL, complete.
BHA96118	Dir 141.8° 22 January 1996, Seq#030 FGSP 1001. LGSP 1798, EOL, complete.
BHA96120	Dir 323.2° 22 January 1996, Seq#031 FGSP 1697. LGSP 917, EOL, complete.
BHA96122	Dir 144.6° 23 January 1996, Seq#032 FGSP 1001. LGSP 1773, EOL, complete.
BHA96124	Dir 326.0° 23 January 1996, Seq#033 FGSP 1685. LGSP 917, EOL, complete.
BHA96126	Dir 147.8° 23 January 1996, Seq#034 FGSP 1001. LGSP 1764, EOL, complete.
BHA96935	Dir 043.5° 25 January 1996, Seq#035 Complete reshoot due nav hang up on 1st attempt. SP 1045, echosounder locking up at 15:52. At around 17:00 wind picking up to 40 kts, nav missing a shot once in awhile, the echosounder not running for more than a few min. at a time. FGSP 1001. LGSP 1557, EOL, complete.
BHA96129	Dir 043.2° 25 January 1996, Seq#036 Incorrect line ID recorded to disc, should have been BHA96129, At 20:20 enountered weather induced steering problems, impossible to maintain 10 m. At 20:50 the spec. was revised to 20m after trying for 30 min. At 20:58 nav running on filter, SP 1231, due to mast rolling in the swell. SP 1242, all OK. SP 1001, SOL, FCSP. SP 1523, EOL, complete.
BHA96125	Dir 223.0° 26 January 1996, Seq#037 SP 1439, SOL, FCSP. SP 917, EOL, complete.

Line	Comments
BHA96119	Dir 043.8° 26/27 January 1996, Seq#038
	SP 1001, SOL, FCSP. SP 1358, the Saturn Inmarsat started to receive a fax transmission and the GPS antenna was swamped until the fax reception was halted by switching off the fax machine. The indicated ship position jumped to the stbd side of the line. SP 1360-1362, long shots caused by navigation. The indicated positions are off-line to stbd. SP 1363, no nav data recorded, there is seismic data. SP 1364, no seismic data recorded. SP 1366, no nav data recorded, there is seismic data. SP 1367-1368 no nav data or seismic data. SP 1369, no seismic data recorded. SP 1370, no nav data recorded, there is seismic data. SP 1371-1372, no nav data or seismic data. SP 1373, no seismic data recorded. SP 1374, no nav data recorded, there is seismic data. SP 1375, no seismic data recorded. SP 1381, no nav data recorded, there is seismic data. SP 1382, no seismic data recorded. SP 1383, nav back on track and settled down. SP 2093, EOL, complete.
BHA96123	Dir 222.9° 27, January 1996, Seq#039
	SP 1959, SOL, FCSP. SP 917, EOL, complete.
	Block B
BHB96102	Dir 322.4° 27 January 1996, Seq#040
	SP 2105, SOL, FCSP. SP 917, EOL, complete.
BHB96100	Dir 144.3° 27 January 1996, Seq#041
	SP 1001, SOL, FCSP. SP 2187, EOL, complete.
BHB96119	Dir 053.8° 27 January 1996, Seq#042
	SP 1001, SOL, FCSP. SP 1598, EOL, complete.
BHB96117	Dir 233.1° 27 January 1996, Seq#043
	SP 1513, 1st dummy SP. 2 dummy SPs lost, SP 1510 and SP 1508 due to Syntrac NDR. SP 1503, SOL, FGSP in Block B. SPs 1319, 1314, 1290, 1275, 1269, 1264, 1218, 1216, 1200, 1141, 1119, no seismic data recorded. SP 1503, SOL, FCSP. SP 917, EOL, complete.
BHB96115	Dir 053.1° 28 January 1996, Seq#044
	SP 991, recording problems on 1st dummy SP. SP 994, program crashed during disc swap. SP 1002, restarted line. SP 1004, SOL, FGSP in Block B. SP 1654, EOL, LGSP, complete.
BHB96113	Dir 234.3° 28 January 1996, Seq#045
	SP 1586, SOL, FCSP. SP 917, EOL, LGSP, complete.
BHB96111	Dir 054.6° 28 January 1996, Seq#046
	SP 1001, SOL, FCSP. SP 1666, EOL, LGSP, complete.
BHB96104	Dir 324.0° 28 January 1996, Seq#047
	SP 1535, SOL, FCSP. SP 917, EOL, LGSP, complete.
BHB96106	Dir 143.8° 28 January 1996, Seq#048
	SP 1001, SOL, FCSP. SP1618, EOL, LGSP, complete.

Line	Comments
BHB96108	Dir 323.2° 28 January 1996, Seq#049 SP 1535, SOL, FCSP. SP 917, EOL, LGSP, complete.
BHB96110	Dir 142.4° 28 January 1996, Seq#050 Line ID on nav disk is B96-110, it should be BHB96110. SP 1001, SOL, FCSP. SP 1618, EOL, LGSP, complete.
BHB96112	Dir 321.8° 29 January 1996, Seq#051 SP 1535, SOL, FCSP. SP 917, EOL, LGSP, complete.
BHB96114	Dir 141.0° 29 January 1996, Seq#052 SP 1001, SOL, FCSP. SP 1752, EOL, LGSP, complete.
BHB96116	Dir 321.0° 29 January 1996, Seq#053 SP 1668, SOL, FCSP. SP 917, EOL, LGSP, complete.
BHB96118	Dir 142.0° 29 January 1996, Seq#054 Line ID on disk as B96-118, should be BHB96118. SP 1001, SOL, FCSP. SP 2219, EOL,LGSP, complete.
BHB96120	Dir 322.0° 29 January 1996, Seq#055 SP 1875, SOL, FCSP. SP 917, EOL, LGSP, complete.
BHB96122	Dir 144.0° 29 January 1996, Seq#056 SP 1001, SOL, FCSP. SP 1610, EOL, LGSP, complete.
BHB96124	Dir 324.1° 29/30 January 1996, Seq#057 SP 1523, SOL, FCSP. SP 917, EOL, LGSP, complete.
BHB96105	Dir 235.3° 30 January 1996, Seq#058 SP 2710, SOL, FCSP. SP 917, EOL, LGSP, complete.
BHB96101	Dir 055.2° 30 January 1996, Seq#059 SP 1001, SOL, FCSP. SP 1050,1052, 1110, nav position(?), MSP. SP 1200, weather increasing ahead, reducing shooting speed and effecting vessel steering. SP 1379, 1408, 1535, 1537, 1618, 1671, 1789 nav position(?), MSP. SP 1869, increased filter to 50 from 40 causing a MSP. SP 1877, 1911, 2050, 2071, 2282, 2303, 2381, 2462 nav position(?), MSP. SP 2503, aborted due to weather. LGSP 2370.
BHB96129	Dir 232.9° 30 January 1996, Seq#060 SP 1510, SOL, FCSP. SP 917, EOL, LGSP, complete.
BHB96127	Dir 052.0° 31 January 1996, Seq#061 SP 1001, SOL, FCSP. SP 1698, EOL, LGSP, complete.

Line	Comments
BHB96123	Dir 234.9° 31 January 1996, Seq#062
	SP 1616, SOL, FCSP. SP 1584, nav position(?), MSP. SP 917, EOL, LGSP, complete.
BHB96121	Dir 055.6° 31 January 1996, Seq#063
	SP 1001, SOL, FCSP. SP 1619, Line aborted due to weather induced loss of cable control. LGSP 1534. The line name recorded on disc is B96-121, the correct name is BHB96121.
BHB96901	Dir 055.2° 02 February 1996, Seq#064
	SP 2286, FSP of overlap, started 1 SP too early. FCSP 2371. SP 2799, EOL, LGSP, complete..
BHB96103	Dir 235.7° 03 February 1996, Seq#065
	SP 2713, SOL, FCSP. SP 1360 & SP1086, no seismic data. SP 917 LGSP EOL Complete.
BHB96107	Dir 054.9° 03 February 1996, Seq#066
	SP 1000, SOL, FCSP. 1st SP incorrect, should have been 1001. SP 2792, EOL, LGSP, complete.
BHB96921	Dir 055.6° 03 February 1996, Seq#067
	SP 1415, FSP of overlap. FCSP 1535 SP 1829, EOL, LGSP, complete.
BHB96125	Dir 233.5° 03 February 1996, Seq#068
	SP 1615, FCSP, SP 917, EOL, LGSP, complete.
BHB96109	Dir 234.7° 03 February 1996, Seq#069
	SP 1558, FCSP, SP 917, EOL, LGSP, complete.

APPENDIX 3

CONTRACTOR'S OPERATIONS REPORT

This appendix comprises the Contractor's Operations Summary.

PGS Exploration

ACQUISITION REPORT

2D SEISMIC SURVEY

OFFSHORE TASMANIA, AUSTRALIA
TASMANIA BASS BASIN
PERMITS T/25P and T/18P

BORAL ENERGY

JOB No. 60110

Acquired by :
M/V ODIN EXPLORER

Prepared by:
PGS EXPLORATION AS
1324 LYSAKER - NORWAY

DISTRIBUTION OF THE ACQUISITION REPORT

Copy No.	Receiver	
COPY 1	Client Company Office	
COPY 2	Client Company Office	
COPY 3	Client Company Office	
COPY 4	Client Company Office	
COPY 5	Client Company Office	
COPY 6	Client Company Office	
COPY 7	Party Chief Acquisition Vessel	
COPY 8	PGS EXPLORATION Office/Archive	
COPY 9	PGS EXPLORATION Office/Archive	

Revision No.	Signature	Date

CONTENTS

CONTENTS (cont.)

1.2 Survey Parameters

2D Definition

Acquisition mode	:	Single Source/Single Streamers
Line orientation	:	Various

Energy Source

Shot interval	:	22,86 meter
Sub-array separation	:	25 meter
Source type	:	TI Sleeve Gun
Air pressure	:	2000 psi.
Volume	:	2660 cu.in.
Number of sub-arrays	:	4
Source depth	:	6 m
Source dimensions	:	8 x 75 meter
Peak-peak (out-128 Hz/72 dB/oct)	:	109,2 barm
P/b ratio (out-128 Hz/72 dB/oct)	:	34,3
Drop out spec.	:	10%, Seres Model

Streamer

Number of streamers	:	1
Streamer separation	:	N/A
Streamer length	:	3840 meter
Streamer depth	:	6 +/- 1 meter
Offset source first receiver group	:	107,5 meter
No of groups	:	252
Group interval	:	15,24
Group length	:	15,09
No of compasses	:	16
No of depth controllers	:	16

Data Recording

Recording length	:	6 sec.
Sampling rate	:	2 ms
Lo-cut filter	:	out
Hi-cut filter	:	218Hz/484 dB per octave
Format	:	Seg D, 8015 2,5 byte

1.3 Navigation

Vessel Positioning

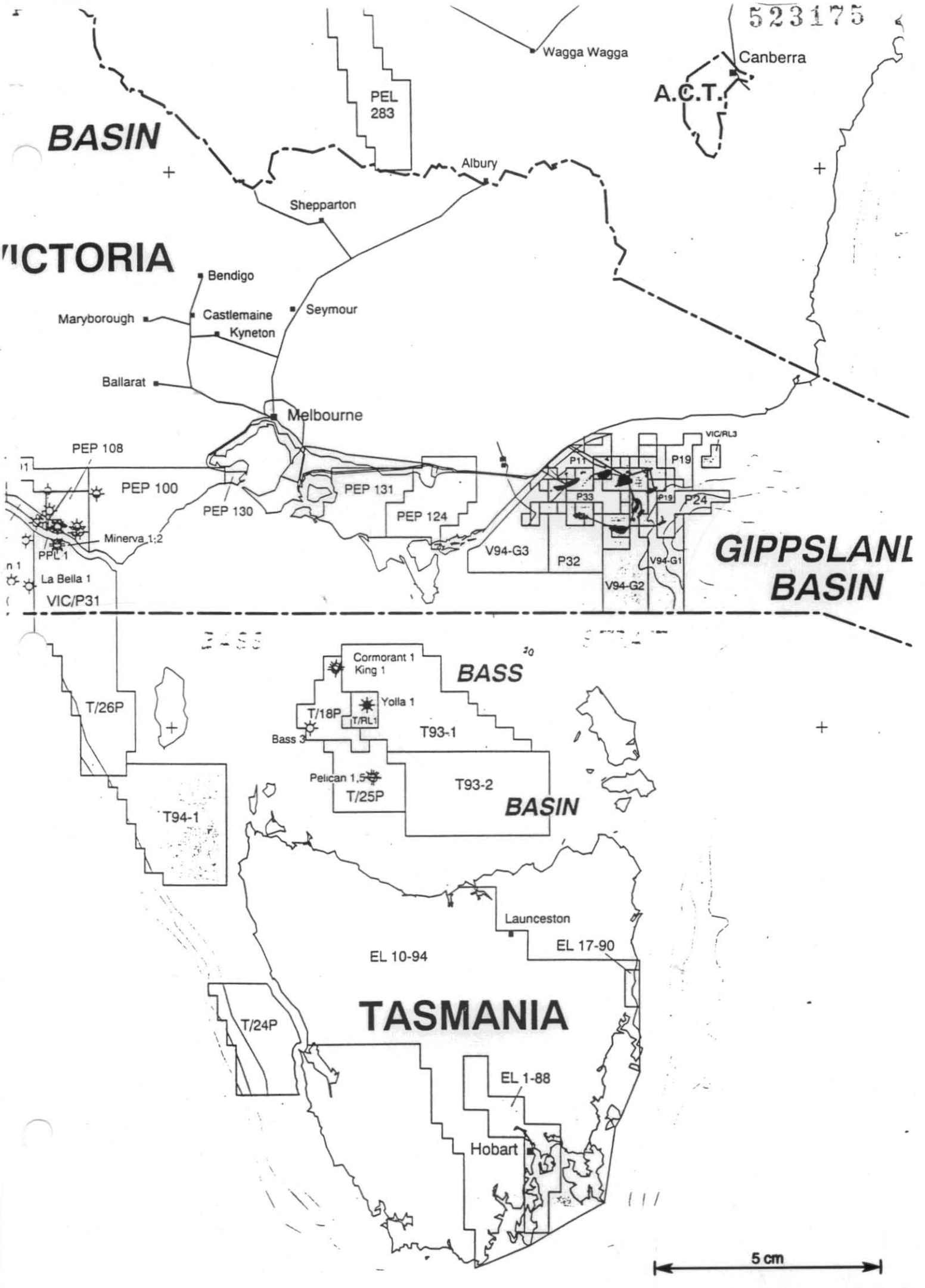
PRIMARY	:	Fugro, Starfix Diff. GPS
SECONDARY	:	N/A
FRONT NETWORK	:	N/A
TAIL NETWORK	:	N/A
STREAMER SHAPE	:	Digibird 5011

Singapore, ... 1996

Andy Cunningham
Operations Manager

1.4 General Information

Client	:	Boral Energy Ltd
Contact persons	:	Doug Roberts
Area of survey	:	Bass Strait, North-West of Tasmania, Ausralia.
Type of survey	:	2D Single Streamer
Agents during survey	:	Holyman's, Devonport / Tidewater Port Jackson Marine, Melbourne
Project Manager	:	Andy Cunningham
Deputy Project Manager	:	Bruce Harrick
Navigation Manager	:	Jon Falkenberg
Safety and QA Manager	:	Charles Jeffrey
Party Chief	:	Jan Ask, Gunnar Brastein
Client's representatives	:	Frank Renton
Fisheries representative	:	N/A
Seismic field tapes were sent to	:	Western Geophysical, Melbourne Australia.
Navigation tapes were sent to	:	PGS Exploration AS, Norway


Wagga Wagga
Canberra
A.C.T.
PEL 283
BASIN
Albury
Shepparton
VICTORIA
Bendigo
Maryborough
Castlemaine
Kyneton
Seymour
Ballarat
Melbourne
PEP 108
PEP 100
PEP 130
PEP 131
PEP 124
Minerva 1;2
PPL 1
La Bella 1
VIC/P31
VIC/RL3
P11
P19
P33
P24
V94-G3
P32
V94-G1
V94-G2
GIPPSLAND BASIN
Cormorant 1
King 1
BASS
Yolla 1
T/18P
T/RL1
Bass 3
T93-1
Pelican 1,5
T/25P
T93-2
BASIN
T/26P
T94-1
Launceston
EL 17-90
EL 10-94
TASMANIA
T/24P
EL 1-88
Hobart
5 cm

2. included in Appendix 3. 523170

TITLE: Baral Energy , Australia
Subtitle: Hummock/Boss 20 Seismic Survey
– VERSION 1 –
– – NAVIGATION DANGERS NOT SHOWN.

Generated: Mon 11-DEC-1995
Scale: 1 : 100000

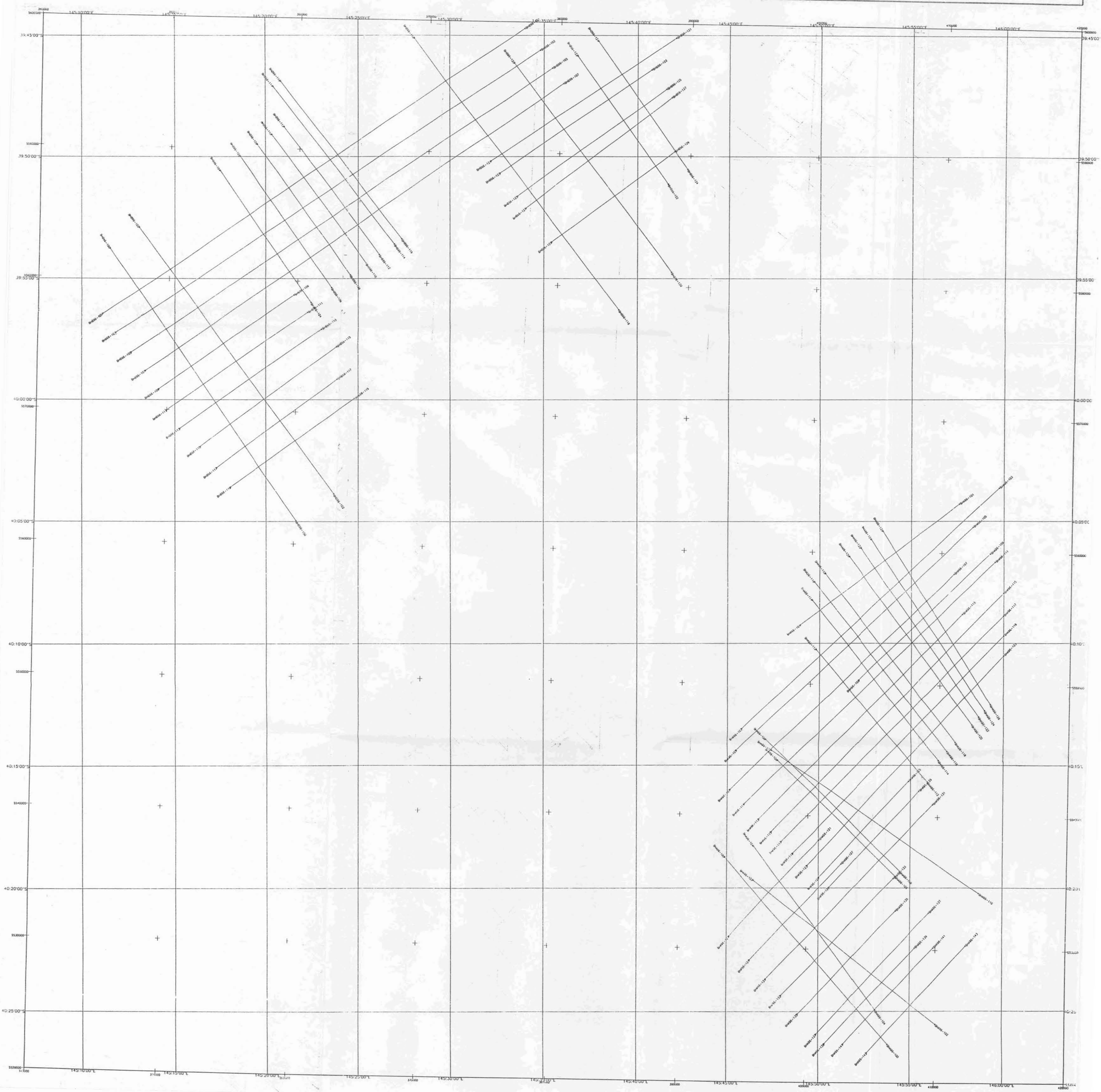
5 cm

Geodetic information:
Datum:
Spheroid name: Australian National
Semi-major axis: 6378160.000 m
Flattening: 1/298.2500

Grid information:
Grid name: UTM
Zone: 55 S
Central meridian: 147.0 E

Produced by PGS Exploration, Singapore
for [illegible]

OR-0426



3 INSTRUMENT & STREAMER CONFIGURATION

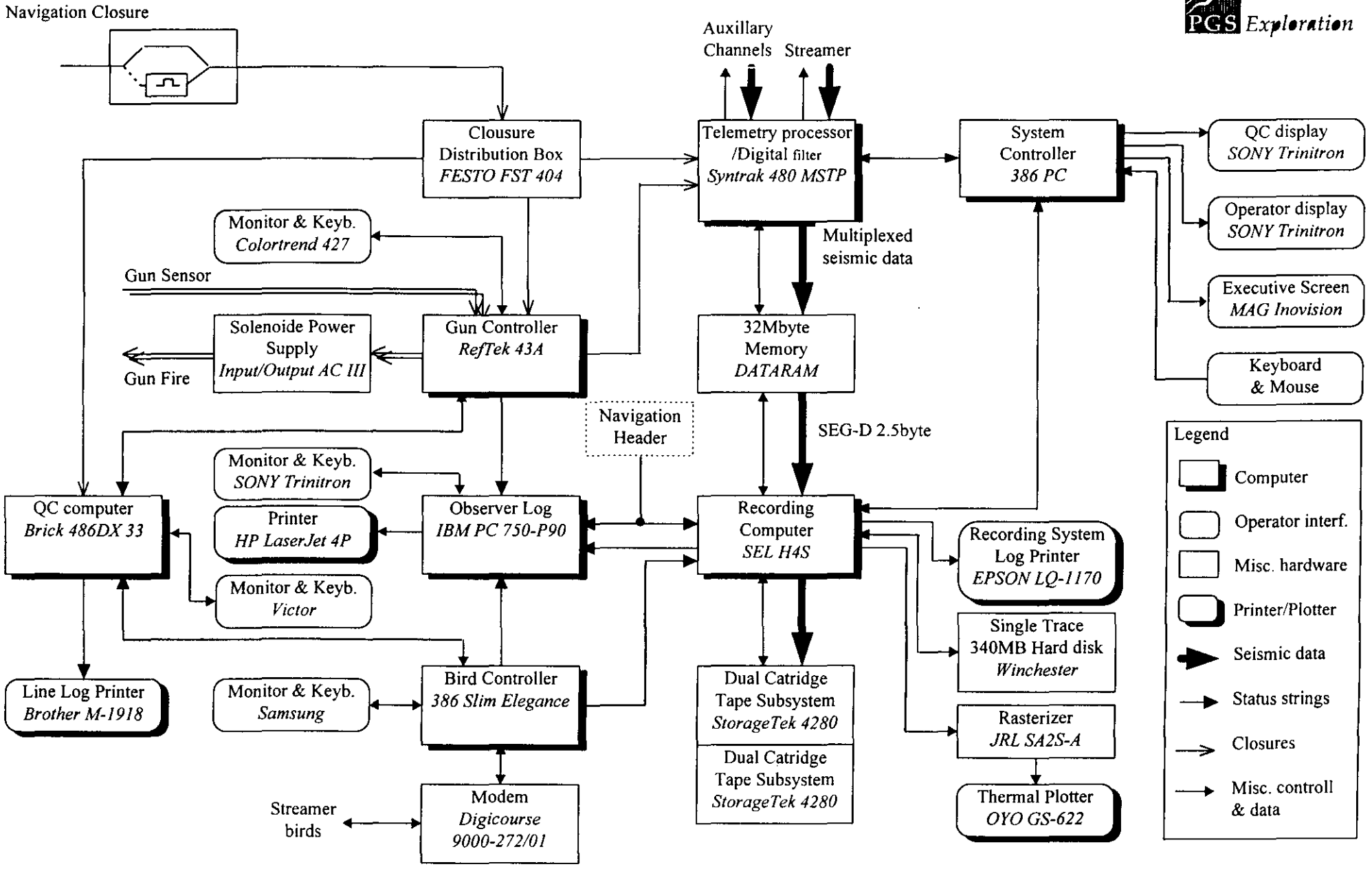
3.1 Instrument Configuration - Block Diagram

5 cm

523178

PGS Exploration

3.1 Block diagram recording instruments M/V Odin Explorer



Date: 2/28/96

S.e &o.

3.2 Geometry

523180

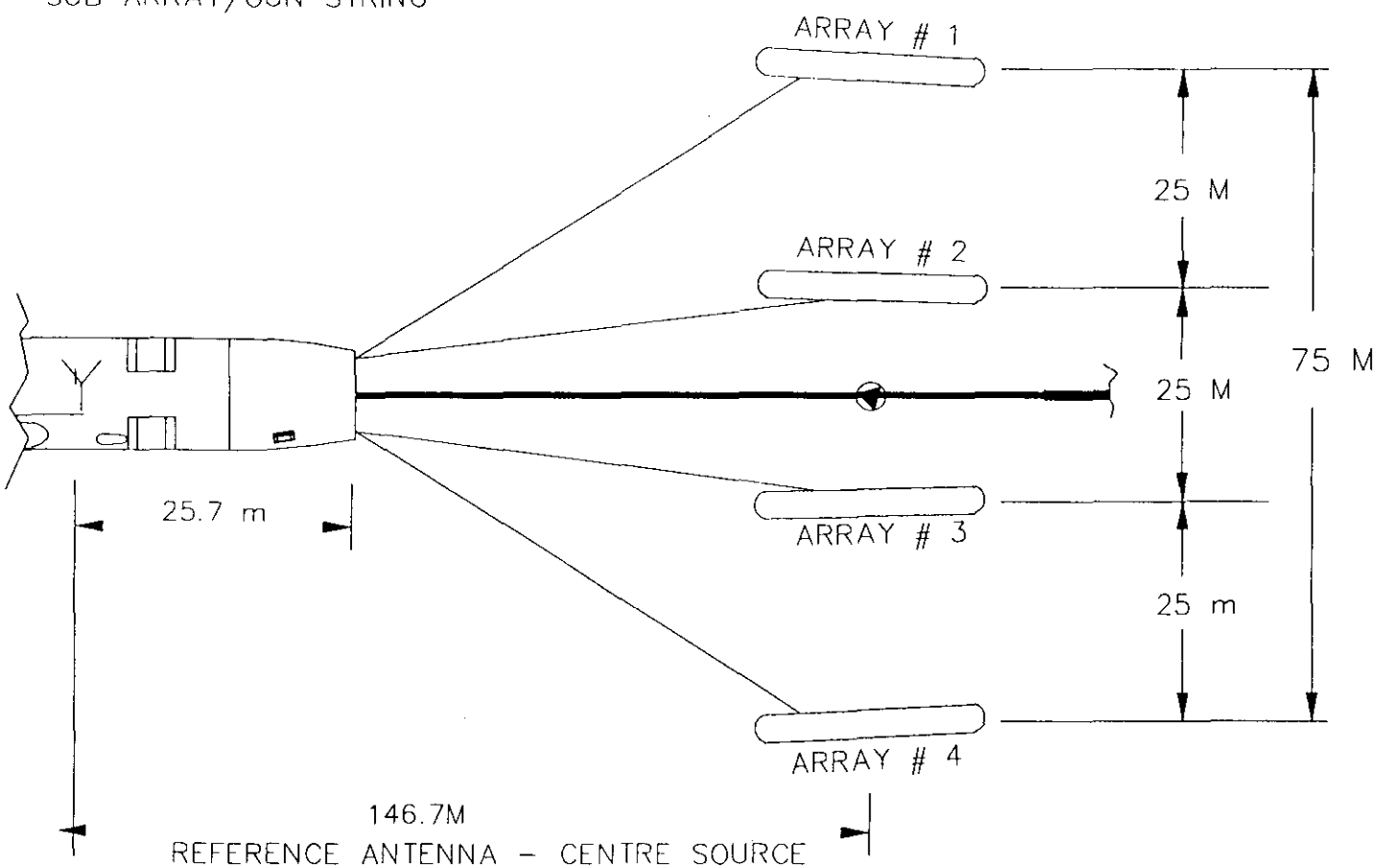
5 cm

GEOMETRICAL CENTRE OF SOURCE

REFERENCE ANTENNA

SUB ARRAY/GUN STRING

M/V ODIN EXPLORER



SOURCE POSITIONING / SPREAD, Drawing no. 1

PROJECT : 60110 CLIENT : Boral Energy AREA : Bass Strait, Australia

3.3 Streamer System

Type of streamer	:	Teledyne/Shell
No. of groups	:	252
Group length interval	:	15,24 m
Group length	:	15,09 m
No of hydr. per group length	:	24
Hydrophone type	:	LRS 2510. Mod. WMI-018
Streamer depth control	:	DigiCourse mod. DigiBird 5011
Streamer depth	:	6 m ±1 m
	:	8-9 m ±1 m in bad weather

Trace Numbering

Centre, streamer no. 1	:	1-252 (Trace 252 closest to vessel)

Each Cable Consists of:

	Number	Length (m)	
Lead-in	1	132 m	
Head stretch sections	1	70.1m	each
Live sections	42	91.44 m	each
Total length active streamer	N/A	3840m	
Tail stretch sections	1	67.5 m	each

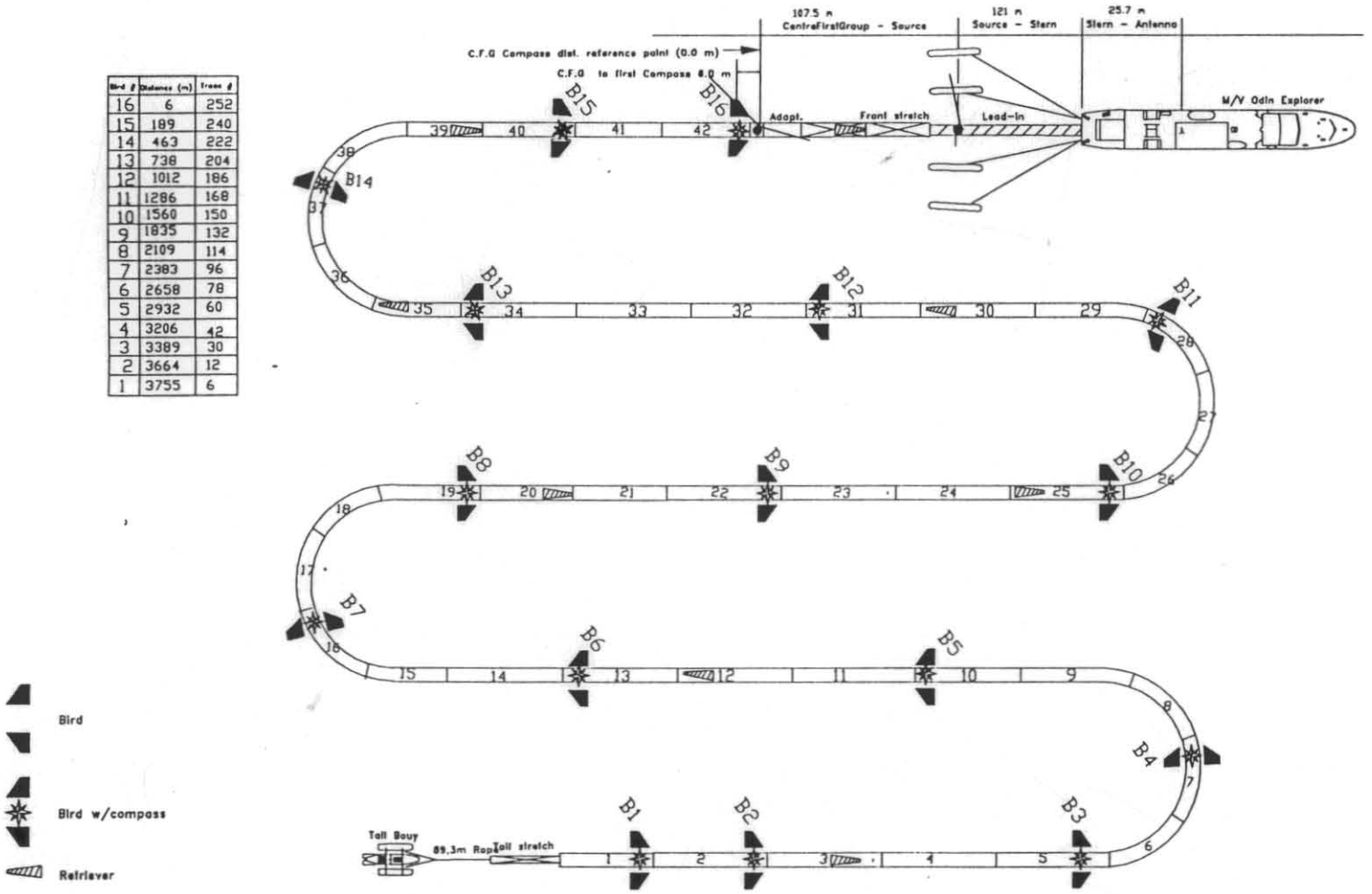
3.4 Streamer Layout

3.5 System Timing Diagram

5 cm

523183

Bird #	Distance (m)	Trace #
16	6	252
15	189	240
14	463	222
13	738	204
12	1012	186
11	1286	168
10	1560	150
9	1835	132
8	2109	114
7	2383	96
6	2658	78
5	2932	60
4	3206	42
3	3389	30
2	3664	12
1	3755	6

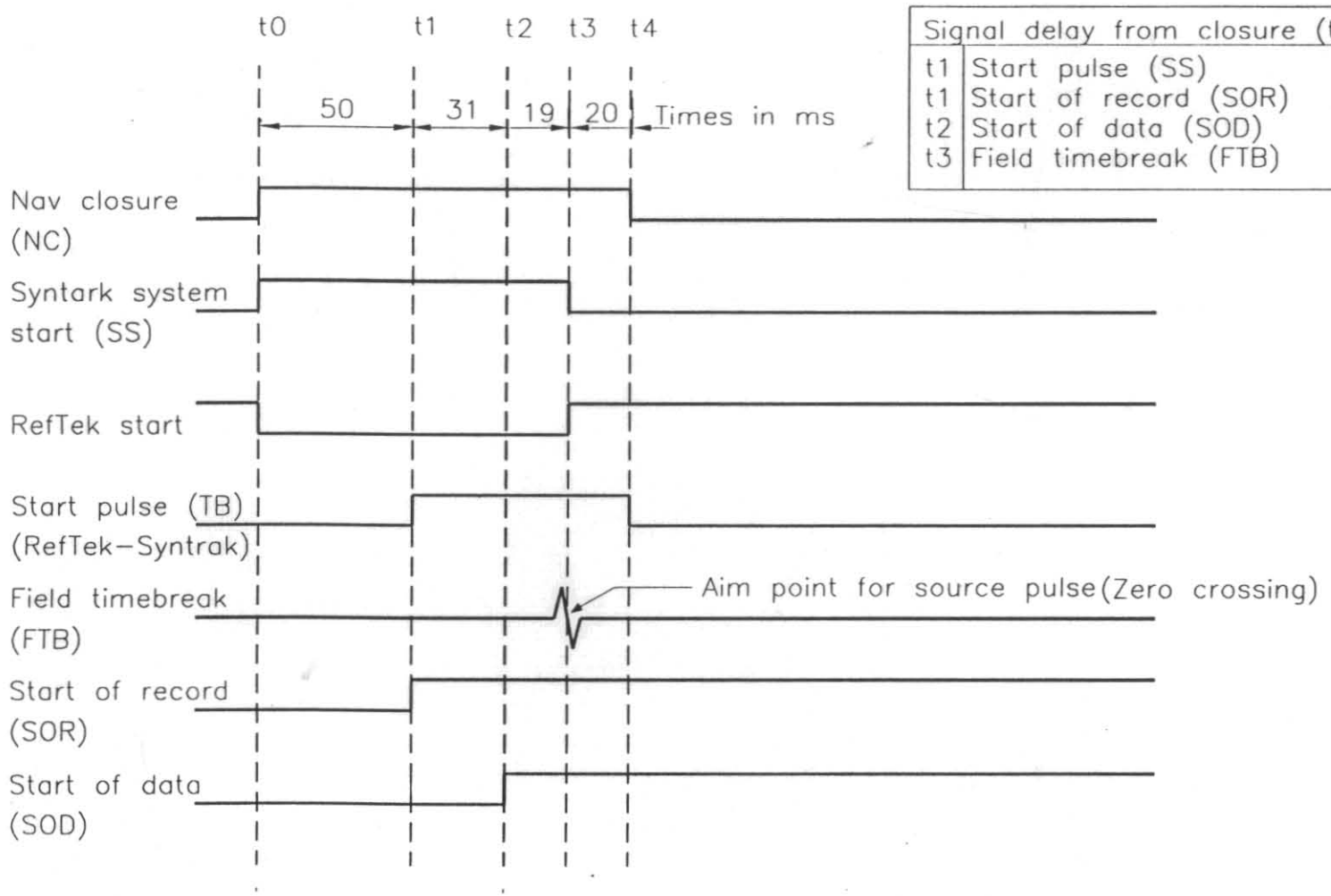


M/V Odin Explorer, Streamer Lay--Out, Drawing No.1

Project:60110 Client:BORAL ENERGY Area:BASS STRAIT

523184

5 cm



Signal delay from closure (t0)		
t1	Start pulse (SS)	50ms
t1	Start of record (SOR)	50ms
t2	Start of data (SOD)	81ms
t3	Field timebreak (FTB)	100ms

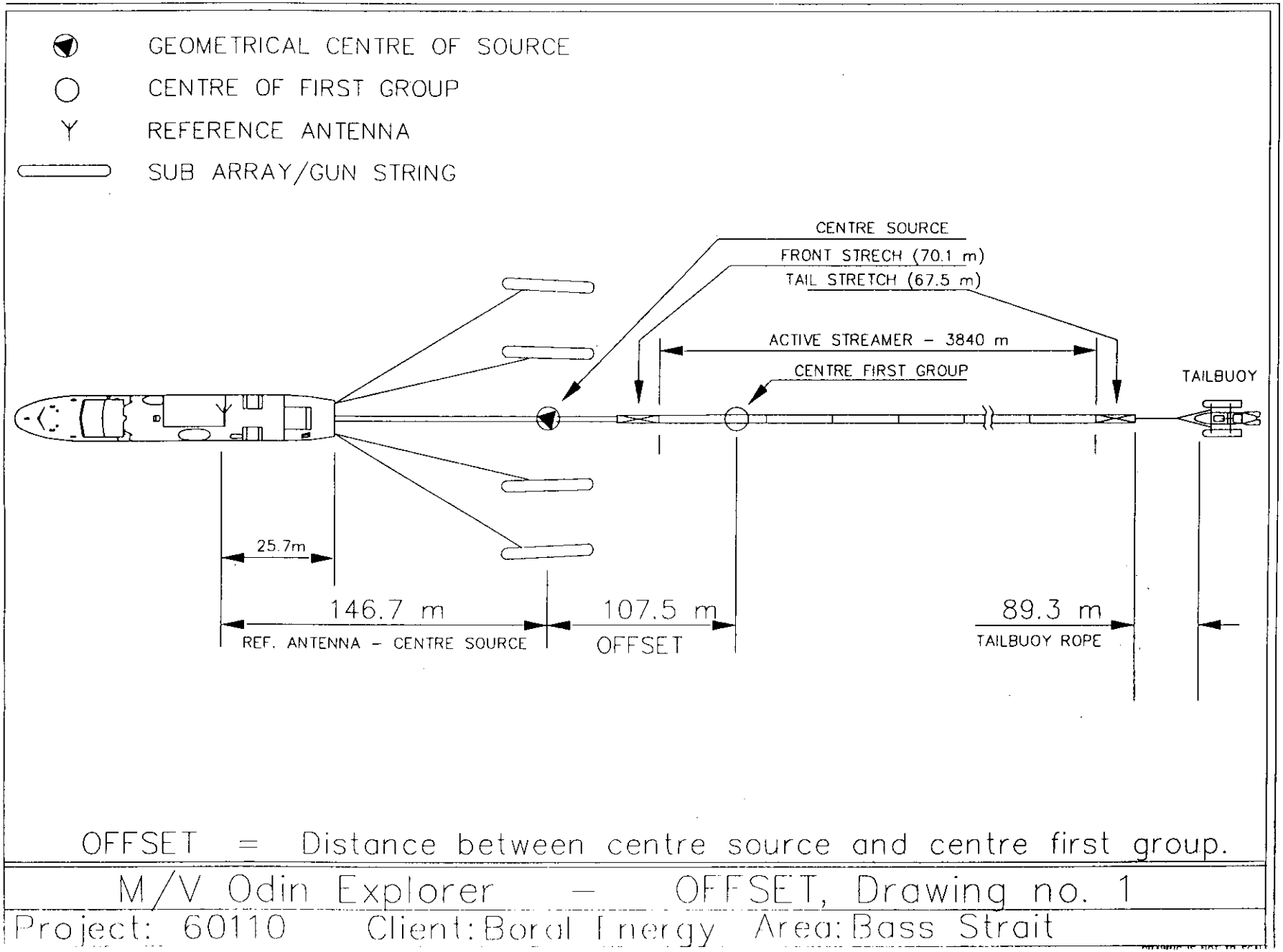
M/V Odin Explorer System timing diagram

Project:60110 Client: Boral Area:Tasmania Bass Strait

3.6 Offset Diagrams

5 cm

523186



OFFSET = Distance between centre source and centre first group.

M/V Odin Explorer - OFFSET, Drawing no. 1

Project: 60110 Client: Boral Energy Area: Bass Strait

4 NAVIGATION

4.1 Datum and Projection

4.1.1 Datums

Survey Datum	:	AGD84	*GPS Datum*	:	*WGS-84*
Ellipsoid	:	Australian National	*Ellipsoid*	:	*WGS-84*
Semi major axis	:	6 378 160	*Semi major axis*	:	*6 378 137 m*
1/flattening	:	298.250	*1/flattening*	:	*298.257*

4.1.2 Datum Shift *WGS-84 to AGD84

X-shift	:	+116.00 meter
Y-shift	:	+50.47 meter
Z-shift	:	-141.69 meter
X-axis Rotation	:	-1115.07E-09 radian
Y-axis Rotation	:	-1890.77E-09 radian
Z-axis Rotation	:	-1619.28E-09 radian
Scale Factor	:	-.0983000

4.1.3 Map Projection

Projection	:	Universal Transverse Mercator
Projection System	:	Grid
Zone	:	55
Central Meridian	:	147° E
Scale Factor	:	0.9996
False Northing	:	10000000
False Easting	:	500000

4.2 Integrated Navigation System

Type	:	EIVA/NaviPac 200/300
Software version	:	NaviPac 61i / NaviDat 18d
Real Time Interface	:	CTLQ/LIBCSO
Computer	:	HP9020U with 33 mHz Turbocard
Printer/Plotter	:	HP ThinkJet

4.3 Primary Navigation

System	:	FUGRO Starfix, Differential GPS
Differential Corrections via	:	Inmarsat
Reference stations	:	New Plymouth
	:	Auckland

Ref. station coordinates			
Melbourne (ID#0006)	:	38°27'53.371"S	144°54'46.906"E
Townsville (ID#0004)	:	19°15'52.645"S	146°48'44.108"E
New Plymouth(ID#0021)	:	39°03'27.185"S	174°04'49.232"E
Auckland (ID#0022)	:	36°47'33.490"S	174°45'50.208"E

After Seq # 32 these stations were used:

Melbourne (ID#0006)	:	38°27'53.371"S	144°54'46.906"E
Bathurst (ID#0018)	:	33°25'46.909"S	149°34'01.959"E
Adelaide (ID#0007)	:	33°56'31.529"S	138°36'25.470"E

Contractor	:	FUGRO, Singapore

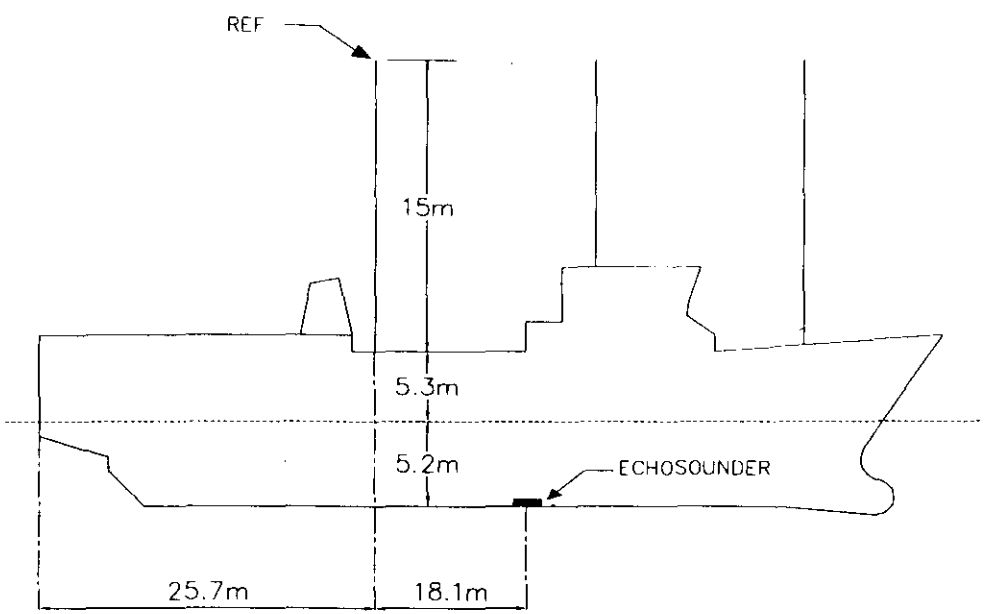
4.4 Secondary Navigation

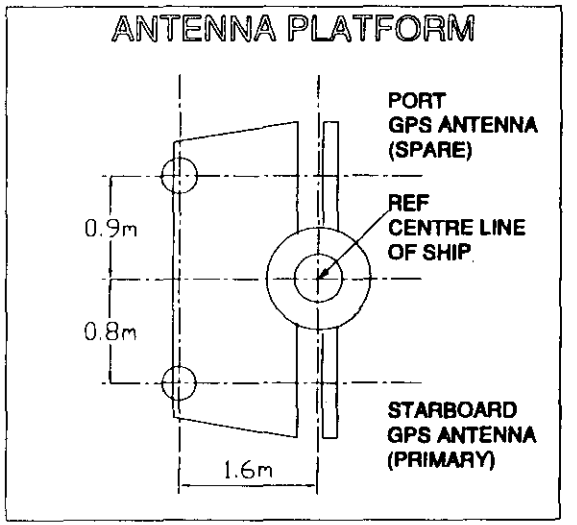
System	:	Raw GPS with Gyro & Log
Mode	:	3D
Stations	:	n/a
Contractor	:	n/a

4.5 Antenna Layout

523190

5 cm





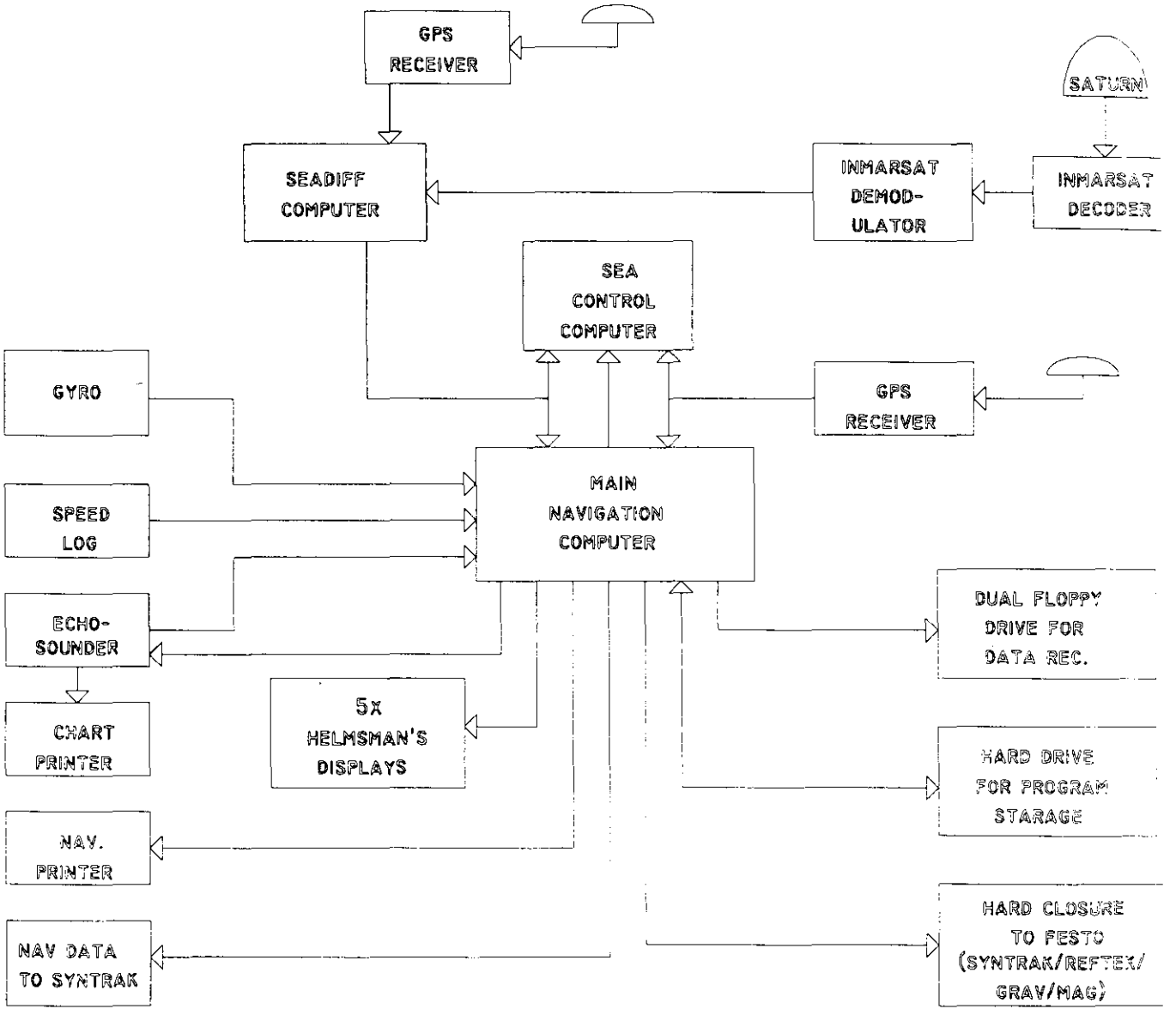
DATE : **16th January 1996**
REF TO CENTRE OF FIRST GROUP : **254.3 m**
REF TO CENTRE OF SOURCE : **146.7 m**
REF TO CDP : **200.5 m**

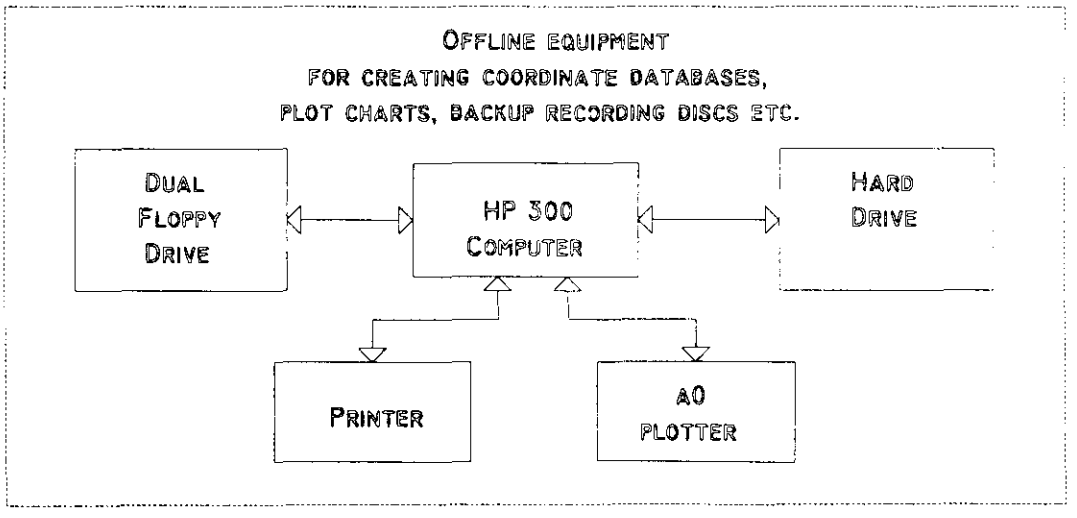
M/V Odin Explorer Antenna Layout
Project:60110 Client:Boral Energy Area: Bass Strait

4.6 Navigation System Block Diagram

523192

BORAL ENERGY BASS STRAIT 15TH JANUARY 1996





4.7 Summary of Navigation

The primary navigation system was Starfix DGPS provided by Fugro Geodetic Pte. (Singapore). Secondary navigation was not requested, but Dead Reckoning was used to provide a gross error check on the primary navigation independent of the Inmarsat RTCM corrections for the first nine sequences. Afterwards it was only monitored using the Seacontrol QC system.

All inputs to the Starfix computer (running Seadiff software) were logged and recorded 24 hours per day for the duration of the prospect.

GPS quality was verified by collecting fixes for a scatterplot while docked in Devonport, Tasmania, 16th January 1996 and again on 24th January 1996. The GPS antenna was placed at a surveyed location and the position confirmed in the local datum. The Differential GPS does not require any calibration.

A Gyro Compass check was performed while alongside the Breakwater Quay in New Plymouth on 12th September for any gross errors.

A lead-line check on each side of the vessel was also performed while alongside the quay to check for any gross errors in the echosounder settings. There was less than a half meter error by this method.

The Differential Corrected GPS Navigation System itself worked 100% during the whole Survey.

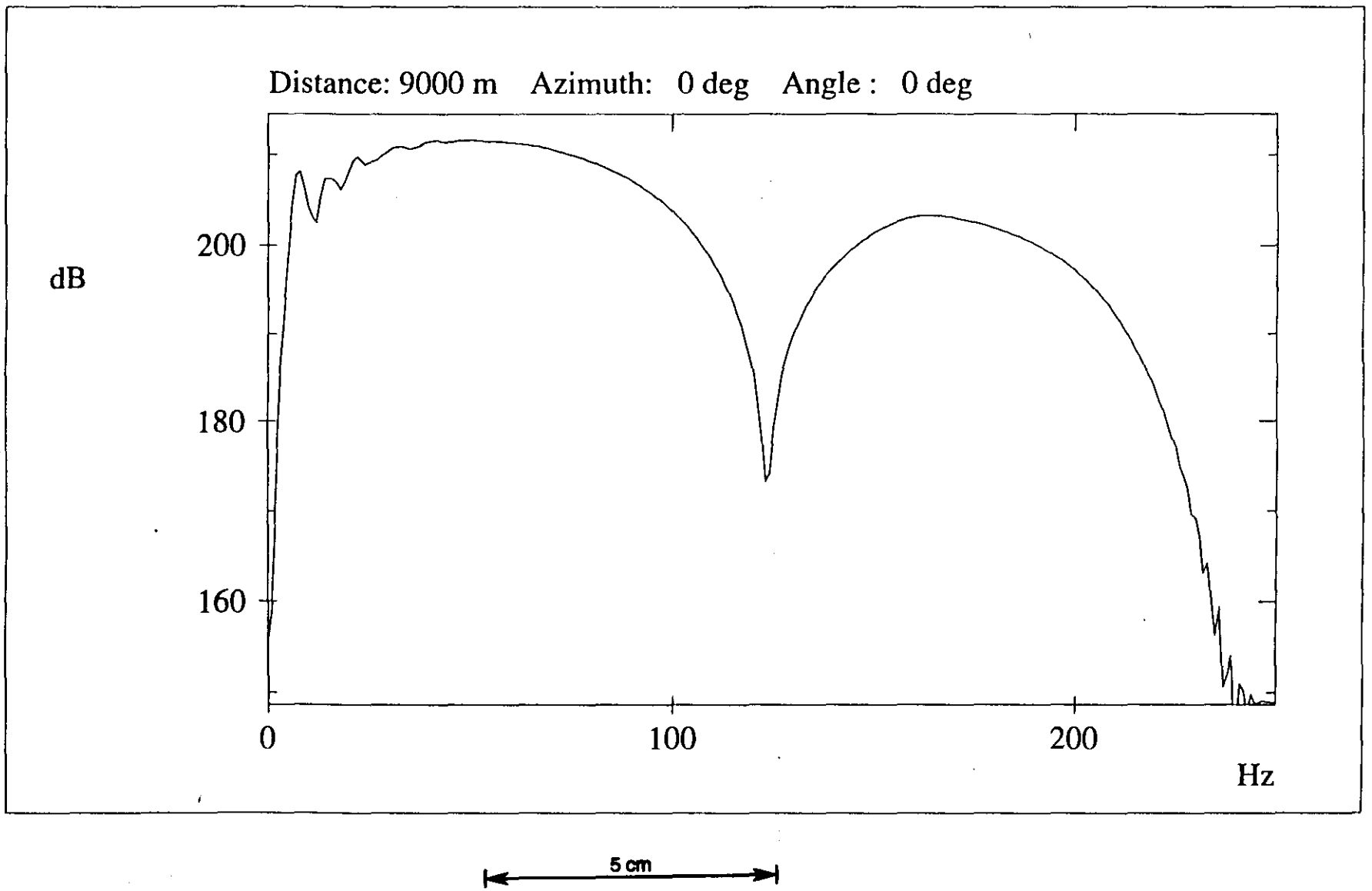
We had two circles caused by the Saturn terminal interfering the GPS receivers antennas on vessel heading of 45 deg. Another circle was due to communication problems between the GPS-receiver and navigation INS computer Raw NMEA input.

5 SEISMIC ENERGY SOURCE

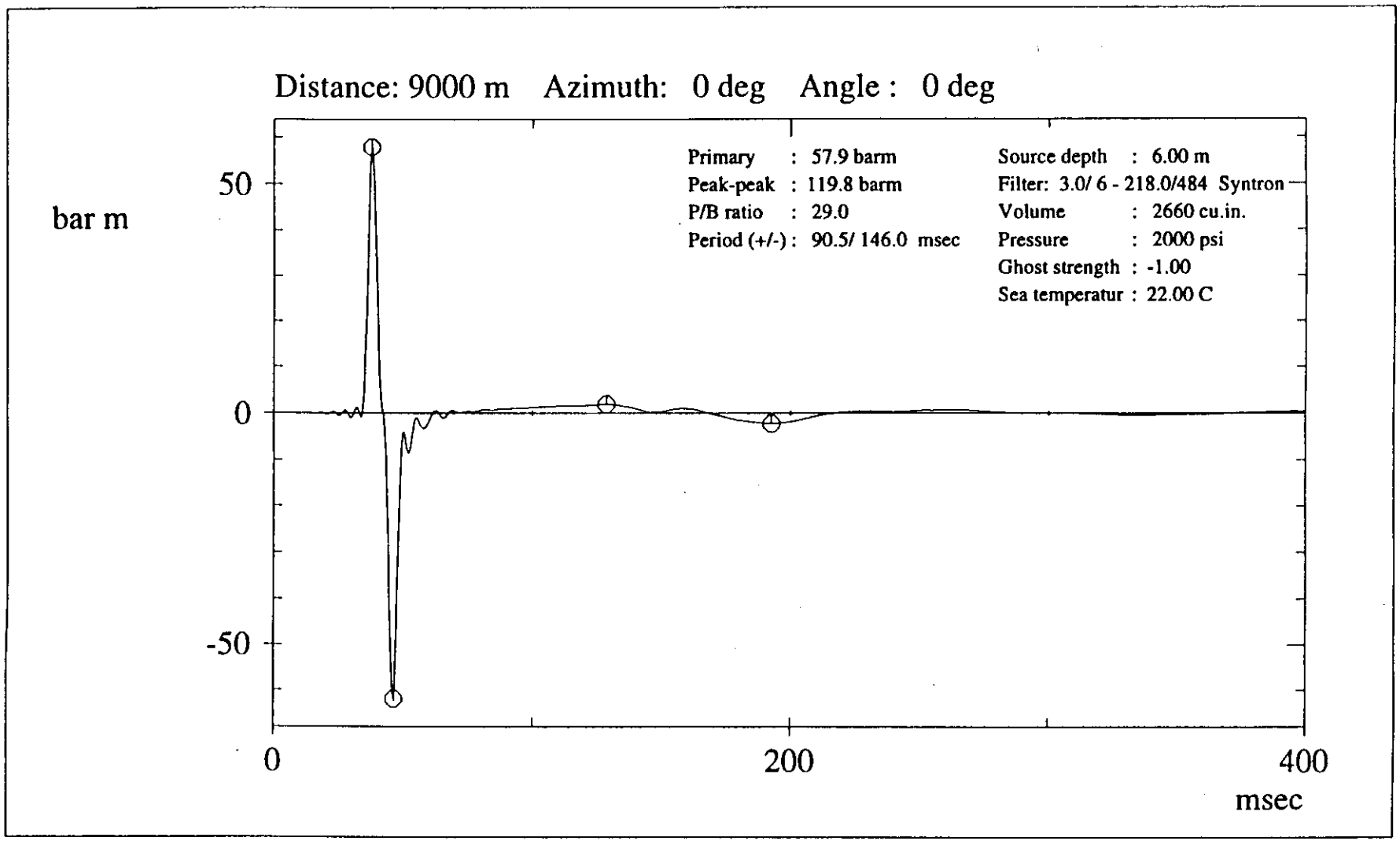
5.1 Energy Source System

Type of guns	:	TI Sleeve Guns I & II
Total volume	:	2660 cu. in.
No. of sub-arrays	:	4
Airgun pressure	:	2000 psi.
Airgun depth	:	6 meters
Shot interval	:	22.86 meters
Sub-array separation	:	25 meters
Source dimensions	:	75 x 8 meters
Peak-peak (out-128 Hz/72 dB/oct)	:	109.2 barm
P/b ratio (out-128 Hz/72 dB/oct)	:	34.3
Drop-out spec.	:	10%, modified Seres model.

Amplitude spectrum of far-field signature of array: S266060a



Far-field signature of array: S266060a



FAR-FIELD SIGNATURE LISTING

Array name	:	S266060a
Total volume	:	2660 cu.in.
Source depth	:	6.00 m
Streamer depth	:	0.00 m
Average pressure	:	2000 psi
Ghost strength	:	-1.00
Primary amplitude	:	57.94 bar m
Peak-peak amplitude	:	118.29 bar m
P/B-ratio	:	28.68
Bubble period (+)	:	90.00 msec
Bubble period (-)	:	146.00 msec
Seawater temperatur	:	22.00 C
Filter	:	
Low-cut frequency	:	3.00 Hz
Low-cut slope	:	6.00 dB/oct
High-cut frequency	:	218.00 Hz
High-cut slope	:	484.00 dB/oct
Instrument	:	Syntron
Sample interval	:	2.00 msec
Far-field position	:	
Distance	:	9000.00 m
Azimuth	:	0.00 deg
Angle of vertical	:	0.00 deg

Amplitudes are in bar m
Time is increasing horizontally

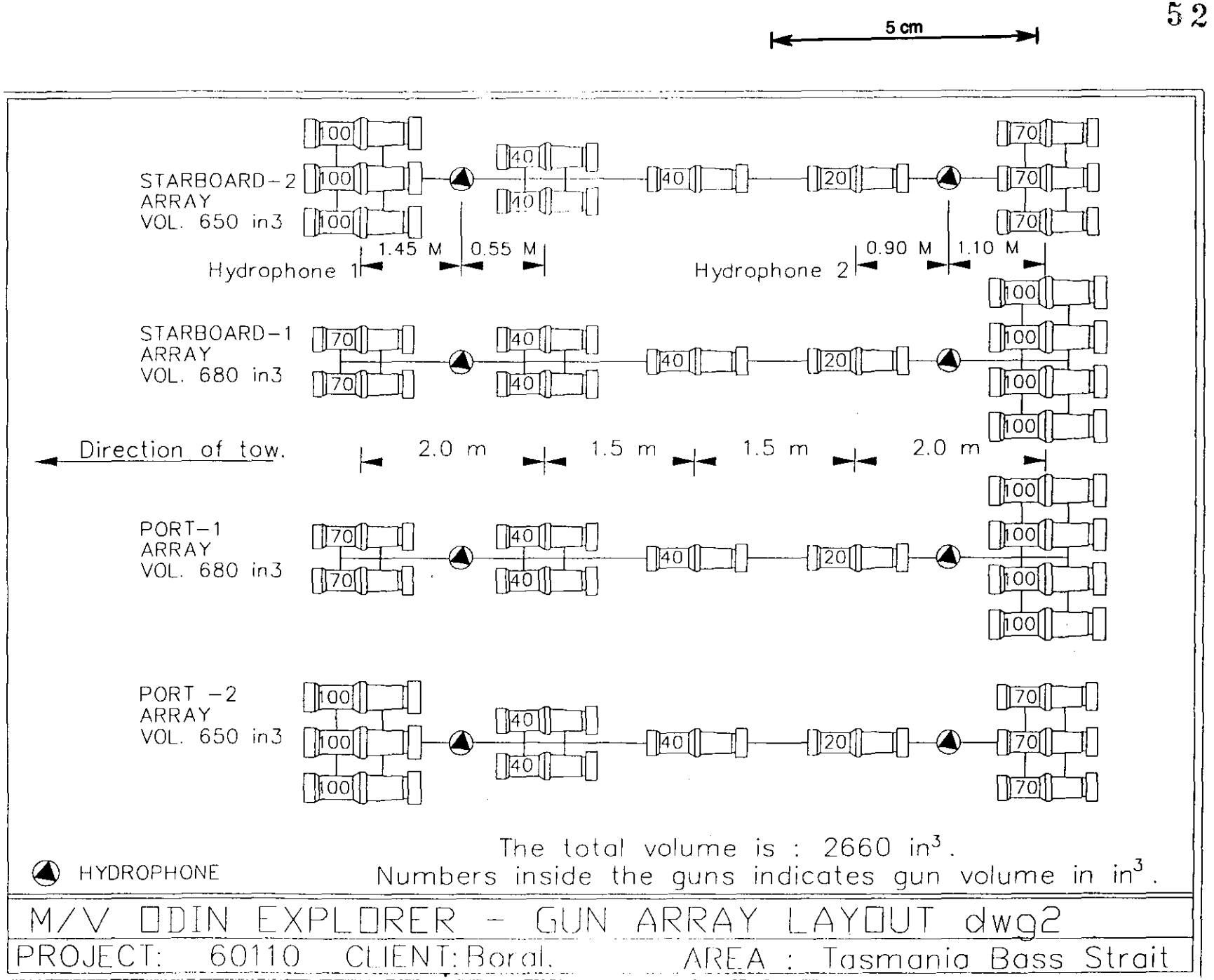
0.000	0.000	-0.001	0.000	0.036	0.010	-0.014
0.061	-0.143	0.131	-0.136	0.033	0.139	-0.393
0.683	-0.974	1.227	-0.833	21.269	57.944	27.717
1.189	-16.995	-60.347	-36.364	-4.231	-8.639	-3.294
-1.524	-3.333	-1.755	0.382	-0.139	-1.013	0.397
0.431	0.071	0.291	0.369	0.342	0.643	0.743
0.645	0.790	0.874	0.889	0.974	1.045	1.073
1.148	1.219	1.264	1.336	1.409	1.463	1.506
1.535	1.540	1.541	1.555	1.591	1.659	1.749
1.836	1.886	1.869	1.769	1.609	1.423	1.211
0.949	0.644	0.354	0.181	0.186	0.347	0.577
0.782	0.928	1.004	0.996	0.888	0.661	0.353
0.040	-0.250	-0.520	-0.786	-1.069	-1.335	-1.542
-1.700	-1.837	-1.977	-2.110	-2.202	-2.238	-2.216
-2.134	-2.006	-1.839	-1.633	-1.393	-1.136	-0.881
-0.642	-0.426	-0.240	-0.077	0.065	0.184	0.283
0.356	0.400	0.417	0.407	0.381	0.345	0.309
0.289	0.292	0.313	0.365	0.466	0.531	0.580
0.613	0.600	0.605	0.624	0.639	0.648	0.653
0.646	0.619	0.574	0.508	0.429	0.347	0.274
0.217	0.178	0.151	0.129	0.109	0.090	0.075
0.066	0.062	0.059	0.053	0.040	0.022	0.002
-0.019	-0.040	-0.062	-0.090	-0.125	-0.167	-0.214
-0.266	-0.319	-0.368	-0.407	-0.434	-0.449	-0.454
-0.449	-0.435	-0.415	-0.389	-0.363	-0.337	-0.316
-0.301	-0.289	-0.278	-0.264	-0.244	-0.217	-0.185
-0.147	-0.105	-0.061	-0.016	0.030	0.074	0.116
0.156	0.193	0.228	0.260	0.289	0.315	0.339
0.362	0.382	0.400	0.415	0.426		

5.4 Drop-out Specification

Any combination up to a loss of 10% in volume with the following exceptions:

- Only one 4 X 100 OUT
- Only one 3 X 100 OUT
- Only one 3 X 70 OUT
- Only three 2 X 40 OUT
- If one 100 in^3 in a 4 X 100 cluster is dropped, an other has to be dropped to avoid creating another 3 X 100 cluster.
- Only two 40 and two 20 (single) out at the same time.
- Maximum of six guns out.

5.5 Gun Array Layout


5 cm
STARBOARD-2
ARRAY
VOL. 650 in3
STARBOARD-1
ARRAY
VOL. 680 in3
PORT-1
ARRAY
VOL. 680 in3
PORT -2
ARRAY
VOL. 650 in3
1.45 M
0.55 M
Hydrophone 1
0.90 M
1.10 M
Hydrophone 2
Direction of tow.
2.0 m
1.5 m
1.5 m
2.0 m
HYDROPHONE
The total volume is : 2660 in3.
Numbers inside the guns indicates gun volume in in3.
M/V ODIN EXPLORER - GUN ARRAY LAYOUT dwg2
PROJECT: 60110 CLIENT: Boral. AREA : Tasmania Bass Strait

6 PERSONNEL & SAFETY

6.1 Seismic Crew M/V Odin Explorer

Shift A: From 16th of January 1996 to 24th of January 1996

Party Chief	Jan E. Ask
Chief Obs.	André Tørring
Senior Obs.	Endre Fidje
Observer	Ole Fostad
Observer	Paul Farnham
Chief Nav.	Haakon Øvergård
Navigator	Antony Warner
Chief Gun	Daniel MacDow
Senior Gun	Sigve Våge
Gun Mech.	Odd G.T. Østerholdt
Gun Mech.	Ole Hollund

Shift B From 24th of January to 4th of February 1996

Party Chief	Gunnar Brastein
Chief Obs.	Runar Wiersdalen
Senior Obs.	Richard Power
Observer	Tore Bull
Observer	Harald Hauge
Chief Nav.	Fred Gosse
Shift Leader Nav.	Allen Hatchard
Chief Gun	Bjørn Thonhaugen
Senior Gun	Per Bjarne Vadseth
Gun Mech.	Finn Wickstrøm
Seis. Processer	Kenneth Hall

Periodic Safety Report

Period: 1/10/96 - 2/4/96 (26 days)

Printed on 2/7/96

Client: Boral Energy
Project No. 60110
Vessel: Master Odin
Party Managers: Gunnar Brastein and

Date last full safety meeting.		**1/22/96**
Date last Fire drill		**1/17/96**
Date last Lifeboat drill	**NB! More than 30 days ago!**	**11/14/95**
Date last MOB boat drill		**1/8/96**
Number of Workboat/FRC launches:		**4**
Total exposure hours MOB/FRC:		**0.36**

Total Exposure Hours	Marine Crew	Seismic Crew	Third Party Crew	Total
	8856	6960	624	16440

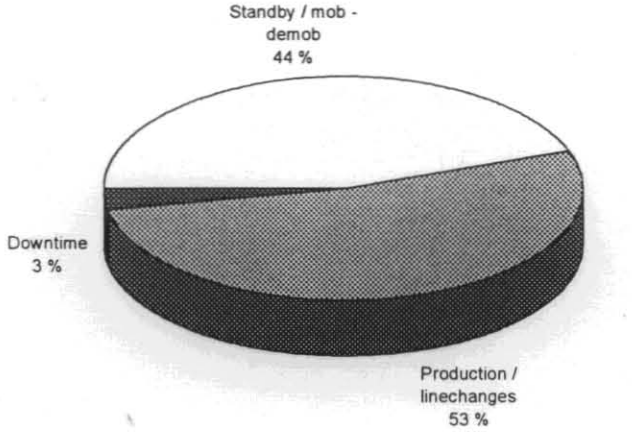
Incident Summary

Date	Category	Time	Location/ Department	Lost Time	Comments
1/21/96	Fire	5:10	Accomodation	No	Engineer using grinder in the corridor outside the enginroom entrance, causing the fire alarm to go off. NO HOTWORK PERMIT WAS FILLED IN!
1/24/96	Sickness (short term health)		Observer	No	Observer Rick Power could not join the vessel due skin disease , stays in Devonport for treatement by Doctor.

7 PRODUCTION STATISTICS

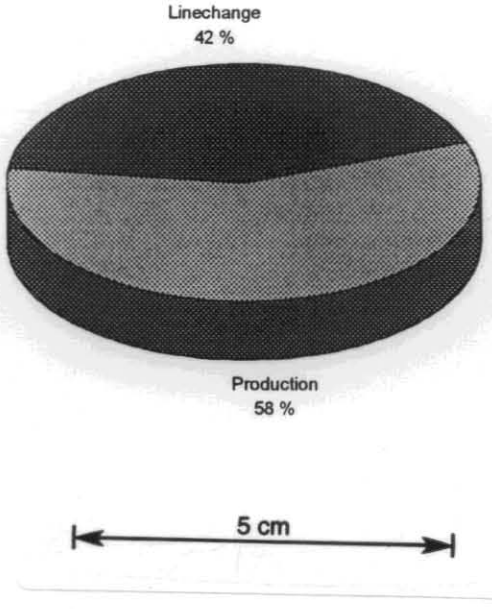
7.1 Production Graphics

Category	Hours
Production / linechanges	250,01
Downtime	14,6
Standby / mob - demob	211,38



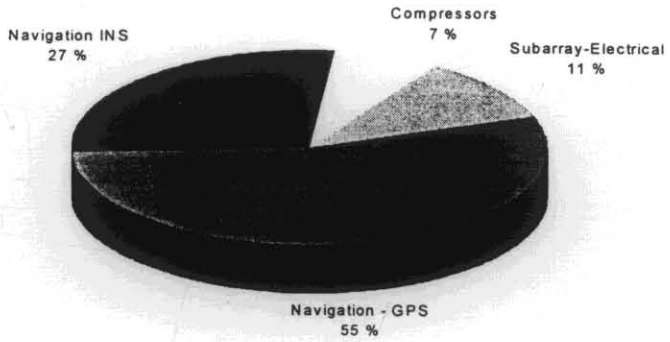
7.2 Production Timing Breakdown

Category	Hours
Production	143,88
Linechange	106,13



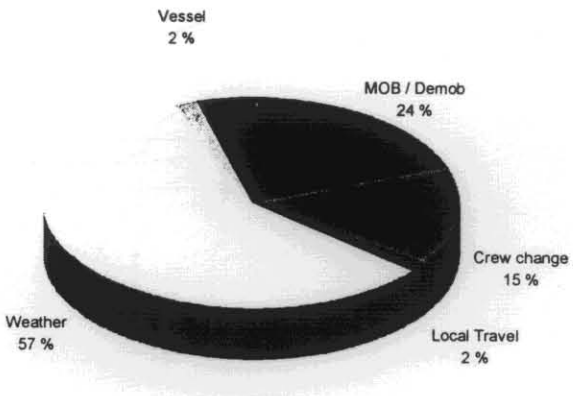
7.3 Technical Downtime Breakdown

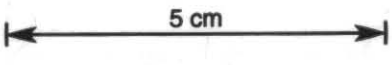
Category	Hours
Navigation - GPS	5,93
Navigation INS	2,98
Compressors	0,78
Subarray-Electrical	1,15



7.4 Standby time breakdown

Category	Hours
Crew change	32,2
Local Travel	3,95
Weather	123,58
Vessel	3,75
MOB / Demob	51,65





Activity Statistics — *All Groups*

Client: Boral Energy
Project No: 60110
Vessel: Master Odin

Period: 1/17/96 - 2/4/96 (19 days)
Printed on 3/7/96

Main Group	Subgroup	Activity	Hours	% of Sub Group	% of Main Group	% of Total
Mechanical						
	Source - Compressors					
		Main Compressor	0.78	100.0%	40.5%	0.2%
	Total for Source - Compressors :		0.78		40.5%	0.2%
	Source - Subarrays					
		Other Sub-Array Electricals	1.15	100.0%	59.5%	0.3%
	Total for Source - Subarrays :		1.15		59.5%	0.3%
Total for Mechanical :			1.93			0.4%
Navigation						
	Navigation - GPS					
		Differential Reference Sign.	5.93	100.0%	66.5%	1.3%
	Total for Navigation - GPS :		5.93		66.5%	1.3%
	Navigation - INS					
		Software - Navigation	2.98	100.0%	33.5%	0.7%
	Total for Navigation - INS :		2.98		33.5%	0.7%
Total for Navigation :			8.92			2.0%
Operation						
	Crew Change					
		In Port	32.20	100.0%	7.2%	7.1%
	Total for Crew Change :		32.20		7.2%	7.1%
	Line Change					
		Line Change	109.60	100.0%	24.6%	24.0%
	Total for Line Change :		109.60		24.6%	24.0%
	Maritime / Vessel					
		Main Engines	3.75	100.0%	0.8%	0.8%
	Total for Maritime / Vessel :		3.75		0.8%	0.8%
	Mob/Demob					
		Ballasting Streamer	4.00	12.6%	0.9%	0.9%
		Demobilization - Other	2.53	8.0%	0.6%	0.6%
		Mobilization - Other	25.12	79.4%	5.6%	5.5%
	Total for Mob/Demob :		31.65		7.1%	6.9%

The data in this report were last updated on 2/4/96 1:46:58 AM

Main Group	Subgroup	Activity	Hours	% of Sub Group	% of Main Group	% of Total
	Production Normal					
		Chargeable Production	140.42	100.0%	31.5%	30.8%
	Total for Production Normal :		140.42		31.5%	30.8%
	Travel					
		Local Travel	3.95	100.0%	0.9%	0.9%
	Total for Travel :		3.95		0.9%	0.9%
	Weather					
		Swell	83.67	67.7%	18.8%	18.3%
		Wind	39.92	32.3%	9.0%	8.8%
	Total for Weather :		123.58		27.8%	27.1%
Total for Operation :			445.15			97.6%
Grand Total :			456.00			

The above is true and correct

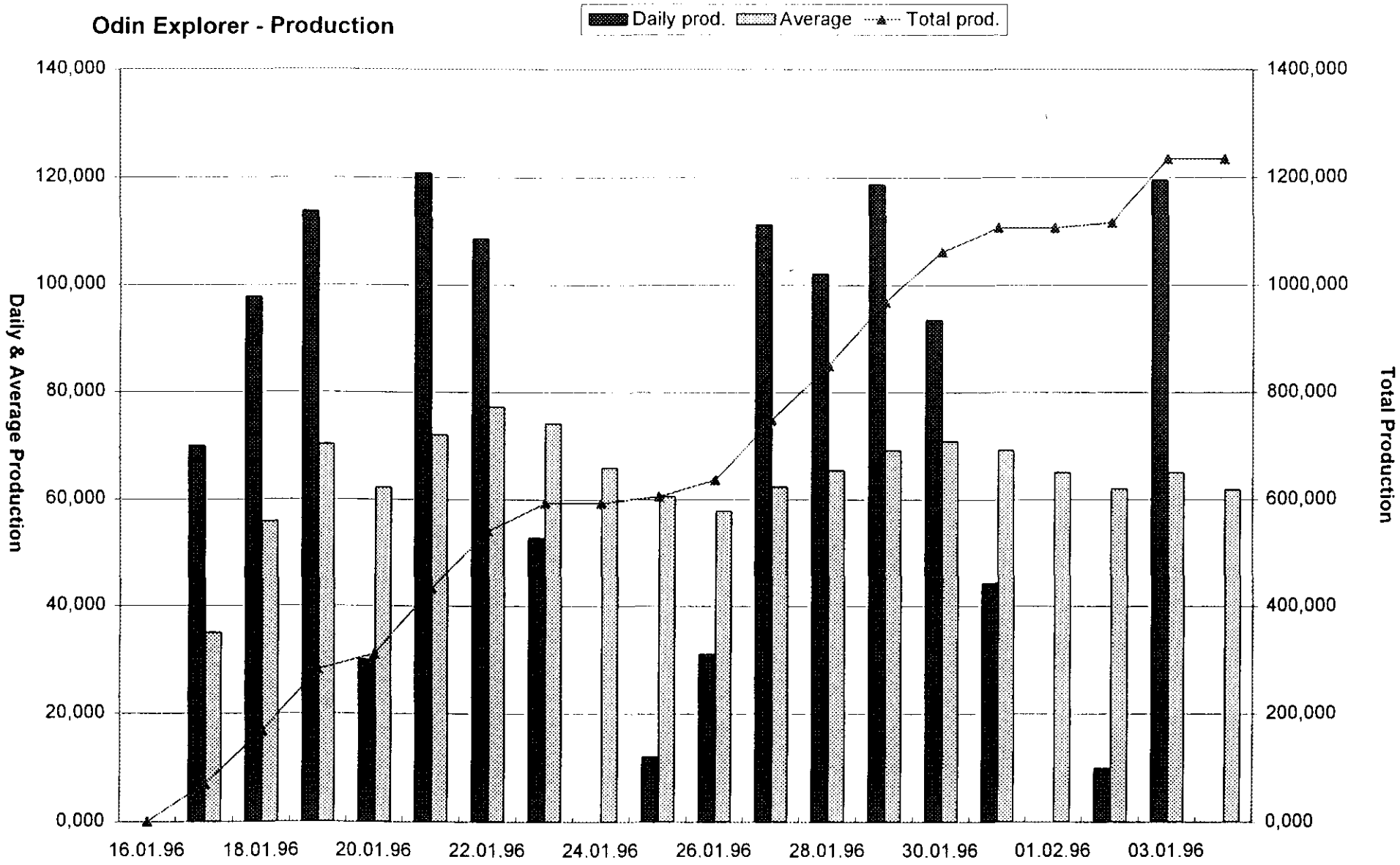
Client's Rep: _____

Party Chief: _____

Gunnar Brastein

8 ATTACHMENTS

8.1 Production Log


Odin Explorer - Production
Daily prod.
Average
Total prod.
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0,000
1400,000
1200,000
1000,000
800,000
600,000
400,000
200,000
0,000
Daily & Average Production
Total Production
16.01.96
18.01.96
20.01.96
22.01.96
24.01.96
26.01.96
28.01.96
30.01.96
01.02.96
03.01.96

5 cm

ODIN Explorer
Trip review

Date:	project #	Daily prod.	Total prod.	Average	Client	Comments:
16.01.96	60110	0,000	0,000	0,00	BoralEnerg	Enrout Devonport/Mobilization
17.01.96	60110	69,952	69,952	34,98	BoralEnerg	Mobilization/Production
18.01.96	60110	97,658	167,610	55,87	BoralEnerg	Production
19.01.96	60110	113,591	281,201	70,30	BoralEnerg	Production
20.01.96	60110	29,924	311,125	62,23	BoralEnerg	Production/Weather
21.01.96	60110	120,815	431,940	71,99	BoralEnerg	Production
22.01.96	60110	108,425	540,365	77,20	BoralEnerg	Production
23.01.96	60110	52,715	593,080	74,14	BoralEnerg	Production/crew-change
24.01.96	60110	0,000	593,080	65,90	BoralEnerg	Crew-change/Weather
25.01.96	60110	11,956	605,036	60,50	BoralEnerg	C-X/Production/Weather/Compressor/nav
26.01.96	60110	30,998	636,034	57,82	BoralEnerg	Production/Weather/Compressors/nav
27.01.96	60110	111,191	747,225	62,27	BoralEnerg	Production/Local Travel
28.01.96	60110	101,978	849,203	65,32	BoralEnerg	Production/Guns
29.01.96	60110	118,598	967,801	69,13	BoralEnerg	Production
30.01.96	60110	93,452	1061,253	70,75	BoralEnerg	Production/Weather/Engines
31.01.96	60110	44,166	1105,419	69,09	BoralEnerg	Production/Weather
01.02.96	60110	0,000	1105,419	65,02	BoralEnerg	Weather
02.01.96	60110	9,807	1115,226	61,96	BoralEnerg	Production/Weather
03.01.96	60110	119,466	1234,692	64,98	BoralEnerg	Production/Demob
04.01.96	60110	0,000	1234,692	61,73	BoralEnerg	Demob

Date	Prime Lines (km):			Infill (km):			Total (km):			*Reshoot (km):*
	Traverse	CDP	Square km/mls	Traverse	CDP	Square km/mls	Traverse	CDP	Square km/mls	*Traverse*
1/17/96	69.952	69.952		0.000	0.000		69.952	69.952		*0.000*
1/18/96	97.658	97.658		0.000	0.000		97.658	97.658		*0.000*
1/19/96	86.754	86.754		0.000	0.000		86.754	86.754		*0.000*
1/20/96	29.924	29.924		0.000	0.000		29.924	29.924		*0.000*
1/21/96	120.815	120.815		0.000	0.000		120.815	120.815		*0.000*
1/22/96	108.425	108.425		0.000	0.000		108.425	108.425		*0.000*
1/23/96	52.715	52.715		0.000	0.000		52.715	52.715		*0.000*
1/25/96	11.956	11.956		0.000	0.000		11.956	11.956		*0.000*
1/26/96	30.998	30.998		0.000	0.000		30.998	30.998		*0.000*
1/27/96	111.191	111.191		0.000	0.000		111.191	111.191		*0.000*
1/28/96	101.978	101.978		0.000	0.000		101.978	101.978		*0.000*
1/29/96	118.598	118.598		0.000	0.000		118.598	118.598		*0.000*
1/30/96	93.452	93.452		0.000	0.000		93.452	93.452		*0.000*
1/31/96	44.166	44.166		0.000	0.000		44.166	44.166		*0.000*
January Total:	1078.581	1078.581		0.000	0.000		1078.581	1078.581		*0.000*
2/2/96	9.807	9.807		0.000	0.000		9.807	9.807		*0.000*
2/3/96	119.466	119.466		0.000	0.000		119.466	119.466		*0.000*
February Total:	129.273	129.273		0.000	0.000		129.273	129.273		*0.000*
Grand Total :	1207.854	1207.854		0.000	0.000		1207.854	1207.854		*0.000*
Daily average for this period:							46.456	46.456		

523210

Line Numbers and Columns Overview

Client: Boral Energy

Period: 1/10/96 - 2/4/96

Project No: 60110

Printed on 2/7/96

*** means complete Line**

Vessel: Master Odin

Date shot	Line Number	Seq No	Line Hdg	First good Shot #	Last good Shot #	Columns		Traverse km	CDP km	Square km
1/17/96	BHA96-100	1	318	1828	908	1	*(1)*	21.054	21.054	*
1/17/96	BHA96-102	2	128	1010	1862	1	*(1)*	19.500	19.500	*
1/17/96	BHA96-104	3	322	1680	917	1	*(1)*	17.465	17.465	*
1/17/96	BHA96-121	4	43	1001	1522	1	*(1)*	11.933	11.933	*
1/18/96	BHA96-127	5	223	1441	917	1	*(1)*	12.002	12.002	*
1/18/96	BHA96-131	6	44	1001	1885	1	*(1)*	20.231	20.231	*
1/18/96	BHA96-133	7	224	1539	917	1	*(1)*	14.242	14.242	*
1/18/96	BHA96-135	8	44	1001	1558		*(1)*	12.756	12.756	*
1/18/96	BHA96-137	9	224	1551	917	1	*(1)*	14.516	14.516	*
1/18/96	BHA96-139	10	44	1001	1523	1	*(1)*	11.956	11.956	*
1/18/96	BHA96-141	11	224	1439	917	1	*(1)*	11.956	11.956	*
1/19/96	BHA96-143	12	44	1001	1568		*(1)*	12.984	12.984	*
1/19/96	BHA96-110	13	304	1534	606		*(1)*	21.237	21.237	*
1/19/96	BHA96-108	14	134	1001	1713		*(1)*	16.299	16.299	*
1/19/96	BHA96-106	15	314	1552	917		*(1)*	14.539	14.539	*
1/19/96	BHA96-109	16	47	1001	1693		*(1)*	15.842	15.842	*
1/19/96	BHA96-105	17	227	2090	917		*(1)*	26.838	26.838	*
1/19/96	BHA96-103	18	48	1001	1256		*(1)*	5.852	5.852	
1/20/96	BAH96-103	18	48	1257	1717		*(1)*	10.538	10.538	
1/20/96	BHA96-103	19	48	1718	2265		*(1)*	12.527	12.527	*
1/20/96	BHA96-101	20	53	1001	1300		*(1)*	6.858	6.858	
1/21/96	BHA96-101	21	53	1301	1755		*(1)*	10.401	10.401	*
1/21/96	BHA96-107	22	226	2041	917		*(1)*	25.718	25.718	*
1/21/96	BHA96-111	23	47	1001	2248		*(1)*	28.529	28.529	*
1/21/96	BHA96-113	24	225	1965	917		*(1)*	23.980	23.980	*
1/21/96	BHA96-115	25	45	1001	2194		*(1)*	27.295	27.295	*
1/21/96	BHA96-117	26	225	2055	1842		*(1)*	4.892	4.892	
1/22/96	BHA96-117	26	225	1841	917		*(1)*	21.146	21.146	*
1/22/96	BHA96-114	27	321	1684	917		*(1)*	17.556	17.556	*
1/22/96	BHA96-112	28	139	1001	1665		*(1)*	15.202	15.202	*
1/22/96	BHA96-116	29	321	1722	917		*(1)*	18.425	18.425	*
1/22/96	BHA96-118	30	142	1001	1798		*(1)*	18.242	18.242	*
1/22/96	BHA96-120	31	323	1697	917		*(1)*	17.854	17.854	*
1/23/96	BHA96-122	32	145	1001	1773		*(1)*	17.671	17.671	*
1/23/96	BHA96-124	33	326	1685	917		*(1)*	17.579	17.579	*
1/23/96	BHA96-126	34	148	1001	1764		*(1)*	17.465	17.465	*
1/25/96	BHA96-129	36	43	1001	1523	1	*(1)*	11.956	11.956	*

The data in this report were last updated on 2/4/96 1:46:58 AM

Date shot	Line Number	Seq No	Line Hdg	First good Shot #	Last good Shot #	Columns		Traverse km	CDP km	Square km
1/26/96	BHA96-125	37	223	1439	917	1	(1)	11.956	11.956	*
1/26/96	BHA96-119	38	44	1001	1833	1	(1)	19.042	19.042	*
1/27/96	BHA96-119	38	44	1834	2093	1	(1)	5.944	5.944	*
1/27/96	BHA96-123	39	223	1959	917	1	(1)	23.843	23.843	*
1/27/96	BHB96-102	40	322	2105	917	1	(1)	27.181	27.181	*
1/27/96	BHB96-100	41	144	1001	2187	1	(1)	27.135	27.135	*
1/27/96	BHB96-119	42	54	1001	1598	1	(1)	13.670	13.670	*
1/27/96	BHB96-115	43	233	1503	917	1	(1)	13.419	13.419	*
1/28/96	BHB96-115	44	53	1004	1654	1	(1)	14.882	14.882	*
1/28/96	BHB96-113	45	234	1586	917	1	(1)	15.316	15.316	*
1/28/96	BHB96-111	46	54	1001	1666	1	(1)	15.225	15.225	*
1/28/96	BHB96-104	47	324	1535	917	1	(1)	14.150	14.150	*
1/28/96	BHB96-106	48	143	1001	1618	1	(1)	14.127	14.127	*
1/28/96	BHB96-108	49	323	1535	917	1	(1)	14.150	14.150	*
1/28/96	BHB96-110	50	142	1001	1618	1	(1)	14.127	14.127	*
1/29/96	BHB96-112	51	322	1535	917	1	(1)	14.150	14.150	*
1/29/96	BHB96-114	52	141	1001	1752	1	(1)	17.191	17.191	*
1/29/96	BHB96-116	53	321	1668	917	1	(1)	17.191	17.191	*
1/29/96	BHB96-118	54	142	1001	2219	1	(1)	27.866	27.866	*
1/29/96	BHB96-120	55	322	1875	917	1	(1)	21.923	21.923	*
1/29/96	BHB96-122	56	144	1001	1610	1	(1)	13.945	13.945	*
1/29/96	BHB96-124	57	324	1523	1247	1	(1)	6.332	6.332	
1/30/96	BHB96-124	57	324	1246	917	1	(1)	7.544	7.544	*
1/30/96	BHB96-105	58	235	2710	917	1	(1)	41.011	41.011	*
1/30/96	BHB96-101	59	55	1001	2370	1	(1)	31.318	31.318	
1/30/96	BHB96-129	60	232	1510	917	1	(1)	13.579	13.579	*
1/31/96	BHB96-127	61	52	1001	1698	1	(1)	15.956	15.956	*
1/31/96	BHB96-123	62	235	1616	917	1	(1)	16.002	16.002	*
1/31/96	BHB96-121	63	56	1001	1534	1	(1)	12.207	12.207	
Sum of Traverse, CDP and Square km for January:								**1105.418**	**1105.418**	
2/2/96	BHB96901	64	55	2371	2799	1	(1)	9.807	9.807	*
2/3/96	BHB96103	65	236	2713	917	1	(1)	41.079	41.079	*
2/3/96	BHB96107	66	55	1000	2792	1	(1)	40.988	40.988	*
2/3/96	BHB921	67	55	1535	1829	1	(1)	6.744	6.744	*
2/3/96	BHB125	68	234	1615	917	1	(1)	15.979	15.979	*
2/3/96	BHB96-109	69	235	1558	917	1	(1)	14.676	14.676	*
Sum of Traverse, CDP and Square km for February:								**129.273**	**129.273**	

The data in this report were last updated on 2/4/96 1:46:58 AM

Date shot	Line Number	Seq No	Line Hdg	First good Shot #	Last good Shot #	Columns	Traverse km	CDP km	Square km
Sum of Traverse, CDP and Square km for this period:							1234.691	1234.691	

The above is true and correct

Client's Rep: _____

Party Chief: _____

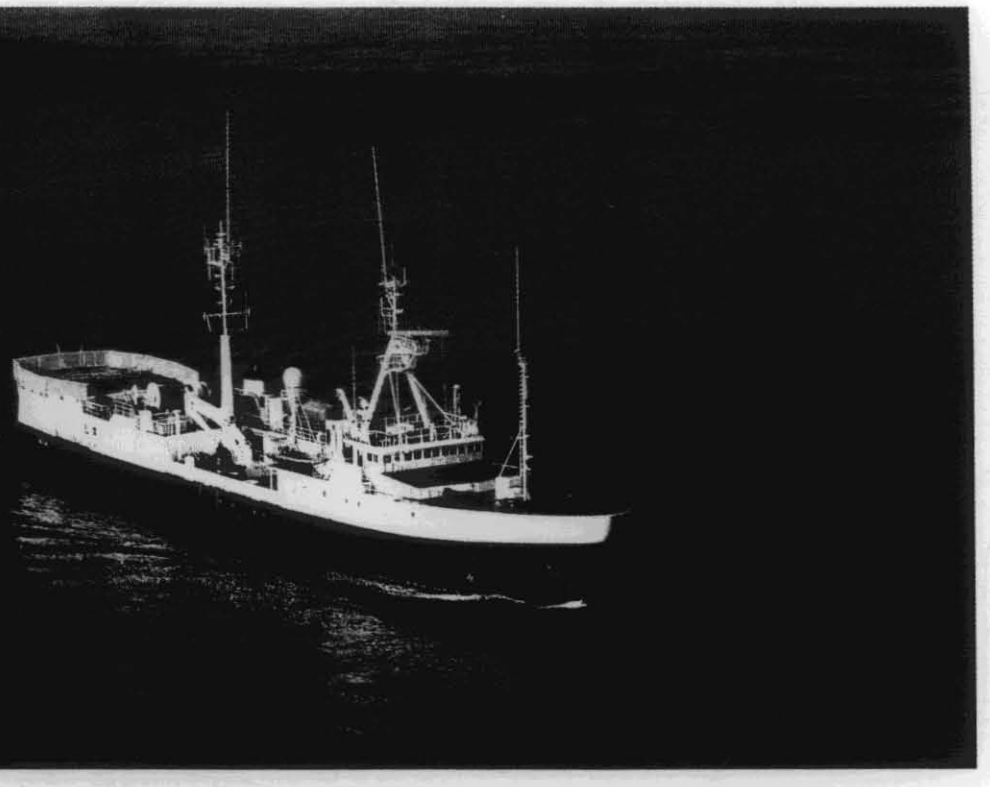
Gunnar Brastein

8.2 Vessel Information M/V Odin Explorer

Vessel Description

M/V Odin Explorer

Updated onboard Odin Explorer, 5. December 1995



M/V Odin Explorer

2D Seismic Vessel

SAFETY

Full compliance with maritime regulations and industry standards (E&P forum/IAGC/ Solas).
Self regulating HSE management system by means of company commissioned external audits.

PRODUCTION CAPACITY

High streamer capacity	Up to 480 channels
Streamer length	Up to 4500 m
Multiple sources	Yes
Compact recording medium	3480 cartridges

NAVIGATION CAPABILITIES

Processing	NAVIMAP QC-tool for recorded raw data. Depth editing-smoothing-plots. Post plot, A1 & A0 format

ONBOARD 2D SEISMIC PROCESSING

2D Processing	Running on LookOut/Seiscribe 3.2 with Compaq 486 & STC 3480 cartridge drive hardware. Offline QC tool for noise analyses, filtering and brute stack
Fast data availability	Transmission by high-speed 14.400 data modem. Nav. data can be sent ashore via satellite in UKOAA format

PGS *Exploration*

M/V Odin Explorer

523216

ENERGY SOURCE

Type	HGS sleeve guns I and II
Max. no. of sub. arrays	4
Compressor type	4 x LMF
Compressor capacity	2 x electric driven, 550 CFM 2 x diesel driven, 480 CFM

STREAMER

Type	Seismic Engineering, Digital
Model	SHELL Digital 240/480
Available group lengths	Steps of 15m(50')

SEISMIC RECORDING INSTRUMENTS

Type	Syntrak 480
Max. no. of channels	480 per streamer
Sample rates	1, 2 or 4 msec
Tape format	SEG D 8015; 2.5 byte
Recording drive	STK 4280

SEISMIC POSITIONING

2D Navigation system	EIVA 200/300
Feathering calculation	By the bridge RADRAR, and compasses
Gyro compass	Arma Brown MK 10
Echo sounder	Simrad EA300 38Khz

NAVIGATION & COMMUNICATION

Radars	10 cm, Atlas 6500 ARPA 3 cm, Kelvin Hughues HT 3001
Gyro compass	Anschutz 110-301/1
Autopilot	Anschutz
Communication aids	VHF, HF, Inmarsat, NMT
Marisat	JRC JUE45A Mark-I
SSB radios	SAIT 5000
VHF	2 Sailor RT2048, 1 Sailor C403, 2 Furuno
Navigation	Magnavox MX-200 6 channel GPS receiver

VESSEL SPECIFICATIONS

Flag	Norwegian
Call sign	LAGQ4
Classification	Germanisher Lloyds
Built/rebuilt	1967/1981/1990
Life boats/rafts	Harding 22'MCM TEMPSC 3! persons/ 3 x 25 persons 1 x 20 persons, Viking
MOB/Work boat	Zodiac MK 3, equipped with 36HK Yanmar diesel
Fire fighting	Foam/Halon
Length	74.3 m (244 f)
Beam	10.8m (35 f)
Draft	5.8 m (19 f)
Gross tonnage	1345
Accommodation	33
Main engine	2 x Deutch 1320 BHP
Propulsion	1 variable pitch, Escher-wys
Bow thruster	Brunvoll 350, 475 HP
Cruising speed	12.5 knots
Operating range	40+ days

PGS *Exploration*

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1 Table of Contents

2 Vessel Particulars for M/V Master Odin

2.1 Technical Information

Name:	M/V Odin Explorer
Call Sign:	L A G Q 4
Flag:	Norway (NIS)
Type:	Seismic Survey Vessel
Built:	1967, Rickmers, Bremerhaven, Germany
Converted:	1981, Kiel, Germany, and 1990 Skagen, Denmark
Home port:	Bergen, Norway
Owner:	Shipman a.s, Austevoll, Norway.
Classification:	Germanisher Lloyds +100 A 4EF Research Vessel + MC CS + NCCS
Length overall:	74,30 meters
Beam:	10,83 meters
Draft:	5,80 meters
Gross Tonnage:	gt1544 t (GT 1901 - 1969 convention)
Net Tonnage:	nt 464t (NT 1140 - 1969 convention)
Cruising Speed:	11,5 knots
Cruising Range:	12.000 nautical miles
Fuel Capacity:	500 cu.m.
Fuel Consumption	9 cu.m/day
Fresh Water capacity	100 cu.m
Fresh Water consumption:	6 -7 cu.m/day
Evaporator	Atlas AFGU3 10 cu.m/day
Endurance	Cruising: 55 days, Seismic: 40 days
Accommodation:	Single cabins: 11, Double cabins: 11
Main Engine:	2 x Deutz 1320 BHP
Generators:	480 Kw, 380/220V 50Hz x 2 (Shaft) 400 Kw, 380/220V 50Hz x 1 (Auxillary)
Propeller:	1 variable pitch, Escher-wyss
Bow Truster:	Brunvold - 350 kw (475 H.P)
Cranes:	M.T.T., SWL 2T 12 MTR
Incinerator:	Atlas ASNI-402A
Radios:	M/F and H/F Skanti TRP 7000 + Sait 5000i MF/HF Skanti WR 8000, 2182khz Watch keeping VHF 3 x Sailor RT 2048 C-908, simplex VHF 1 x Sailor RT146 C-403, duplex VHF 1x Furuno FM 55, portable VHF 2 x ICOM IC M5, portable + 2 x ICOM IC M15 UHF 3 x Motorola MX1000 + 2 x Motorola GP300

Radars:	10 cm, Atlas 6500 S 3 cm, Kelvin Hughes Nucleus 6000A Arpa slave monitor in instrument room.
GPS Navigator:	Magnavox MX200
Satellite Navigator:	Shipmate RS-5100
Radio Nav System:	Shipmate RS-4000 (Decca Navigator)
Gyro Compass:	Anschutz 110-301/1
Autopilot	Anschutz
Rudderindicator:	Simens
Course Monitor:	Anschutz
Speed Log:	SAL Imcor-2
Fathometer:	Kejio Denki KC 110 color, range:1-800 meters, 30 Khz transduser
Navtex/weather fax:	Furuno Navtex NX500/ Furuno Faximile Reciever 210
Weather station	AANDENRAA 3400, Wind monitoring system
Video Monitoring system:	Videocameraes on backdeck + stb.bridge wing + port wing Videomonotors located on bridge and instrument-room
Internal telephone/PA	TOA HF-660M Intercom. 220/24 volt. With 38 units
Inmarsat System:	1-JRC - JUE - 45A Mark-I 2-SATURN 3S90 Fax-1: Lanier 125, Fax-2: Panasonic KX-F190CN
Inmarsat numbers:	Phone:1312261 / Fax:1312262 (Phone-2:1315731 / Fax-2:1315732)
Data Modem:	USRobics Courier, dual standard, 14.400 baud. (2-HSDL 64KB)
Cellular Systems:	NMT: 94503117 / 94129729
2nd Cellular Numbers:	To be rented locally.

2.2 Vessel Safety

Life Boat:	Harding 22'MCM 35 pers, Equipped after SOLAS
Life Rafts:	3 x 25, 1 x 20, Viking, Equipped after SOLAS
Rescue Boat:	Alusafe MOB 700, 130 BHP, Equipped after SOLAS Radar Transponder: McMurdo sart 9 Ghz, Shipmate GPS-rec.
Emergency Radios:	Radio Holland TRP4750 life boat radio, Emergency beacon, Jotron TRON 30 S Mk II Free float 406 mhz sat. Radar transponder: TRON sart 9 Ghz
Life Boat radios	Radio Holland TRP 4750 life boat radio, Radar Transponder: McMurdo sart 9 Ghz
Fire pump:	80 cu.m pr min
Emergency fire pump:	80 cu.m pr min
Fire Extinguisher:	Powder: 23 + 2 portable a 75 kg + 1 Portable 50 kg C02 : 20, Graphite: 1, Halon: 3
Halon System:	Instrument room, Compressor room, Engine room, Paint Store and Incinerator room.
Streamer reel fire fighting:	Fixed foam system Minimax + portable foam.
Fire suits (BA-sets):	2 x Draeger PA 80/1800-1
Air compressor:	Draeger MCH6 (For refilling air to BA-sets)
Smoke hoods:	Dräger parat mask c (traveller) 30ea, Smoke shields 12 ea Placed in each cabin, and at working areas.
Line thrower:	4 x Pains-Wessex Speedline Int.
Survival suits:	27 x FCO OBAN Survival suits MK 90 19 x Helly Hansen E 305-7 / Immersion Suit
Life vests:	38 x T-Vesten, Mod 87 19 x Seamaster
Life rings:	With light/smoke : 2, With Light : 4, Standard : 2
Work floating vest	25 x Crewsaver Seafire
Gasmonitor:	Exotox 40 - portable
Medical Equipment:	Certified to ships medicine no. 5, first aid boxes in galley, engine room, instrument room, gun shack and bridge .
Resuscitators:	1 set in hospital

2.3. Vessel Safety Procedures

Fire Drill:	Every two weeks
Lifeboat drill:	Every two weeks
MOB drill:	Twice in a trip
Equipment testing:	In accordance with drill
Testing of radios:	In accordance with drill
Safety meetings:	Twice each shift
First aid instructions:	In accordance with drill
Safety shoes	Yes
Eye protection	Yes
Ear protection	Yes
Hard hats	Yes

3. Energy Source

3.1 Airgun system

3.1.1 General Description of Air Gun Array

No. of arrays	1, optional 2 (flip-flop)
Type	Seres Point Source
No. sub arrays	4
Sub array configuration	10 Gun precision cluster
No. of air guns	40
Air Gun type	H.G.S Sleeve I/II
Volume	2660 cu.in
Gun Depth, nominal	6 - 7,5 m
Towing with, nominal	Inner array = 25m, Outer array = 75m.
Seismic Offset	From 50 - 150 meter.
Nominal working pressure	2000 psi

3.1.2 Array layout.
For gun string layout see drawing no.: 2

3.1.3 Source Positioning
Source positioning is achieved by firing guns on each array and measuring the time from when the gun fires to when the pulse reaches the hydrophones on the other sub arrays. By doing this on all arrays both the spread of the array and the in-line skew can be measured. To determine the distance of the source behind the vessel, the gun umbilicals are physically measured. This will give the distance from reference antenna to center source.

See drawing no.: 3.

3.1.4 Towing techniques
The 10 air guns on each subarray are suspended on a steel frame from a PVC floating paravane. Separation between each array is achieved by adjusting the number of links on the chain which is connected between the floating paravane and the main towing harness.

3.2 Source Triggering
The sequence of events is initiated by the navigation system generating a TTL pulse which triggers a FESTO programmable timing controller. The FESTO then sends a TTL closure to start the Syntrak 480 recording instruments, and generates a TTL pulse that initiate the REFTEK RT43 gun synchronizer to fire the airguns. The Ref-Tek sends a Time break to the Syntrak and fires the guns after a 50 ms delay.

Timing diagram, see drawing no. : 4.

3.3 Energy Synchronization

3.3.1 Air Gun Source Controller General Specifications

The RT-43 is a 16 bit microprocessor bus system, based on the Texas Instrument Micro controller TM 990/101 and the TI TMS 9900 microprocessor. The software is written in global modules using the companies own multitasking system.

Manufacturer	Refraction Technology, USA
Model	REF -TEK RT-43
No of guns	48
Input gain	Programmable
Parameter Back-up	Non-volatile RAM
Color Data Monitor	Colortrend, Hi-res 720 x 442 pixels
Synchronization model	Automatic Individual
Synchronization	Typical +/- 1.50 msec
Resolution	0.25 msec
Timing method	Zero Crossing
Solenoid Power supply	AIRCON III, I/O Inc., USA For SV-2 & SV-3
Solenoid Power supply	REF TEK For SV-2 only

3.3.2 Quality Control System, QSEIS.

QSEIS is a ON-LINE QC system developed by Geoteam running on a PC/486. An intelligent serial port card is used for interfacing to the gun controller REFTEK RT-43 external serial , streamer controller and navigation computer. After each line there is a print out of the gun performance statistics to complement the reporting of individual misfires produced on line. The primary functions are:

Gun: Reading gun timing for every shot and immediately report gun firing out of the selected time window, misfire or any changes in volume. At operator selected intervals, print timing distribution for every gun in a table with 1/4 msec resolution and present a graphic representation for every gun standard deviation

Streamer: Reading depth, compass and fin angle from Digicourse. At operator selected intervals reports sensors out of specification and computing feather angle.

Nav.: Reading shot point, time and position from navigation and file no. From gun controller for printout together with Digicourse data.

WX: A weather station for wind monitoring is installed, and will be interfaced late 95

Manufacturer	Geoteam a.s / Denis Buchwalter
Software	QSEIS ver. 2.1, 11 Nov 92, QC Package On screen Graphics & Hardcopy
Hardware-Computer	486 33 Mhz PC, VGA Color screen
Intelligent serial card	Digiboard 8 ch.
Hardcopy	Brother, 24 pin Printer
Aux. Screen	Video splitter, with extra VGA Color screen located in the shooting shack
Recording	3,5" 1,44 Mb Floppy (IBM-PC format, ASCII)
Wind monitor	AANDENRAA 3400

3.3.2.1 Printer output - ON LINE, QSEIS

At intervals defined by the operator
- Streamer depth, time, position, water depth, feathering, SP, file (RT-file)
- Gun standard deviation.

- Independent of the interval: Gun errors

3.3.2.2 Printer output - at End Of Line, QSEIS. (End of line statistics)

- Gun summary table
- Gun standard deviation for every gun for the whole line.
- Error Calculations in %
- Streamer statistics:
  Minimum, mean, maximum and average fin angle for every Digibird sensor.
  Percentage of readings and shots within the depth tolerance.
  Feather statistics, minimum and maximum feather angle.

Data printed on a printer is also logged to the hard disc. Ancillary functions include graphical presentation of Gun timing for on-line monitoring and summary log files for Gun timing and streamer depth to hard disc.

3.4 Compressor Plant for M/V Master Odin

Compressors	2 x Diesel Driven (Detroit Type 12V-71) 2 x Electric Driven (AEG Type 355R M4)
Manufacturer	LMF
Type	VGd 2610 W14
Output Pressure	2000 PSI
Output Capacity	2 x 550 CFM, each. Electric 2 x 480 CFM, each. Diesel

4 Digital Streamer

4.1 Electronic Modules

Capable of recording 480 channels at 1 msec sample rate with NO sample skew. Quality control diagnostics controlled from the onboard telemetry system. The modules also contain straingauge type of depth transducers, accurate to ± 1.5 ft. Every module contains an automatic equalization filter to compensate for random variations in line attenuation.

Number of seismic ch's per module	12
Sample Rate	1 msec
Preamp	12 dB
Input noise	≤ 0.2 μB RMS
Dynamic Range	110 dB
Distortion	< 0.02%

4.2 Streamer General Specifications

Digital streamer with a fixed group length of 15.09 meters. The cable consists of 2 types of 300 ft sections with Syntron streamer modules at every 2nd section. Max. number of ch is 480, with 6 channels in every section. There are overlapping groups at both ends of the active sections by quarter of the front group of the in the preceeding section.

Active streamer length	3600 m nominal (Max 6000m)
Stretch sections	2 @ 70 m head, 1 @ 67 m tail
Channels, total	240 (400)
Channel numbering	240 head, 1 tail (400 head, 1 tail)
Streamer Type	Digital
Streamer manufacturer	Teledyne / Shell
Group length	15.09 m
Group Interval	15,24 m
Hydrophone type	LRS-2510, Model WMI-018
Group per section	6
Hydrophones per group	24
Group sensitivity	27 V/B +/-5%
Operating depth, nominal	10 meters +/- 1 m
Active section length	91 meter (300ft)
Active section thickens	76 mm

Note:
The vessel can on a reasonable notice be configured to a dual streamer operation 2 x 3000m.

4.2.1 Elastic sections

- Front Stretches:

Length	70,1 meter
Diameter	90 mm
No of pins in the plug	47

- Tail stretch:

Length	67 meter
Diameter	50 mm
No of pins in the plug	37

Single rope, no wire bundle, Digicourse seawater return

- Tailbuoy-rope 110 meter

4.2.2 Towing sections

- Leadin w/leadin boot:

Length	200 meter
Diameter	40 mm

4.2.3 Auxillary sections

- 40' Adapter:

47 -> 37 pin adapter. Contain active hydrophones connected to first (nearest) channel

4.2.4 Streamer Positioning

Offset is determined by measuring the distance from the geometrical center of the source to the center of first the group. Using a single Gun, this is done by measuring the time from when the gun fires, using the Gun Sensor, to when the pulse reaches the streamer first group. Taking into account the distance from the near-field hydrophone to the Gun, the hydrophone might be used instead of the Gun Sensor. The propagational velocity of sound through water is measured using propagation time between group xx and group yy.

See drawing no. : 1

Tailbuoy positioning (feathering angle) is achieved using a combination of ship's Arpa radar and evaluation of data from cable mounted compass birds.

Active Tailbuoy on request.

4.2.5 Streamer retrievers

Automatic streamer retrievers

Manufacture:	Concord Technologies, Inc., Houston; USA
Model:	SRD-300 recovery device
No. In use pr 3000 m streamer:	7
Release depth:	30 meter

4.3 Auxillary Systems

4.3.1 Streamer Control

Manufacturer	Digicourse Inc., USA
DAU, model	293A·
System controller - Computer	IBM compatible 386/16 Mhz PC
Monitor	VGA, Color
Software Version	Digiscan Graphic package, V2.73A
Modem, Model	293-1, PROM ver 4.9
Cable Unit model - 5010 Bird	Leveler, Depth, (Temp)
- 5011 Bird	Leveler, Depth, Compass, (Temp)
No of Units (5010)	16
No of Units (5011)	20

Interfaces:
The Digicourse controller is polled by QSEIS.
Serial RS232 output to QSEIS and SYNTRAK external header port..

4.3.1.1 Digicourse 5010 Birds, 5011 Compass/Birds

Manufacturer	Digicourse Inc. . U . S . A .
Mechanical:	
Weight	6.1 pounds or 2.8 Kg in sea water
Length	48.2 inches (1.2 meters)
Mounting	2.9 " bird collars
Battery:	
Cells	4 Lithium D cells
Life	6-8 weeks
Communication:	
Type	Serial FSK
Frequency	27 Mhz
Data Rate	2400 Bits/sec
Diving plane:	
Lift	35 pounds (15.9 Kg) at 5 knots
Airfoil	NACA 651-012 airfoil section
Aspect ratio	2.0
Wing Span	19 inches (48 cm)
Surface area	140 sq inches (903 sq.cm)
Depth Sensor:	
Operating range	to 400 feet (122 m)
Accuracy	+/- 0.5 feet (0.15 m)
Resolution	+/- 0.1 feet (0.03 m)
Compass:	
Resolution	0.3 degrees
Accuracy	+/- 0.5 degrees
Sampling	0.3 to 6 seconds selectable
Averaging	0,3,7,15,31 samples selectable

5 Recording Equipment

5.1 Syntrak 480 Data Acquisition System (480 MSTP System)

SYNTRAK-480 multi-streamer recording system

The SYNTRAK-480 is the industry standard digital seismic acquisition system from a well respected independent equipment manufacturer. The SYNTRAK-480 is used by practically all Seismic contractors today, who have not developed their own systems. The SYNTRAK-480 is capable of acquiring seismic data sampled at 2 msec. with 8 streamer of 480 ch. each.

The SYNTRAK-480 consists of the on board recording system and the in-sea data acquisition modules, which are connected in between streamer sections at regular intervals.

The acquisition modules employ surface mount technology for reliability and shock/vibration immunity. The module housing is manufactured from titanium alloy for strength, light weight and corrosion resistance. The inside of the acquisition module is filled with 40 PSI of dry nitrogen, to avoid deterioration of sensitive circuitry by moisture.

The noise, distortion and dynamic range parameters of the acquisition modules are so good, that the precision of the overall system is practically limited, only by factors like geology and weather.

The acquisition modules samples the seismic data at 1 msec interval. However the on board system uses several floating point digital signal processors to re-sample the data any way the customer requires. Due to the 63 point FIR filter used, the theoretical high-cut filter slope is better than 480 dB pr octave. Besides the 250 Hz/72 dB anti-alias filter, the in-sea unit contains an 8 Hz/18 dB low cut filter, to avoid limiting the dynamic range of the system with large unwanted low frequencies. The low-cut filter can be disabled by operator command, which would reduce the low frequency cut-off of the system to 3 Hz/6 dB.

The acquisition system uses a 16 bit A/D converter, which in conjunction with other circuitry results in a dynamic range of better than 110 dB.

The acquisition modules contain a calibration oscillator, to verify the integrity of each acquisition channel. The test/calibration routines can be invoked by the operator by software command. The on board system will analyze the data and will inform the observer about channels which might not conform to manufacturers specifications. A hard copy of the test data is provided as well. The acquisition module contains a very unique test circuitry to measure the electrical parameters of the hydrophone array. This test incorporates leakage, wire continuity and capacitance measurement. The hydrophone array is charged with a pulse of known amplitude and duration via a calibrated resistor. The shape of the charge as well as discharge curve across the hydrophone is measured and compared with the signature of a good hydrophone array. This test goes far beyond the measurements possible with conventional analogue streamer/test systems.

The data transmission of the SYNTRAK MSTP system uses digital serial transmission with repeaters in each module adaptive equalization between the acquisition modules, to allow a modest amount of electrical leakage on the transmission line, without damaging the integrity of the data transmitted. The on board unit contains a complex error detection circuitry, which will inform the observer of any possible transmission errors. In case of a transmission error, the questionable sample will be set equal to the previous sample, rather than being zeroed. This will cause the least amount of damage to the data in a real time system.

The operator can constantly view the data acquired in various different ways. A "wiggle" trace display, similar to the oscilloscope display familiar from the DFS-5 days. This display allows the operator to determine seismic interference, vessel propeller or towing noise as well as electrical leakage spikes on the hydrophone array. A cross-hair cursor allows to determine the channel number of a faulty trace. Another display allows to view the data in a "frozen" form similar to a conventional trace plotter however for several hundred channels at the same time. A thermal plotter provides a hard copy of all channels at regular intervals.

After a seismic line has been completed, a single trace plot can be requested. Again the quality of this plot is far superior than plots produced by the older carbonized paper plotters.

All seismic data is written to STK 4280 cartridge drives. Four tape transports are constantly on line. The rather high redundancy is required to avoid data loss in case of a tape transport or magnetic tape malfunction.

The in sea electronic is powered by 140 Volt DC. To avoid potential electrocution hazard when the power cables are severed, the power supply contains a very fast ground fault interrupter. This circuit disconnects the power from the streamer as soon as the current in the positive wire is unequal the current in the negative wire.

Basic specification of the Syntrak-480 recording system.

Manufacturer	:	Syntron Inc., USA
Type	:	Syntrak MSTP 480
Max number of streamers	:	6
Max number of channels / str	:	480
Auxiliary channels	:	12 (or 0)
	:	
Channels per Aquisition Module	:	12
Preamplifier gain	:	12 dB
Sample rate	:	1 ms in the streamer electronic module.
Lo-cut Filter type	:	Butterworth
Cut-off	:	Out: 3 Hz, 6 dB/Octave
		In: 8 Hz, 18 dB/Octave
Hi-Cut Filter Type	:	Butterworth Thompson
Cut-off	:	250 Hz, 72 dB/Octave
Digital filter type	:	Standard 63-point Finite Impulse Response.

Digital filter and re-sampling applied for 2 and 4 ms operation.

Standard alias Filters	:	2 ms and 4 ms Linear Phase
High frequency cut-off	:	-12 dB, 2 ms @ 218 Hz and 4 ms @ 102 Hz
Phase response	:	Linear
Recording Format	:	2.5 byte, Seg-D, DMX.
Recording Media	:	2 x dual STK-4280 drives.
Recording density	:	IBM-3480, 18 tracks, 37871 cpi.
On-line QC	:	Wiggle display, Shot display,

Observer log, Single trace plot, Shot-plot, Trace RMS noise.

Off-line QC	:	Instrument test, Trace-plot, Shot-plot, Header-dump.

Filters
The sample rate in the streamer electronic module is 1 ms for 2 or 4 ms recording, on-board digital filtering is applied before sample-rate reduction.

Due to digital filtering, Time-break from source controller is delayed 31 ms by the recording system.

Lo-cut Filter:

Type	:	Butterworth
Cut-off	:	Out 3 Hz, 18 db/Octave
		In: 8 Hz, 18 db/Octave

Hi-Cut Filter

Type	:	Butterworth Thompson
Cut-off	:	250 Hz, 72 db/Octave

Digital Filter

* Standard 63-point Finite Impulse Response (FIR)
* 2 ms and 4 ms Linear Phase
* -12 db @ 220 Hz for 2 ms sample rate
* -12 dB @ 101 Hz for 4 ms sample rate
* 480 dB per octave filter slope.

5.2 Storage System

All seismic data is written to STK 4280 cartridge drives. Four tape transports are constantly on line. The rather high redundancy is required to avoid data loss in case of a tape transport or magnetic tape malfunction

Tape stations, manufacture	Storage Technology, USA
Model	2 x dual STK-4280 Cartridge drives.
Recording method	ANSI / IBM 3480
Recording Media	1/2 inch IBM-3480 Cartridge
Recording density	37871 cpi.
Number of tracks	18 parallel
Capacity	Unformatted: 246 MB 25 KB records: 218 MB
Error management	Parity, CRC, DRC, VRC
Tape Speeds:	
- Read/write	2.0 m/s
- Rewind/Search	4.0 m/s
- Rewind time	55 s maximum
- Data transfer rate	2.982 MB/s
Connectivity	SCSI, STK, FIPS
Recording Format	SEG-D, 2.5 byte, Demultiplexed 8015.

5.3 SEG D Format 8015 / Header

The Syntrak External header size is maximum 3168 bytes. The data to the external header is transferred over two serial communication ports. Data from port 2 is added to data from port 1. The actual length will vary according to configuration , but will be in multiples of 32 bytes, i.e. (Number of bytes from port 1 + number of bytes from port 2) rounded up to next multiple of 32 .

Actuall number of 32 byte blocks in External Header is specified in byte 32 in general header.

External data from the Navigation system is transferred over communication port 1. (J1) The length of the data string is user configurable and recorded to SEG D External Header.

In single vessel operations, the Navipac port sending data to the Syntrak is called "CSO".

Optional: In multi vessel operations, the GIN III port sending data to the Syntrak on the slave vessel is called Syntrak "link connection with an external computer"

External data from the Digicourse-controller is transferred over communication port 2. (J6)

5.3.2 SEG-D Tape Format

The seismic data is recorded in the SEG-D standard format. SEG-D 8015 2.5 byte format.

General Header

Bytes 1 - 32

Byte 1,2 = File number
Byte 3,4 = Format code (8015)
Byte 26,27 = Record length
Byte 29 = Channel sets (2)
Byte 31 = Number of extended header blocks (9)
Byte 32 = Number of 32 byte block for External header (10)

The size of Extended and External header may vary.

Channel Set Header

Channel Set Header Size = Bytes 32 * Channel sets (2)
Set 1 described briefly, Set 2 description start on byte 65.

Bytes 33 - 64 (Set 2: 65 - 95)
Byte 33 = Scan Type (1)
Byte 34 = Set Number (1)
Byte 35,36 = Start Time (0 ms), unless water delay activated
Byte 37,38 = End Time (ms)
Byte 40 = MP (HEX 8C for 12 dB Preamp)
Byte 41,42 = Number of Aux. traces
Byte 44 = Gain Mode (09)

Extended Header (Host Recording System Status)

Bytes 97 - 383 (Size in multiples of 32 bytes, Size may vary with configuration)
Contain user defined information such as Client,
Project, Line number etc.

Byte 99,100 = Number of channels
Byte 112 = Number of streamers
Byte 128,135= Line identification (streamer 1)
Byte 136,143= Line identification (streamer 2)etc.

External Header

Bytes 385 - 704 (Size in multiples of 32 bytes, size may vary with configuration)
Bytes 385 - 475 Navigation string (Time, Shot point, Position in Northing, Easting etc.)
Bytes 476 - 704 Digicourse string (Time, Cable depths, Compass data)

Byte 705-1251 Aquisition module descriptions.

5.4. QC facilities and Tests

5.4.1 Trace plots

Single trace recorder:	Syntrak / OYO GS 622
Trace displayed:	Selectable
Trace plots:	OYO GS 622 Thermal Plotter

5.4.2 Automatic Label printer (TLP 2044)

- Every Tape change
- Single trace labels
- Box labels etc.

5.4.3 Automatic Observer log

- Autolog v.304
- IBM compatibel PC
- Laser printer for reports.
- Label printer TLP 2044

Interfaced to:

- Syntrak serial port, to extract SP, File, System errors and so on.
- Digicourse, for depth data
- Navigation

Description

- Automatic Observer log.
- The log can be edited, and additional comment added.
- On line display of digi birds.
- Generates an end-of-line statistics report on depths.

5.4.4 Off-line QC, Processing and instrument tests

5.4.4.1 General specifications

The vessel is equipped with a mini off-line QC and processing system - LookOut. LookOut is running on a Compaq/486 PC hardware platform. The main features are:

- Noise analysis, filtering, brut stack.
- Shot-plot, Trace RMS noise, Header dump.
- Tape checks.
- Tape copying.

Manufacturer:	Lookout Geophysical
Software:	Seiscope ver. 3.2

5.4.4.2 Seiscope Equipment list

Computer:	Compaq Deskpro 486-33/L Mhz
Monitor:	Sony 17" Color Super-VGA
Hard Copy unit	HP PAINT Jet, (Optional OYO 622 Plotter)
Interfaces:	RS232 serial, Centronics parallel, SCSI, Versatek.
Tape drive	STK 4280, Single drive w/ Stacker
Recording media:	3480 Tape cartridge

5.4.4.3 SeiScope software description

I) General
- Menus
- On-line HELP
- Graphics:
  - Color screen plot
  - Color coded amplitude
  - Hardcopy plot
  - Color screen capture
    - output tag & queue

II) Frequency Domain Processing
- Waterfalls:
  - Frequency-offset-amplitude
  - Frequency-time-amplitude
- FK Analysis:
  - Windowing
  - Power spectra
  - Filter design & application

III) Interactive Processing
- Parameter Selection Processing
  - Bandpass filter
  - Deconvolution
  - Gain
  - Trace spectra

IV) Batch Processing
- Stacking and Data Processing
  - Band-pass/Reject Filter
  - Correlation
  - Constant Velocity Stacks
  - Deconvolution
  - Deconvolution panels
  - Demultiplex/reformat
  - First Break Mute
  - Filter Panels
  - FK filtering
  - Hard copy plotting
  - Normal moveout Correction
  - Screen Plotting
  - Sort and Gather
  - Stacking

V) Data I/O
- Reformat 3480 Cartridges:
  - SEG-B
  - SEG-D (multiplexed)
  - SEG-D (demultiplexed)
  - SEG-Y
- Reformat floppy discs:
  - LGC PC format
- Output:
  - 3480 Cartridge
  - Floppy

6 NAVIGATION SYSTEM

6.1 EIVA - Real Time Integrated Navigation System

6.1.1 General

Type	2D Integrated Nav. system
Model	EIVA NAVIPAC 300
Manufacturer	EIVA a.s., Denmark
Program Version	Navipac 61 I
GPS Receiver	2 x Trimble Navigation, 4000DL II
Gyro Compass	Arma Brown MK.10 (Interfaced trough a Lehmkuhl repeater)
Speed Log	Sal-Imcor-2 Doppler Log (Interfaced via a DGH timer)
Echosounder	Simrad EA300P, range = 0,25 - 1500 meters, with Canon PJ-1080 Color Printer w/ 38 Khz transducer
Draft Correction	Yes (Nominal 5,2m when topped with fuel)
Shot Interval, nominal	Customer specified, nominal 30,48m
Line mode	Grid or Rhumb lines or simulated Great Circle
Projection	Selectable btween UTM and TM.
Working Spheroid	Job Specified
Semi-major axis	Job Specified
Inverse Flattening	Job Specified
Working Datum Used	Job Specified

6.1.2 Eiva Equipment List

Computer	1 - H.P. 9920U Computer, w/33 MHz turbo
Expander	1 - H.P. 9888A I.O.
Dual Disc Drive	1 - H.P. 9122C 3.5" 1,44 Mb
Mass storage unit	1 - IEM, 320 Mb Hard disc
Helmsman display	1 - H.P. RGB Color Monitor 5 - NEC Multisync Color Monitor
Console	1 - H.P. 35731B Monochrome Monitor
Monitor amplifier/splitter	1 - BARCO
Printer	1 - H.P. 2225A Thinkjet Printer
Interface	To all common Navigation systems
Location of Helmsman display:	Navigator / Observer / Gun Shack / Bridge / Party Chief / Client rep.

6.1.2.1 NAVIPAC On-line Storage System

Disc Drive:	H.P. 9122C
Recording medium	3.5" 1,44 MB floppy disc
Floppy format:	Hewlett Packard - LIF
Rawdata file format:	EIVA Recdata

6.1.3 Radio Navigation Systems

All LOP's are filtered and smoothed and de-skewed to shot time before they are used in position fix calculations. The filtering window can be set by the navigator. The smoothing is done by a straight line approximation through the last 5 readings, and the value being used in the fix is a weighted average of the reading and the predicted value from the straight line approximation. A maximum of 9 LOP's from combinations of Radio systems can be used in any fix, and all LOP's can have a specified weight.

6.1.3.1 GPS

Filtering and smoothing is done in the same way as for Radio LOP's, but the filtering and smoothing is applied to GPS positions directly.

- Acoustic Data - N/A, Laser data - N/A

6.1.3.2 Dead Reckoning System

General Specifications

Gyro Compass:	Arma Brown, Model : Mark 10
Gyro , signal converter/repeater:	Lehmkuhl LR60C, Gyro compass repeater.
Speed Log:	Consilium Marine, Model : Sal-Imcor-2
Speed log interface:	DGH timer

Dead Reckoning System Comments

The Dead Reckoning can be used to steady the Differential GPS when the DOP's are high and a secondary navigation system is not available for whatever reason. The EIVA system provides real time error correction through an alpha-beta filter. The amount of correction the Dead Reckoning applies to the navigation position is controlled by the operator.

6.1.4 REAL TIME (Displays) in EIVA / NAVIPAC

Radio Navigation Systems:
-Standard deviation
-Error Ellipse
For each LOP:
-Radionav channel configuration
-Raw value
-Residual
-Variance over 5 points of difference between raw and smoothed values
GPS
-Raw position (Latitude and Longitude)
-DGPS position (Latitude and Longitude)
-Difference in position(delta-easting and delta northing) between Radio navigation and GPS
Digibird Compass Data
Recording raw-readings of compass data from Digicourse only.
Tailbouy GPS tracking with Seadiff. (Optional)

- Acoustic Data - N/A
- Sonardyne - N/A
- Laser data, Same as for Simrad HPR. - N/A
- Real Time Binning - N/A

6.1.5 PRINTER OUTPUT (On Line) EIVA/Navipac

6.1.5.1 Dead Reckoning

At intervals defined by the operator:
-Date/Time
-Lat/Long
-Northings/Eastings in the chosen map projection (Primary & Secondary)
-Gyro compass bearing
-Course made good
-Distance off line
-Speed from primary navigation system
-Log speed
-Record number on floppy disc
-Water depth
-Operator defined offset positions ie =CFG=,
when used active tailbouy position, range & bearing.

Radio Navigation Systems
-Radio navigation configuration and channel numbers
-Raw radio readings

GPS
-PDOP value
-Raw position (Latitude and Longitude)
-Difference in position(delta-east and delta-northing) between Radio navigation and GPS
- Trimble 4000 string as recorded from Seadiff

Tailbouy
Tailbouy position UTM N,E + Lat,Lon

- Acoustic Data - N/A
- Compass Data - N/A (On QSEIS prints max 15 compasses only)

6.1.5.2 Printer output at end of line.

Line Statistics:
- Distance off line Histogram
- Standard deviation of radio navigation fixes Histogram
- Shot point interval distance, Histogram
- Compass data - N/A (QSEIS only)
- Time between shots
- Number of sats.

6.1.5.3 Baseline Crossing

Automatically computes C-O for baselines & extended baselines.

Prints sum of ranges (less any delays), computed baseline, C-O, and distance from baseline.

6.1.6 OUTPUT ON SERIAL LINE - COSTOMER SPECIFIED OUTPUT "CSO"

6.1.6.1 Output on serial line, START OF LINE
- Start of line + Line name

6.1.6.2 Output on serial line, EVERY SHOT
- Time, Event No., Easting, Northing, Water depth, Gyro, SMG, CMG, CVG

6.1.6.3 Output on serial line, END OF LINE
- End of line + Line name

This output is output on a RS 232 line (9600,N,8,2).
The message is 90 characters long, and is formatted as ASCII text,
except for SOL and EOL which is 28 characters.

The "CSO" setup, can within reasonable limits, be altered by the operator onboard.

The "CSO" is interfaced to SYNTRAK recording system and QSEIS.

6.2 Differential GPS Navigation System

6.2.1 General Specifications

SkyFix is providing differential GPS corrections from multiple GPS reference stations via the Inmarsat satellite communication system.

6.2.2 Inmarsat diff. Link hardware, GEO-REF or FUGRO (FUGRO in brackets)

Diff. Link Manufacturer	Geoteam a.s., Oslo, Norway. (or FUGRO Singapore)
Satellite Demodulator	Geo-Ref / Fram 460R (FUGRO: JRC 45 MK 1)
Translator	IFT 200 (FUGRO: JECCA)

6.2.3 Interface software, SEADIFF

SEADIFF is a software package for real-time differential GPS processing. It can handle 9 GPS satellites simultaneously. SEADIFF is outputting corrected Latitude / Longitude to NAVIPAC. (SEADIFF can also be interfaced to a wide range of other radio navigation systems) The Seadiff also includes quality control of the performance of the reference station network and the onboard equipment in real time. This includes display of Standard Deviation of Residuals when an over determined solution is available and comparing multiple reference stations.

Manufacturer	Seatex a.s., Trondheim, Norway
Model	Seadiff Ver 6.0
Datum	Selectable
Computer	HP Vectra Pentium/100MHz PC
Monitor	SVGA Color
Intelligent serial interface	8 CH Digiboard

6.2.4 GPS receivers, TRIMBLE

Manufacturer	Trimble Navigation
Type	GPS Satellite Receiver
Model	4000 DL II
Software Versions	Nav Ver. 5.41 - 28 Feb. 1991 Sig. Ver. 1.18 - 12 Nov 1991 Boot Ver. 3.27 - 16 Aug. 1991

6.2.5 Spare units, Onboard

Diff link	Geo-ref./Fram 460R Satellite,Demodulator, IFT 200 translator. (FUGRO: Jecca)
Computer	HP Vectra Pentium/100MHz
GPS	4000 DL II Receiver and 2 antennas w/cable

6.2.6 Diff. stations

The system can in the present configuration receive differential GPS corrections from up to 12 reference stations with an update rate of less than five seconds. It can monitor the difference of derived positions from a maximum of 6 individual stations.

See appendix 4, for a World Wide list of reference station.

6.2.7 Inmarsat satellites

Data from the reference stations are transmitted through dedicated telephone lines to the Inmarsat uplink station in the area. At the uplink station, the datastreams are combined into one, and transmitted through the Inmar satellite used in the area.. Onboard the vessel, the data are received using a JRC ship station.

6.3 SEACONTROL NAVIGATION QC PACKAGE

6.3.1 General

SEACONTROL is a stand alone data logging and quality control system for marine survey navigation. The program is designed to run on a IBM compatible PC/AT computer under MS-DOS. This system is used on Master Odin as an aid to the navigator to ensure good quality navigation. It is interfaced to the raw navigation system(s) separately and produces it's own position, and also receive the Navipac position. It then compares all interfaced systems to give a good, independent quality control check on-line.

Manufacturer	SEATEX a.s., Trondheim, Norway
Program Version	Seacontrol 1. 651, 08 Apr. 1994
Datum Shift	Selectable
Interfaced To	Geo-Ref DGPS (FUGRO Starfix) Raw GPS Navipac Hard Closure + To all common navigation systems
Projections	UTM and TM

6.3.2 Seacontrol Equipment list:

Computer	Brick 486 DX 33 Mz PC
Intelligent Interface	8 Channel Serial Board - Digiboard
RAM	1 . 9 Mb total
Hard-disc	40 Mb
Floppy-disc	1. 44 Mb 3 . 5 "
Monitor	Hitachi VGA Color
Printer	Star LC-10

6.3.3 Real time display:

Difference in positions, Geographical & Grid Coordinates, SD's, SMG, CMG, Gyro, Error ellipse for radio navigation LOP's.

6.3.4 Printout at EOL:

Timeseries statistics for Radio Navigation

6.3.5 Data logging:

- UKOOA P2/86
- ASCII Positions

6.4 Navigation Onboard 2D off-line QC-tool.

6.4.1 General Specifications

NAVIMAP is a off-line Nav. QC tool for Navipac Recdata. NAVIMAP is designed to run on the series 300 Hewlett Packard computers. The main features are:

- Convert Recdata to EIVA-Processed file format.
- List Raw data
- Print sp-intervals, out of operator entered specifications.
- Produce Postplots from Navipac Recdata discs. (Multi plots)
- Runline plot. (Track plot)
- Depth smoothing and editing.
- Bathy Charts. (w/tide corrections) , line by line - not contour charts.
- GPS Scatter plots (in harbor).

Manufacturer:	EIVA a.s., Denmark
Program version:	Navimap 039C

6.4.2 Navimap Off-line Equipment List

1 - H.P. 7595B, Draftmaster SX Plotter.
Plot size: A3 & A1 & A0
1 - H.P. 9122C 3.5" Dual Disc Drive.
1 - IEM 3018, Mass Storage Unit, 180 Mb Winchester hard-disc.
1 - H.P. 82913A, Monochrome Monitor
1 - H.P. 2225AY, Thinkjet Printer
1 - H.P. 9000/300 Computer

The Off-line system is also a back-up system for the On-line system.

6.4.3 Navidat

Line coordinate database administrator software. (Navidat 18D)
Running on the Navimap hardware.

- Preplots on the HP-Draftmaster
- Pac_Lin & Pac_key, managing the line coordinate database used on Navipac.

6.5 Cycle controller (Closure box)

General
The cycle controller sends trigger signal to the recording system. It has two inputs (0 and 1) and eight outputs (0 to 7). Output 0-3 is TTL, output 4-7 is a choice between TTL and contact closure.
When "off-line", the FESTO is programmable from an IBM-PC with FST (Festo Software Tool).

Manufacturer	FESTO Electronic, Germany.
Model	FESTO FPC-404, Programmable controller.
Type	PLS

Input-0	Navigation, TTL
Output-0	Ref. Tek Gun Controller, TTL
Output-1	Syntrak, TTL
Output-7	QSEIS, Contact closure
Output-4	Gravity

6.6 Antenna Layback

The system positions are referred to the Transit Satellite antenna.
Positions to Starboard and Fore get a positive sign.

Distance of Primary GPS Nav. Ant. Forward	+0.1 m
Distance of Primary GPS Nav. Ant. Port	-1.6 m
Distance of Secondary GPS Nav. Ant. Forward	+0.1 m
Distance of Secondary GPS Nav. Ant. Starboard	+1.6 m

See drawing no. : 6

When other navigation systems are used, antenna positions will be different from this.

6.7 Fast availability of Navigation data.

Navipac Recdata can be transmitted to the main office for processing and QC'ing the day after the data is shot. High speed modem transfer at 14.400 baud via JRC Inmarsat-A is used.

HSDL (High Speed Data Link) is also available via a 2nd onboard Inmarsat-A terminal, Saturn 3S.90. At a speed of 64 KBPS, using a Comstream 701 digital modem.

Appendix 1

STANDARD GUN DROP-OUT SPECIFICATIONS FOR SERES POINT SOURCE. MASTER ODIN 2660 CU.IN ARRAY

CRITERIA: TO STAY WELL WITHIN 15% DROP IN AMPLITUDE AND 15% DROP IN PEAK TO PEAK BUBBLE RATIO.

ARRAY DESCRIPTION:

2 x (4 x 100 Cu.In.) Clusters
2 x (3 x 100 Cu.In.) Clusters
2 x (3 x 70 Cu.In.) Clusters
2 x (2 x 70 Cu.In.) Clusters
4 x (2 x 40 Cu.In.) Clusters
4 x 40 Cu.In. Single Guns
4 x 20 Cu.In. Single Guns

The sub-arrays are very compact, totalling a lenght of only 7 meters from center first to last gun.

THE FOLLOWING DROP OUT CAN BE ACCEPTED:

- Any combinations up to a loss of 15% in volume, with the following exeptions:

  - ONLY ONE 4 X 100 OUT
  - ONLY ONE 3 X 100 OUT
  - ONLY ONE 3 X 70 OUT
  - ONLY THREE 2 X 40 OUT
  - IF ONE 100 CU.IN. IN A 4 X 100 CLUSTER IS DROPPED, AN ANOTHER HAS TO BE DROPPED TO AVOID CREATING AN ANOTHER 3 X 100.
  - ONLY TWO 40 AND TWO 20 SINGLE OUT AT THE SAME TIME.
  - MAX 6 GUNS OUT.

Appendix 2 PGS Standard Processing QC Sequence - OPTIONAL.

PGS Acquisition QA/QC sequence - 2D

The following notes outline the systems and structure of the Acquisition QA/QC typically carried out on the PGS 2D vessels.

Clearly if a project involves a final 2D processing, then a different action should be taken.

Generalised System set-up

One IBM RS6000 system, running IBM UNIX AIX 3.2, configured with :

Local Memory (RAM)	: 128Mb
Disk storage	: 28Gb.
8mm storage	: The workstation has a dedicated exabyte drive.
3480 cartrige drive	: Storagetek 4280 w/Stacker
Thermal plotter.	: OYO Geospace - GS636, 36".

We are currently running **ProMax** software version 5.1 and AIX 3.2.5.

QC processing sequence

Processing is aimed in general, not at attenuating noise, but in showing the data either as recorded or as it would be presented to a shore or vessel based processing centre.

31 ms static for digital filter delay
Adjacent trace summation with differential NMO if recording with 12.5 metre groups
Gain recovery
Pre decon mute
DBS
NMO. Velocities should be picked on a grid no coarser than 2km
Mute
Stack
Gun & cable static correction
TVF
Amplitude balancing
Display

QC displays, routine production of the following:

one shot every km
near trace plots
NMO corrected gathers or supergathers as dictated by fold
stack section, all with appropriate scaling. N.B. AGC is not appropriate

General

In addition to this, the QC system is available for detailed investigation of specific data areas.

RMS Values

Computation of rms windows on one or more window per trace. These are suggested to be the last 500 ms of the trace for a 'noise' estimate and any client specified signal window. In cases where the water is deep enough a measure of true ambient noise is taken from the water column. EOL displays if RMS noise window. The data will be plotted on a trace by trace basis in ProMax.

Data Archiving

A "ProMAX Line Archive" is taken for each line processed. This should include decimated shots (if created), various stack files and the near traces. Velocity and flow data are automatically captured by this method. The value of these datasets is for reloading on the vessel during the course of subsequent acquisition, and they have little long term value as a general archive.

Stacks - **SEG Y** archive tape containing the raw stacks for each line.

A velocity tape containing the information for each line.

ProMAX archive of master flows.

523247

STARFIX STATION DETAILS

Station ID	Location	Country Area	Satellite ##	Latitude	Longitude	Height
1	Perth	Australia	Optus-IOR	S 31 56 40.42	E 115 50 30.36	11.00
2	Karratha	Australia	Optus-IOR	S 20 45 57.59	E 116 52 41.18	8.90
3	Darwin	Australia	Optus-IOR	S 12 24 56.99	E 130 55 40.27	84.90
4	Townsville	Australia	Optus	S 19 15 52.65	E 14648 44.11	73.13
5	Brisbane	Australia	Optus	S 27 28 38.51	E 153 01 37.34	93.10
6	Melbourne	Australia	Optus-POR	S 38 27 53.37	E 144 54 46.91	144.90
7	Adelaide	Australia	Optus	S 34 56 31.53	E 138 36 25.46	52.41
8	Kalgoorlie	Australia	Optus	S 30 45 06.96	E 121 28 49.88	367.40
9	Okinawa	Japan	POR	N 26 15 17.94	E 127 42 44.32	72.49
10	Singapore	Singapore	IOR	N 01 17 46.14	E 103 47 28.33	57.81
11	Miri	Malaysia	IOR	N 04 24 01.20	E 113 59 41.75	57.40
12	Vung Tau	Vietnam	IOR	N 10 20 34.17	E 107 05 28.16	36.40
13	Hong Kong	Hong Kong	IOR-POR	N 22 21 55.64	E 114 00 23.65	21.99
14	Kuching	Malaysia	IOR-POR	N 01 33 26.51	E 110 21 01.41	100.92
15	Kota Kinabalu	Malaysia	IOR-POR	N 05 58 42.12	E 116 04 33.83	99.80
16	Bali	Indonesia	IOR	S 08 40 42.28	E 115 11 55.76	53.70
17	Bombay	India	IOR	N 19 02 42.29	E 073 01 51.45	-27.82
18	Bathurst	Australia	Optus	S 33 25 46.90	E 149 34 01.96	756.80
19	Subic Bay	Philippines	IOR-POR	N 14 48 57.15	E 120 16 56.2	59.30
20	Bahrain	M.East	IOR	N 26 09 34.18	E 050 28 16.52	-10.60
21	New Plymouth	N.Z.	Optus-POR	S 39 03 27.19	E 174 04 49.23	56.07
22	Auckland	N.Z.	Optus-POR	S 36 47 33.49	E 174 45 50.21	51.40
23	Kuantan	Malaysia	IOR	N 03 48 04.19	E 103 18 24.37	16.27
24	Satun (UNOCAL)	Thailand	IOR	N 09 17 10.62	E 101 24 43.32	19.60
25	Bangkok	Thailand	IOR	N 13 48 58.484	E 100 33 37.856	31.85
26						
51	Karratha (Monitor)	Australia	Optus	S 20 45 57.34	E 116 52 41.39	9.00
53	Singapore (Monitor)	Singapore	IOR	*N 01 17 46.14	*E 103 47 28.32	*57.80

Locations and Heights for all reference and monitor stations are with respect to WGS 84 Datum.

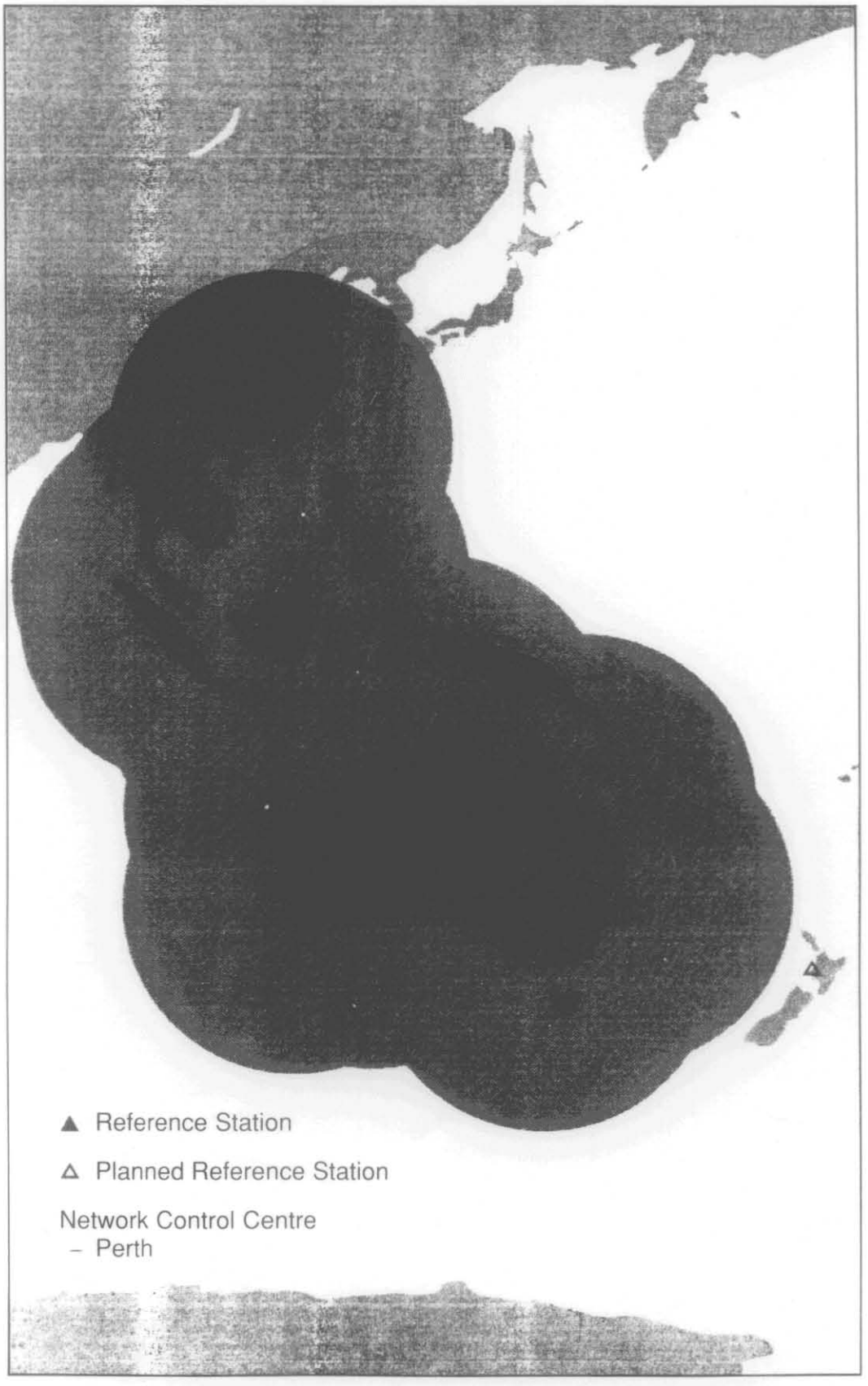
Satellites broadcasting differential corrections are subject to change due to Project requirements.

* Indicates provisional co-ordinates and heights only !

FUGRO

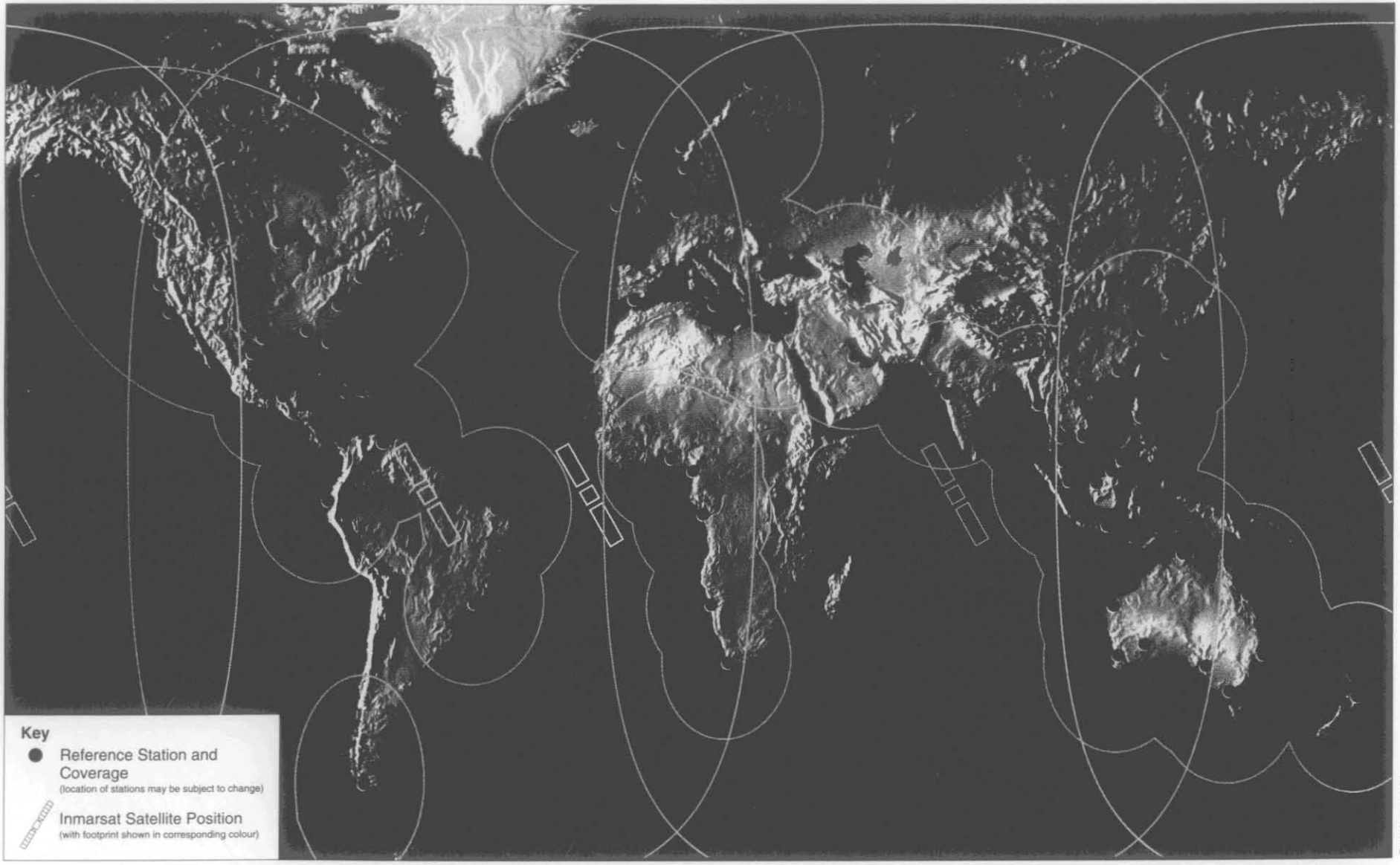
STARFIX

S.E. ASIA, PACIFIC and AUSTRALASIA
2000km Range



ISSUED AUGUST 1994

STARFIX GLOBAL COVERAGE – 2000 km RANGE



October 1995

STARFIX centres: John E Chance & Assoc. Inc., USA. Tel: +1 713 773 5670 Fugro Starfix Pte Ltd., Singapore. Tel: +65 774 1433 Fugro Starfix (Europe) AS, Norway. Tel: +47 22 52 14 80

STARFIX GLOBAL COVERAGE

Starfix Reference Stations

REGION 1

North West Europe
Aberdeen 57 12 N, 02 05 W
Haarlem 52 22 N, 04 40 E
Ørlandet 63 40 N, 09 35 E
Rogaland 58 48 N, 05 40 E
Shannon 52 41 N, 08 55 W
Tromsø 69 39 N, 18 56 E
Torshavn 62 00 N, 06 46 W

Mediterranean & Middle East
Bahrain 26 09 N, 50 28 E
Baku 40 21 N, 50 14 E
Cairo 29 58 N, 31 16 E
Crete 35 18 N, 25 09 E
Gibraltar 36 08 N, 05 20 E
Istanbul 41 03 N, 28 59 E
Malta 35 51 N, 14 29 E

West Africa
Cape Town 33 50 S, 18 32 E
Douala 04 03 N, 09 42 E
Lagos 06 27 N, 03 23 E
Pointe-Noire 04 47 S, 11 51 E
Walvis Bay 22 57 S, 14 30 E

REGION 2

Australia /New Zealand
Adelaide 34 56 S, 138 36 E
Auckland 36 47 S, 174 45 E
Bathurst 33 25 S, 149 34 E
Brisbane 27 28 S, 153 01 E
Darwin 12 25 S, 130 55 E
Karratha 20 45 S, 116 52 E
Melbourne 38 28 S, 144 54 E
New Plymouth 39 03 S, 174 04 E
Perth 31 56 S, 115 50 E
Townsville 19 15 S, 146 48 E

Asia
Bali 08 40 S 115 12 E
Bangkok 13 49 N, 100 34 E
Bombay 19 02 N, 073 01 E
Gulf of Thailand 09 17 N, 101 24 E
Hong Kong 22 22 N, 114 00 E
Kota Kinabalu 05 58 N, 116 04 E
Kuantan 03 48 N, 103 18 E
Kuching 01 33 N, 110 21 E
Miri 04 24 N, 113 59 E
Okinawa 26 15 N, 127 42 E
Sachalin (pending)
Shanghai (pending)
Singapore 01 18 N, 103 47 E
Subic Bay 14 49 N, 120 16 E
Vung Tau 10 20 N, 107 05 E

REGION 3

North America
Carmen 18 39 N, 91 49 W
Cocoa Beach 28 07 N, 80 35 W
Duluth 16 50 N, 92 13 W
Everett 47 54 N, 122 16 W
Fayetteville 35 06 N, 78 55 W
Houston 29 35 N, 95 30 W
Long Island 40 47 N, 72 16 W
Mercedes 26 06 N, 97 51 W
Pensacola 30 29 N, 87 14 W
Redding 40 34 N, 122 22 W
San Diego 32 55 N, 117 14 W

South America
Guayaquil 02 12 S, 79 53 W
Punta Arenas 53 10 S, 70 54 W
Recife (pending)
Rio de Janeiro 22 57 S, 43 10 W
Valencia 10 10 N, 67 57 W

For further information contact:

FUGRO

SEADIFF

Differential GPS Software for the Professional

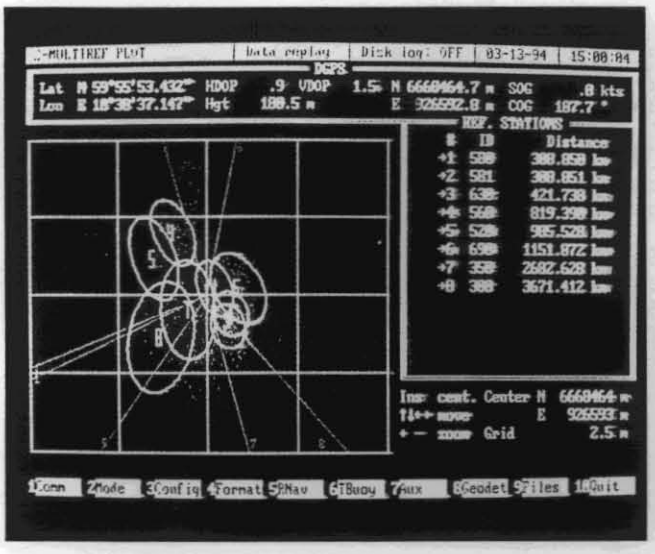
Seadiff DGPS software offers a complete positioning solution and a comprehensive set of QC functions tailored to ensure the integrity and quality of your data at all times.

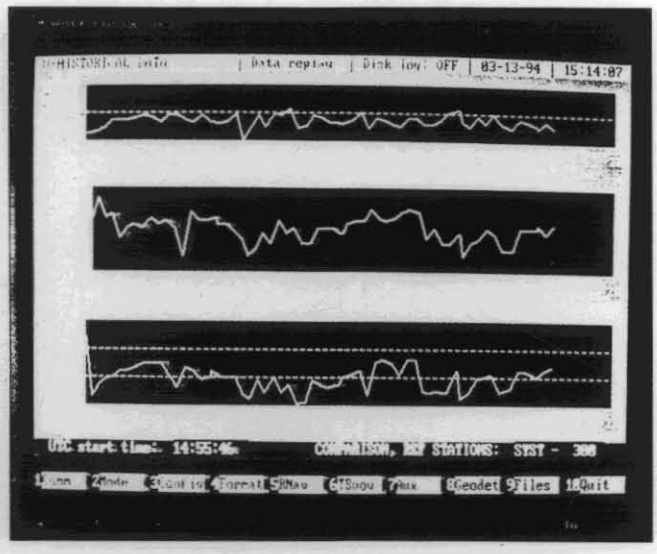
The primary function of the Seadiff software is to use all available DGPS data collected and computed at the mobile unit to provide the user with real-time indication of the position performance. This is achieved by presentation of quality parameters as recommended by UKOOA. Key methods employed to achieve this are:

Multiple Reference Stations
DGPS corrections can be received from up to 12 individual reference stations and independent positions from each can be computed to provide a primary solution. An integrated solution can be derived combining data from a set of reference stations. This provides increased accuracy and effectively minimises the effects of temporary errors affecting a single reference station.

Redundant Observations
Whenever possible, redundant observations are used to provide a reliable estimate of the quality of the position solution. All available satellite data together with external height information is used to generate statistical parameters.

Time Series Plots
Display of time series plots illustrates, in graphical format, trends in DGPS positioning performance and quality control parameters.





Main Benefits:

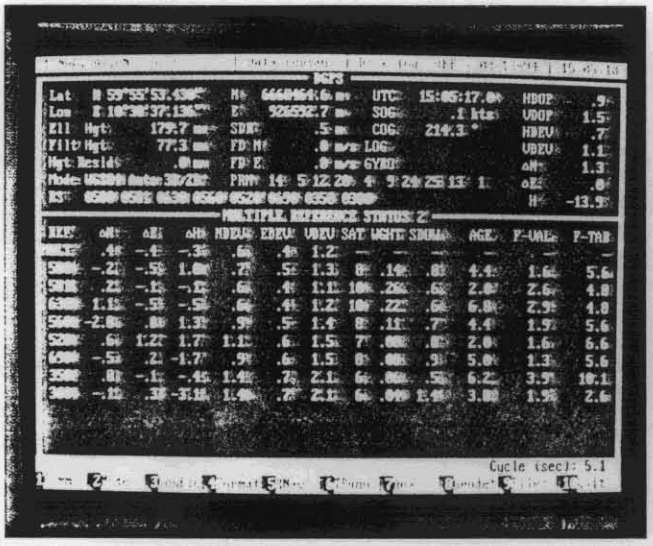
- On-line plots of SDUW, residuals, corrections, HDOP, height etc.
- Multiple reference station solution
- Comparison of local positions derived by means of data from all reference stations
- Calibration of conventional radio navigation systems.
- Statistical testing for gross errors, W-test and F-test.
- Time series presentation of essential QC parameters.
- Real-Time graphical presentation of LOPs and satellite positions.
- Quality indicators, according to the UKOOA recommendation, of the final fix computed (error ellipses, MDE and external reliability).
- Satellite coverage prediction presented on-line.
- Logging capability.
- Replay of logged files.
- Post processing with reference station data.

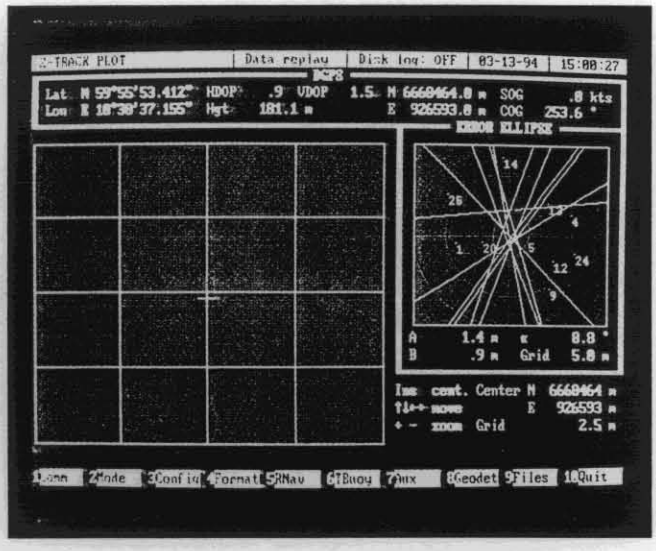
SEADIFF

Automatic Position Fix QC
Prior to the position computation all pseudo-ranges are statistically tested for gross errors using the W-test method (data snooping). Each observation is carefully weighted taking into account satellite elevation, age of differential corrections, distance from the reference station and rate of change of correction. Ionospheric and tropospheric models can be selected for enhanced performance over extended distances.

Datum Conversion
All positions are performed in the WGS 84 satellite datum. The user can then select conversions into any local datum for presentation of the results using a 7 parameter transformation. The data can be output as geographical or UTM coordinates.

Tracking Capability
In addition to calculating vessel position, Seadiff may also be used to track up to 16 remote units equipped with GPS transponders (GEOTRACK). Both relative and absolute position will be calculated with a typical update rate of 0.5 Hz. Full quality control and integrity checking are also applied to the transponder data.





Estimated Position Accuracy
Estimates of the accuracy of the calculated positions are based on a priori parameters and residuals of the GPS range measurements. This information also affects the weighting of the corrections into a multiple reference station solution.

Graphical Presentation
The time series plots include GPS data such as:

- First differences
- HDOP/VDOP
- Height and filtered height
- Normalized residuals
- Position comparisons
- Standard deviation of unit weight
- Age corrections
- F-test statistics
- Marginally detectable error (MDE)
- Pseudo-range corrections

Hardware Requirements
The software will run on a standard pentium / 486 PC.

External Interfaces
Several formats are supported for interfacing to external computers. Among these are:
GIN III
NMEA 0183
Trimble 4000

Other formats available on request

The STARFIX system is available worldwide. For further information or service contact:

Australia: Fugro Survey Pty Ltd tel. 61-9-322-4955 fax 61-9-322-1775. **Dubai:** Fugro Survey Middle East tel. +971-4-342930 fax +971-4-342931. **India:** Fugro Geonics (India) PVT. Ltd tel. +91-22 767 1059 fax +91-22-7672818. **Indonesia:** Fugro Geodetic Indonesia tel. +62-21-684407 fax +62-21-6401244. **Italy:** Oceansismica SpA. tel. +39-6-521-9319 fax +39-6-521-9297. **Netherlands:** Fugro Survey BV tel. +31-23-5359-294 fax +31-23-5331-398. **Nigeria:** Fugro Survey (Nigeria) Ltd. tel. +234-84-235095 fax: +234-84-233991. **Norway:** Geoteam AS tel. +47-22-522400 fax +47-22-523438. **Singapore:** Fugro Geodetic Pte. Ltd. tel. +65-5430200 fax +65-5430500. **United Kingdom:** UDI-Wimpol Ltd. tel. +44-1224-257500 fax +44-1224-257501. **USA:** John E. Chance & Assoc. Inc. tel. +1 713 773 5670 fax +1-713-773-5698.

For further information contact:

October 1995

GEOTRACK

The professional GPS tracking solution

GEOTRACK is a DGPS-based, multi-purpose tracking system which offers a comprehensive solution to all surface positioning requirements. GEOTRACK composes a Vessel Control Unit (VCU) which is capable of handling up to 16 Tracking Units (TBU) providing a simple compact equipment package.

GEOTRACK system features
The TBUs may be positioned at any location within an area of several kilometres (line of sight). Simple setting of TBU radio frequencies is possible from an external handheld terminal. GEOTRACK can produce absolute positions or relative position vectors.

Real-time QC
Enables reliable on-line checking and rejection of poor measurements. A number of time-series plots offer an on-line visualisation of GPS/DGPS data quality including all parameters required in the UKOOA specification.

Compact and Rugged Housing
The TBU is a fully integrated unit with all electronics and antennas enclosed within a single compact and rugged housing.

Rapid TBU Position Update Cycle
A 2 second update rate for up to 16 TBUs provides sufficient data for rapid TBU positioning and continuous monitoring of data quality.

Comprehensive Data Logging Facilities
Allows logging of all raw GPS/DGPS measurements and calculates information in a variety of formats. Together with the optional post-processing services this provides a powerful tool for analysing/correcting any problems found in the data.

Shot Point Contact Closure
GEOTRACK accepts a contact closure input from the client system to enable logging of data at each shot point or other external events.

Geotrack Applications
- 3D seismic surveys
  - Streamer tailbuoy positioning
  - Streamer leadbuoy positioning
  - Source float positioning
  - Inter-vessel / dual vessel operations
- Barge management
- Anchor handling operations
- Vessel traffic monitoring

Geotrack benefits

- High position accuracy and quality
- Data integrity checking according to UKOOA recommendations
- Real-time QC/QA functions utilising time series plots
- Fast TBU position update rate (16 TBU in 2 seconds)
- Minimal TBU maintenance
- Simple system diagnostics
- Simple fault detection
- Highly configurable to client system requirements
- Proven reliability and performance
- Low power consumption
- Built-in voltage monitoring in each TBU
- Highly integrated and reliable mechanics
  - splash proof (IP67)
  - shock absorbant mounting

October 1995

523254

GEOTRACK

Technical specifications:

System configuration
The GEOTRACK system configuration comprises 1 to 16 Tail Buoy Units, 1 to 2 VCU rack units and a PC running the Seadiff software.

Performance

Accuracy	1-3m (2D, 95%)
Update Rate	0.5 Hz
Sequencing	8 units sharing one frequency

Environment

Operational temperature	-10C to +40C
Storage temperature	-40C to + 70C
Humidity	100%, fully sealed
Water proof	IP67

Physical

Weight	4.7 kg
Diameter	150 mm
Overall diameter	190 mm
Length	800 mm
Input voltage	11-30 VDC
Power consumption	6W
Bracket for mast mounting	

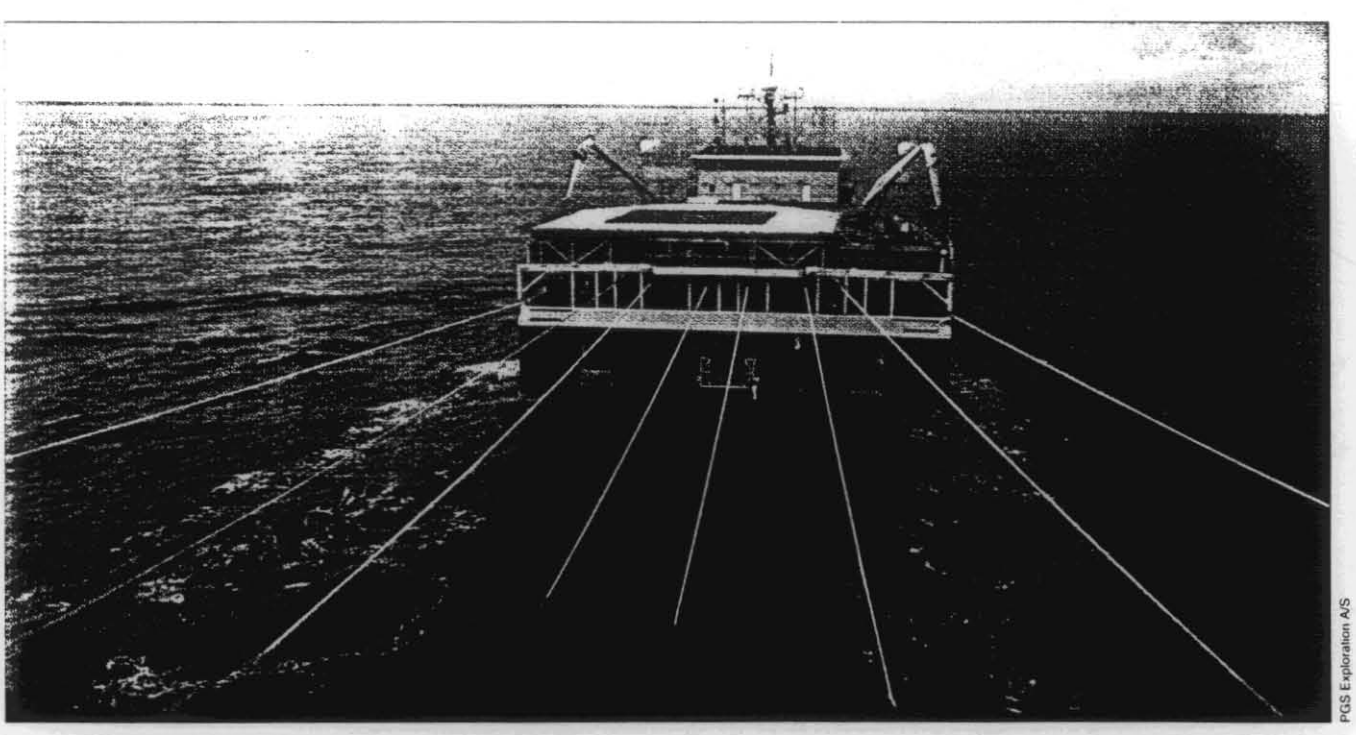
GPS receivers
Trimble 6 channel SVeeSix CM2
Trimble 8 channel DSM
Ashtech 12 channel OEM receiver

Radio

Modem	4800 bps
GMSK Antenna	Metz
Frequency	457-459 MHz
Channel separation	25 KHz
Transmission power	0.5W
Range min.15 km (line of sight)	

Features
- Rack mounted VCU for onboard reception of data
- Accurate positioning of up to 16 units can be calculated simultaneously within a 2 second update rate
- GPS receiver, radio, processor and antennas contained in a physical unit
- Software configurable frequency
- Continuous battery voltage monitoring
- Fully automatic operation of the transponder units

Specifications subject to change.



PGS Exploration A/S

The STARFIX system is available worldwide. For further information or service contact:

Australia: Fugro Survey Pty Ltd tel. 61-9-322-4955 fax 61-9-322-1775. **Dubai:** Fugro Survey Middle East tel. +971-4-342930 fax +971-4-342931. **India:** Fugro Geonics (India) PVT. Ltd tel. +91-22 767 1059 fax +91-22-7672818. **Indonesia:** Fugro Geodetic Indonesia tel. +62-21-684407 fax +62-21-6401244. **Italy:** Oceansismica SpA. tel. +39-6-521-9319 fax +39-6-521-9297. **Netherlands:** Fugro Survey BV tel. +31-23-5359-294 fax +31-23-5331-398. **Nigeria:** Fugro Survey (Nigeria) Ltd. tel. +234-84-235095 fax: +234-84-233991. **Norway:** Geoteam AS tel. +47-22-522400 fax +47-22-523438. **Singapore:** Fugro Geodetic Pte. Ltd. tel. +65-5430200 fax +65-5430500. **United Kingdom:** UDI-Wimpol Ltd. tel. +44-1224-257500 fax +44-1224-257501. **USA:** John E. Chance & Assoc. Inc. tel. +1 713 773 5670 fax +1-713-773-5698.

For further information contact:

October 1995

STARFIX DGPS Demodulator

The Starfix Demodulator

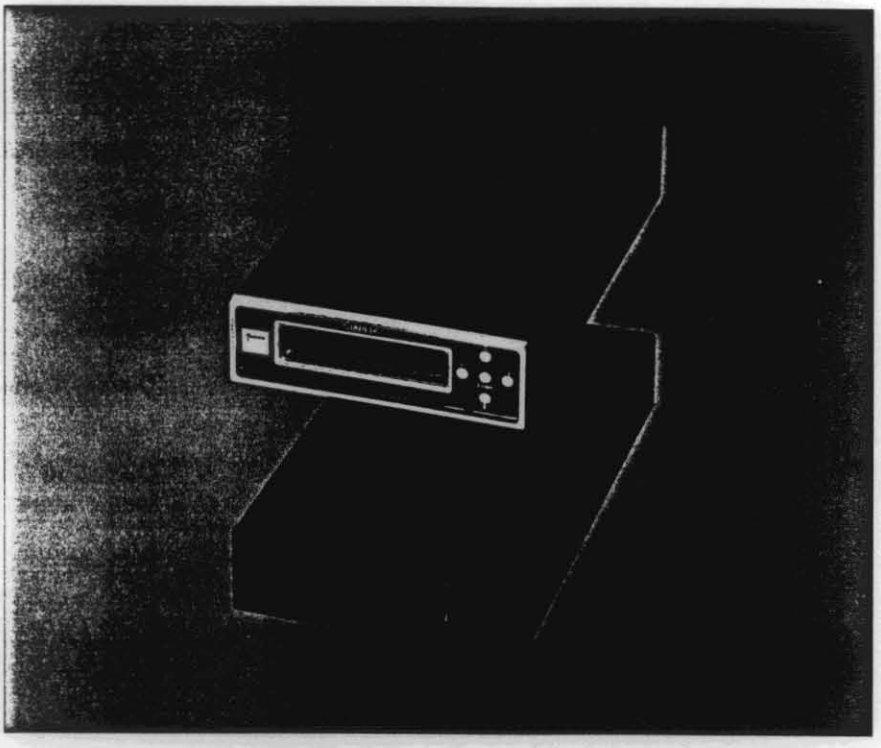
STARFIX DGPS corrections are now easily accessible to anybody requiring accurate worldwide positioning through a new generation STARFIX demodulator.

The new demodulator has been designed for use worldwide, for all marine applications and incorporates a number of unique features to ensure reliability and user friendly operation.

The STARFIX system
The Fugro STARFIX system provides differential GPS corrections from multiple GPS reference stations via the Inmarsat satellite communication system.

The STARFIX system now covers most of the world with some 60 reference stations. Corrections are transmitted via all four Inmarsat satellites. Data from the worldwide STARFIX reference station network is available to users with an existing Inmarsat terminal, a dedicated M-Dome, or a flat plate antenna. The STARFIX system is designed and operated to meet the exacting requirements of the offshore industry.

Accuracy of the STARFIX system is 1-2 m, with 95% probability in the horizontal plane at short and medium ranges (approx. 1000 km); and 3 m with 95% probability at ranges exceeding 2000 km. User accuracy is dependent on the GPS receiver used.



Above: the STARFIX DGPS demodulator

Features

- Small, lightweight, ruggedly built unit
- Compatible with a variety of antenna systems
- Single and multiple DGPS correction message in RTCM format (user selected)
- Integrated key-pad and display
- Real-time performance indicators
- Key operating parameters may be accessed and edited via a simple menu system
- Remote access facility (via satellite link)
- Built-in messaging capability (receive only)

523256

STARFIX DGPS Demodulator

Technical Specifications

INMARSAT DATA LINK

Uplink stations: Eik, Norway; Perth, Australia; Southbury, USA

Inmarsat Satellites:
Atlantic Ocean East Region (AOR-E), 15.5 deg west
Atlantic Ocean West Region (AOR-W), 54 deg west
Indian Ocean Region (IOR), 64.5 deg east
Pacific Ocean Region (POR), 178 deg east

Data rate:
600, 1200, 2400 baud user data rates.

Link reliability: 99.97%

Link bit error rate: Better than 10^{-5}

DIFFERENTIAL CORRECTIONS

Data format: RTCM-104 v.2.0

Data blocks:
RTCM-104 data block 1,3,16 (Differential GPS Corrections, Reference Station Parameters, and Special Message.)

Update rate block 1: Typically less than 4 seconds.

STARFIX DEMODULATOR

Size: 15 cm W x 27 cm D x 4.5 cm H

Weight: 1.2 kg

Power: 10 Watts (10-32 Volt DC)

Display/Control: Two lines by 20 Characters LCD display / four button control

Operating temperature: -20 to +50 deg C

Output: RTCM corrections for one or more reference stations

Note: Specifications may be subject to change.

The STARFIX system is available worldwide. For further information or service contact:

Australia: Fugro Survey Pty Ltd tel. 61-9-322-4955 fax 61-9-322-1775. **Dubai:** Fugro Survey Middle East tel. +971-4-342930 fax +971-4-342931. **India:** Fugro Geonics (India) PVT. Ltd tel. +91-22 767 1059 fax +91-22-7672818. **Indonesia:** Fugro Geodetic Indonesia tel. +62-21-684407 fax +62-21-6401244. **Italy:** Oceansismica SpA. tel. +39-6-521-9319 fax +39-6-521-9297. **Netherlands:** Fugro Survey BV tel. +31-23-5359-294 fax +31-23-5331-398. **Nigeria:** Fugro Survey (Nigeria) Ltd. tel. +234-84-235095 fax: +234-84-233991. **Norway:** Geoteam AS tel. +47-22-522400 fax +47-22-523438. **Singapore:** Fugro Geodetic Pte. Ltd. tel. +65-5430200 fax +65-5430500. **United Kingdom:** UDI-Wimpol Ltd. tel. +44-1224-257500 fax +44-1224-257501. **USA:** John E. Chance & Assoc. Inc. tel. +1 713 773 5670 fax +1-713-773-5698.

For further information contact:

October 1995

9. DELIVERABLES

9.1 Seismic Data Shipments

523258

Proforma Invoice No: MOD0121/96

Department Seis.Proc.

PGS *Exploration*

Consignor: Odin Explorer William Holyman & Sons Pty. Ltd 16-18 North Caroline Street P.O. Box 838 Devonport Tasmania 7310 AUSTRALIA **Ref:** Darrell Willcox **Phone:** 00-61-04 27 80 42 **Fax:** 00-61-04 27 01 50	**Consignee:** Boral Energy 3rd Floor 60 Hindmarsh Square Adelaide, SA 5000 Australia **Attn:** Mark Taylor **Phone:** 00-61-8-235 3737 **Fax no:** 00-61-8-223 1851
Type of freigth: Air **Place of dispatch:** Devonport,Tasmania	**Department:** Seis.Proc. / KH **Date :** 04.02.96

Certified true and correct.
Values are for customs purposes only.
Delivery terms : C.I.F.

Sign:

Party chief Gunnar Brastein

Proforma Invoice / Packing List

Box	Item	QTY	Serial no	Description	Weigth (in Kg)	Value
1	1			Seismic paper records Brute stacks(Seq 35 to 69)	4	$5
	2	3		8mm Exabyte data tapes-SEG-Y stacks(Seq 35 to 69)		$15
	3			Copies of Observers Logs for Seq 35 to 69		
	4			Tube containing Boral sections and Nav. post plots		$10
Total No. of Boxes			1	**Total Weigth (in Kg)** 4	**Total value for customs**	$30

PGS Exploration AS. Strandveien 4 Phone: +47 67526400 Fax: +47 67526464

523259

Department Seis.Proc.

PGS Exploration

Consignor: Odin Explorer William Holyman & Sons Pty. Ltd 16-18 North Caroline Street P.O. Box 838 Devonport Tasmania 7310 AUSTRALIA **Ref:** Darrell Willcox **Phone:** 00-61-04 27 80 42 **Fax:** 00-61-04 27 01 50	**Consignee:** PGS Tensor A/S Strandveien 4, 1324 LYSAKER P.O. Box 337, 1324 Lysaker, NORWAY' **Attn:** MARIANNE LEFDAL **Phone:** 00-47 67 526400 **Fax no:** 67 58 36 38
Type of freigth: Air **Place of dispatch:** Devonport,Australia	**Department:** Seis.Proc. / KH **Date :** 04.02.96

Certified true and correct.
Values are for customs purposes only.
Delivery terms : C.I.F.

Sign:

Party chief Gunnar Brastein

Proforma Invoice / Packing List

Box	Item	QTY	Serial no	Description	Weigth (in Kg)	Value
1	1	20		8mm Exabyte seismic tapes -	2	$100
				Promax Line Archives for Project 60110		
1	2	2		Copy of QC processing report,paper and disk copy		$5
Total No. of Boxes			1	**Total Weigth (in Kg)** 2	**Total value for customs**	$105

PGS Exploration AS.
Strandveien 4
P.O. Box 290
N-1324 Lysaker
Norway
Phone: +47 67526400
Fax: +47 67526464

523260

Proforma Invoice No: MOD0119/96

Department Instrument

PGS Exploration

Consignor: Odin Explorer William Holyman & Sons Pty. Ltd 16-18 North Caroline Street P.O. Box 838 Devonport Tasmania 7310 AUSTRALIA **Ref:** Darrell Willcox **Phone:** 00-61-04 27 80 42 **Fax:** 00-61-04 27 01 50	**Consignee:** Western Geophysical - Melbourne 9th Floor ANL House 432 St. Kilda Road Melbourne, Victoria Australia **Attn:** Mark Stanley **Phone:** 00-61-3 9820 8700 **Fax no:**
Type of freigth: Air **Place of dispatch:** Devonport.	**Department:** Instrument / RMP. **Date :** 05.02.96

Certified true and correct.
Values are for customs purposes only.
Delivery terms : C.I.F.

Sign: _____

Party chief Gunnar Brastein

Proforma Invoice / Packing List

Box	Item	QTY	Serial no	Description		Weigth (in Kg)	Value
1	0	30	Box 11	Seismic Data Tapes	2057 - 2086	7.5	$15
2	0	30	Box 12	Seismic Data Tapes	2087 - 2116	7.5	$15
3	0	30	Box 13	Seismic Data Tapes	2117 - 2146	7.5	$15
4	0	30	Box 14	Seismic Data Tapes	2147 - 2176	7.5	$15
5	0	30	Box 15	Seismic Data Tapes	2177 - 2206	7.5	$15
6	0	30	Box 16	Seismic Data Tapes	2207 - 2236	7.5	$15
7	0	30	Box 17	Seismic Data Tapes	2237 - 2266	7.5	$15
8	0	30	Box 18	Seismic Data Tapes	2267 - 2296	7.5	$15
9	0	30	Box 19	Seismic Data Tapes	2297 - 2326	7.5	$15
10	0	30	Box 20	Seismic Data Tapes	2327 - 2356	7.5	$15
11	0	30	Box 21	Seismic Data Tapes	2357 - 2386	7.5	$15
12	0	10	Box 22	Seismic Data Tapes	2387 - 2397	3.1	$10
12	0	5		Single Trace Tapes	Seq 65 - 69	1.8	$5
13	0	30	Box 23	Single Trace Tapes	Seq 35 - 64	7.5	$15
14	0	47		Shot Plots Seq 35 - 69		13	$1
15	0	47		Single Trace Plots and Observer Envelopes \ Seq 35-69.		6	$1
15	0	0				0	$
	0	0		JOB NUMBER - 60110 / BORAL ENERGY.		0	$
Total No. of Boxes		9	**Total Weigth (in Kg)**		113.9	**Total value for customs**	$197

PGS Exploration AS. Strandveien 4 Phone: +47 67526400 Fax: +47 67526464

9.2 Navigation Data Shipments

523262

Navigation Data Log

PGS *Exploration*

PROJECT No.	CLIENT	AREA	VESSEL
60110	BORAL ENERGY	BASS STRAIT	M/V ODIN EXPLORER

DATE	SEQ	LINE	TIME		DATA DISC		SHOT POINTS			KILOMETERS			COMMENTS
1996	No.	NAME	SOL	EOL	No.	REC	FSP	LSP	TOTAL	PROD	O/L	NTBP	
17.jan	001	BHA96100	05:06	05:34	60110-001	698	1828	1659	170	3,886			Disc swap
17.jan	"	"	05:34	05:35			1658	1652	7	0,160			Lost Shots
17.jan	"	"	05:35	07:37	60110-002	2796	1651	908	744	17,008			Complete
17.jan	002	BHA96102	09:28	12:02	60110-003	3310	1010	1862	853	19,500			Complete
17.jan	003	BHA96104	13:49	13:54	60110-004	2908	1680	917	764	17,465			Complete
17.jan	004	BHA96121	21:59	23:25	60110-005	2006	1001	1522	522	11,933			Complete
18.jan	005	BHA96127	00:47	01:34	60110-006	1075	1441	1168	274	6,264			Hangup
18.jan	"	"	01:34	01:34			1167	1167	1	0,023			Not on disc
18.jan	"	"	01:34	01:35			1166	1162	5	0,114			Lost Shots
18.jan	"	"	01:35	02:17	60110-007	926	1161	917	245	5,601			Complete
18.jan	006	BHA96131	03:47	05:05	60110-008	1812	1001	1469	469	10,721			Hangup
18.jan	"	"	05:05	05:07			1470	1475	6	0,137			Lost Shot
18.jan	"	"	05:07	06:19	60110-009	1537	1476	1885	410	9,373			Complete
18.jan	007	BHA96133	08:08	08:18	60110-010	277	1539	1479	61	1,394			Hangup
18.jan	"	"	08:18	08:19			1478	1472	7	0,160			Lost Shots
18.jan	"	"	08:19	08:33	60110-011	359	1471	1381	91	2,080			Hangup
18.jan	"	"	08:33	08:34			1380	1377	4	0,091			Lost Shots
18.jan	"	"	08:34	09:53	60110-012	1730	1376	917	460	10,516			Complete
18.jan	008	BHA96135	11:25	12:03	60110-013	739	1001	1230	230			5,258	**Do not process**
18.jan	"	"	12:03	12:04	"		1231	1239	9			0,206	**Do not process**
18.jan	"	"	12:04	12:56	60110-114	984	1240	1558	319			7,292	**Do not process**

REMARKS

TOTALS THIS PAGE	
116,426	PRODUCTION
0,000	OVERLAP
12,756	NO CHARGE

523263

PGS *Exploration*

Navigation Data Log

PROJECT No.	CLIENT	AREA	VESSEL
60110	BORAL ENERGY	BASS STRAIT	M/V ODIN EXPLORER

DATE	SEQ	LINE	TIME		DATA DISC		SHOT POINTS			KILOMETERS			COMMENTS
1996	No.	NAME	SOL	EOL	No.	REC	FSP	LSP	TOTAL	PROD	O/L	NTBP	
18.jan	009	BHA96137	14:37	16:22	60110-015	1922	1551	917	635	14,516			Complete
18.jan	010	BHA96139	17:58	19:24	60110-016	1638	1001	1523	523	11,956			Complete
18.jan	011	BHA96141	21:00	22:25	60110-017	1636	1439	917	523	11,956			Complete
19.jan	012	BHA96143	00:07	01:42	60110-018	1782	1001	1568	568	12,984			Complete
19.jan	013	BHA96110	03:28	06:07	60110-019	2891	1534	606	929	21,237			Complete
19.jan	014	BHA96108	07:38	09:39	60110-020	2224	1001	1713	713	16,299			Complete
19.jan	015	BHA96106	11:29	13:16	60110-021	1991	1552	917	636	14,539			Complete
19.jan	016	BHA96109	14:43	16:37	60110-022	2167	1001	1693	693	15,842			Complete
19.jan	017	BHA96105	18:09	21:25	60110-023	3639	2090	917	1174	26,838			Complete
19.jan	018	BHA96103	23:17	23:59	60110-025		1001	1256	256	5,852			Midnight SP
20.jan	"	"	00:00	01:15	"	2234	1257	1717	461	10,538			Aborted
20.jan	019	BHA96903	03:55	04:09	60110-024		1634	1717	84		1,920		Overlap
20.jan	"	"	04:09	05:40	"	1955	1718	2265	548	12,527			Complete
20.jan	020	BHA96101	21:32	22:21	60110-026		1001	1300	300	6,858			Aborted
21.jan	021	BHA96901	01:02	01:15	60110-027		1218	1300	83		1,897		Overlap
21.jan	"	"	01:15	02:31	"	1662	1301	1755	455	10,401			Complete
21.jan	022	BHA96107	04:06	07:20	60110-028	3495	2041	917	1125	25,718			Complete
21.jan	023	BHA96111	09:30	13:05	60110-029	3857	1001	2248	1248	28,529			Complete
21.jan	024	BHA96113	14:29	17:25	60110-030	3274	1965	917	1049	23,980			Complete
21.jan	025	BHA96115	18:50	22:02	60110-031	3697	1001	2194	1194	27,295			Complete
21.jan	026	BHA96117	23:24	23:59	60110-032		2055	1842	214	4,892			Midnight SP
22.jan	"	"	00:00	02:36	"	3540	1841	917	925	21,146			Complete

REMARKS

TOTALS THIS PAGE	
323,903	PRODUCTION
3,817	OVERLAP
0,000	NO CHARGE

523264

PGS *Exploration*

Navigation Data Log

PROJECT No.	CLIENT	AREA	VESSEL
60110	BORAL ENERGY	BASS STRAIT	M/V ODIN EXPLORER

DATE 1996	SEQ No.	LINE NAME	TIME SOL	TIME EOL	DATA DISC No.	DATA DISC REC	SHOT POINTS FSP	SHOT POINTS LSP	SHOT POINTS TOTAL	KILOMETERS PROD	KILOMETERS O/L	KILOMETERS NTBP	COMMENTS
22.jan	027	BHA96114	06:45	08:51	60110-033	2396	1684	917	768	17,556			Complete
22.jan	028	BHA96112	10:00	11:50	60110-034	2071	1001	1665	665	15,202			Complete
22.jan	029	BHA96116	13:05	15:18	60110-035	2516	1722	917	806	18,425			Complete
22.jan	030	BHA96118	16:50	19:01	60110-036	2487	1001	1798	798	18,242			Complete
22.jan	031	BHA96120	20:25	22:34	60110-037	2431	1697	917	781	17,854			Complete
23.jan	032	BHA96122	00:23	02:30	60110-038	2413	1001	1773	773	17,671			Complete
23.jan	033	BHA96124	04:00	06:07	60110-039	2405	1685	917	769	17,579			Complete
23.jan	034	BHA96126	07:42	09:48	60110-040	2370	1001	1764	764	17,465			Complete
			Crew change 24/01/96.										
25.jan	035	BHA96935	15:45	17:18	60110-041	1629	1001	1557	557	12,733			Complete
25.jan	036	BHA96129	20:19	21:46	60110-042	1528	1001	1523	523	11,956			Complete
26.jan	037	BHA96125	00:18	01:48	60110-043	1560	1439	917	523	11,956			Complete
26.jan	038	BHA96119	21:55	00:00	60110-044	-	1001	1833	833	19,042			Midnight SP
27.jan	"	"	00:00	00:38	"	3154	1834	2093	260	5,944			Complete
27.jan	039	BHA96123	02:03	05:00	60110-045	3041	1959	917	1043	23,843			Complete
27.jan	040	BHB96102	10:42	13:30	60110-046	3453	2105	917	1189	27,181			Complete
27.jan	041	BHB96100	14:56	17:46	60110-047	3458	1001	2187	1187	27,135			Complete
27.jan	042	BHB96119	19:49	21:16	60110-048	1754	1001	1598	598	13,670			Complete
27.jan	043	BHB96117	22:35	23:56	60110-049	1720	1503	917	587	13,419			Complete
28.jan	-	-	-	-	60110-050	-	-	-	-	-	-	-	Bad disc

REMARKS

TOTALS THIS PAGE	
306,873	PRODUCTION
0,000	OVERLAP
0,000	NO CHARGE

523263

PGS *Exploration*

Navigation Data Log

PROJECT No.	CLIENT	AREA	VESSEL
60110	BORAL ENERGY	BASS STRAIT	M/V ODIN EXPLORER

DATE 1996	SEQ No.	LINE NAME	TIME SOL	TIME EOL	DATA DISC No.	DATA DISC REC	SHOT POINTS FSP	SHOT POINTS LSP	SHOT POINTS TOTAL	KILOMETERS PROD	KILOMETERS O/L	KILOMETERS NTBP	COMMENTS
28.jan	044	BHB96115	02:50	04:19	60110-051	1883	1004	1654	651	14,882			Complete
28.jan	045	BHB96113	06:33	08:12	60110-052	1963	1586	917	670	15,316			Complete
28.jan	046	BHB96111	09:40	11:20	60110-053	1944	1001	1666	666	15,225			Complete
28.jan	047	BHB96104	13:00	14:27	60110-054	1820	1535	917	619	14,150			Complete
28.jan	048	BHB96106	15:50	17:19	60110-055	1816	1001	1618	618	14,127			Complete
28.jan	049	BHB96108	18:42	20:12	60110-056	1815	1535	917	619	14,150			Complete
28.jan	050	BHB96110	21:41	23:13	60110-057	1812	1001	1618	618	14,127			Complete
29.jan	051	BHB96112	00:41	02:09	60110-058	1824	1535	917	619	14,150			Complete
29.jan	052	BHB96114	04:00	05:46	60110-059	2213	1001	1752	752	17,191			Complete
29.jan	053	BHB96116	07:24	09:17	60110-060	2193	1668	917	752	17,191			Complete
29.jan	054	BHB96118	11:25	14:31	60110-061	3546	1001	2219	1219	27,866			Complete
29.jan	055	BHB96120	16:11	18:35	60110-062	2794	1875	917	959	21,923			Complete
29.jan	056	BHB96122	20:35	22:03	60110-063	1786	1001	1610	610	13,945			Complete
29.jan	057	BHB96124	23:22	00:00	60110-064	-	1523	1247	277	6,332			Midnight SP
30.jan	"	"	00:00	00:46	"	1783	1246	917	330	7,544			Complete
30.jan	058	BHB96105	02:19	06:39	60110-065	5207	2710	917	1794	41,011			Complete
30.jan	059	BHB96101	09:07	13:29	60110-066	-	1001	2370	1370	31,318			LGSP abort due weather
30.jan	"	"	13:29	13:58	"	4298	2371	2503	133			3,040	Scratch
30.jan	060	BHB96129	21:20	23:15	60110-067	1743	1510	917	594	13,579			Complete
31.jan	061	BHB96127	01:02	02:56	60110-068	2045	1001	1698	698	15,956			Complete
31.jan	062	BHB96123	04:39	06:33	60110-069	2050	1616	917	700	16,002			Complete

REMARKS

TOTALS THIS PAGE	
345,986	PRODUCTION
0,000	OVERLAP
3,040	NO CHARGE

523266

PGS *Exploration*

Navigation Data Log

PROJECT No.	CLIENT	AREA	VESSEL
60110	BORAL ENERGY	BASS STRAIT	M/V ODIN EXPLORER

DATE 1996	SEQ No.	LINE NAME	TIME SOL	TIME EOL	DATA DISC No.	DATA DISC REC	SHOT POINTS FSP	SHOT POINTS LSP	SHOT POINTS TOTAL	KILOMETERS PROD	KILOMETERS O/L	KILOMETERS NTBP	COMMENTS
31.jan	063	BHB96121	08:11	09:35	60110-070	-	1001	1534	534	12,207			Aborted d.t weather
31.jan	"	"	09:35	09:49	"	1808	1535	1619	85			1,943	Scratched
02.feb	064	BHB96901	22:35	22:47	60110-071	-	2286	2370	85	1,943	1,943		Overlap
02.feb	"	"	22:47	23:54	"	1481	2371	2799	429	9,807			Complete
03.feb	065	BHB96103	01:25	05:45	60110-072	5215	2713	917	1797	41,079			Complete
03.feb	066	BHB96107	07:20	11:50	60110-073	5180	1000	2792	1793	40,988			Complete
03.feb	067	BHB96921	14:15	14:27	60110-074	-	1451	1534	84		1,920		Overlap
03.feb	"	"	14:27	15:09	"	1102	1535	1829	295	6,744			Complete
03.feb	068	BHB96125	16:22	18:01	60110-075	2046	1615	917	699	15,979			Complete
03.feb	069	BHB96109	19:52	21:28	60110-076	1879	1558	917	642	14,676			Complete

Suvey is complete 03/02/96.

REMARKS

TOTALS THIS PAGE	
143,424	PRODUCTION
3,863	OVERLAP
1,943	NO CHARGE

APPENDIX 4

SEISMIC DATA PROCESSING REPORT

This appendix comprises the Contractor's Data Processing Report.

WESTERN ATLAS

Western Geophysical

FINAL REPORT
FOR DATA PROCESSING
BHA96 & BHB96 2D SEISMIC SURVEY

PERMIT AREAS T/25A & T/18P

WESTERN GEOPHYSICAL AUSTRALIA
A DIVISION OF
WESTERN ATLAS INTERNATIONAL INC
A.R.B.N. 009 474 908

OCTOBER 1996
WGC Project Number: J2168

Table of Contents

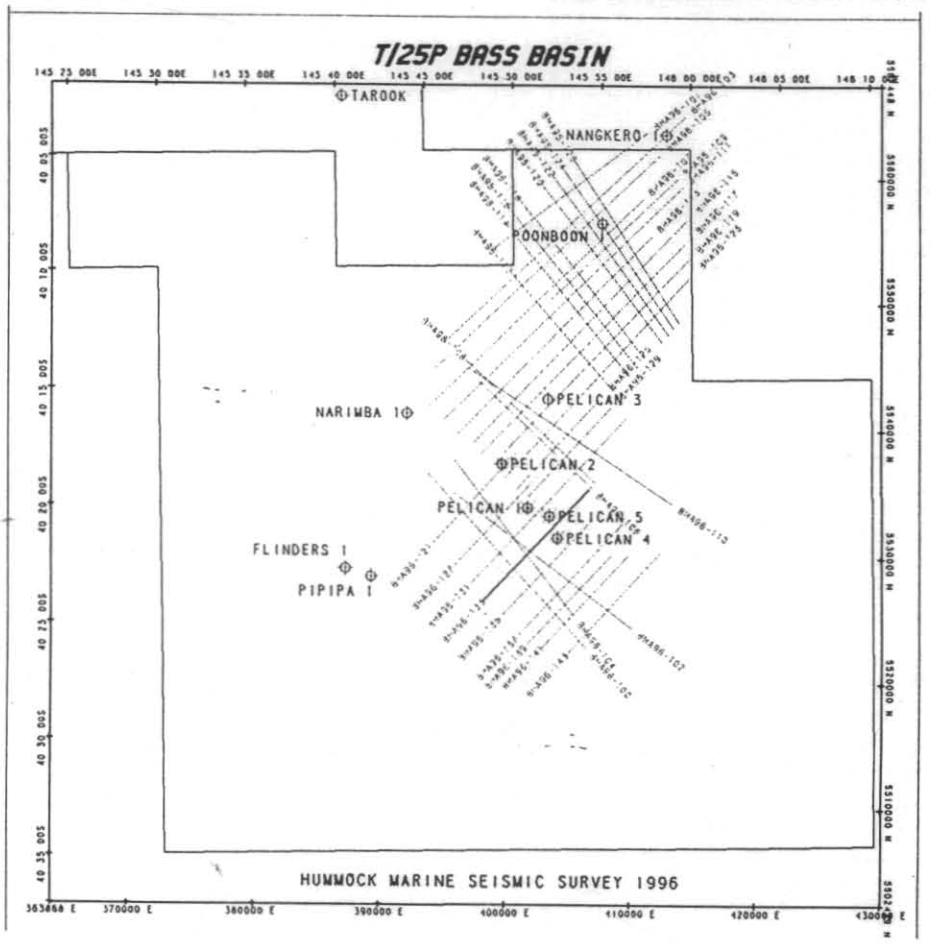
1 INTRODUCTION

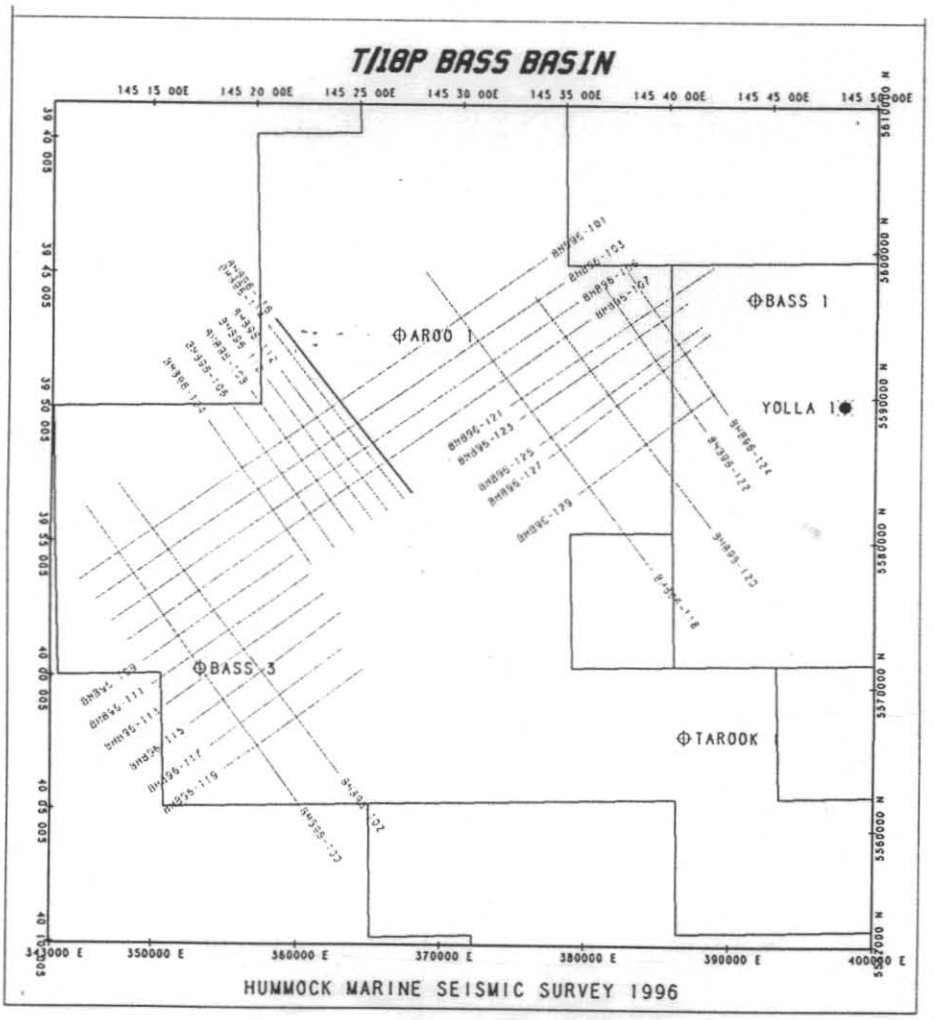
This report details the processing of the BHA96 & BHB96 2D seismic surveys carried out by Western Geophysical Australia. The project was conducted for Boral Energy Resources Ltd in permits T/25A AND T/18P in the Bass Strait, north of Tasmania. A line location map is shown in Figure 1-1.

PERMIT	KMS
T/25A (BHA96)	666.49
T/18P (BHB96)	527.72
TOTAL:	**1194.21**

Production data processing was conducted between February and September 1996 at the Melbourne Digital Processing Centre of Western Geophysical Australia. Computing facilities in Houston Texas were linked to the geophysical staff using Western's extensive Wide Area Network (WAN). This enabled all of the main processing to be performed on an IBM 3090 series mainframe. Filming was performed on Laserdot™ hardware in Adelaide via the same WAN.

The procedures and programs utilised in processing the data are described below in the order in which they were applied. The project was coordinated for Boral by Mark Taylor, and managed for Western by Dee Connolly with geophysical supervision by Mark Stanley.


T/25P BASS BASIN
TAROOK
NANGKERO
POONBOON
NARIMBA 1
PELICAN 3
PELICAN 2
PELICAN 1
PELICAN 5
PELICAN 4
FLINDERS 1
PIPIPA 1
HUMMOCK MARINE SEISMIC SURVEY 1996


T/18P BASS BASIN
AROO 1
BASS 1
YOLLA 1
BASS 3
TAROOK
HUMMOCK MARINE SEISMIC SURVEY 1996

2 ACQUISITION SUMMARY

2.1. ACQUISITION PARAMETERS.

The field data were collected by PGS, using the Odin Explorer, job number 60110. The following parameters were utilised:

Streamer	252 traces 15.24 metre group interval (3825.24 metres total active length) depth - 6 metres near offset - 107.76 metres
Energy source	Airgun arrays, 1330 cubic inches depth - 6.0 metres firing interval - 22.86 metres
Instrumentation	Syntrak 480 SEG-D 8015 BPI (2.5byte) Low cut filter - 3 Hz (6 dB/octave slope) High cut filter - 218 Hz (484 dB/octave slope)
Data Sampling	2 ms sampling interval 6144 ms record length.
Polarity	Positive pressure at the hydrophone produces a negative number on tape (SEG Standard).

3 PROCESSING SUMMARY

3.1. PROCESSING SEQUENCE

	Conversion of Field Tapes to WGC Code 4 Format	
	Resample to 4ms	
	81ms delay compensation	
		Near Trace, Select Shot & Amplitude QC to identify bad shots and traces
	Edit bad shots and traces and attenuate spikes	
	Spherical Divergence	
	Gain Correction	
	Shot Domain FK Filter	
	Adjacent Trace Sum	
Brute Stack	Designature	1st Pass Velocity Analysis
	FK Multiple Attenuation	
	Deconvolution	
Demultiple Stack		DMO 2nd Pass Velocity Analysis
	Instantaneous AGC gain	
Dmo Stack	DMO Stack	
	NMO	
	Inner and outer trace mutes applied	
	Gun and Cable Correction	
Dmo Stack Film	Bandpass Filter and Scaling	
Migration Film	Migration	
	Bandpass Filter and Scaling	

4 PERSONNEL

Name	Title	Responsibilities
Mark Stanley	Processing Manager (Melbourne)	Project Manager and technical control.
Dee Connolly	Senior Geophysicist	Coordination of day to day running of project and testing. Report
Niels Stienstra	Junior Geophysicist	Assistance with deliverables

5 TESTING

5.1. INTRODUCTION

Line BHA96-115 was selected as a test line.

5.2. SHOT DOMAIN FK FILTER

To attenuate linear noise present on shot records, a two dimensional filter was designed and applied in the frequency wave-number (FK) domain.

Normal Moveout (NMO) correction applied prior to FK filtering increases the separation between reflected signals and coherent noise in the FK domain, thus enabling more effective filtering to be carried out.

Various filters were tested (with and without NMO applied) and the following parameters were chosen using stacked data for appraisal:

Trace Spacing	Pass zone	Taper
15.24m	+/- 3.66 ms/trace	7.32 ms/trace

5.3. ADJACENT TRACE SUM

Tests were run to compare 2:1 to 3:1 adjacent trace sum. Resulting NMO stacks were compared and the 3:1 summed version was chosen since it showed similar resolution to the 2:1 summed section and more effective noise attenuation.

5.4. DESIGNATURE

Designature is applied on a shot-by-shot basis to estimate a time-invariant, surface-consistent source wavelet from the seismic data and replace it with a zero phase wavelet or a digital minimum phase equivalent which has some desired amplitude spectrum. The minimum phase spectrum of the source is calculated from an average amplitude spectrum of all traces within a shot gather. An inverse operator is designed to construct the source wavelet. The operator includes (a) an estimate of the instrument filters; (b) source and receiver depth ghosts; and (c) short period multiples. This operator is then applied to all traces within the gather. A removable AGC was applied to avoid a design bias towards shallow, relatively high amplitude data.

Various frequency bandwidths were tested and the following parameters were selected:

Output Frequency	Wavelet Length	Output Phase
5Hz/18dB/oct - 93Hz/36dB/oct	400 ms	Zero

5.5. DECONVOLUTION BEFORE STACK

Tests on stacked data were performed to determine (a) the effectiveness of deconvolution (DBS); (b) whether it should be applied before or after FK multiple attenuation (MAFK); and (c) the optimum deconvolution parameters. It was decided to use a single window gapped deconvolution, applied after MAFK with parameters as follows:

Gap:	48ms
Operator:	248ms
Window (near trace):	300-3400ms

5.6. MULTIPLE ATTENUATION

Two multiple attenuation procedures were tested.

1. FK Multiple Attenuation (MAFK)
2. Radon

❖FK multiple attenuation (MAFK) is carried out in three stages:-

1. Normal moveout (NMO) correction is applied to the data using a reduced velocity trend derived from interpreted first pass velocity analysis. This results in primary reflections being over-corrected and multiples under-corrected.
2. The NMO corrected data are transformed into the FK domain. The primary and multiple reflections are mapped on opposite sides of the zero wave number axis. A filter to zero out the quadrant of the FK domain associated with multiples is then applied. After filter application the data are transformed back into the T-X domain.
3. Inverse NMO is applied using the reduced velocity function. This restores the primary events to their original positions for subsequent processing.

❖Radon demultiple is based on the theory that hyperbolic move-out becomes almost parabolic if approximate move-out is applied. The parabolas containing multiple energy are modelled by forward and inverse transforms and subtracted from the original moved-out CDP gather in the time domain. However the Radon transform is not a full one (i.e. it cannot model all multiple energy in Radon space), hence a MAFK is applied first to the data to remove slower multiples.

Velocity analyses were used to determine the demultiple parameters. This allowed gather and stack data to be examined with the coherency contours clearly showing the effect on the primary velocity functions. MAFK and Radon were tested; Radon showed no appreciable improvement over MAFK and was not used. Velocity reductions from 85% to 98% were tested.

From these tests the following MAFK parameters were selected:

Time (ms)	% velocity
0	92
6000	92

5.7. MUTES

Mute tests were run with the mutes from previous processing in the area being used as the central position. Milder and harsher mutes were compared with the central function. A harsher outer mute was chosen as it improved continuity of an event in the region 2300 - 2800ms.

OUTER MUTE

Offset (m)	Time(ms)
300	4
333	450
1098	1300
2568	2200
3933	2300

INNER MUTE

Offset (m)	Time(ms)
107	1500
750	2000
1000	2500
1050	6000

5.8. PRE-STACK SCALING

Trial	Scaling
1.	1000 ms AGC
2.	2000 ms AGC
3.	6000 ms AGC
4.	No scaling

An AGC of 6000ms was chosen.

5.9. DMO

DMO stacks were run with dip limits of 30^{o}, 45^{o} and 60^{o}. A dip limit of 60^{o} was chosen. A test was also run using a regional velocity function to determine the operator width in traces. A 110 trace operator width was calculated.

5.10. TAU-p FILTERING

Tau-p filter was tested to strengthen events within the specified dip ranges. Tests comprised dips of 8 and 12 ms per trace with mixbacks of 50%, 70% and 90%. However no significant benefit was noted and tau-p was not used.

5.11. MIGRATION

Three methods of migration were tested:

Trial	Migration
1.	Finite Difference
2.	Kirchhoff
3.	Modified Residual

❖Finite Difference migration can image dips up to 35 degrees and can handle lateral velocity variations.

❖Kirchhoff migration can image steep dips, upto 90 degrees, but does not handle lateral velocity variations well.

❖Modified Residual Migration consists of migrating the data twice. An Extended Stolt (FK) Migration is applied to the data first. This is accurate to 90 degrees, even with velocity variations with depth. As this method uses a time migration algorithm, and hence applies a pseudo depth conversion before migration, it is extremely sensitive to lateral velocity variation. For this reason a minimum velocity function (extracted from the original velocity field) is used to migrate the data. A second "residual" migration is therefore required using a residual velocity field derived from the difference between the original velocity field and minimum velocity function. The finite difference algorithm is used for this residual phase. The advantage of this method is accurate imaging of steep dips.

The data was migrated using the percentages of the second pass velocity trend smoothed over 300 CDPs :-

Modified Residual Migration produced the best result. Further tests were then carried out to determine the best velocity to correctly migrate events. The following percentage velocities migration were produced:

Trial	% of stacking velocity
1.	105%
2.	100%
3.	95%
4.	90%
5.	85%

From these trials the following time-percentages were selected:

Modified Residual Migration

Time (ms)	%
0	100
1000	100
3000	100
6000	100

5.12. TIME VARIANT FILTERS

Filtered panels were produced over a stacked portion of the line. From these a time variant filter was devised.

Time (ms)	Low cut (Hz)	Slope (dB/octave)	High Cut (Hz)	Slope (dB/octave)
0	12	18	90	36
500	10	18	90	36
1000	8	18	90	36
2000	6	18	80	36
3000	5	18	50	36
4000	5	18	40	36
6000	5	18	35	36

5.13. SCALING

Gain tests were produced with the following AGC windows:

Trial	Scaling
1.	No scaling
2.	500 ms
3.	1000 ms
4.	2000 ms
5.	4000 ms
6.	6000 ms
6.	Expanding window AGC

The expanding windows AGC was chosen with control points as follows:

Start Time (ms)	**Window Length (ms)**
0	100
1000	600
6000	1000

6 PROCESSING SEQUENCE

6.1. POLARITY

The data for all vintages were recorded to conform with the SEG standard for causal seismic data (Sheriff, R.E., Encyclopaedic Dictionary of Exploration Geophysics, Third Edition) whereby 'the onset of a compression from an explosive source is represented by a negative number'. This recording polarity was maintained throughout the processing sequence.

6.2. FORMAT CONVERSION

The field data were converted to WGC Code 4 format. Full word, 32 bit floating point data with geophone amplitude maintained.

6.3. RESAMPLE

The data were resampled from an acquisition sampling rate of 2ms to a processing sample rate of 4ms. To avoid any aliasing resulting from this resample, a minimum phase anti-alias high cut filter of 93.75 Hz with a slope of 36 dB/octave was applied.

6.4. STATIC CORRECTION

A -81 ms correction was applied to compensate for an acquisition delay.

6.5. DATA INTEGRITY QC

Displays of near trace sections and shot records of each line were produced to identify bad channels and shots.

To assist with quality control, a QC attribute plot representing amplitudes was also used to identify bad data.

6.6. FIELD DATA EDITS

Records flagged as bad in the Observer's logs or as displayed in the near trace gather and QC attribute plots were edited from the processing sequence.

6.7. ZONE ANOMALY PROCESSING (ZAP)

Displays of selected shots and near trace gathers showed the data was contaminated with spikes. It was decided to use ZAP which is an automated routine to remove anomalous amplitudes. ZAP is applied in three stages:

1. The RMS amplitude is determined over specified windows for each trace within a shot.
2. The calculated RMS values are then decomposed into source, receiver, geology and offset components in a surface consistent manner using the Gauss-Seidel method.
3. The calculated RMS value for each window derived from stage 2 is compared with the actual value measured in stage 1. A scalar is then designed and applied in a surface consistent, time varying manner to reduce anomalously high amplitude data (including spikes) to normal levels.

ZAP successfully attenuated the spikes.

6.8. SPHERICAL DIVERGENCE

To correct for spherical spreading, the inverse of the amplitude decay factor (A) was applied to the data using the following velocity function :-

Time (ms)	Velocity (m/s)
0	1500
100	1500
200	1550
500	2100
800	2300
1600	2450
2400	2850
3600	3500
6000	4300

6.9. GAIN CORRECTION

A gain correction of 3 dB/sec was applied from 0 to 5 seconds.

6.10. DIP FILTERING (FK) - SHOT DOMAIN

The following NMO FK filter designs were used to attenuate linear noise present on shot records:-

Trace Spacing	Pass zone	Taper
15.24 m	-/+ 3.66 ms/trace	7.32 ms/trace

NMO was applied prior to FK filtering with the velocity function used for spherical divergence. A removable AGC of 300ms was also applied prior to FK filtering.

6.11. ADJACENT TRACE SUM

A 3:1 adjacent trace sum was carried out with full NMO applied using the velocity function employed prior to FK filtering.

Input	**Ouput**
252 channels	84 channels

6.12. DESIGNATURE

Designature was applied using the following parameters:

Wavelet Length:	400 ms
Output Frequency:	5HZ/18dB/oct - 93Hz/36dB/oct
Output Phase:	zero

6.13. FIRST PASS VELOCITY ANALYSIS

Velocity analyses were carried out at 2km intervals along each line. Twenty-one adjacent CDPs were selected at each location.

6.14. F-K MULTIPLE ATTENUATION FILTER (MAFK)

MAFK was applied using the following reduced percentage of the velocity trend.

Time (ms)	**% of first pass trend**
0	92
6000	92

6.15. DECONVOLUTION BEFORE STACK

Predictive deconvolution was applied on a trace by trace basis to compress the time duration of seismic wavelet and restore frequency components weakened and dispersed while propagating in an inhomogeneous and attenuating medium - the earth.

Deconvolution was applied using the following parameters over one window for all vintages:

Gap:	48 ms
Operator:	248 ms
Window:	300-3400 ms (near offset)

6.16. SECOND PASS VELOCITY ANALYSIS

DMO velocity analyses were produced at 1 km intervals along each survey line. The first pass velocity trend was used as the central function.

6.17. INSTANTANEOUS AGC GAIN

Automatic gain compensation was applied sample by sample with a 6000 ms gate.

6.18. DIP MOVEOUT (DMO)

Reflections which emanate from a horizon with zero dip are all zero offset, and true stacking velocities can be calculated. However, if the horizon is dipping, reflection point dispersal occurs up dip of the true zero offset location. True stacking velocities cannot be calculated and the horizon will be inaccurately imaged using traditional processing methods.
To move finite offset data down dip to true zero offset, Dip Moveout (DMO) is used.

DMO is carried out on NMO corrected data sorted to common offset. It is a wave theoretical process that converts the NMO corrected data to zero offset independent of dip. After DMO has been applied, all dipping events will be correctly imaged by post stack migration. A useful by-product of DMO is the dispersive effect it has on coherent noise.

For second pass velocity analysis, the data were sorted to common offset. NMO correction was then applied using first pass velocities. DMO was then carried out (with the high-fidelity option turned on) using a 110 trace operator with a maximum dip limit of 60 degrees for all vintages.

6.19. NORMAL MOVEOUT APPLICATION, MUTING AND DMO STACK

The normal moveout corrections for the second pass stacks were computed from the picked second pass velocities. The calculations were performed independently for each line using a straight ray computation method. DMO was applied to the data, and a stacked output produced.

Prior to DMO the following outer and inner trace mutes were applied:-

Outer	Time (ms)	4	450	1300	2200	3300
	Offset (m)	300	333	1098	2568	3933
Inner	Time (ms)	1500	2000	2500	6000	
	Offset (m)	107	750	1000	1050	

6.20. GUN AND CABLE STATICS CORRECTION

To compensate for the depth of the gun and cable below sea level, the following combined correction was applied :

Correction: -8 ms

6.21. MODIFIED RESIDUAL MIGRATION

Modified Residual Migration consists of migrating the data twice. An Extended Stolt (FK) Migration is applied to the data first. This is accurate to 90 degrees, even with velocity variations with depth. As this method uses a time migration algorithm, and hence applies a pseudo depth conversion before migration, it is extremely sensitive to lateral velocity variation. For this reason a minimum velocity function, extracted from the original velocity field, is used to migrate the data. A second "residual" migration is therefore required using a residual velocity field derived from the difference between the original velocity field and minimum velocity function. The finite difference algorithm is used for this residual phase. The advantage of this method is accurate imaging of steep dips.

The data was migrated using the time variant percentages of the final pass velocity trend smoothed over 300 CDPs :

Time (ms)	**%**
0	100
6000	100

6.22. TIME VARIANT FILTER

The following zero phase time variant filter was applied to all vintages:-

Time	**Low cut**	**Slope**	**High Cut**	**Slope**
(ms)	**(Hz)**	**(dB/octave)**	**(Hz)**	**(dB/octave)**
0	12	18	90	36
500	10	18	90	36
1000	8	18	90	36
2000	6	18	80	36
3000	5	18	50	36
4000	5	18	40	36
6000	5	18	35	36

6.23. SCALING

The following gain with expanding overlapping windows was applied:

Start Time (ms)	**Window Length (ms)**
0	100
1000	600
6000	1000

7 APPENDICES

7.1. DELIVERABLE ITEMS

7.1.1. Archive Tapes

One copy of final migrated data was produced on exabyte (2.5g):-

CLIENT:	**Boral Energy**
SURVEY:	BHA96 & BHB96
LINES:	ALL LINES
AREA:	BASS BASIN T/25A & T/18P
FORMAT:	SEGY exabyte 2.5g 6000ms @ 4ms
DATE:	**24 April 1996**

One copy of raw migrated data was produced on exabyte (2.5g):-

CLIENT:	**Boral Energy**
SURVEY:	BHA96 & BHB96
LINES:	ALL LINES
AREA:	BASS BASIN T/25A & T/18P
FORMAT:	SEGY exabyte 2.5g 6000ms @ 4ms
DATE:	**January 1997**

One copy each of raw and filtered stack data were produced on exabyte (2.5g):-

CLIENT:	**Boral Energy**
SURVEY:	BHA96 & BHB96
LINES:	ALL LINES
AREA:	BASS BASIN T/25A & T/18P
FORMAT:	SEGY exabyte 2.5g 6000ms @ 4ms
DATE:	**January 1997**

[CONTINUED OVERPAGE]

DMO gather data for lines BHB96-100 and BHB96-108 were produced on exabyte (2.5g):

CLIENT:	**Boral Energy**
SURVEY:	BHB96
LINES:	BHB96-100, BHB96-108
AREA:	BASS BASIN T/25A & T/18P
FORMAT:	SEGY exabyte 2.5g 6000ms @ 4ms
DATE:	**24 April 1996**

7.1.2. Velocity Data

A diskette comprising 2nd pass DMO velocities for all lines in ascii format was supplied along with the picked paper DMO velocity analyses.

7.1.3. Films

The final filtered stack and migration outputs were displayed as follows :-

Filtered and Scaled Stack - on film with two accompanying prints

Horizontal Scale	1:25 000
Vertical Scale	3.75 in/s
Display Polarity	Negative numbers displayed as trough
Display Gain :	11 dB

Filtered and Scaled Migration - on film with two accompanying paper prints

Horizontal Scale	1:25 000
Vertical Scale	3.75 in/s
Display Polarity	Negative numbers displayed as trough
Display Gain :	11 dB

7.2. LINE SUMMARY

No.	LINE	FSP	LSP	DIR	KM
1	HBA96-100	1828	908	318.0	21.05
2	HBA96-101	1001	1755	53.4	17.26
3	HBA96-102	1010	1880	127.8	19.91
4	HBA96-103	1001	2265	47.5	28.92
5	HBA96-104	1680	917	322.6	17.47
6	HBA96-105	2090	917	227.1	26.84
7	HBA96-106	1552	917	313.8	14.54
8	HBA96-107	2041	917	226.5	25.72
9	HBA96-108	1001	1713	133.9	16.3
10	HBA96-109	1001	1693	46.8	15.84
11	HBA96-110	1544	606	306	21.47
12	HBA96-111	1001	2248	16.6	28.53
13	HBA96-112	1001	1665	139.3	15.2
14	HBA96-113	1965	917	225.1	23.98
15	HBA96-114	1684	917	321.3	17.56
16	HBA96-115	1001	2194	44.6	27.29
17	HBA96-116	1722	917	321.4	18.43
18	HBA96-117	2055	917	224.8	26.04
19	HBA96-118	1001	1798	141.9	18.24
20	HBA96-119	1001	2093	44.6	24.99
21	HBA96-120	1697	917	323.3	17.85
22	HBA96-121	1001	1522	43.8	11.93
23	HBA96-122	1001	1773	144.6	17.67
24	HBA96-123	1959	917	222.9	23.84
25	HBA96-124	1685	917	326	17.58
26	HBA96-125	1439	917	223.7	11.96
27	HBA96-126	1001	1764	147.8	17.47
28	HBA96-127	1441	917	224	12
29	HBA96-129	1001	1523	43.9	11.96
30	HBA96-131	1001	1885	44.2	20.23
31	HBA96-133	1539	917	224.3	14.24
32	HBA96-135	1001	1558	44.3	12.76
33	HBA96-137	1551	917	223.6	14.52

No.	LINE	FSP	LSP	DIR	KM
34	HBA96-139	1001	1523	44.4	11.96
35	HBA96-141	1439	917	223.9	11.96
36	HBA96-143	1001	1568	43.6	12.98
37	HBB96-100	1001	2187	145.4	27.13
38	HBB96-101	1001	2503	55.2	34.36
39	HBB96-102	2105	917	322.4	27.18
40	HBB96-103	2713	917	235.7	41.08
41	HBB96-104	1535	917	324	14.15
42	HBB96-105	2710	917	235.3	41.01
43	HBB96-106	1001	1618	144.9	14.13
44	HBB96-107	1000	2792	54.9	40.99
45	HBB96-108	1535	917	324.2	14.15
46	HBB96-109	1558	917	235.7	14.68
47	HBB96-110	1001	1618	143.3	14.13
48	HBB96-111	1001	1666	54.6	15.22
49	HBB96-112	1535	917	322.8	14.15
50	HBB96-113	1586	917	234.3	15.32
51	HBB96-114	1001	1752	141	17.19
52	HBB96-115	1004	1654	53.1	14.88
53	HBB96-116	1668	917	321	17.19
54	HBB96-117	1503	917	234.1	13.42
55	HBB96-118	1001	2219	142	27.87
56	HBB96-119	1001	1598	54.9	13.67
57	HBB96-120	1875	917	322.8	21.92
58	HBB96-121	1001	1829	55.6	18.95
59	HBB96-122	1001	1610	144.9	13.94
60	HBB96-123	1616	917	234.9	16
61	HBB96-124	1523	917	325	13.88
62	HBB96-125	1615	917	234.3	15.98
63	HBB96-127	1001	1698	53	15.96
64	HBB96-129	1510	917	233.7	13.58

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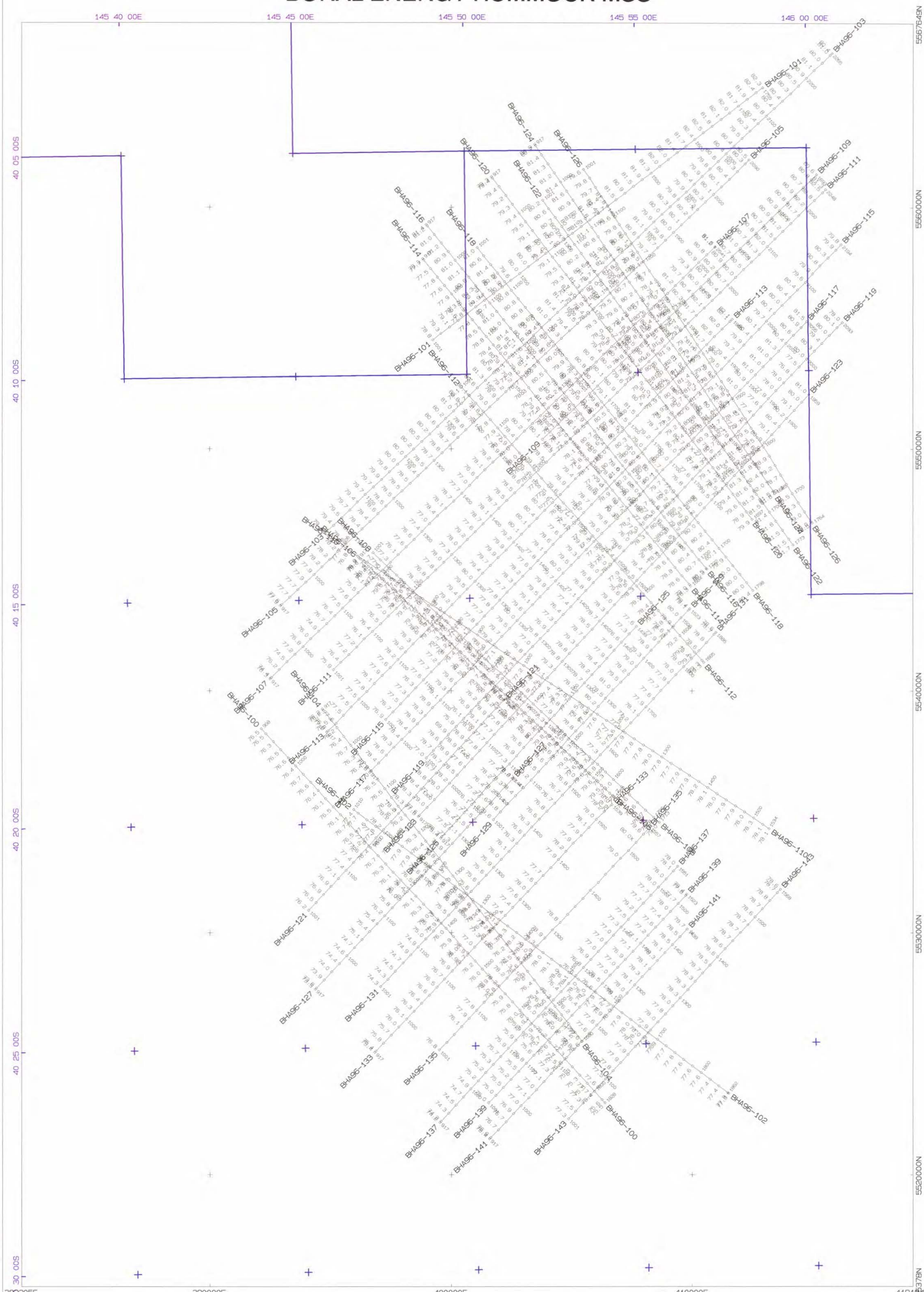
BORAL ENERGY HUMMOCK MSS



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KILOMETRES

UNIVERSAL TRANSVERSE MERCATOR PROJECTION
AUSTRALIAN NATIONAL SPHEROID
CENTRAL MERIDIAN 147 00 00E

5 cm

BORAL ENERGY

PERMIT T/25P, BASS BASIN, TASMANIA

Water Bottom Depth
T/25P
(metres)

OR-427

MapSheet: 96SEISMIC_DCR		Grid Size :	Drafted By :
Generated By : dcr	Datum : M.S.L.	Smoothing :	Checked By :
Author : dcr/wst	Contour Int.:	Scale: 1:100000	Plan No.:
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PH: 8235 3737 Fax:8235 1851 Interstate prefix (08) International prefix (618) A.C.N. 007 845 338