AquaEnergy Group Ltd.

An Ocean Energy division of Finavera Renewables Limited

December 7, 2006

168.0001.0200

Magalie Roman Salas, Secretary
Federal Energy Regulatory Commission
888 First Street, NE, Room 62-52
Washington, D.C. 20426

VIA FEDEX

Subject: **Makah Bay Offshore Wave Energy Pilot Project (FERC Docket No. ~~DI02-3-002~~) – Study Information**

P-12751-000

Dear Secretary Salas:

AquaEnergy Group, Ltd (AquaEnergy) submitted its License Application for an original license for a minor water power project, FERC Docket No. DI02-3-002, on November 7, 2006. On several occasions, the License Application references two studies that were conducted during this licensing process. The *Environmental Assessment Seabed Survey* was conducted by Thales GeoSolutions, Inc. and it is dated October, 2002. Another report that provides information related about current measurements, wave measurements, sediment sampling, and wind and river discharge data, is titled *Makah Bay Offshore Wave Energy Pilot Project*. The study was conducted by Evans Hamilton, Inc. and is dated March, 2006.

You will find attached, two original hardcopies and eight electronic copies of the subject study information on individual compact disks. If you have any questions about this submittal, please contact Mary Jane Parks at mjparks@finavera.com or me at 425-430-7924.

Sincerely,
AquaEnergy Group, Ltd.

A. Weinstein

Alla Weinstein
Chief Executive Officer

AW/AC/elt
Enclosures

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THALES

AquaEnergy Group Ltd.

Environmental Assessment
Seabed Survey

P-12751-000

Makah Bay

Washington

Report

Thales Document No: TGP-2577-RPT-01-00

Applicable to:	Thales GeoSolutions (Pacific), Inc.
Controlled by:	Survey Manager Thales GeoSolutions (Pacific), Inc. 3738 Ruffin Road San Diego, CA 92123
Telephone:	(858) 292-8922
Facsimile:	(858) 292-5308

REPORT CERTIFICATION FOR

Environmental Assessment Seabed Survey

Makah Bay, Washington

Final Report

TGP-2577-RPT-01-00

This issue of the report has been approved by:

1. Project Manager Roland Poeckert
2. Data Center Supervisor Carol McKenzie

This report has been distributed to:

1. AquaEnergy Group Ltd. 1 Copy
2. Sound and Sea Technology 1 Copy

The following versions of this report have been issued:

0	10/18/02	Makah Bay	RP	CMcK	
REV	DATE	DESCRIPTION	APPROVED		

CONTENTS

2.3 CALIBRATIONS AND QUALITY CONTROL

In addition to the online QC tools and displays available in both TEI's Isis and Thales GeoSolution' WinFrog, described in previous sections, the following calibrations and checks were also conducted.

2.3.1 Vessel Offset Survey

A survey of the vessel was undertaken after all equipment was mobilized, and the exact offsets between the various sonar systems and sensors could be measured. Results are given in Appendix H.

2.3.2 MBES Patch Test Calibration

MBES patch test calibrations were carried out to derive the mounting offsets between the sonar head and motion reference units. Procedures for acquiring patch test data can be found in Appendix I.

Patch test lines were acquired prior to survey. Additional lines were acquired to aid in determination of roll offset, after survey operations were complete. Patch test values are applied in processing. Processing method and patch test results can be found in Section 3.1.1.5.

2.4 DATA QUALITY

Throughout the survey, the quality of all data was generally good. However, some limiting factors were experienced. A significant swell in the shallower areas degraded the MBES data to some extent. However, this was mitigated somewhat by having more than 100% coverage.

The SBP data quality is good. Some records show acoustic penetration of the seabed to over 10 meters (see the example in Appendix M).

3 DATA PROCESSING

The data were processed in Thales GeoSolutions' San Diego office.

3.1 BATHYMETRY

All soundings were processed using CARIS's Hydrographic Information Processing System (HIPS) on Windows 2000 workstations. CARIS was used to clean data, produce Digital Terrain models (DTM's) and generate contours for chart production.

Thales GeoSolutions' Chart-X software and AutoCAD Map R5.0 were utilized for contour labeling and charting.

3.1.1 Corrections to Bathymetry Data

Within CARIS HIPS, Reson 8101 soundings were corrected for calibrated patch test results, vessel offsets, vessel motion, draft, sound velocity and tide.

3.1.1.1 Vessel Offsets

Offsets established during the Vessel Offset Survey (Section 2.3.1), were used to correct bathymetry to compensate for differences between the transducer head and GPS antenna position. Offsets are detailed in Appendix H. Offsets were entered in to the Vessel Configuration File in CARIS HIPS, so that CARIS could correct the bathymetry during processing.

3.1.1.2 Sound Velocity Profiles

Processed sound velocity profiles (SVP) were used to correct bathymetry for sound refraction, or ray bending. SVP data was collected at the times and locations listed in Appendix F, and a sample profile is shown in Figure 2-2.

SVP's were applied within CARIS. Thales GeoSolutions (Pacific), Inc.' SVP 1.2 Processing Software was used to process the SVP data set, removing duplicated points and noise, to generate a smooth interpolation curve that depicted the original profile at the finest resolution available in CARIS.

3.1.1.3 Static Draft

Static draft observations were measured from both sides of the M/V Quicksilver. The two measurements were averaged to obtain the static draft correction and the correction was then applied to bring soundings from the transducer level to the water level.

The static draft value was entered in to the Vessel Configuration file within CARIS. It should be noted that draft is actually distance from the common reference point (CRP) to the water level; CARIS takes into account the distance from the CRP to the transducer head in its calculations as well.

3.1.1.4 Tides

All sounding data was reduced to Mean Lower Low Water (MLLW) by CARIS using NOAA Observed Preliminary Tide data from Gauge No. 9443090, Neah Bay, WA. Summarized tidal data is located in Appendix J.

3.1.1.5 Patch Test

Patch tests were completed for both MBES using seafloor topology to bring swaths run at varying speeds, headings, and overlaps into coincidence. Patch tests are employed so that data can be corrected for navigation timing, pitch, azimuth and roll offsets, which may exist between the MBES transducer and the MRU.

The navigation time error adjustment was performed on sets of two coincident lines, run at different velocities, in the same direction over sloping terrain or a conspicuous topographic feature. The nadir beams from each line were compared and brought in to alignment, by adjusting the timing error value.

The pitch error adjustment was performed on sets of two coincident lines, run at the same velocity, over sloping terrain or a conspicuous object, in opposite directions. The navigation time error was already identified. The nadir beams from each line were compared and brought in to alignment, by adjusting the pitch error value.

The azimuth error adjustment was performed on sets of two lines, run over a conspicuous topographic feature. Lines were run in opposite directions, at the same velocity with the same outer beams crossing the feature. The navigation time error and pitch error were already identified. Data from the same outer beams for each line were compared and brought in to alignment, by adjusting the azimuth error value.

The roll error adjustment was performed on sets of two coincident lines, run over flat terrain, at the same velocity, in the opposite direction. The navigation time error, pitch error and azimuth error were already identified. Data across a swath was compared for each line and brought in to agreement, by adjusting the roll error value.

Patch test data was then corrected using the identified values, and the process repeated to check their validity.

Patch Test values were obtained in CARIS HDCS calibration mode. Calculated values were then entered in to the Vessel Configuration file so that data could be corrected during the processing procedure. Correction values used are given in Table 3-1.

Table 3-1 Patch Test Results

Test	Correction
Navigation Timing Error	0.00 sec
Pitch Offset	0.00°
Azimuth Offset	+2.10°
Roll Offset	+0.05°

3.1.2 Cleaning

The XTF files were converted to CARIS HIPS format for bathymetry processing. Prior to each survey line being converted from XTF to CARIS's HIPS format, the vessel offsets, patch test calibration values and static draft measurements were entered into the vessel configuration file. Once converted, the SVP files were loaded into each line and the line corrected for sound refraction. During SVP correction the bathymetry was also corrected for dynamic vessel heave, pitch, and roll. The attitude, heading, navigation, and bathymetry data were examined for noise and gaps. Nadir beam filters were used to reject data from the outer reaches of the swaths. It should be noted that rejection does not mean deletion from the data set; soundings were simply flagged as 'rejected', and could be re-accepted if necessary.

After each individual line was examined and cleaned in CARIS's Swath Editor (Figure 3-1), the tide file was loaded and the lines merged. During merging, tide and draft corrections were applied. Subsets were then created in CARIS's Subset Edit mode (Figure 3-2) and adjacent overlapping lines of corrected bathymetry data examined to identify any tidal busts, sound velocity errors, motion errors, and data gaps. Any residual noise in the data set was also rejected at this time.

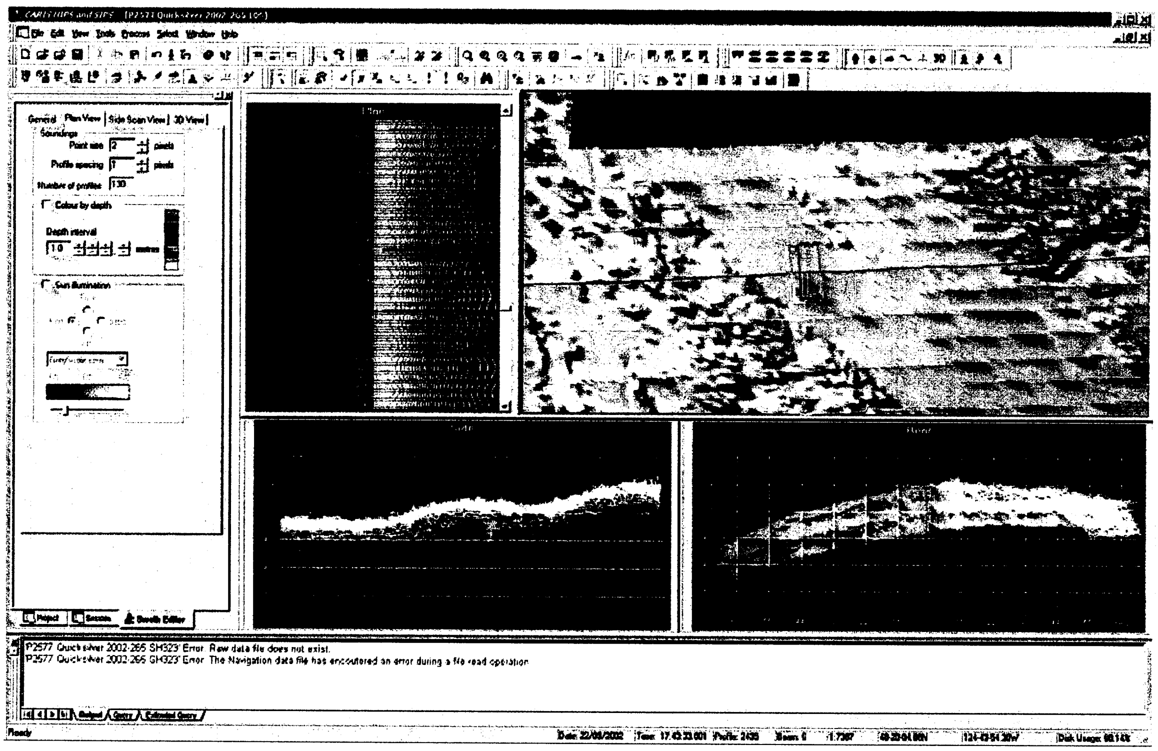

Figure 3-1 CARIS Swath Editor

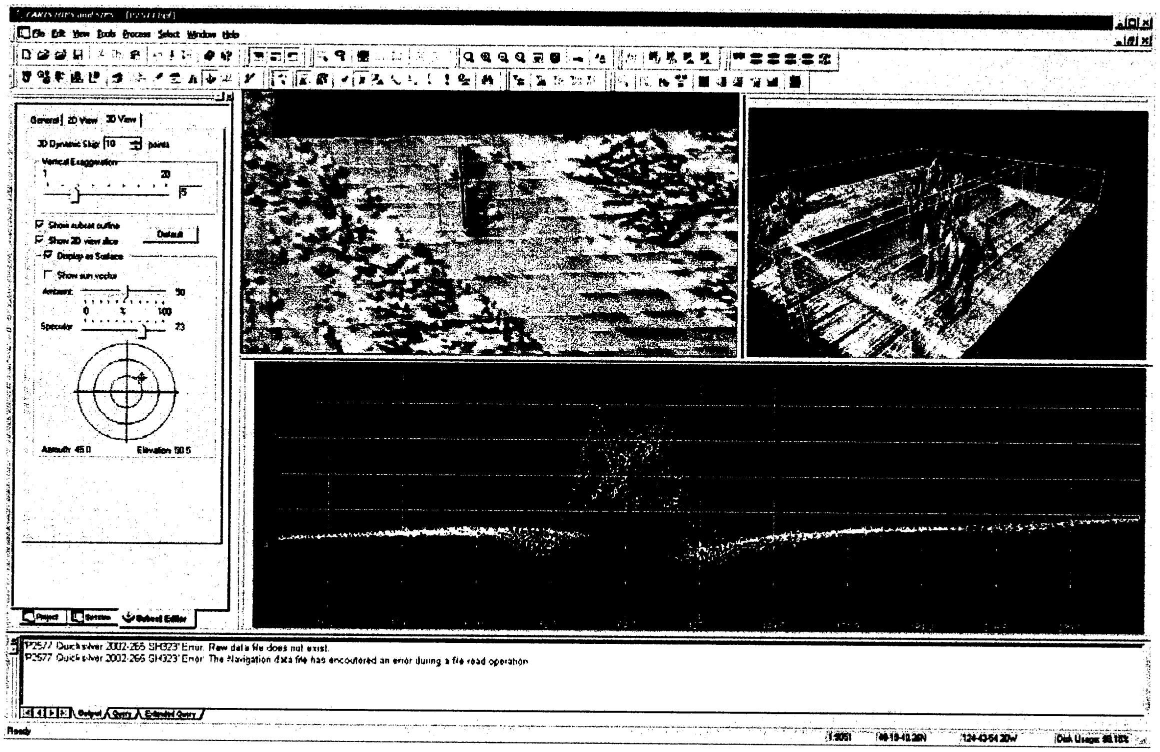

Figure 3-2 CARIS Subset Editor

3.1.3 DTM and Contour Production

After data were cleaned in both Swath Editor and Subset Mode, a DTM grid was created at 5m resolution in CARIS for contour production.

The grids created within CARIS were mean weighted grids, thus depicting a mean seafloor. Two weighting methods were used in grid creation, range weighting and grazing angle weighting.

Range weighting is based on a sounding's distance from a grid node, where soundings located closer to the node have a greater weight than soundings further away. The number of grid nodes that each sounding influences is determined by the size of the beam footprint. The beam footprint is calculated using water depth, MBES beam width, and grazing angle. Therefore, MBES type is taken in to account during DTM creation.

Grazing angle weighting is based on a beam's intersection angle with the seafloor, whereby a higher weight is given to beams from the inner part of a swath than to outer beams from adjacent track lines. This weighting value is important in areas with adjacent or overlapping track lines.

Sun-illuminated images of the grid were created within CARIS using the image manager. These images were then exported as geotiff files.

Once the DTM was generated, it was utilized to create contours at 1m intervals using the CARIS Fieldsheet Contour Wizard. Contours were exported from CARIS in DXF format and imported into Thales' Chart-X software for charting.

3.2 BACKSCATTER

Backscatter data were processed and mosaicked using TEI's Isis Sonar, BathyPro and DelphMap. Figure 3-3 illustrates the backscatter processing data flow.

3.2.1 Corrections to Backscatter Data

3.2.1.1 Vessel Offsets and Vessel Motion

Original XTF files logged by TEI's ISIS contained position relative to the primary GPS antenna. To correctly geo-encode and process the backscatter, position needed to be relative to the MBES transducer. Using Thales' Chart-X software, MBES transducer position was calculated from the GPS antenna position as logged in the WinFrog RAW files, taking in to account the measured vessel offsets and vessel motion. New ASCII MBES position files were exported from Chart-X and this navigation was inserted to create new XTF files using TEI's NavInXtf utility.

3.2.1.2 Gain Corrections

Time Varied Gain curves (TVG) were set to compensate for signal strength variations. The resulting compensated data more accurately indicates the true variations in seabed reflectivity across the area surveyed.

Bottom tracking settings were adjusted to ensure correct tracking of the seabed. Once the bottom tracking was correctly set, the water column was removed from the data set by applying a slant range correction.

3.2.1.3 Terrain Correction

Backscatter data from the Reson 8101 were terrain-corrected in TEI's Isis Sonar software. ASCII XYZ files of generated DTM grid nodes were exported from CARIS. These files were imported into TEI's BathyPro software and a DTM generated that could be recognized by TEI's software suite. The DTM was then used by TEI's Isis and DelphMap when mosaicking the backscatter data.

3.2.2 Mosaic Creation

A mosaic of backscatter data at 1m resolution was created using TEI's ISIS Sonar and DelphMap. DelphMap allows lines to be layered in any order; therefore, lines were mosaicked individually then put in the most desirable order before merging into one final mosaic. Once a mosaic was finalized within DelphMap, it was exported in GeoTiff format and imported to AutoCAD Map R5.0 for interpretation and charting.

Boundaries between lithologic units were defined during the interpretation process. For final charting, isolated rocks and other sonar targets were also identified.

3.3 SUB BOTTOM PROFILES

Sub bottom profile data was processed using TEI's DelphSeismic and SeismicGIS programs. Sub-bottom data records were reviewed and vessel offsets were applied to the digital sub-bottom profiler records.

Filters were applied in TEI's DelphSeismic to suppress noise, while Time Varied Gains (TVG's) were adjusted to highlight reflectors. Filter and gain values varied with depth, ambient noise and sea-state. Vessel offsets were also applied. Geo-encoded sub-bottom images were then created by DelphSeismic and viewed in SeismicGIS. These images were linked to a DelphMap window containing the backscatter mosaic of the survey area, which aided interpretation. The maximum sediment thickness across the survey area was measured and the continuity of reflectors noted.

Sediment thickness, along with position, was exported to an ASCII file. This file was then gridded to generate isopachs, using the Quicksurf DTM utility within AutoCAD. Isopachs created in AutoCAD were then imported in to Thales' Chart-X software, for labeling and final charting.

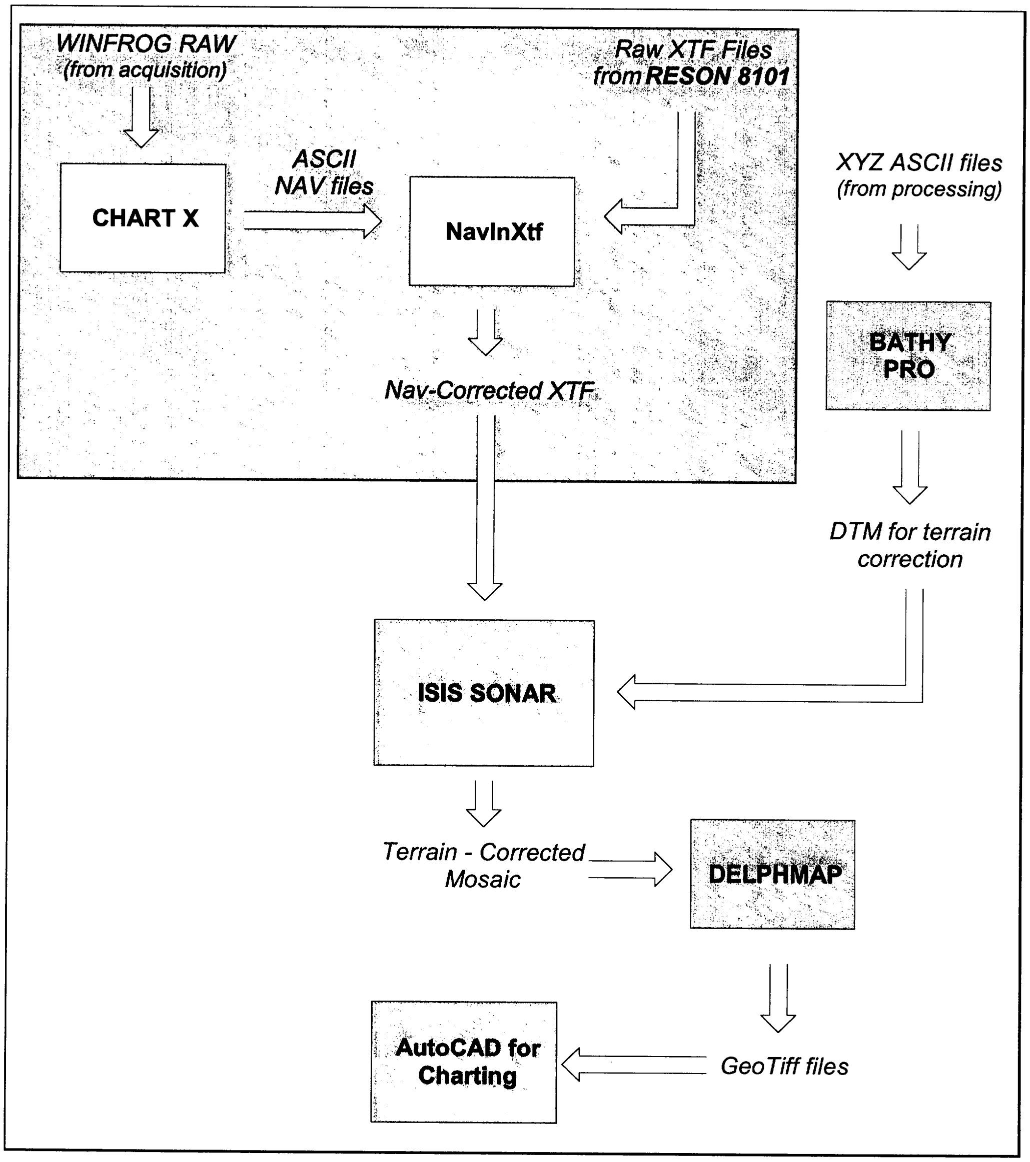

Figure 3-3 Backscatter Data Processing Flow

4 CHARTING AND DATA PRODUCTS

The majority of the charting was carried out using Thales' Chart-X software. The software was used to generate chart backgrounds, legends and all vector data layers. It was also used to perform cartographic edits, such as name placement, line width modifications, etc... However, for final production, all charts were converted from Chart-X format to AutoCAD Map R5.0 DWG format. Once in AutoCAD, raster images were inserted, including backscatter mosaics and sun-illuminated bathymetry. Any remaining minor cartographic edits were also made at this time.

4.1 FINAL PRODUCTS

After final processing was completed at Thales GeoSolutions (Pacific) San Diego office, the following final deliverables for the survey were provided:

- Geotiff of sun-illuminated bathymetry for entire survey area at a 5m resolution
- Geotiff of backscatter mosaic for entire survey area at a 1m resolution
- 1:5000 Charts for the entire survey area (Paper, DWG format on CD)
  - 2 x *Bathymetry* charts
  - 2 x *Seabed Features* charts
  - 2 x *Multibeam Backscatter* charts
  - 1 x *Profile* chart (*RPL To be Determined*)
- Report
  - Environmental Assessment Seabed Survey Report (*TGP-2577-RPT-01*) (Paper, PDF on CD)

A full list of charts can be found in Appendix K.

5 RESULTS

5.1 RPL

To Be Determined.

5.2 BATHYMETRY

The bathymetry shows that the seabed on average descends gently from the shore to approximately 50m water depth at the location of the proposed wave-energy power generation facility. Several rock outcrops cross the area, and the relief across these outcrops is very steep locally, with some pinnacles rising over 5 meters from the otherwise relatively flat seabed. An example of this can be seen in the data samples shown in Appendix M. Abrasions on these outcrops could sever a cable. Bathymetry data is shown on the *Bathymetry* charts.

5.3 SEAFLOOR GEOLOGY

The seafloor within the survey area consists primarily of fine-grained sand and silt surrounding large rock outcrops and smaller groups of scattered rock. Sand- to silt-sized sediment covers approximately 60% of the seafloor within the survey boundary, the remaining 40% consisting of rock outcrop.

Multibeam backscatter data reveal large areas of modern sediment surrounding rock outcrop. Coarse-grained, angular sediment blankets much of the rock in a shallow layer and extends minimally beyond the edge of the outcrop. Sub bottom profiler data are consistent with this finding. Ripples are seen locally in the coarse-grained, angular sediment covering the rock. Their wavelength is <2 meters and they occur in an area approximately 50 meters by 200 meters at 15 meters water depth, and are indicated on the *Seafloor Features* chart.

Rock outcrops appear to be crystalline rock, probably mafic in nature based on the regional geology. Gabbro and diorite faulted against pillow basalts and Cretaceous sedimentary layers have been mapped immediately south of the survey area, a good indication as to the nature of the rocks seen here. Northwest trending layers in the rock have been fractured, creating the blocky appearance seen throughout the outcrops. Figure 5-1 illustrates the northwest trend of the rock and the fracturing (distance across lower edge of image is approximately 240m, left side of image is North).

The shape of the western rock outcrop combined with the overall northwest trend of the outcrops together would suggest that tectonic activity has occurred in the area (Figure 5-2). Note the straight, sharp contact between rock and sediment that exists along the seaward edge of the rock.

Figure 5-1 Backscatter image of blocky rock outcrop.

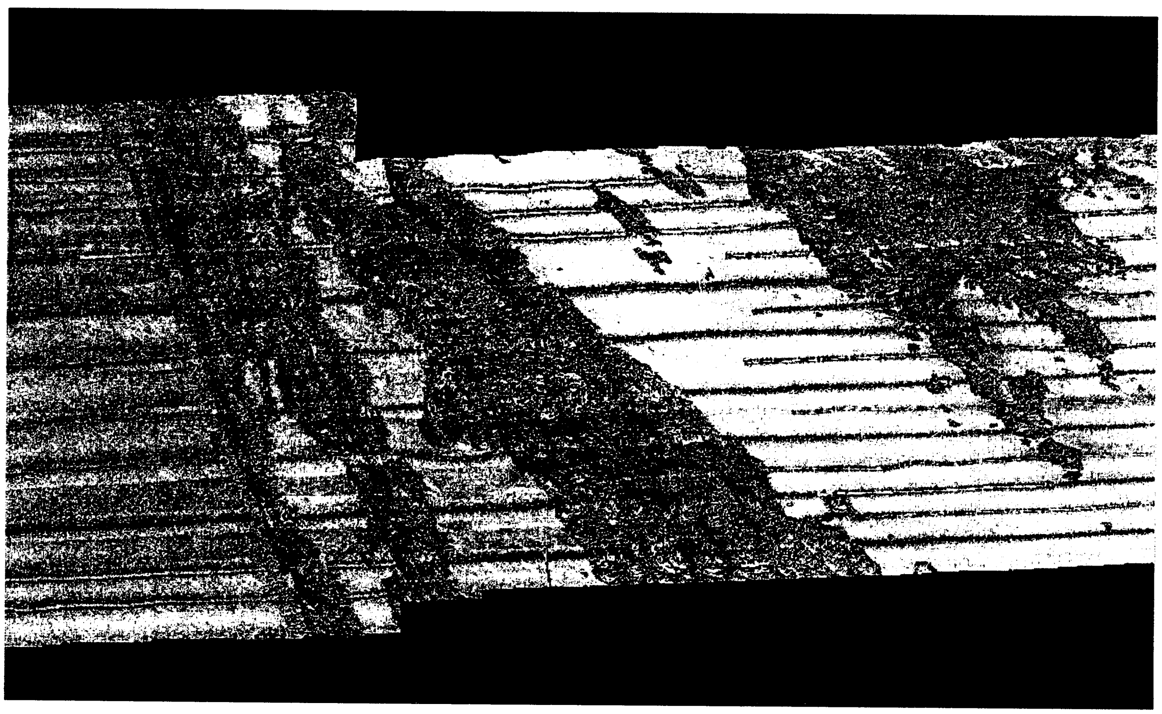

Figure 5-2 Northwest trend of rock outcrop.

The regional geology represents the unique end member of the Cascadia subduction zone, where the Juan de Fuca plate is sliding beneath the North American plate. Therefore, it is known that a large amount of folding and faulting has occurred in the rocks of this area and that a large accretionary complex exists offshore northern

Washington. The Callawah fault (left-slip) is a major fault that has been mapped both onshore and off, and trends northwest through the nearby Makah Reservation and Cape Flattery.

Sediments within the study area grade from fine-grained sand in the inshore area to silt in the seaward portion. There is no distinct boundary between the grain sizes, but the grain size and water depth together indicate that the boundary between the lower beach and inner shelf occurs within the survey area (most likely around 15 to 25 meter water depth).

Sub-bottom profiler data reveal a sediment layer varying in thickness from less than 0.5m at edges of rock outcrop to 11 meters at the western extent of the survey area. At the eastern extent of the survey, sediment is thickest (7 meters) between northern and southern rock outcrops in a small, buried basin. The basin is asymmetrical, deepening steeply from the north and gently from the south. Further to the west, within the interior of the survey area where rock and scattered rock are abundant, sediment thickness is not greater than 2m. Further to the west sediment gently thickens to 5 meters, and then shoals steeply to the edge of another rock outcrop. At the westernmost edge of rock, sediment thickens sharply to approximately four meters, and then begins to thicken gradually to the west to a depth of 11 meters.

Sediment thickness for the entire survey area is illustrated on the *Seabed Features* charts (TGPI-2577-AE-003-NF-000 and TGPI-2577-AE-004-NF-000). Figure 5-3 is taken from an east-west trending line across the southern portion of the survey area and shows shallow sediment layer interrupted by several small rocks.

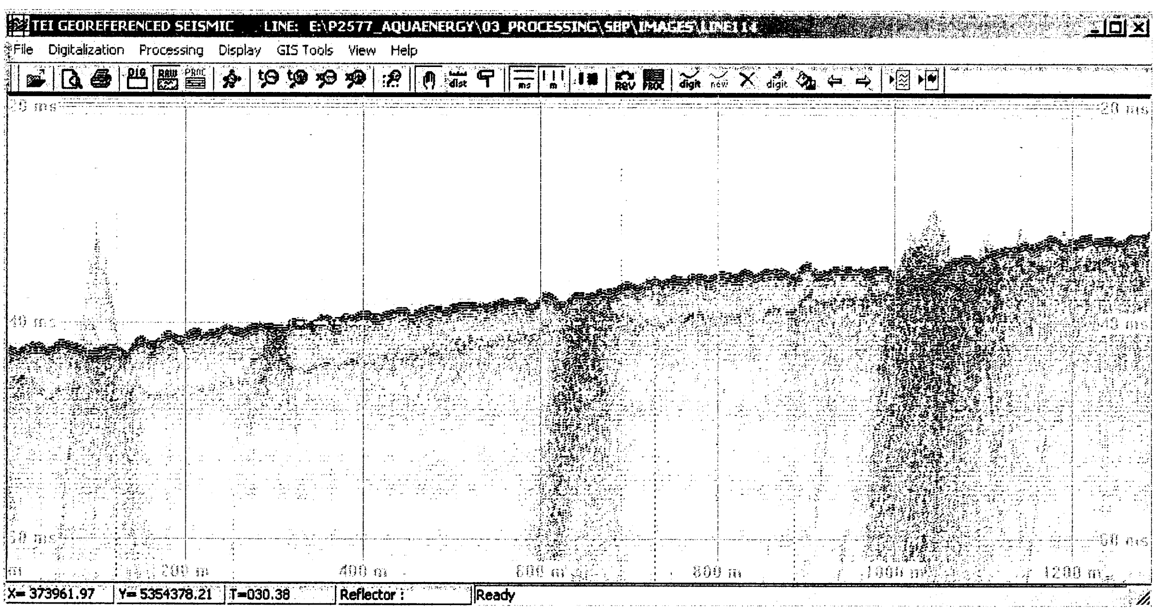

Figure 5-3 Shallow sub bottom data.

Sonar contacts within the survey area are mostly scattered rock adjacent to rock outcrops. Contacts are listed in Table 5-1 and shown on the *Seabed Features* chart. Any feature smaller than 10m and not indicated by sub-bottom profiler data has been identified as a target. This includes features that are most likely rock but that are surrounded by sediment with a thickness greater than 1m. Abrasions on rocks or rock outcrops could sever a cable.

Table 5-1 Sonar Contacts

Target No.	Northing	Easting	W (m)	L (m)	Description
SC01	5354495.4605	371253.2984	4	23	linear feature
SC02	5354236.4379	371330.5302	2.5	12.8	linear feature
SC03	5354211.6958	371323.3438	3.5	10.1	linear feature
SC04	5354357.3397	371983.6931	3.1	4.3	debris or rock
SC05	5354346.2785	371992.8424	3.5	6.5	debris or rock
SC06	5354320.4980	372009.6596	3.2	3.4	debris or rock
SC07	5354958.4382	372069.9076	4	4.4	rock
SC08	5354918.6927	372075.3415	3.6	4.6	rock
SC09	5354816.2557	372185.9065	4.7	8.1	rock
SC10	5354882.7642	372487.9649	1.6	6.8	rock
SC11	5354988.4496	372536.7999	2.2	5.9	rock
SC12	5354986.2603	372581.8436	1.7	2.6	rock
SC13	5354984.0170	372575.5584	1.7	2.7	rock
SC14	5354947.0067	372580.2410	2.2	3	rock
SC15	5354944.0955	372587.5223	1.8	3	rock
SC16	5354815.4682	372670.2631	3.4	8.1	rock
SC17	5354337.2692	375980.0568	2.1	5.6	debris or rock
SC18	5354355.2017	373300.3087	2.7	4.6	rock
SC19	5354322.2081	373302.2504	3.1	3.3	rock
SC20	5354417.1242	373544.4558	3	3	rock
SC21	5354432.4840	373585.5716	1.3	6	rock
SC22	5354703.0980	373586.4436	1.6	3.7	linear feature
SC23	5354625.3384	373888.6148	3.1	4.1	rock
SC24	5354536.2213	373950.6365	3.5	7.3	rock
SC25	5354526.2038	373958.0211	3.2	3.2	rock
SC26	5354528.3127	373990.1972	1.6	3.8	rock
SC27	5354526.2038	374002.3292	4.8	7.1	rock
SC28	5354519.3497	374065.0989	2.2	4.6	rock
SC29	5354496.1513	374179.5614	2.3	5.1	rock
SC30	5354278.5257	375012.9025	1.3	2.5	rock
SC31	5354275.3337	375038.9382	2.5	2.5	rock
SC32	5354342.8458	375075.4061	5.5	7.1	rock or debris

Appendix A : DAILY EVENT LOGS

THALES

Time (UTC)	Survey – Daily Events Log
19 Sep 2002	
14:00	Install MBES and SBP on M/V Quicksilver
20 Sep 2002	
02:00	Installation of MBES and SBP completed
14:00	Continue mobilization of vessel
22:00	Complete mobilization – transit to Shilshole Bay
23:30	Patch test and HDMS calibration run
21 Sep 2002	
01:00	Patch test complete – transit to Shilshole Marina, Seattle, WA
01:30	Arrive Shilshole Marina
02:00	Refueling vessel completed
16:45	Transit from Shilshole Marina, Seattle, WA, to Neah Bay, WA.
22 Sep 2002	
02:26	Conduct HDMS calibration runs
03:00	Arrive at Neah Bay, WA.
14:30	Transit from Neah Bay to Makah Bay
16:45	SOL line 102; Hdg 85°
17:05	EOL – stop at ~10 m WD
17:08	SOL line 104; Hdg 265°
17:25	EOL
17:35	SOL line 106; Hdg 85°
17:54	EOL
17:59	SOL line 108; Hdg 265°
18:01	Abort line due to ISIS crash
18:08	SOL line 108; Hdg 265° - restart line at beginning
18:26	EOL
18:36	SOL line 110; Hdg 85°
18:50	EOL
18:52	SOL line 112; Hdg 265°
19:05	EOL – stop in middle of survey area to conduct SVP cast
19:08	SVP cast
19:14	SOL line 112a; Hdg 265° - resume survey along line
19:22	EOL
19:25	SOL line 114; Hdg 85°
19:47	EOL
19:54	SOL line 116; Hdg 265°
20:18	EOL
20:22	SOL line 117; Hdg 85°
20:29	EOL
20:34	SOL line 100; Hdg 265°
20:40	EOL
20:43	SOL line 101; Hdg 85°
20:48	EOL
20:54	SVP cast
21:54	SOL line 202; Hdg 126° - first of shore parallel survey runs
22:02	EOL

THALES

Time (UTC)	Survey – Daily Events Log
22:04	SOL line 204; Hdg 306°
22:10	EOL
22:16	SOL line 206; Hdg 126°
22:24	EOL
22:28	SOL line 208; Hdg 306°
22:36	EOL
22:40	SOL line 210; Hdg 126°
22:48	EOL
23:08	SOL line 212; Hdg 306°
23:15	EOL
23 Sep 2002	
00:03	SOL line 214; Hdg 306°
00:07	Stop survey – ISIS crash
00:17	SOL line 214a; Hdg 306° - resume survey after ISIS reboot
00:21	EOL
00:25	SOL line 216; Hdg 126°
00:32	EOL
00:34	SOL line 217; Hdg 306°
00:38	EOL – stop survey due to dense kelp bed on line
00:40	SOL line 218; Hdg 126°
00:44	EOL
00:46	SOL line 219; Hdg 306°
00:53	EOL
00:55	SOL line 220; Hdg 126°
01:01	EOL – ISIS crash
01:06	SOL line 115; Hdg 265°
01:18	EOL
01:20	SVP cast
01:24	SOL line 113; Hdg 85°
01:40	EOL
01:50	Transit to Neah Bay
03:20	Arrive at Neah Bay
14:15	Transit from Neah Bay to Makah Bay
15:35	Arrive at Makah Bay
15:40	SOL line 103; Hdg 85°
15:52	Stop survey – ISIS crash
15:58	SOL line 103a; Hdg 85° - resume survey after ISIS reboot
16:05	EOL
16:10	SOL line 105; Hdg 265°
16:20	EOL
16:22	SOL line 107; Hdg 85°
16:32	EOL
16:34	SOL line 109; Hdg 265°
16:38	Stop survey – ISIS crash
16:43	SOL line 109a; Hdg 265° - resume survey after ISIS reboot
16:51	EOL
16:54	SOL line 111; Hdg 85°
17:06	EOL
17:09	SOL line 116a; Hdg 265° - infill
17:20	Stop survey – ISIS crash
17:25	SOL line 116b; Hdg 265° - resume infill survey after ISIS reboot
17:30	EOL

THALES

Time (UTC)	Survey – Daily Events Log
17:39	SVP cast
17:58	SOL line 207; Hdg 306°
18:04	EOL
18:09	SOL line 209; Hdg 126°
18:11	Stop survey – ISIS crash
18:16	SOL line 209b; Hdg 126° - resume survey after ISIS reboot
18:21	EOL
18:28	SOL line 301SH – shallow water shore parallel survey
18:29	Stop survey – ISIS crash
18:34	SOL line 301SHb - resume survey after ISIS reboot
18:41	EOL
18:43	SOL line 302SH
18:50	EOL
18:52	SOL line 303SH
18:55	Stop survey – ISIS crash
18:59	SOL line 304SH
19:06	EOL
19:08	SOL line 305SH
19:14	EOL
19:16	SOL line 306SH
19:17	Stop survey – ISIS crash
19:24	SOL line 306SHb – resume survey line
19:25	Stop survey – WinFrog crash
19:52	SOL line 306SHc – resume survey line
19:57	EOL
20:00	SOL line 307SH
20:05	EOL
20:07	SOL line 308SH
20:10	EOL – lost differential corrections at EOL
20:14	SOL line 309SH
20:19	EOL
20:21	SOL line 310SH
20:27	EOL
20:29	SOL line 311SH
20:31	Stop survey – ISIS crash
20:38	SOL line 312SH
20:42	Stop survey – ISIS crash
20:47	SOL line 313SH
20:50	Stop survey – ISIS crash
21:00	SOL line 314SH
21:05	Stop survey – ISIS crash
21:14	SOL line 315SH
21:16	Stop survey – ISIS crash – check with TEI regarding reasons for ISIS crashes
	Assume that MBES shot rate is too high in shallow water – reduce shot rate from 10 Hz to 5 Hz ?? need to check this as this isn't what the MBES logs reflect – they still say 10 Hz
21:50	Reboot ISIS
21:51	SOL line 213; Hdg 306° - infill
21:58	EOL
22:02	SOL line 315SH; rerun this line from the start (aborted previously due to ISIS crash)
22:10	EOL
22:15	SOL line 316SH
22:23	Stop survey – ISIS crash
22:29	SOL line 317SH

Time (UTC)	Survey – Daily Events Log
22:33	Stop survey – ISIS crash
22:42	SOL line 318SH
22:46	EOL
22:50	SOL line 319SH
22:55	EOL
22:57	SOL line 320SH
23:03	EOL
23:08	SOL line 321SH – reduce shot rate to 4 Hz
23:15	EOL
23:24	SVP cast
23:30	SOL line 322SH
23:31	EOL
23:33	SOL line 323SH
23:38	EOL
23:40	SOL line 324SH
23:45	EOL
23:47	SOL line 325SH
23:53	EOL
23:54	SOL line 326SH
24:00	EOL
24 Sep 2002	
00:02	SOL line 327SH
00:08	EOL
00:10	SOL line 328SH
00:14	EOL
00:16	SOL line 329SH
00:17	Stop survey – ISIS & WinFrog crash
00:43	SOL line 330SH
00:45	EOL
00:47	SOL line 331SH
00:54	EOL
01:05	SOL line 332SH
01:11	EOL
01:13	SOL line 333SH
01:19	EOL
01:21	SOL line 334SH
01:27	EOL
01:28	SOL line 335SH
01:31	EOL – closest approach to shoreline
01:35	SOL line 108b – inshore tie line
01:46	EOL
01:49	SOL line 336SH – infill
01:50	EOL
01:51	SOL line 211 – infill
01:56	EOL
01:58	SOL line 217a – infill
02:01	EOL
02:11	SOL Tie1 – offshore tie line
02:15	EOL
02:22	SOL Tie2 – offshore tie line
02:27	EOL
02:34	SVP cast
02:38	Transit to Neah Bay

THALES

Time (UTC)	Survey – Daily Events Log
03:55	Arrive at Neah Bay
14:30	Depart Neah Bay to conduct patch test
18:20	Arrive back at Neah Bay – hand off patch test data
18:30	Depart Neah Bay – transit to Seattle, WA
25 Sep 2002	
04:00	Arrive at Northlake Shipyard, Seattle, WA
14:00	Demob vessel
19:00	Demob of vessel completed

Appendix B: DAILY PROJECT REPORTS

THALES

Daily Survey Report

VESSEL: M/V Quicksilver
E-mail : roland.poeckert@thales-geosolutions.com
Telephone: +1 858 292-8922
Fax: +1 858 292-5308

Thales GeoSolutions (Pacific), Inc.
3738 Ruffin Road
San Diego, CA

To:	Attn:	Via:
Thales GeoSolutions (Pacific), Inc	William Speidel	e-mail
AquaEnergy	Mary Jane Park	e-mail
Sound & Sea Technology	Dallas Meggitt	e-mail

Project No. P2577 Report No. 001 Date : 19 Sep 2002

Makah Bay

AA. Location at 24:00 UTC: Alongside - Northlake Shipyard, Seattle, WA

BB. Weather summary:

Time (EDT)	Pressure (mb)	Wind (Dir/Knts)	Sea Dir/m	Air Temp °C	Water Temp °C	Visibility nm
0600	in port					
1200	in port					
1800	in port					
2400	in port					

GG. Forecast Winds NW 15 kt; seas 1 m

EE. Event Diary

From (PDT)	To	Description	Code
00:00	07:00	Standby	sbm
07:00	19:00	Install Reson MBES and SBP	md
19:00	24:00	Standby	sbm

THALES

FF. Time summary (hrs:mins): (C1,C4,C5,C6) 19 Sep 2002

Item		Description	Today	Cumulative	Km Today	% of Total	Comment
Mob/Demob	md		12:00	**012:00**		50%	
Transit	tr		00:00	**000:00**	**0.0**		
Standby	sbm		12:00	**012:00**		50%	
Calibrations	cal		00:00	**000:00**			
Operational	op1	Data Acq.	00:00	**000:00**	**0.0**		
	op2	Standby	00:00	**000:00**			
	op3	Weather	00:00	**000:00**			
	tro	Transit	00:00	**000:00**	**0.0**		
Route Development	rda	Additional	00:00	**000:00**	**0.0**		
	rdt	Transit	00:00	**000:00**	**0.0**		
	rdw	Weather	00:00	**000:00**			
Unit Rate Work	urw		00:00	**000:00**			
Standby	sb1	ex-Weather	00:00	**000:00**			
	sbw	Weather	00:00	**000:00**			
	sbo	Other	00:00	**000:00**			
Disputed Time	dd	Downtime	00:00	**000:00**	**0.0**		
	do	Other	00:00	**000:00**	**0.0**		
Re-Runs	rr		00:00	**000:00**	**0.0**		
Breakdown	be	Equipment	00:00	**000:00**			
	bv	Vessel	00:00	**000:00**			
Other Nil Revenue	onr		00:00	**000:00**			
TOTAL			24:00	**0024:00**	**0.0**	**100%**	
Non-Paid/Disputed Time as a % of Accumulated Hrs since end of Mobilisation						0%	

C3. Survey Progress

		Today km	Cumulative km
Estimated survey distance	110.0	0.0	0.0
		Today %	**Cumulative %**
Total Route Development	0.0 km	0.0%	0.0%

Average Speed of Advance over the last 24 Hrs 0.0 Knots

C2. Personnel Onboard

		Total Man Days	No. On/Off Today
Thales:	5	5	5/0
Sub-Contract:	0	0	0
Client:	0	0	0
Ship:	0	0	0

C7. Fuel

	Used Since Last Update	Start	Remaining
IFO -30:	0.0 ton	0.0 Ton	0.0 Ton
MGO:	0.0 ton	0.0 Ton	0.0 Ton
Lube Oil:	0 kg	0 kg	0 kg
Fresh Water:	0.0 ton	0.0 Ton	0.0 Ton

DD. Safety

	Today	Cumulative	Comment
Drills :	0	0	
Incidents :	0	0	
False alarms :	0	0	

JJ. Proposed Work for next 24 hrs.:

Complete mobilisation
Calibrate MBES - patch test
Transit to Neah Bay

Seabed Sampling

Today	0
Cumulative	**0**

Sound Velocity Profiles

	CTD	SVP	XBT
Today	0	0	0
Cumulative	**0**	**0**	**0**

HH. Comments:

TGPI personnel on project: Roland Poeckert, Pete Pelletier, Dale Reynolds, Marcus Ballwebber, Scott Stanley

Note All times are in PDT (GMT-7).

II. Client Comments:

Roland Poeckert
Thales GeoSolutions (Pacific), Inc.

Signed: ____________________

Signed: ____________________

A signed paper copy of this report is retained in the field and constitutes the official Daily Progress Report.

THALES

Daily Survey Report

VESSEL: M/V Quicksilver

E-mail : roland.poeckert@thales-geosolutions.com
Telephone: +1 858 292-8922
Fax: +1 858 292-5308

Thales GeoSolutions (Pacific), Inc.
3738 Ruffin Road
San Diego, CA

To:	Thales GeoSolutions (Pacific), Inc	Attn:	William Speidel	Via:	e-mail
To:	AquaEnergy	Attn:	Mary Jane Parks	Via:	e-mail
To:	Sound & Sea Technology	Attn:	Dallas Meggitt	Via:	e-mail

Project No. P2577 Report No. 002 Date : 20 Sep 2002

Makah Bay

AA. Location at 24:00 UTC: Alongside - Shilshole Marina, Seattle, WA

BB. Weather summary:

Time (EDT)	Pressure (mb)	Wind (Dir/Knts)	Sea Dir/m	Air Temp °C	Water Temp °C	Visibility nm
0600	in port					
1200	in port					
1800		NW/5	<0.5			
2400	in port					

GG. Forecast Winds NW 10-15 kt; seas 0.5 m

EE. Event Diary

From (PDT)	To	Description	Code
00:00	07:00	Standby	sbm
07:00	15:00	Complete mobilisation	md
15:00	16:30	Transit to Shilshole Bay for patch test	tr
16:30	18:00	MBES patch test	cal
18:00	18:30	Transit to Shilshole Bay marina	tr
18:30	19:00	Fuel vessel	md
19:00	24:00	Standby	sbm

THALES

FF. Time summary (hrs:mins): (C1,C4,C5,C6) 20 Sep 2002

Item		Description	Today	Cumulative	Km Today	% of Total	Comment
Mob/Demob	md		08:30	**020:30**		43%	
Transit	tr		02:00	**002:00**	**5.0**	4%	
Standby	sbm		12:00	**024:00**		50%	
Calibrations	cal		01:30	**001:30**		3%	
Operational	op1	Data Acq.	00:00	**000:00**	**0.0**		
	op2	Standby	00:00	**000:00**			
	op3	Weather	00:00	**000:00**			
	tro	Transit	00:00	**000:00**	**0.0**		
Route Development	rda	Additional	00:00	**000:00**	**0.0**		
	rdt	Transit	00:00	**000:00**	**0.0**		
	rdw	Weather	00:00	**000:00**			
Unit Rate Work	urw		00:00	**000:00**			
Standby	sb1	ex-Weather	00:00	**000:00**			
	sbw	Weather	00:00	**000:00**			
	sbo	Other	00:00	**000:00**			
Disputed Time	dd	Downtime	00:00	**000:00**	**0.0**		
	do	Other	00:00	**000:00**	**0.0**		
Re-Runs	rr		00:00	**000:00**	**0.0**		
Breakdown	be	Equipment	00:00	**000:00**			
	bv	Vessel	00:00	**000:00**			
Nil Revenue	onr		00:00	**000:00**			
TOTAL			24:00	**0048:00**	**5.0**	**100%**	
Non-Paid/Disputed Time as a % of Accumulated Hrs since end of Mobilisation						0%	

C3. Survey Progress

		Today km	Cumulative km
Estimated survey distance	110.0	0.0	0.0
		Today %	**Cumulative %**
Total Route Development	0.0 km	0.0%	0.0%

Average Speed of Advance over the last 24 Hrs 0.0 Knots

C2. Personnel Onboard

		Total Man Days	No. On/Off Today
Thales:	5	10	0/1
Sub-Contract:	0	0	0
Client:	0	0	0
Ship:	0	0	0

C7. Fuel

	Used Since Last Update	Start	Remaining
IFO -30:	0.0 ton	0.0 Ton	0.0 Ton
MGO:	0.0 ton	0.0 Ton	0.0 Ton
Lube Oil:	0 kg	0 kg	0 kg
Fresh Water:	0.0 ton	0.0 Ton	0.0 Ton

DD. Safety

	Today	Cumulative	Comment
Drills :	0	0	
Incidents :	0	0	
False alarms :	0	0	

JJ. Proposed Work for next 24 hrs.:

Seabed Sampling / **Sound Velocity Profiles**

	Seabed Sampling	CTD	SVP	XBT
Today	0	0	1	0
Cumulative	**0**	**0**	**1**	**0**

HH. Comments:

TGPI personnel: Scott Stanley left

II. Client Comments:

Roland Poeckert
Thales GeoSolutions (Pacific), Inc.

Signed: ______________________

Signed: ______________________

A signed paper copy of this report is retained in the field and constitutes the official Daily Survey Report.

THALES

Daily Survey Report

VESSEL: M/V Quicksilver

E-mail : roland.poeckert@thales-geosolutions.com
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Thales GeoSolutions (Pacific), Inc.
3738 Ruffin Road
San Diego, CA

To:	Thales GeoSolutions (Pacific), Inc	Attn:	William Speidel	Via:	e-mail
To:	AquaEnergy	Attn:	Mary Jane Parks	Via:	e-mail
To:	Sound & Sea Technology	Attn:	Dallas Meggitt	Via:	e-mail

Project No. P2577   Report No. 003   Date : 21 Sep 2002

Makah Bay

AA. Location at 24:00 PDT: Alongside - Neah Bay, WA

BB. Weather summary:

Time (EDT)	Pressure (mb)	Wind (Dir/Knts)	Sea Dir/m	Air Temp °C	Water Temp °C	Visibility nm
0600	in port					
1200		NE/10	<0.5			
1800		NE/10	1			
2400	in port					

GG. Forecast Winds NW 10-15 kt; seas 0.5 m

EE. Event Diary

From (PDT)	To	Description	Code
00:00	08:00	Standby	sbm
08:00	20:00	Transit to Neah Bay	tr
20:00	24:00	Standby	sbm

THALES

FF. Time summary (hrs:mins): (C1,C4,C5,C6) 21 Sep 2002

Item		Description	Today	Cumulative	Km Today	% of Total	Comment
Mob/Demob	md		00:00	**020:30**		28%	
Transit	tr		12:00	**014:00**	**0.0**	19%	
Standby	sbm		12:00	**036:00**		50%	
Calibrations	cal		00:00	**001:30**		2%	
Operational	op1	Data Acq.	00:00	**000:00**	**0.0**		
	op2	Standby	00:00	**000:00**			
	op3	Weather	00:00	**000:00**			
	tro	Transit	00:00	**000:00**	**0.0**		
Route Development	rda	Additional	00:00	**000:00**	**0.0**		
	rdt	Transit	00:00	**000:00**	**0.0**		
	rdw	Weather	00:00	**000:00**			
Unit Rate Work	urw		00:00	**000:00**			
Standby	sb1	ex-Weather	00:00	**000:00**			
	sbw	Weather	00:00	**000:00**			
	sbo	Other	00:00	**000:00**			
Disputed Time	dd	Downtime	00:00	**000:00**	**0.0**		
	do	Other	00:00	**000:00**	**0.0**		
Re-Runs	rr		00:00	**000:00**	**0.0**		
Breakdown	be	Equipment	00:00	**000:00**			
	bv	Vessel	00:00	**000:00**			
Nil Revenue	onr		00:00	**000:00**			
TOTAL			24:00	**0072:00**	**0.0**	**100%**	
Non-Paid/Disputed Time as a % of Accumulated Hrs since end of Mobilisation						0%	

C3. Survey Progress

		Today km	Cumulative km	Average Speed of Advance
Estimated survey distance	110.0	0.0	0.0	over the last 24 Hrs
		Today %	**Cumulative %**	0.0 Knots
Total Route Development	0.0 km	0.0%	0.0%	

C2. Personnel Onboard

		Total Man Days	No. On/Off Today
Thales:	4	14	0
Sub-Contract:	0	0	0
Client:	0	0	0
Ship:	0	0	0

C7. Fuel

	Used Since Last Update	Start	Remaining
IFO -30:	0.0 ton	0.0 Ton	0.0 Ton
MGO:	0.0 ton	0.0 Ton	0.0 Ton
Lube Oil:	0 kg	0 kg	0 kg
Fresh Water:	0.0 ton	0.0 Ton	0.0 Ton

DD. Safety

		Today	Cumulative	Comment
Drills	:	0	0	
Incidents	:	0	0	
False alarms	:	0	0	

JJ. Proposed Work for next 24 hrs.:

Begin survey at Makah Bay

Seabed Sampling / **Sound Velocity Profiles**

	Seabed Sampling	CTD	SVP	XBT
Today	0	0	0	0
Cumulative	**0**	**0**	**1**	**0**

HH. Comments:

II. Client Comments:

Roland Poeckert
Thales GeoSolutions (Pacific), Inc.

Signed: ______________________

Signed: ______________________

A signed paper copy of this report is retained in the field and constitutes the official Daily Survey Report.

THALES

Daily Survey Report

VESSEL: M/V Quicksilver
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3738 Ruffin Road
San Diego, CA

To:	Thales GeoSolutions (Pacific), Inc	Attn:	William Speidel	Via:	e-mail
To:	Thales GeoSolutions (Pacific), Inc	Attn:	James Hailstones	Via:	e-mail
To:		Attn:		Via:	e-mail

Project No. P2577 Report No. 004 Date : 22 Sep 2002

Makah Bay Environmental Assessment
Seabed Survey

AA. Location at 24:00 PDT: Alongside - Neah Bay, WA

BB. Weather summary:

Time (EDT)	Pressure (mb)	Wind (Dir/Knts)	Sea Dir/m	Air Temp °C	Water Temp °C	Visibility nm
0600	in port					
1200		E/10	<0.5			10.0
1800		E/10	1			10.0
2400	in port					

GG. Forecast Winds NW 10 kt; seas 1 m

EE. Event Diary

From (PDT)	To	Description	Code
00:00	07:30	Standby	op2
07:30	09:47	Transit to Makah Bay	tro
09:47	10:54	Survey Lines 102, 104 & 108	op1
10:54	11:09	Survey Line 108; abort due to ISIS crash	be
11:09	11:30	Survey Line 108; restart at SOL	op1
11:30	11:53	Survey Line 110	op1
11:53	12:06	Survey Line 112; stop mid way for SVP cast	op1
12:06	12:15	SVP cast	op1
12:15	12:22	Resume survey of line 112	op1
12:22	13:49	Survey Lines 114, 116, 117, 100 & 101	op1
13:49	14:54	SVP cast	op1
14:54	15:48	Survey Lines 202, 204, 206, 208 & 210 (shore parallel)	op1
15:48	16:09	HDMS crash	be
16:09	16:15	Survey Line 212	op1
16:15	17:03	HDMS crash	be
17:03	17:07	Survey Line 214	op1
17:07	17:17	ISIS crashed	be
17:17	17:25	Complete survey of line 214	op1
17:25	17:46	Survey lines 216, 217, 218 & 219	op1
17:46	18:06	ISIS crashed	be
18:06	18:18	Survey line 115	op1
18:18	18:25	SVP cast	op1
18:25	18:40	Survey line 113	op1
18:40	20:10	Transit to Neah Bay	tro
20:10	24:00	Standby	op2

THALES

FF. Time summary (hrs:mins): (C1,C4,C5,C6) 22 Sep 2002

Item		Description	Today	Cumulative	Km Today	% of Total	Comment
Mob/Demob	md		00:00	**020:30**		21%	
Transit	tr		00:00	**014:00**	**0.0**	15%	
Standby	sbm		00:00	**036:00**		38%	
Calibrations	cal		00:00	**001:30**		2%	
Operational	op1	Data Acq.	06:59	**006:59**	**45.0**	7%	
	op2	Standby	11:20	**011:20**		12%	
	op3	Weather	00:00	**000:00**			
	tro	Transit	03:47	**003:47**	**30.0**	4%	
Route Development	rda	Additional	00:00	**000:00**	**0.0**		
	rdt	Transit	00:00	**000:00**	**0.0**		
	rdw	Weather	00:00	**000:00**			
Unit Rate Work	urw		00:00	**000:00**			
Standby	sb1	ex-Weather	00:00	**000:00**			
	sbw	Weather	00:00	**000:00**			
	sbo	Other	00:00	**000:00**			
Disputed Time	dd	Downtime	00:00	**000:00**	**0.0**		
	do	Other	00:00	**000:00**	**0.0**		
Re-Runs	rr		00:00	**000:00**	**0.0**		
Breakdown	be	Equipment	01:54	**001:54**		2%	
	bv	Vessel	00:00	**000:00**			
Nil Revenue	onr		00:00	**000:00**			
TOTAL			24:00	**0096:00**	**75.0**	**100%**	
Non-Paid/Disputed Time as a % of Accumulated Hrs since end of Mobilisation						0%	

C3. Survey Progress

		Today km	Cumulative km	Average Speed of Advance
Estimated survey distance	110.0	45.0	45.0	over the last 24 Hrs
		Today %	**Cumulative %**	1.0 Knots
Total Route Development	0.0 km	40.9%	40.9%	

C2. Personnel Onboard

		Total Man Days	No. On/Off Today
Thales:	4	18	0
Sub-Contract:	0	0	0
Client:	0	0	0
Ship:	0	0	0

C7. Fuel

	Used Since Last Update	Start	Remaining
IFO -30:	0.0 ton	0.0 Ton	0.0 Ton
MGO:	0.0 ton	0.0 Ton	0.0 Ton
Lube Oil:	0 kg	0 kg	0 kg
Fresh Water:	0.0 ton	0.0 Ton	0.0 Ton

DD. Safety

	Today	Cumulative	Comment
Drills :	1	1	Safety briefing given by captain prior to leaving the dock
Incidents :	0	0	
False alarms :	0	0	

JJ. Proposed Work for next 24 hrs.:

Complete survey

Seabed Sampling

Today	0
Cumulative	**0**

Sound Velocity Profiles

	CTD	SVP	XBT
Today	0	3	0
Cumulative	**0**	**4**	**0**

HH. Comments:

Survey in shallow water, <8 m, hampered by kelp beds and ~2 m high rock pinnacles.
HDMS failed twice due to loss of GPS signal. Reseating the GPS antenna cables appears to have fixed the problem.

II. Client Comments:

Roland Poeckert
Thales GeoSolutions (Pacific), Inc.

Signed: ______________________

Signed: ______________________

A signed paper copy of this report is retained in the field and constitutes the official Daily Survey Report.

THALES

Daily Survey Report

VESSEL: M/V Quicksilver
E-mail : roland.poeckert@thales-geosolutions.com
Telephone: +1 858 292-8922
Fax: +1 858 292-5308

Thales GeoSolutions (Pacific), Inc.
3738 Ruffin Road
San Diego, CA

To: Thales GeoSolutions (Pacific), Inc	Attn: William Speidel	Via: e-mail
To: Thales GeoSolutions (Pacific), Inc	Attn: James Hailstones	Via: e-mail
To:	Attn:	Via: e-mail

Project No. P2577   Report No. 005   Date : 23 Sep 2002   Page 1 of 2

Makah Bay Environmental Assessment
Seabed Survey

AA. Location at 24:00 PDT: Alongside - Neah Bay, WA

BB. Weather summary:

Time (EDT)	Pressure (mb)	Wind (Dir/Knts)	Sea Dir/m	Air Temp °C	Water Temp °C	Visibility nm
0600	in port					
1200		E/5	NW/1.5			10.0
1800		Light airs	NW/1			10.0
2400	in port					

GG. Forecast Winds NW 10 kt; seas 1 m

EE. Event Diary

From (PDT)	To	Description	Code
00:00	07:15	Standby	op2
07:15	08:40	Transit to Makah Bay	tro
08:40	08:52	Survey line 103	op1
08:52	08:58	ISIS crashed	be
08:58	09:38	Complete survey of line 103(A); survey lines 105, 107, 109	op1
09:38	09:43	ISIS crashed	be
09:43	10:20	Complete survey of line 109(A); survey line 116A (fill gap)	op1
10:20	10:25	ISIS crashed	be
10:25	10:30	Complete survey of line 116(B)	op1
10:30	10:39	SVP cast	op1
10:39	10:58	Transit to next survey line	tro
10:58	11:11	Survey lines 207 & 209	op1
11:11	11:16	ISIS crashed	be
11:16	11:29	Complete survey of line 209(A)	op1
11:29	11:30	Shift to shore parallel runs; survey line 300SH	op1
11:30	11:34	ISIS crashed	be
11:34	11:55	Survey lines 302SH (stop due to kelp), survey line 303SH (start at kelp)	op1
11:55	12:14	Survey lines 303SH, 304SH & 305SH (all limited by kelp to north)	op1
12:14	12:52	ISIS / WinFrog crashed	be
12:52	14:05	Survey lines 306SH through 314SH (ISIS crashed several times)	op1
14:05	14:50	ISIS crashed; problem referred to office and TEI	be
14:50	16:15	Survey lines 213 (in-fill), 315SH through 321SH	op1
16:15	16:30	SVP cast	op1
16:30	17:17	Survey lines 322SH, 323SH, 324SH, 325SH, 326SH, 327SH, 328SH & 329SH	op1
17:17	17:43	ISIS / WinFrog / HDMS all crashed at about the same time	be
17:43	18:35	Survey lines 330SH, 331SH, 332SH, 333SH, 334SH & 335SH	op1
18:35	19:38	Survey tie lines and in-fill lines 108B, 336SH, 211, 217A, Tie1 & Tie2	op1
19:38	20:55	Transit to Neah Bay	tro
20:55	24:00	Standby	op2

THALES

FF. Time summary (hrs:mins): (C1,C4,C5,C6) 23 Sep 2002

Item		Description	Today	Cumulative	Km Today	% of Total	Comment
Mob/Demob	md		00:00	**020:30**		17%	
Transit	tr		00:00	**014:00**	**0.0**	12%	
Standby	sbm		00:00	**036:00**		30%	
Calibrations	cal		00:00	**001:30**		1%	
Operational	op1	Data Acq.	08:25	**015:24**	**68.0**	13%	
	op2	Standby	10:20	**021:40**		18%	
	op3	Weather	00:00	**000:00**			
	tro	Transit	03:01	**006:48**	**33.0**	6%	
Route Development	rda	Additional	00:00	**000:00**	**0.0**		
	rdt	Transit	00:00	**000:00**	**0.0**		
	rdw	Weather	00:00	**000:00**			
Unit Rate Work	urw		00:00	**000:00**			
Standby	sb1	ex-Weather	00:00	**000:00**			
	sbw	Weather	00:00	**000:00**			
	sbo	Other	00:00	**000:00**			
Disputed Time	dd	Downtime	00:00	**000:00**	**0.0**		
	do	Other	00:00	**000:00**	**0.0**		
Re-Runs	rr		00:00	**000:00**	**0.0**		
Breakdown	be	Equipment	02:14	**004:08**		3%	
	bv	Vessel	00:00	**000:00**			
Nil Revenue	onr		00:00	**000:00**			
TOTAL			24:00	**0120:00**	**101.0**	**100%**	
Non-Paid/Disputed Time as a % of Accumulated Hrs since end of Mobilisation						0%	

C3. Survey Progress

		Today km	Cumulative km	Average Speed of Advance over the last 24 Hrs
Estimated survey distance	110.0	68.0	113.0	1.5 Knots
		Today %	**Cumulative %**	
Total Route Development	0.0 km	61.8%	102.7%	

C2. Personnel Onboard

		Total Man Days	No. On/Off Today
Thales:	4	22	0
Sub-Contract:	0	0	0
Client:	0	0	0
Ship:	0	0	0

C7. Fuel

	Used Since Last Update	Start	Remaining
IFO -30:	0.0 ton	0.0 Ton	0.0 Ton
MGO:	0.0 ton	0.0 Ton	0.0 Ton
Lube Oil:	0 kg	0 kg	0 kg
Fresh Water:	0.0 ton	0.0 Ton	0.0 Ton

DD. Safety

	Today	Cumulative	Comment
Drills :	0	1	
Incidents :	0	0	
False alarms :	0	0	

JJ. Proposed Work for next 24 hrs.:

Additional patch test
Transit to Seattle/ demob

Seabed Sampling

Today	0
Cumulative	**0**

Sound Velocity Profiles

	CTD	SVP	XBT
Today	0	3	0
Cumulative	**0**	**7**	**0**

HH. Comments:

Survey in shallow water at north edge of survey area limited by dense kelp beds.
Numerous ISIS crashes appear to be caused by high data rates in shallow water. Reduced ping rate from 10 to 5/s, which solved the problem.
Near shore survey limited to ~5 m WD; 1-2 m swell prevented any closer approach to beach.

II. Client Comments:

Roland Poeckert
Thales GeoSolutions (Pacific), Inc.

Signed: ____________________

Signed: ____________________

A signed paper copy of this report is retained in the field and constitutes the official Daily Survey Report.

THALES

Daily Survey Report

VESSEL: M/V Quicksilver
E-mail : roland.poeckert@thales-geosolutions.com
Telephone: +1 858 292-8922
Fax: +1 858 292-5308

Thales GeoSolutions (Pacific), Inc.
3738 Ruffin Road
San Diego, CA

To:	Thales GeoSolutions (Pacific), Inc	Attn:	William Speidel	Via:	e-mail
To:	Thales GeoSolutions (Pacific), Inc	Attn:	James Hailstones	Via:	e-mail
To:		Attn:		Via:	e-mail

Project No. P2577 Report No. 006 Date : 24 Sep 2002

Makah Bay Environmental Assessment

Seabed Survey

AA. Location at 24:00 PDT: Alongside - Seattle, WA

BB. Weather summary:

Time (EDT)	Pressure (mb)	Wind (Dir/Knts)	Sea Dir/m	Air Temp °C	Water Temp °C	Visibility nm
0600	in port					
1200		E/10	1			10.0
1800		NE/10	1			10.0
2400	in port					

GG. Forecast

EE. (PDT) — **Event Diary**

From	To	Description	Code
00:00	07:30	Standby	sbm
07:30	11:30	Patch test	md
11:30	21:00	Transit to Seattle	tr
21:00	24:00	Standby	sbm

THALES

FF. Time summary (hrs:mins): (C1,C4,C5,C6) 24 Sep 2002

Item		Description	Today	Cumulative	Km Today	% of Total	Comment
Mob/Demob	md		04:00	**024:30**		17%	
Transit	tr		09:30	**023:30**	**0.0**	16%	
Standby	sbm		10:30	**046:30**		32%	
Calibrations	cal		00:00	**001:30**		1%	
Operational	op1	Data Acq.	00:00	**015:24**	**0.0**	11%	
	op2	Standby	00:00	**021:40**		15%	
	op3	Weather	00:00	**000:00**			
	tro	Transit	00:00	**006:48**	**110.0**	5%	
Route Development	rda	Additional	00:00	**000:00**	**0.0**		
	rdt	Transit	00:00	**000:00**	**0.0**		
	rdw	Weather	00:00	**000:00**			
Unit Rate Work	urw		00:00	**000:00**			
Standby	sb1	ex-Weather	00:00	**000:00**			
	sbw	Weather	00:00	**000:00**			
	sbo	Other	00:00	**000:00**			
Disputed Time	dd	Downtime	00:00	**000:00**	**0.0**		
	do	Other	00:00	**000:00**	**0.0**		
Re-Runs	rr		00:00	**000:00**	**0.0**		
Breakdown	be	Equipment	00:00	**004:08**		3%	
	bv	Vessel	00:00	**000:00**			
Nil Revenue	onr		00:00	**000:00**			
TOTAL			24:00	**0144:00**	**110.0**	**100%**	
Non-Paid/Disputed Time as a % of Accumulated Hrs since end of Mobilisation						0%	

C3. Survey Progress

		Today km	Cumulative km	Average Speed of Advance
Estimated survey distance	110.0	0.0	113.0	over the last 24 Hrs
		Today %	**Cumulative %**	0.0 Knots
Total Route Development	0.0 km	0.0%	102.7%	

C2. Personnel Onboard

		Total Man Days	No. On/Off Today
Thales:	4	26	0
Sub-Contract:	0	0	0
Client:	0	0	0
Ship:	0	0	0

C7. Fuel

	Used Since Last Update	Start	Remaining
IFO -30:	0.0 ton	0.0 Ton	0.0 Ton
MGO:	0.0 ton	0.0 Ton	0.0 Ton
Lube Oil:	0 kg	0 kg	0 kg
Fresh Water:	0.0 ton	0.0 Ton	0.0 Ton

DD. Safety

	Today	Cumulative	Comment
Drills :	0	1	
Incidents :	0	0	
False alarms :	0	0	

JJ. Proposed Work for next 24 hrs.:

Complete demobilisation

Seabed Sampling

Today	0
Cumulative	**0**

Sound Velocity Profiles

	CTD	SVP	XBT
Today	0	1	0
Cumulative	**0**	**8**	**0**

HH. Comments:

II. Client Comments:

Roland Poeckert
Thales GeoSolutions (Pacific), Inc.

Signed: ____________________

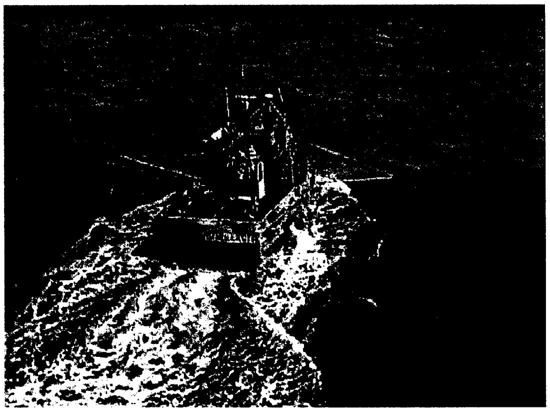
Signed: ____________________

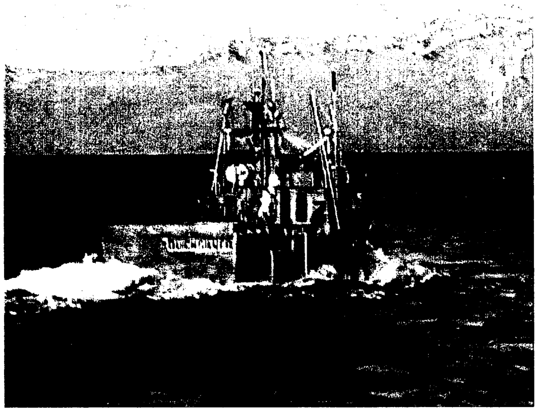
A signed paper copy of this report is retained in the field and constitutes the official Daily Survey Report.

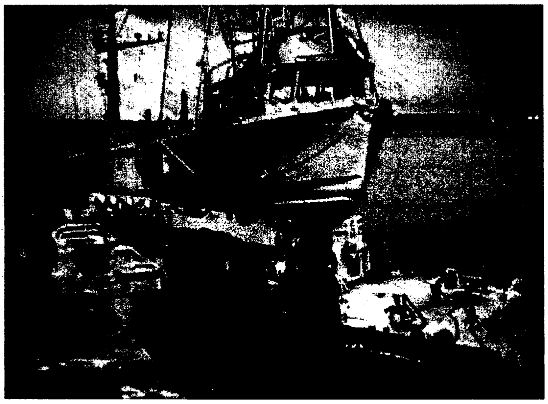
Appendix C : VESSEL SPECIFICATIONS

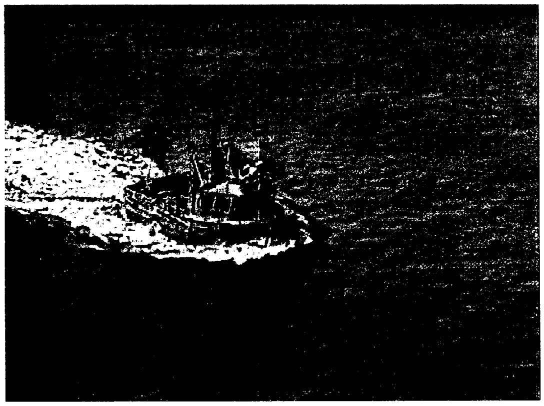
THALES

M/V Quicksilver	
Official Number	947419
Owner	Marcus Ballweber
Year Built	1989
Length	32 ft
Beam	15.5 ft
Draft	3 ft
Tonnage	
Gross	28
Net	15
Power	800 hp
Electrical	5 kW









Appendix D : EQUIPMENT SPECIFICATIONS

THALES

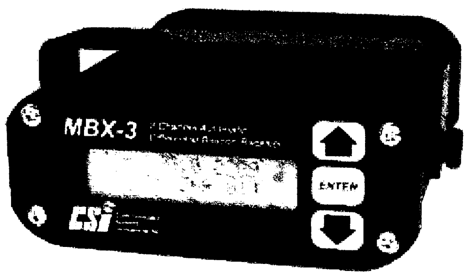
MBX-3

2 Channel Automatic Differential Beacon Receiver

Standalone Radiobeacon Receiver

FEATURES

- Dual independent channels for superior automatic beacon tracking
- State-of-the-art digital architecture enhances beacon reception
- Fast acquisition times ensure you are up and running quickly
- 2-line by 16-character LCD display provides more information simultaneously
- Global beacon table listing gives you quick access to beacons by name
- Low power consumption gives extended battery life for portable applications
- Automatic and manual tune modes provide operational versatility
- Optional internal splitter and GPS signal output port for use with combination GPS/beacon antennas
- Firmware upgrades are easily loaded into the receiver through the serial port
- Wide selection of antennas available



Advanced Beacon Receiver Technology

The CSI MBX-3 beacon receiver employs CSI's third generation of digital receiver technology to receive free DGPS signals broadcast by the networks of 300 kHz radiobeacons deployed worldwide.

Using these signals, the MBX-3 beacon receiver outputs differential correction data in the industry standard RTCM SC-104 format accepted by differential-ready GPS receivers.

The advanced digital signal processing techniques of the MBX-3 allow for reliable extraction of DGPS data from the beacon broadcasts, even in noisy environments.

Ease of Operation

The MBX-3 incorporates a large 2-line by 16-character display and 3-switch keypad. The intuitive menu system provides access to receiver status information and operating parameters.

You may configure the MBX-3 beacon receiver for either automatic or manual tune operation using the convenient menu system. A new global beacon table within the receiver menu system allows selection of beacons by name.

Automatic Operation

In automatic mode, the two channels of the beacon receiver cooperatively construct and maintain a table of radiobeacons available in your area. The receiver's primary channel automatically locks to the station providing the highest quality signal. This ensures that the MBX-3 is always locked to the best beacon in the area.

Antennas

The MBX-3 receiver may use any of a variety of antennas offered by CSI. Options include an E-field Whip antenna, two varieties of H-field beacon Loop antennas, and a combination GPS/beacon antenna.

All CSI antennas incorporate band-pass filtering and integral preamplifiers. The MBX-3 receiver provides power to these active antennas.

H-field beacon Loop antennas do not require a counterpoise ground connection and are ideal for portable applications. They are also less susceptible than a conventional whip antenna to predominate E-field noise, including precipitation static.

Hassle-Free Upgrading

The MBX-3 supports firmware upgrades as improvements to firmware or changes to the global beacon table are made. These upgrades are easily loaded into the receiver through the serial port using a PC computer.

Configuration Software

CSI offers custom Windows 95® software for beacon receiver configuration, monitoring receiver performance, and decoding RTCM data. A terminal interface and data logging capability are also included.

Warranty

CSI is committed to supporting its products and offers a one-year warranty on parts and labor.

Contact us to discover why the MBX-3 is the right choice for your application.

THALES

MBX-3 – *2 Channel Automatic Differential Beacon Receiver*

Receiver Specifications

Channels: 2 independent channels
Frequency Range: 283.5 to 325.0 kHz
Channel Spacing: 500 Hz
MSK Bit Rates: 50, 100, and 200 bps
Cold Start Time: < 1 minute
Warm Start Time: < 2 seconds
Demodulation: Minimum shift keying
Sensitivity: 2.5 µV/m for 10 dB SNR
Dynamic Range: 100 dB
Frequency Offset: ± 5 Hz
Adjacent Channel Rejection: 60 dB
Correction Output Protocol: RTCM SC-104
Input/Status Protocol: NMEA 0183

Communications

Interface Level: RS-232C or RS-422
Baud Rates: 2400, 4800, 9600

Environmental Specifications

Operating Temperature: -30°C to +70°C
Storage Temperature: -40°C to +80°C
Humidity: 95% non-condensing
EMC: EN 60945
EN 50081-1
EN 50082-1
FCC: Part 15, sub-part J, class A digital device

Power Specifications

Input Voltage: 9 - 40 VDC
Nominal Power: 2.5 W
Nominal Current: 210 mA
Antenna Voltage Output: 10 VDC (5 VDC optional)

Mechanical Specifications

Dimensions: 150 mm L x 125 mm W x 51 mm H (5.9" L x 4.9" W x 2.0" H)
Weight: 0.64 kg (1.4 lb)
Display: 2-line by 16-character LCD
Keypad: 3-key switch membrane
Power Connector: 2-pin circular locking
Data Connector: DB9-S
Antenna Connector: BNC-S
Optional GPS Output Port: TNC-S

Operating Modes

MBX-3 Mode (Default): RTCM SC-104 correction and NMEA status message output (Default Mode)
MBX-E Mode: RTCM SC-104 correction and NMEA status message output and GPS NMEA message input for position and satellite status display.

NMEA 0183 I/O

- Receiver Automatic and Manual tune command
- Frequency and data rate query
- Receiver performance and operating status queries
- Automatic search almanac queries (proprietary)
- Baud rate selection command (proprietary)
- Receiver tune command
- Force cold start command (proprietary)
- Software upgrade command (proprietary)
- Configuration up-load command (proprietary)

Accessories

Antenna: Various
Power Cables: Various
Antenna Cables: Various
Data Cables: Various
CSI Beacon Command Center: MS Windows 95® beacon control software

Pin-Out, RS-232C

DB9 Pin #	Description
2	TXD, RTCM SC-104 / status output
3	RXD, configuration input
5	Signal return

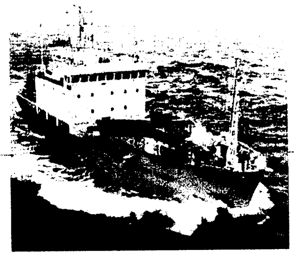
Pin-Out, RS-422

DB9 Pin #	Description
1	TXD +, RTCM SC-104 / status output
2	TXD -, RTCM SC-104 / status output
4	RXD -, configuration input
5	Signal return
7	RXD +, configuration input

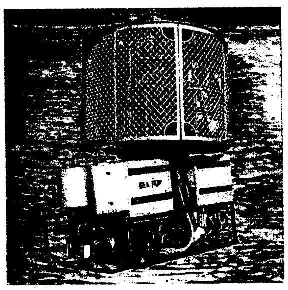
CSI Authorized Dealer

Communication Systems International, Inc.
1200 – 58th Avenue S.E., Calgary, AB, Canada, T2H 2C9
Phone: (403) 259-3311 Fax: (403) 259-8866
Web: www.csi-dgps.com e-mail: info@csi-dgps.com

THALES



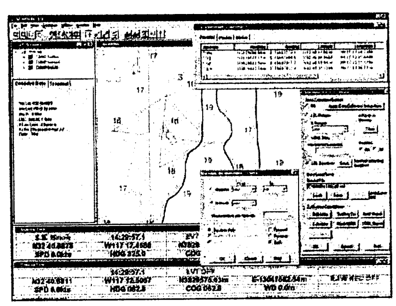
WinFrog Integrated Navigation System



Thales GeoSolutions (Pacific), Inc. (TGPI), a member of the Thales GeoSolutions family, specializes in providing services and software for the marine survey and positioning industry. We employ the most experienced professionals in the industry, and as a company have more than 20 years of success worldwide. We specialize in integrating systems to provide advanced solutions to handle all of your survey and positioning needs.

We take pride in our ability to give customers the personalized attention of a small company while providing them with the resources and infrastructure of a large, global organization. Our customers benefit from the fact that we develop and test our own solutions, on our own projects, before releasing them commercially. Our clients know they are receiving a system that has been proven in the field.

At TGPI, we understand our customers' needs because we work alongside them. Our project managers and their teams maintain full control of a project from beginning to end to ensure a project's technological and commercial success. Whether in the field or at the drawing board, our customers are confident that they are receiving a product that meets their needs.



TGPI provides you with the latest innovations in integrated navigation and data management system software.

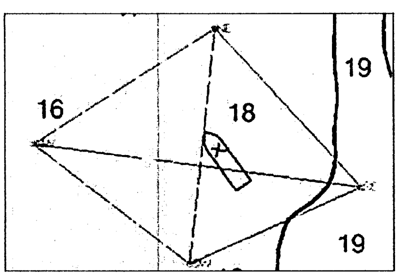
THALES

WinFrog is a complete Integrated Navigation System that combines surface navigation and underwater positioning into one cost-effective package. Its modular design allows customization to meet users' various needs.

The core program provides you with real-time position and navigation information, and can simultaneously collect data from up to 25 types of devices, including other GPSs and sounders. WinFrog currently supports over 300 different devices through either serial or Ethernet communications. It also allows you to define multiple vehicles, each having its own devices, names, offsets, tracks and shapes. In addition, data can be output through industry standard NMEA or customized formats.

WinFrog also supports multiple file formats for graphical display, including C-MAP, ARCS and BSB electronic charts, as well as DXF, DWG, DGN and other file formats.

With over 500 licenses in operation for customers in fields ranging from marine survey to underwater construction, WinFrog is today's integrated navigation and data management system solution. Our success in many industries stems from our commitment to delivering complete solutions based on customers' needs and tailoring our systems to ensure complete satisfaction.



THALES

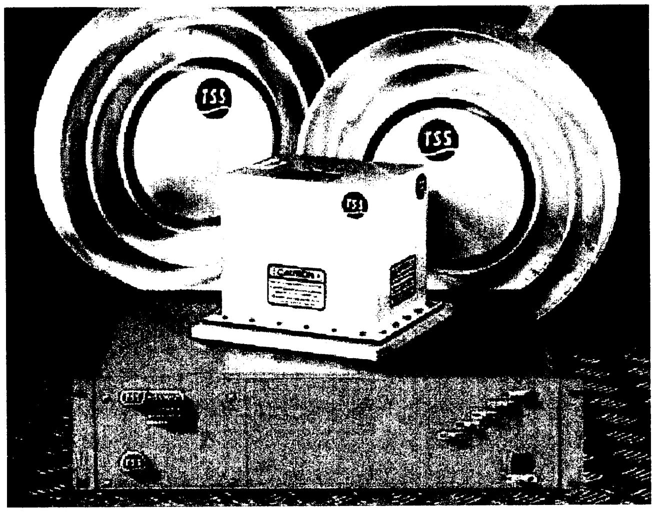
TSS

POS/MV 220

POS/MV 220

POSITION AND ORIENTATION SYSTEM

- Roll and pitch accuracy to 0.05° in all dynamics
- True heading accuracy to 0.05° independent of latitude and dynamics
- DGPS or RTK position accuracy
- No motion artefacts, even in severe conditions
- Robust high MTBF military grade inertial sensors <10°/hour IMU
- No gyro spin-up time
- Proven technology
- Digital, analogue and Ethernet interfaces
- Self-calibrating for rapid deployment
- Industry standard



Complete navigation and attitude solution for marine vessels

POS/MV is a GPS aided Inertial Navigation System (INS) that delivers full six-degrees of freedom (position and orientation) solutions for marine vessels. POS/MV has the functionality of a gyro-compass, GPS receiver and a motion sensor in a single self-calibrating package.

Modern sonar/acoustic systems can be limited in their performance by the use of conventional motion sensors. The limiting factor is that the accuracy of conventional sensors degrades with increasing dynamics. This results in shorter operational windows and reduced survey accuracy.

POS/MV has been developed to meet the exacting requirements of today's multibeam sonar systems. Using significantly higher performance inertial sensors than conventional systems, and a sophisticated aided inertial navigation algorithm, POS/MV provides high accuracy attitude data regardless of platform dynamics. In addition, POS/MV provides smooth position data at high update rates, continuity of data during GPS outages and high accuracy true heading regardless of latitude.

The inertial heading solution is aided by a carrier phase GPS sub-system (GAMS). Hence POS/MV computes accurate true heading independent of latitude and dynamics (unlike traditional gyro-compasses). This is maintained even where GPS reception is poor, given that the heading drift is only 0.08° per minute during GAMS outage.

The key benefit of POS/MV is the accuracy and stability of the position and attitude data. Hence, with POS/MV, survey operations can continue through deteriorating sea conditions and in areas where GPS/DGPS reception is problematic.

Over 100 POS/MV users are already benefiting by making full use of outer beams, from an increased window of operability, through continuous data collection during turns and by maintaining data during short GPS outages.

POS/MV enables survey operators to make the most of their investment in multibeam sonar.

TSS TECHNOLOGY IN MOTION

*The **HDMS 220** is identical to the POS/MV 220, but does not export position during GPS outages.*

THALES

TSS

POS/MV 220

Technical Specifications		
PERFORMANCE	RTK	DGPS
Position (m CEP)	0.02 - 0.10	0.5 - 2.0
Velocity (m/s)	0.01	0.03
Roll and pitch	<0.05°	0.05°
True heading	4m baseline: 0.05°, 2m baseline: 0.1°	
Heading drift rate during GAMS (GPS) outage	0.08°/minute	
Heave	5% of heave amplitude or 5cm	
PHYSICAL SPECIFICATIONS		
Size	IMU PCS Antenna Choke ring	204 x 204 x 168mm 441 x 111 x 346mm 2.5U, 19" rack mount 178 x 77mm (2 off) 370 x 61mm (2 off)
Weight	IMU PCS	3.5Kg 7 Kg
Power	120/220 VAC, 60/50 Hz, 60W	
Temperature	IMU & Antennas PCS	-40° to +60°C 0° to +60°C
Humidity	IMU & Antennas PCS	0 to 100% 5 to 95% RH non-condensing
Cables	IMU Antennas	8m standard 15m (2 off standard)
INTERFACES		
Ethernet Interface (10base-T)	Function Data UDP Ports IP Port	Operate POS/MV & record data Position, attitude, heading, velocity, track and speed, acceleration, status and performance, raw data. All data has time and distance tags Display port - low rate (1Hz) data Data port - high rate (1-200Hz) data Control port - used by POS controller
RS232 Interface (DB9 males)	NMEA Port High rate attitude data port	GGA, HDT, VTG, GST, ZDA, PASHR, PRDID (1-50Hz) Roll, pitch, true heading and heave in all multibeam proprietary formats (1-200 Hz)
Options	Internal RTK GPS receiver; analogue interface (roll, pitch & heave); field support kit	

Represented by:

TSS (UK) Ltd:
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Tel +44 (0)1224 707081 Fax +44 (0)1224 707085 E-mail: tssmail@tssuk.co.uk

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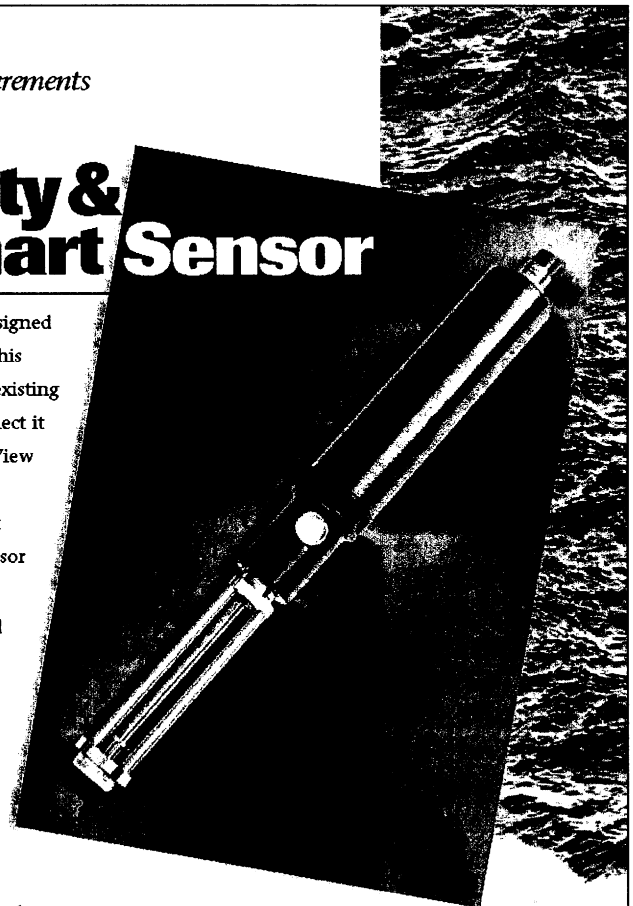
DP1800220E
A VOSPER THORNYCROFT Company
www.tss-realworld.com

Due to continuous development of our products, specifications may vary from those listed above.

THALES

The **ONLY CHOICE** *for reliable measurements of sound velocity and pressure.*



Sound Velocity & Pressure Smart Sensor

The SV&P Smart Sensor is a low cost instrument designed to measure sound velocity and pressure in water. This highly adaptive sensor is ideal for integration into existing data collection platforms or OEM equipment. Connect it directly to a PC or combine it with an AML Smart View hand-held display and hand hauled profiles can be conducted in real-time. Its small size, extremely fast response time and high sampling rate make the sensor ideal for fast profiles or tow speeds.

Each sensor has internal calibration coefficients and outputs real-time data to allow a "plug and play" environment. The optional addressable features provide for daisy chaining with other sensors allowing the user to create their own system.

Sensors

SOUND VELOCITY

- Proprietary "Time of Flight" technology
- 1400 to 1550 m/s standard measuring range
- ±0.050 meters per second accuracy
- 0.015 meters per second resolution
- 145 µs response time
- Temperature compensated

PRESSURE

- Semiconductor strain gauge (temperature compensated)
- Available ranges: 0-10, 20, 50, 100, 200, 500 dbars (higher ranges available)
- ±0.05% full scale accuracy
- 0.01 dbar resolution
- 10 ms response time

Electrical

- 10 samples per second maximum
- RS-232 ASCII communications
- Optional: RS-485 or TTL
- Autobaud rates from 2,400 to 38,400 baud

Power

- 40 mA sampling current
- External 8 – 16 Vdc (12 Vdc nominal)
- Optional power configurations available upon request

Mechanical

- Weight: 575 grams in air
  180 grams in water
- Dimensions: 45.7 mm (1.80") Ø x 368 mm (14.5")
- Construction: Type 316 stainless sensor & plate, INVAR rods, acetal housing rated to 500 meters.
  Optional: Type 316 stainless steel housing rated to 4,500 meters.
  Optional: Titanium housing rated to 10,000 meters
- Connector: IMPULSE Miniature Wet Pluggable™ Series
- Environment: Operating: -20° to 50°C
  Storage: -40° to 60°C

Instrumentation **THROUGH** *Innovation*

APPLIED MICROSYSTEMS LTD

THALES

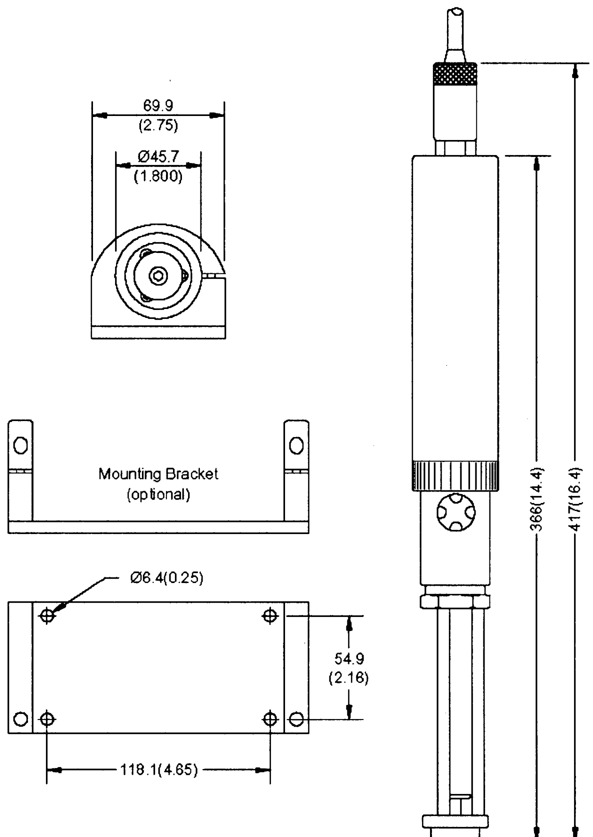
Sound Velocity & Pressure Smart Sensor

Accessories and Software

See Accessories Data Sheet for available options and software.

Smart Talk Data Logging Software is included at no charge with every sensor.

Mechanical Details:



mm(inches)

Instrumentation **THROUGH** *Innovation*

APPLIED MICROSYSTEMS LTD

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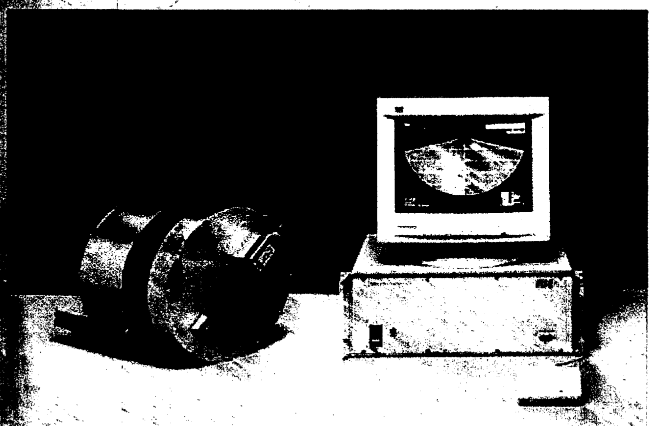
THALES

SeaBat

SeaBat 8101
PRODUCT SPECIFICATION
240kHz MULTIBEAM ECHO SOUNDER



- Phase and Amplitude Bottom Detection
- 150° Wide Swath Coverage
- 240 kHz Frequency
- Up to 500m Range Capability
- Portable Configuration
- Meets USACE Class 1 Standards
- Meets IHO Standards

The SeaBat 8101 Multibeam Echo Sounder measures discrete depths, enabling complex underwater features to be mapped with precision. Dense coverage is achieved utilizing up to 3,000 soundings per second for a swath that can be over 500 meters wide, even as the survey vessel travels at speeds of over 18 knots.

With high accuracy and a measurement rate up to 30 profiles per second, the SeaBat 8101 enables surveys to be completed faster and in greater detail than previously realized. The SeaBat is an integral part of the new, integrated bathymetry surveying systems.

The SeaBat transducer is available pressurized for depths from 100 to over 3,000 meters. Small and lightweight, it can be can be mounted on small un vehicles (ROV, AUV or towed) and taken to where accurate measure required.

RESON

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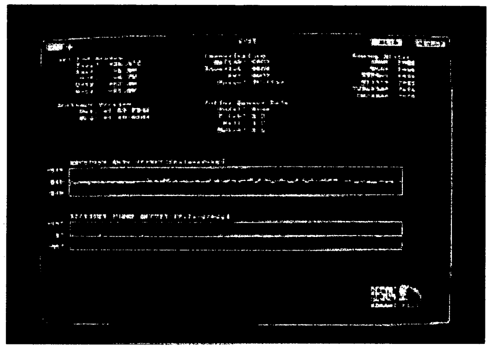
THALES



SeaBat 8101 Built-In Test Environment ("BITE") Screen

SYSTEM SPECIFICATIONS

Operating Frequency:	240kHz
Range Scales:	5, 10, 15, 20, 25, 35, 50, 75, 100, 125, 150, 175, 200, 250, 300, 350, 400, 450, 500m.
Range Resolution:	1.25 cm
Number of Beams:	101
Horizontal Beamwidth:	1.5°
Horizontal Coverage:	150°
Vertical Beamwidth:	1.5°
Update Rate:	Range-variable up to 30 times per second

SONAR HEAD SPECIFICATIONS

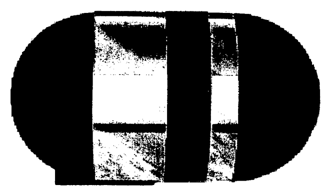
Power Requirement:	24VDC, 2 Amps max. (Power available from surface processor.)
Uplink:	Digital, 76.8 Mbaud
Down Link Control:	RS-232 or RS-422, 19,200 baud
Operating Depth:	100 meters (300m, 1500m, 3000m & 6000m avbl.)
Dimensions:	266x320mm W/Diam (does not include projector)
Temperature:	Operating: -5° to +40°C Storage: -30° to +55°C
Weight (aluminum):	Dry: 26.8 kg (59 lbs) Wet: 4.8 kg (10.6 lbs)
Weight (titanium):	Dry: 40 kg (88 lbs) Wet: 18 kg (39.6 lbs)

DISPLAY SPECIFICATIONS

Screen Size:	14 inch Diagonal
Input:	SVGA (800x600, 72 Hz)
Display:	High Resolution Color
Power Consumption:	62 W

PROCESSOR SPECIFICATIONS

Power Requirements:	115/230VAC, 50/60Hz, 100W max.
Data Output:	Selectable, 300-155.2 Kbaud or Ethernet 10 base T or 10 base 2
Video Output:	SVGA (800x600, 72 Hz) or NTSC or PAL video.
Graphics Colors:	256 colors (8-bit)
Display Mode:	Sector Format
Display Arc:	150°
Input Device:	3-Button Trackball
Dimensions:	19" rack, 4U high (266x483x434mm HWD)
Temperature:	Operating: 0° to +40°C Storage: -30° to +55°C
Weight:	20 kg (44 lbs)



SeaBat 8101 Head with Optional Fairings

OPTIONS

Option 033:	Side Scan Upgrade
Option 034:	Mounting Plate Assembly
Option 035:	Fairings (pictured above)
Option 036:	Spares Kit
Option 037:	Titanium Housing
Option 038:	210° Swath
Option 040:	Extended-Range Projector
Option 049:	Increase Transducer Depth Rating

Version 4.0
032399

RESON

Due to our policy of continuous product improvement, specifications are subject to change without notice.

THALES

GeoAcoustics

GeoPulse
Profiler System

Introduction

The GeoPulse Sub-bottom Profiler is a tried and tested, industry standard sub-bottom profiling system for shallow geophysics. It is highly flexible allowing operation as either a hull mounted deep water system, an "over-the-side mount" system for small boat operations or as a towed system.

The Transmitter (Model 5430A) allows control of the output power, frequency and the number of full cycles included in the outgoing pulse. Seabed returns can be conditioned by analogue means using the GeoPulse Receiver (Model 5210A) or digitally using one of our range of GeoPro Sonar Processors.

Data from the GeoPulse Receiver (Model 5210A) can be displayed directly onto a wide range of industry standard graphic recorders. The GeoPulse Profiler is often used in combination with our Dual Frequency Side Scan sonar.

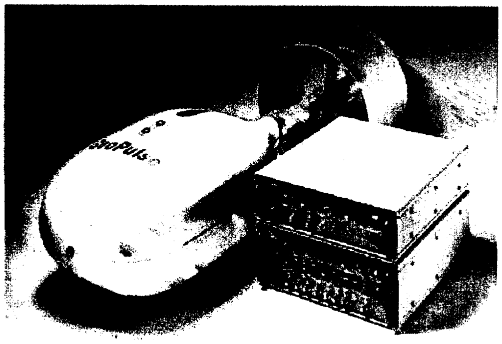
Features

Transmitter Model 5430A

- Output power continuously adjustable to 10kW.
- 2-12kHz frequency range, operator selectable with front panel dial.
- Pulse length selected by number of cycles to improve efficiency of transducers and reduce "ringing".
- Transmit repetition rate controlled externally or internally, operator selectable.
- Internal switch for 115/230 VAC operation. Unit is protected against damage caused by improper line voltage.
- Impedance matching switch allows operation with single or multiple transducer arrays.
- Separate/combined switch to transmit on portion of transducer array and receive on remaining portion or to modify beam pattern of transducer array.
- Indicators to easily monitor all system parameters.

Receiver Model 5210A

- Combined TVG and operator controllable gain provide up to 100dB of active gain for low amplitude signal processing.
- Automatic bottom tracking provides constant TVG adjustment regardless of bottom variation or degree of slope. (Manual TVG is standard)



- AGC provides operator with the ability to manipulate receiver sensitivity for a given reflector intensity.
- Key program: Multiply and divide-by functions for source triggering flexibility in deep water or extremely shallow water.
- The tape interface allows for recording of either raw or processed data. Eliminates costly interface devices and provides calibration signal for proper recorder adjustment.
- Optic isolation between receiver and source power supply prevents ground loop interference on acoustic record.
- TVG record annotation: Upon switch closure by operator or by Nav interface, places a mark at every 6dB point throughout TVG ramp on record.
- Compensates for spreading and attenuation losses through the water column in deep water.
- All gain controls, manual or TVG, are in fixed increments enabling relative reflectivity of different areas to be compared.
- Signal output to tape recorder is displayed by LEDs signifying maximum possible dynamic range or presence of "clipping".
- Data can be displayed directly onto a wide range of industry standard graphic recorders.

Over-the Side Transducer Mount Model 132B

The 132B transducer array is specifically designed for small boat operation at lower speeds. The transducers are mounted on a plate at the end of a vertical, gimballed staff. The staff, in turn, is supported by a mounting pad, which can be fastened to either the deck of the boat, or to an athwart-ships timber. The gimballed unit relieves excess strain on the mounting pad and provides freedom of motion fore, aft, and athwart-ships to ensure the transducer beam remains directed at the sea floor despite motion of the vessel.

THALES

Towed Transducer Vehicle Model 136A
The Model 136A fish is the workhorse of the GeoAcoustics profiling systems. It has logged more survey kilometres and more pipeline crossings than any other profiling vehicle in the world. Its design allows for stable, noise-free towing in high seas and at speeds up to 12 knots. The rugged galvanised body and fibreglass cowling, provides protection for four profiling transducers and will stand up to the punishment encountered at sea. Standard options available for the 136A Fish include side scan sonar transducers to allow simultaneous profiling and side scanning from one vehicle.

Basic System

The basic system includes the following:

- GeoPulse Transmitter (Model 5430A)
- GeoPulse Receiver (Model 5210A)
- Towfish (Model 136) containing
- Profiling Transducers (Model 137D)

The four transducer Model 136 Towfish provides a stable sub-tow survey platform, which may be towed down to 600 metres using a standard 2000 metre armoured tow cable. Alternative deployment options for the profiling transducers are:

- Hull Mount – Can be configured with up to 16 transducers providing a narrow beam pattern for deep water operation, whilst still achieving good penetration.
- Over-the-side Transducer Mount (Model 132) – It is possible to use the system in very small boats for river, harbour or shallow lake surveys and also bridge scour investigations.

For more advanced applications we recommend that the GeoPulse Receiver (Model 5210A) is replaced by one of our range of GeoPro Sonar Processors.

Specifications

Transmitter Model 5430A

Output:	10kW with 0.75% duty cycle, continuously adjustable. 2 to 12kHz, continuously adjustable. Short circuit proof. Impedance matched.
Pulse Cycles:	1, 2, 4, 8, 16 or 32 cycles of the frequency selected. The transmitted output pulse will be phase coherent within 22.5°.
Key: External:	2 to 12V pulse, either + or – leading edge triggered. Maximum width 50ms to eliminate double triggering. Transformer isolated.
Internal:	Set by internal potentiometer, 1 to 10pps, uncalibrated.
Output to Receiver or GeoPro Sonar Processor:	Transformer isolated. Frequency response flat between approximately 1kHz and 20kHz. Two modes of operation: A: Flat gain –0dB gain B: Short range TVG -20dB (10:1) of attenuation during transmit pulse and a –20dB to 0dB ramp within 15ms after end of transmit signal.
Power:	115/230 VAC ± 10%, 47 to 63Hz, 220W maximum.
Auxiliary Power:	IEC connector, unfused, 6A maximum.
Environmental:	Operational: -5 to 50°C, Storage: -15 to 85°C
Dimensions:	45.7cm (L) x 43cm (W) x 13cm (H), 18kg

Receiver Model 5210A

Amplifier:	Differential common mode rejection: 100dB at 60Hz. Sensitivity 30µV RMS in, produces 1V RMS out at 90dB total gain with TVG.
Signal to noise:	20dB at 100dB gain 1kHz centre frequency and 1kHz bandwidth.
Coarse gain:	40dB maximum.
Fine gain:	0 – 30dB in 3dB increments.
Filter:	Low pass and high pass, active type, maximally flat, 24dB/octave minimum roll-off, 0 gain, 0.02kHz to 15kHz adjustable in ½ octave increments. Knobs interlock to prevent overlap.
TVG:	Dynamic range: 30dB Rate: approximately flat to 30dB in 14ms. Manual delay: vernier adjust from 1 to 14ms with multiplier of x 1, x 10, x 100 and internal select of x 1000.
AGC:	Attack adjustable from 330µs to 330ms. Decay: adjustable from 330µs to 330ms. Range: 20dB
Power:	115/230VAC ± 10% (internal switch selectable), 47 to 63Hz, 45W maximum.
Environmental:	Operational: -5 to 50°C, Storage: -15 to 85°C
Dimensions:	45.7cm (L), x 43cm (W), x 17.8cm (H), 12kg.

Models 132B & 136A (fitted with Model 137D transducers for general sub-bottom profiling)

Beam width:	55° at 3.5kHz. 40° at 5.0kHz. 30° at 7.0kHz (4 Transducers)
Source level:	214dB re 1µPa/1M
Dimensions:	
132B	70 cm (L) x 52 cm (W) x 46 cm (H), 120kg Mounting Staff: One section 183 cm, two sections 360 cm
136A:	156 cm (L) x 46 cm (W) x 46 cm (H), 125kg

Specification sheet subject to change without notice (9-Profiler-6900/A 01/2001)

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THALES

caris®

Bathymetric and Sonar Data Processing and Production

CARIS HIPS & CARIS SIPS

Hydrography. Cable and Pipeline Routing. Minecountermeasures. Side Scan search and recovery. Geophysical Exploration. Management of Fisheries. No matter what the application, the reliability and usability of your cleaned bathymetric and side scan sonar survey data is critical.

Based on its reputation for rigorous and proven algorithms, CARIS HIPS, for processing large bathymetric datasets, and CARIS SIPS, for processing side scan sonar imagery and multibeam backscatter data, have been selected number one among marine and hydrographic specialists for over 10 years.

PURPOSE-BUILT PROCESSING

Area and line based cleaning, 3D visualization, integrated sensor cleaning tools. These are but a few of the features that clearly suggest one thing: CARIS HIPS and CARIS SIPS are purpose-built processing and production systems.

INFORMATION YOU CAN USE

Tiling, contours, depth areas, shoal-biased sounding selection and an interactive dynamic profile are among the multitude of outputs that can be generated from your clean bathymetry and sonar data. Bottom line, CARIS software turns your survey data into information you can use.

ENGINEERED TO WORK TOGETHER

CARIS software systems are engineered to work together. CARIS HIPS and CARIS SIPS are standalone systems but are also capable of operating in unison offering the functionality and format support allowing you to take your clean data further.

BUILT TO GROW ON

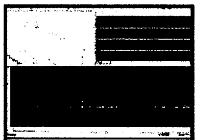
Open an S-57 ENC file and display the data with other data types such as BSB, HCRF, and GeoTIFF as well as vector CARIS map data. Regardless of your current workflow, CARIS HIPS and CARIS SIPS are built to grow on.

CARIS HIPS and CARIS SIPS are backed by training from subject matter experts, assistance in data production flowline implementation, and by knowledgeable and responsive support personnel.

Review the suite of CARIS HIPS and CARIS SIPS products described on the reverse side and contact CARIS today about a solution that is right for you.

turning data into information

CARIS HIPS & CARIS SIPS Product Suite



HIPS Singlebeam

Supported Formats:
- Hypack, Winfrog
- Generic ASCII Data

Data Cleaning:
- Interactive singlebeam depth cleaning
- Automatic singlebeam spike filters

Data Processing:
- Apply tides / zoning
- Apply SV corrections

HIPS Multibeam Lite

Supported Formats:
- *HIPS Singlebeam, PLUS*
- Atlas, Furuno, GSF, LADS, Seabeam / Elac, SeaFalcon, Simrad, UNB, XTF

Data Cleaning:
- *HIPS Singlebeam, PLUS*
- Interactive swath cleaning
- Automatic swath filters
- Refraction repair
- Integrated side scan display

Data Processing:
- Apply tides / zoning
- Apply SV corrections

HIPS Multibeam Professional

Supported Formats:
- *same as HIPS Multibeam Lite*

Data Cleaning:
- *HIPS Multibeam Lite, PLUS*
- 3D subset area cleaning
- Statistical surface cleaning

Data Processing:
- *HIPS Multibeam Lite, PLUS*
- Weighted gridding

SIPS Lite

Supported Formats:
- Cmax, Coda, EdgeTech, GSF, MarineSonics, Qmips, Segy, XTF
- Generic ASCII Data

Data Cleaning:
- Side Scan viewing and cleaning
- Digitize towfish altitude

Data Processing:
- Re-compute towfish navigation
- Slant range correction
- Mosaic

SIPS Professional

Supported Formats:
- *same as SIPS Lite*

Data Cleaning:
- *same as SIPS Lite*

Data Processing:
- *SIPS Lite, PLUS*
- Generate side scan contacts database

HIPS & SIPS Common

Data Tools:
- Vessel configuration
- Tide / Svp preparation
- Attitude / Navigation cleaning
- GPS RTK Tide
- Background displays (CARIS, S-57, BSB, HCRF, TIF...)

Mapping Tools:
- Variable depth tiling
- Sounding selection
- Contouring
- Plotting

For more information on CARIS HIPS and CARIS SIPS contact:

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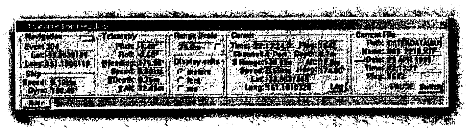
THALES

Isis Sonar

Sidescan Sonar Aquisition and Processing

Acquisition | Processing

TEI Isis® Sonar continues to be the most advanced sidescan sonar acquisition system available today. Isis Sonar is the tool of choice for a variety of applications including: mine-hunting, hydrography, archeology, environmental studies, oilfield engineering, civil engineering, oceanography, and law enforcement.



Quality Control

Isis Sonar typically displays a waterfall display of the sonar data, a signal window, and a survey parameter screen. Isis Sonar produces a real-time mosaic which greatly increases survey productivity. The mosaic is created in TEI Delph® Map as the survey proceeds, allowing the operator to alter the survey plan to ensure full coverage or gather more data on a feature of interest. Surveying is made easier with the possibility of setting different types of alarms.

Wide Compatibility

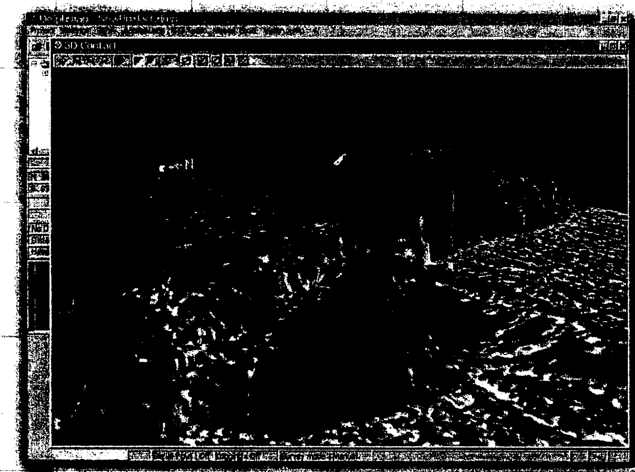
Isis Sonar can be smoothly integrated to any sidescan sonar available today. It performs accurate data logging for both analog and digital sonars from: Edgetech, Klein, Benthos, and many others. Isis Sonar can be delivered with a special rugged workstation designed to withstand the rigors of offshore work.

Accurate Data Acquisition

The quality of the sonar imagery is ensured by TEI's experience in system integration. Isis Sonar is delivered with a custom interface to each sonar model. Isis Sonar can also simultaneously acquire data from additional sensors including magnetometers, sub-bottom profilers, and gravity meters. Isis Sonar's mosaic processing options are the most extensive available with an emphasis on rigorous data geo-referencing.

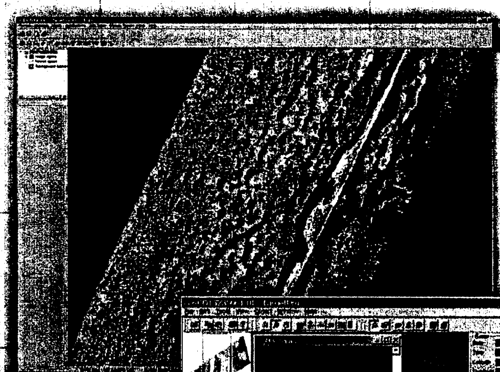
THALES

Isis Sonar



Rich Features

Isis Sonar rigorously integrates external sensors including GPS & gyros, and correctly logs & geo-references sonar imagery. Isis Sonar stores sonar data in TEI's open XTF (eXtended Triton Format), an industry standard. Isis Sonar may also be used in conjunction with a short baseline acoustic positioning system to more accurately determine the exact position of the towfish. The ability to take into account the towfish layback is a standard feature. It is possible to view 3D sidescan draped over bathymetry in Delph Map.



Continuous R & D

Isis Sonar is also the result of a long-term effort conducted in cooperation with TEI customers, the most advanced sidescan sonar users in the world. It incorporates innumerable improvements based on their expert feedback and exacting requirements. As a result, Isis Sonar offers a depth of features unmatched by any other sidescan acquisition and processing system.

Object Database

Isis Sonar can be augmented with TEI Target Pro which creates a database of images of submerged objects, and allows measurement of each object directly on the sonar image.

Isis Sonar is the standard search and recovery system of the US Navy, NOAA, and many other US government agencies. A demonstration version can be downloaded from www.tritonelics.com.

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Fax [illegible]

THALES

THALES

Data Fusion

All data acquired and processed by TEI acquisition and processing modules can be displayed in Delph® Map; this includes sidescan data from Isis® Sonar, multibeam data from Isis® Bathy and Bathy Pro™, and sub-bottom and shallow seismic data from Delph® Seismic+Plus. Delph Map displays and allows manipulation of the following types of raster data sets: bathymetry DTMs, sidescan sonar mosaics, sub-bottom profiles, seismic sections, GPR profiles, and gridded surfaces from magnetometers and gravity meters. Various display modes and definable color palettes are available to maximize the usefulness of raster imagery. Computing the difference between two maps produced at a time interval is possible for bathymetry DTMs with the Volume Computation tool and forsidescan sonar mosaics with the A-B tool. Delph Map imports raster images as background information, such as GeoTIFF files (e.g., satellite imagery, scanned navigation charts) and C-MAP electronic navigation charts.

Vector Objects

Vector information can be imported into Delph Map in a variety of formats including DXF, SHP, and CLA. Contacts saved during playback and analysis of raw sonar data may also be imported and displayed as vector objects (symbols) laid-over raster imagery. Other vector objects that may be displayed include iso-contours, boundaries of seabed types (e.g., as identified by TEI's SeaClass™ bottom classification module), depth soundings, and navigation hazards.

Delph Map offers full digitizing capabilities. Operators may draw directly on the screen to highlight areas and objects of interest. All on-screen interpretations are stored as vector objects exportable to other software packages in DXF format. Profiles may be extracted across a given region of the survey area, with all layers (surface and subsurface) associated with that region displayed in the profile window. Position and depth information associated with the profile may be exported as an ASCII file for reporting and analysis purposes.

Specialized Tools

A number of tools in Delph Map are designed to minimize interpretation time for a data set. The tools include: automated pipeline tracking and span detection, automated object detection, automated digitization, and automated object measurement. Databases are created with each of these tools, which may be exported as ASCII files for reports or manipulated to modify the results of the automated interpretations.

Data Analysis

Delph Map allows 3D analysis of data layers in two different ways. The first involves creation of a full resolution 3D model through selection of a point on the mosaic or DTM. The second involves selecting an area to analyze and then viewing all data files composing that area in a 3D perspective window. Both methods allow free rotation of the data for better viewing and interpretation. An example is draping a mosaic over a DTM to analyze texture information relative to relief.

Survey Planning & Operations Monitoring

Delph Map offers full survey planning and control through its Delph® Nav option. Survey lines may be imported into or created within Delph Map, and vessel position relative to these lines may be monitored in real-time. An option exists for ROV monitoring and simulation against a geo-referenced background layer (e.g., mosaic or DTM) with the ROV Flight module. The same function is available for tracking the position of a dredge's cutting head in TEI Nessie Dredge.

Printing

Any Windows-supported printer or plotter can be used to create hard copies of imagery and maps displayed in Delph Map, with the direction of printing controlled by the operator.

All images displayed in Delph Map can be exported as TIFF, GeoTIFF or DXF (AutoCad) files.

Triton Elics International

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112, Rue Brancion
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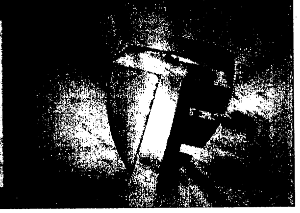
Fax ++(33) 1 44 19 65 89

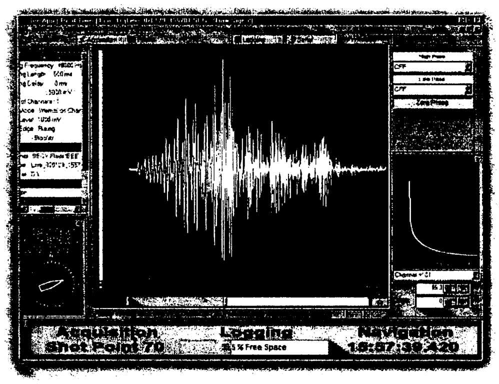


THALES

Delph Seismic+Plus

Next Generation Logging and Processing

Acquisition Processing

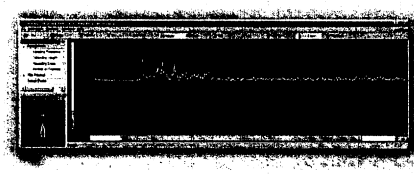


TEI's new data acquisition and processing system is the result of 12 years of experience in accurately logging data from shallow seismic systems and sub-bottom profilers.

The acquisition and the processing functions are increasingly performed by different teams aboard survey vessels. Delph® Seismic+Plus reflects this structure by providing a data logger that creates a SEG-Y file, -and- a full-featured processing module that may run on the same computer or on a remote computer connected to a network.

Top Priority: Online Quality Control

Recording prime quality data can be a challenge, especially when simultaneously supervising several pieces of equipment. Delph Seismic+Plus' data logger features an easy-to-read display with warning messages, color-coded (Green, Yellow or Red background) to indicate the nature and severity of the warning.



Data Input Status

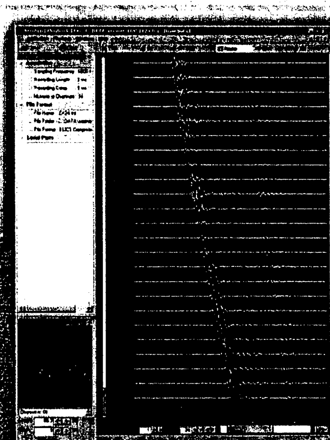
- Status indicating either the system is acquiring data (or not)
- Automatic detection and warning display of data clipping
- Automatic detection of low level signal

Navigation/Ancillary Sensors Status

- Status indicating that the input is active (or not)
- User-defined time-out warning

Logging Status

- Logging proceeding (or not)
- File size display
- Available space remaining
- Automatic line switching based on file size, number of shots
- Data logging in SEG-Y format, 32-bit floating point, when 24-bit data are acquired.



Process and Workflow

Different users with different tasks may access the same file from different locations. A typical scenario consists of a client's representative performing quality control and processing on selected portions of a data set while a geophysicist processes and interprets the data.

THALES

Delph Seismic+Plus

High Quality Acquisition for Analog Systems

The use of a 24 bits A/D converter simplifies data acquisition when using sparkers, boomers, and air guns, and maintains an extremely high dynamic range for digitized data. This sigma/delta converter also performs anti-aliasing, which improves data quality.

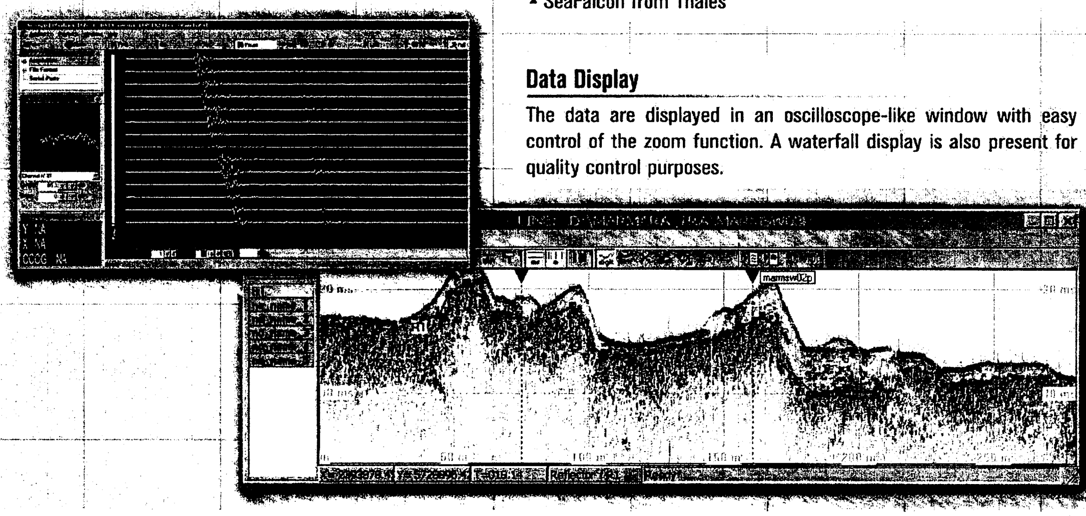
Dedicated Interface

The logging system connects with existing devices through a dedicated purpose-built interface; a single interface will not require any selection. The set-up parameters are specific to each device. Interfaces available for sub-bottom profilers include:

- Chirp II from Benthos
- FSSB from Edgetech
- SeaFalcon from Thales

Data Display

The data are displayed in an oscilloscope-like window with easy control of the zoom function. A waterfall display is also present for quality control purposes.



Advanced Processing

Delph Seismic+Plus reads the file being recorded and performs digital signal processing such as band pass filters, adaptive gain control, and bottom detection and finally geo-references the data.

The geo-referencing occurs in near real-time. After a maximum delay of 10 pings, the data are displayed in profile view with a user-defined zoom on the vertical and horizontal axes. In this geo-referenced form, true slope measurements are possible. The profile is corrected for depth in the case of a deep-tow system.

A one-dimension migration algorithm is included. This algorithm can be applied on the grid data to remove edge artifacts and to convert the data from a time series to a depth series.

The fully processed data can be displayed in two ways: at a fixed scale with the data slowly scrolling in the window or- at a dynamic scale where the full recorded line is displayed.

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75015 Paris, France
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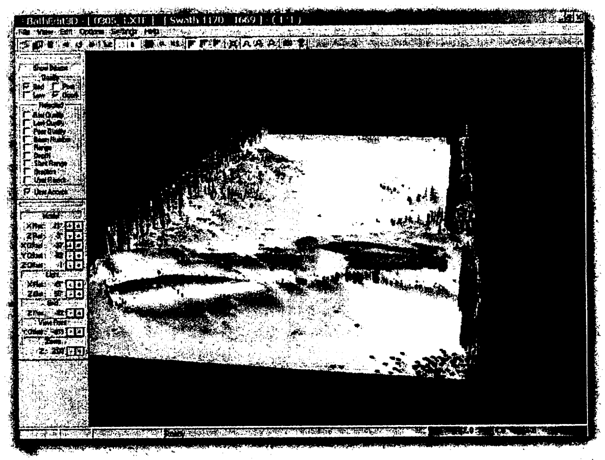
THALES

Bathy Pro

Advanced Bathymetry Processing

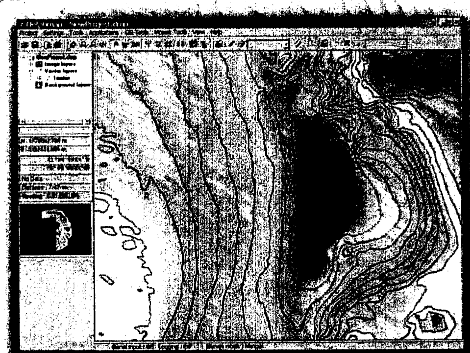
Processing

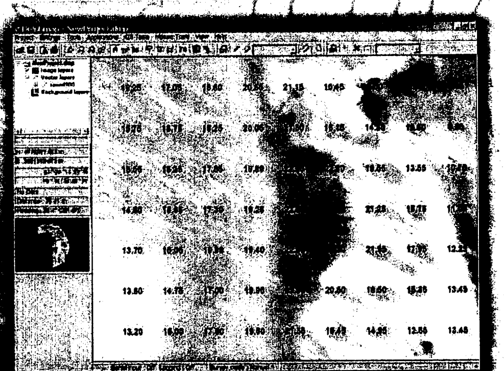


TEI Bathy Pro™ is a powerful solution designed for the challenges of modern bathymetry data processing. Bathy Pro offers the flexibility of producing grid, contour and sounding files to any user defined specification while keeping the processing-to-collection ratio to a minimum. It is the result of years cooperation with hydrographers and surveyors working in a variety of operations.

Automatic Processing

In automatic mode, the operator chooses processing parameters to be used to edit the data, and tags unacceptable data points. The resulting data set, the grid, sounding or contour file, use only the soundings that meet a minimum quality level. Bathy Pro's automatic processing is very fast: 1 million soundings can be processed in a matter of minutes. A typical eight hour survey day can be processed in under one hour.



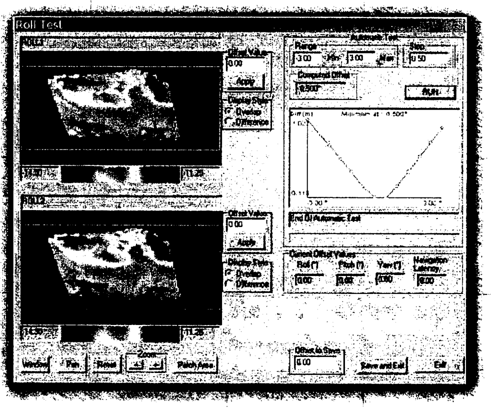


Interactive Bathymetry Processing

Bathy Pro gives the operator control over processing. Bathymetry data can be processed interactively or automatically: processed in batch modes for multiple line files, or for a specific selection of a line's segment. In interactive mode, the operator can review each sounding point and data from vessel motion for data anomalies. This process allows for each swath to be viewed, compared and analyzed. Filters can be set to flag data points that do not fit user-defined criteria.

THALES

Bathy Pro



Calibration & Patch Test

Bathy Pro includes an advanced tool for determining offsets to compensate for biases and latencies present in an integrated multibeam system. The patch test will automatically compute optimal offset values from a set of overlapping survey lines using either bathymetry or (for greater accuracy) sidescan data, if available.

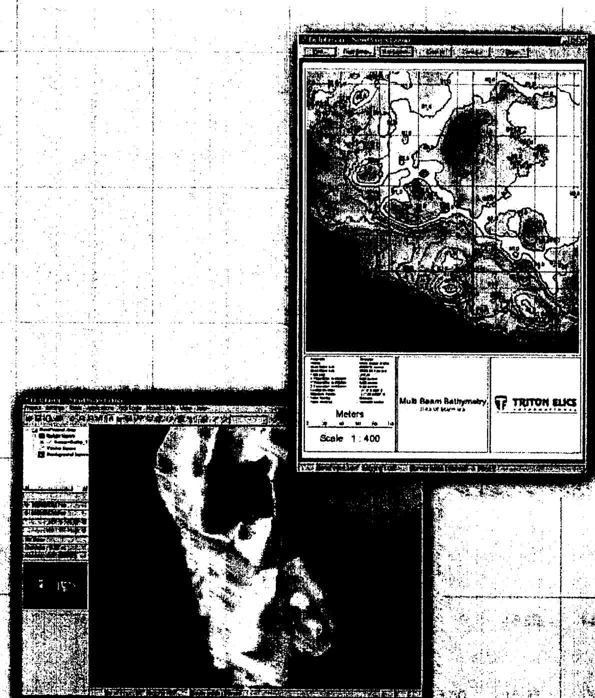
Processing Options

When processing data, the raw file remains unmodified throughout, allowing for re-processing with different parameters. A database is built for those selected points that have been flagged during the processing routine, allowing for quick access for re-evaluating those suspected points. The many filters that can be implemented include the following:

- Beam Quality
- Angle from vertical
- Beam number
- Depth Range
- Gradient
- Slant range

Manual Processing on a 3D Map

Bathy Pro now delivers ultimate control in manual editing with editing on a 3D representation of the raw data. With the ability to rotate the data and illuminate the model, subtle artifacts become visible. Any dubious points can be flagged in this view. The operator may select single points or entire areas with the mouse, query the data for information, and eliminate points from the final data set. Automated processing will re-compute surrounding areas, and rebuild the contours, sounding charts, and grid files.



Special Maps

After building a DTM, Bathy Pro can compute iso-contours or produce a traditional soundings chart. Volume computations are also available. The operator has full control over the parameters to produce any type of map.

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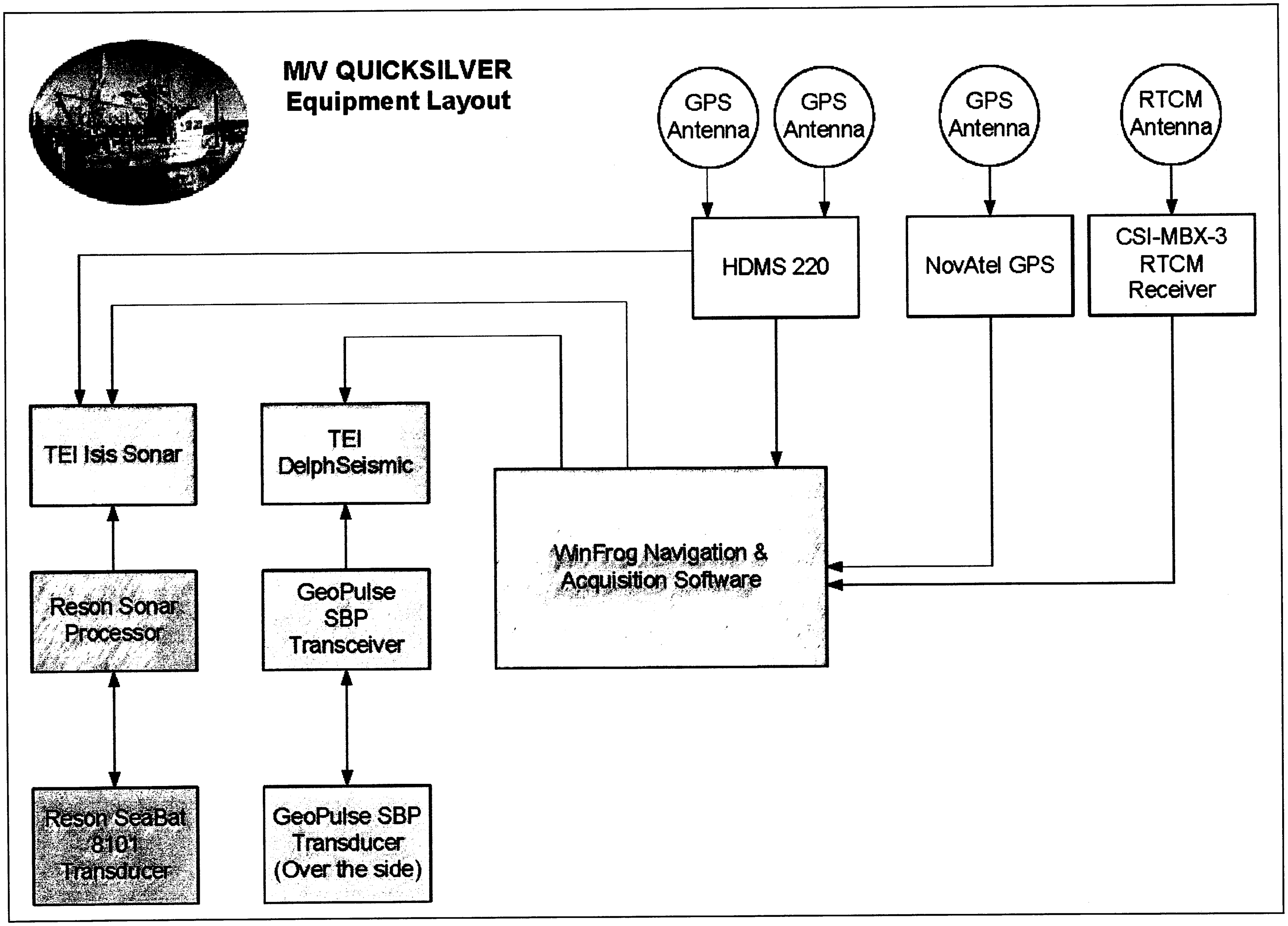
Appendix E : DETAILED EQUIPMENT LAYOUT DIAGRAM


M/V QUICKSILVER
Equipment Layout
GPS Antenna
GPS Antenna
GPS Antenna
RTCM Antenna
HDMS 220
NovAtel GPS
CSI-MBX-3 RTCM Receiver
TEI Isis Sonar
TEI DelphSeismic
WinFrog Navigation & Acquisition Software
Reson Sonar Processor
GeoPulse SBP Transceiver
Reson SeaBat 8101 Transducer
GeoPulse SBP Transducer (Over the side)

Appendix F : SVP TIMES & LOCATION

Date	Time UTC	Latitude	Longitude	Water Depth (m)
22 Sep 2002	19:08	48° 19.788' N	124° 43.588' W	40
22 Sep 2002	20:54	48° 20.294' N	124° 44.074' W	45
23 Sep 2002	01:20	48° 19.782' N	124° 43.278' W	30
23 Sep 2002	17:34	48° 19.646' N	124° 43.934' W	42
23 Sep 2002	23:24	48° 19.848' N	124° 41.183' W	17
24 Sep 2002	02:34	48° 20.277' N	124° 44.316' W	42

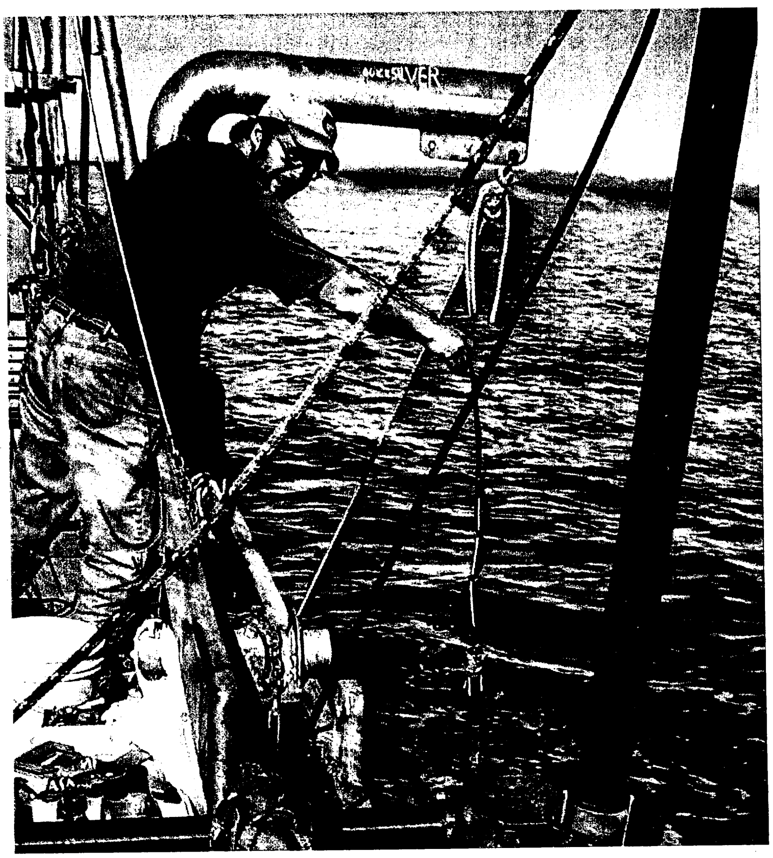


Figure F-1 AML SVP probe being deployed

THALES

Sound Velocity Profile

THALES

Thales Geosolutions (Pacific), Inc.
3738 Ruffin Road
San Diego, California

CLIENT: *AquaEnergy Group, Ltd.*
PROJECT: *Makah Bay Environmental Assessment Survey*
AREA: *Makah Bay*
JOB No: *2577*
VESSEL: *M/V Quicksilver*

Date of Launch: 22-Sep-02
Time of Launch: 19:08:00 UTC

Probe type : AML SV&P
Depth : 50 m

Latitude : 48° 19.788' N
Longitude : 124° 43.588' W

Depth (m)	Velocity (m/s)		Depth (m)	Velocity (m/s)		
1	1494.86		38	1479.26		
2	1494.55		40	1479.26		
3	1494.07		42	1479.31		*
4	1493.14		44	1479.30		*
5	1492.42		46	1479.30		*
6	1491.82		48	1479.29		*
7	1490.72		50	1479.28		*
8	1488.95		55			
9	1486.34		60			
10	1484.53		65			
11	1482.62		70			
12	1482.14		75			
13	1482.06		80			
14	1482.02		90			
15	1481.85		100			
16	1481.64		150			
17	1481.40		200			
18	1481.12		250			
19	1480.99		300			
20	1480.84		400			
21	1480.59		500			
22	1480.41		600			
23	1480.27		700			
24	1480.18		800			
25	1480.17		900			
26	1480.17		1000			
27	1480.15		1500			
28	1480.14		2000			
29	1480.08		2500			
30	1480.06		3000			
32	1480.05		3500			
34	1480.01		4000			
36	1479.59		4500			

* Extrapolated values

2002-265-1908.sv1

THALES

Sound Velocity Profile

THALES

Thales Geosolutions (Pacific), Inc.
3738 Ruffin Road
San Diego, California

CLIENT: *AquaEnergy Group, Ltd.*
PROJECT: *Makah Bay Environmental Assessment Survey*
AREA: *Makah Bay*
JOB No: *2577*
VESSEL: *M/V Quicksilver*

Date of Launch: 22-Sep-02
Time of Launch: 20:54:00 UTC

Probe type : AML SV&P
Depth : 50 m

Latitude : 48° 20.294' N
Longitude : 124° 44.074' W

Depth (m)	Velocity (m/s)		Depth (m)	Velocity (m/s)		
1	1495.85		38	1479.20		
2	1494.78		40	1479.23		
3	1493.62		42	1479.25		
4	1492.45		44	1479.30		
5	1491.54		46	1479.34		
6	1489.52		48	1479.34		*
7	1484.90		50	1479.33		*
8	1482.85		55			
9	1482.32		60			
10	1481.66		65			
11	1481.44		70			
12	1481.42		75			
13	1481.28		80			
14	1481.24		90			
15	1481.26		100			
16	1481.22		150			
17	1481.10		200			
18	1480.79		250			
19	1480.53		300			
20	1480.31		400			
21	1479.95		500			
22	1479.66		600			
23	1479.49		700			
24	1479.44		800			
25	1479.39		900			
26	1479.39		1000			
27	1479.32		1500			
28	1479.31		2000			
29	1479.32		2500			
30	1479.28		3000			
32	1479.19		3500			
34	1479.17		4000			
36	1479.17		4500			

* Extrapolated values

2002-265-2054.sv1

Sound Velocity Profile

THALES

Thales Geosolutions (Pacific), Inc.
3738 Ruffin Road
San Diego, California

CLIENT: *AquaEnergy Group, Ltd.*
PROJECT: *Makah Bay Environmental Assessment Survey*
AREA: *Makah Bay*
JOB No: *2577*
VESSEL: *M/V Quicksilver*

Date of Launch: 23-Sep-02
Time of Launch: 01:20:00 UTC

Latitude : 48° 19.782' N
Longitude : 124° 43.278' W

Probe type : AML SV&P
Depth : 40 m

Depth (m)	Velocity (m/s)		Depth (m)	Velocity (m/s)		
1	1498.68		38	1480.33		*
2	1498.39		40	1480.33		*
3	1496.54		42			
4	1495.91		44			
5	1494.16		46			
6	1493.23		48			
7	1491.91		50			
8	1490.32		55			
9	1487.90		60			
10	1487.46		65			
11	1486.82		70			
12	1486.20		75			
13	1485.74		80			
14	1485.18		90			
15	1484.12		100			
16	1483.22		150			
17	1482.55		200			
18	1481.85		250			
19	1481.51		300			
20	1481.04		400			
21	1480.74		500			
22	1480.65		600			
23	1480.56		700			
24	1480.50		800			
25	1480.41		900			
26	1480.37		1000			
27	1480.33		1500			
28	1480.32		2000			
29	1480.31		2500			
30	1480.32		3000			
32	1480.35		3500			
34	1480.35		4000			
36	1480.34		4500			

* Extrapolated values

2002-266-0120.sv1

THALES

Sound Velocity Profile

THALES

Thales Geosolutions (Pacific), Inc.
3738 Ruffin Road
San Diego, California

CLIENT: *AquaEnergy Group, Ltd.*
PROJECT: *Makah Bay Environmental Assessment Survey*
AREA: *Makah Bay*
JOB No: *2577*
VESSEL: *M/V Quicksilver*

Date of Launch: 23-Sep-02
Time of Launch: 17:34:00 UTC

Probe type : AML SV&P
Depth : 50 m

Latitude : 48° 19.646' N
Longitude : 124° 43.934' W

Depth (m)	Velocity (m/s)		Depth (m)	Velocity (m/s)		
1	1497.29		38	1479.44		
2	1495.47		40	1479.43		
3	1494.03		42	1479.45		
4	1490.45		44	1479.47		*
5	1489.18		46	1479.46		*
6	1489.12		48	1479.46		*
7	1489.01		50	1479.45		*
8	1488.39		55			
9	1487.98		60			
10	1487.67		65			
11	1487.53		70			
12	1487.33		75			
13	1487.04		80			
14	1486.79		90			
15	1486.66		100			
16	1486.52		150			
17	1486.52		200			
18	1486.27		250			
19	1485.80		300			
20	1485.40		400			
21	1485.23		500			
22	1485.02		600			
23	1484.71		700			
24	1484.48		800			
25	1484.09		900			
26	1483.05		1000			
27	1482.58		1500			
28	1482.04		2000			
29	1481.69		2500			
30	1481.12		3000			
32	1480.22		3500			
34	1479.82		4000			
36	1479.59		4500			

* Extrapolated values

2002-266-1734.sv1

THALES

Sound Velocity Profile

THALES

Thales Geosolutions (Pacific), Inc.
3738 Ruffin Road
San Diego, California

CLIENT: *AquaEnergy Group, Ltd.*
PROJECT: *Makah Bay Environmental Assessment Survey*
AREA: *Makah Bay*
JOB No: *2577*
VESSEL: *M/V Quicksilver*

Date of Launch: 23-Sep-02
Time of Launch: 23:24:00 UTC

Probe type : AML SV&P
Latitude : 48° 19.848' N
Depth : 17 m
Longitude : 124° 41.183' W

Depth (m)	Velocity (m/s)		Depth (m)	Velocity (m/s)		
1	1500.50		38			
2	1499.90		40			
3	1499.02		42			
4	1498.08		44			
5	1497.08		46			
6	1496.18		48			
7	1494.86		50			
8	1493.98		55			
9	1493.59		60			
10	1493.13		65			
11	1492.65		70			
12	1492.59		75			
13	1492.14		80			
14	1490.10		90			
15	1488.42		100			
16	1486.18		150			
17	1486.05		200			
18			250			
19			300			
20			400			
21			500			
22			600			
23			700			
24			800			
25			900			
26			1000			
27			1500			
28			2000			
29			2500			
30			3000			
32			3500			
34			4000			
36			4500			

* Extrapolated values

2002-266-2324.sv1

THALES

Sound Velocity Profile

THALES

Thales Geosolutions (Pacific), Inc.
3738 Ruffin Road
San Diego, California

CLIENT: *AquaEnergy Group, Ltd.*
PROJECT: *Makah Bay Environmental Assessment Survey*
AREA: *Makah Bay*
JOB No: *2577*
VESSEL: *M/V Quicksilver*

Date of Launch: 24-Sep-02
Time of Launch: 02:34:00 UTC

Probe type : AML SV&P
Depth : 45 m

Latitude : 48° 20.277' N
Longitude : 124° 44.316' W

Depth (m)	Velocity (m/s)		Depth (m)	Velocity (m/s)		
1	1495.47		38	1480.41		
2	1493.74		40	1480.14		
3	1491.46		42	1479.81		
4	1490.45		44	1479.81		*
5	1487.82		46			
6	1486.47		48			
7	1486.22		50			
8	1486.18		55			
9	1486.20		60			
10	1486.23		65			
11	1486.21		70			
12	1486.11		75			
13	1485.79		80			
14	1485.21		90			
15	1485.07		100			
16	1484.69		150			
17	1484.58		200			
18	1484.53		250			
19	1484.50		300			
20	1484.49		400			
21	1484.45		500			
22	1484.22		600			
23	1483.85		700			
24	1483.10		800			
25	1482.42		900			
26	1482.29		1000			
27	1482.05		1500			
28	1481.64		2000			
29	1481.15		2500			
30	1480.72		3000			
32	1480.52		3500			
34	1480.42		4000			
36	1480.43		4500			

* Extrapolated values

2002-267-0234.sv1

THALES

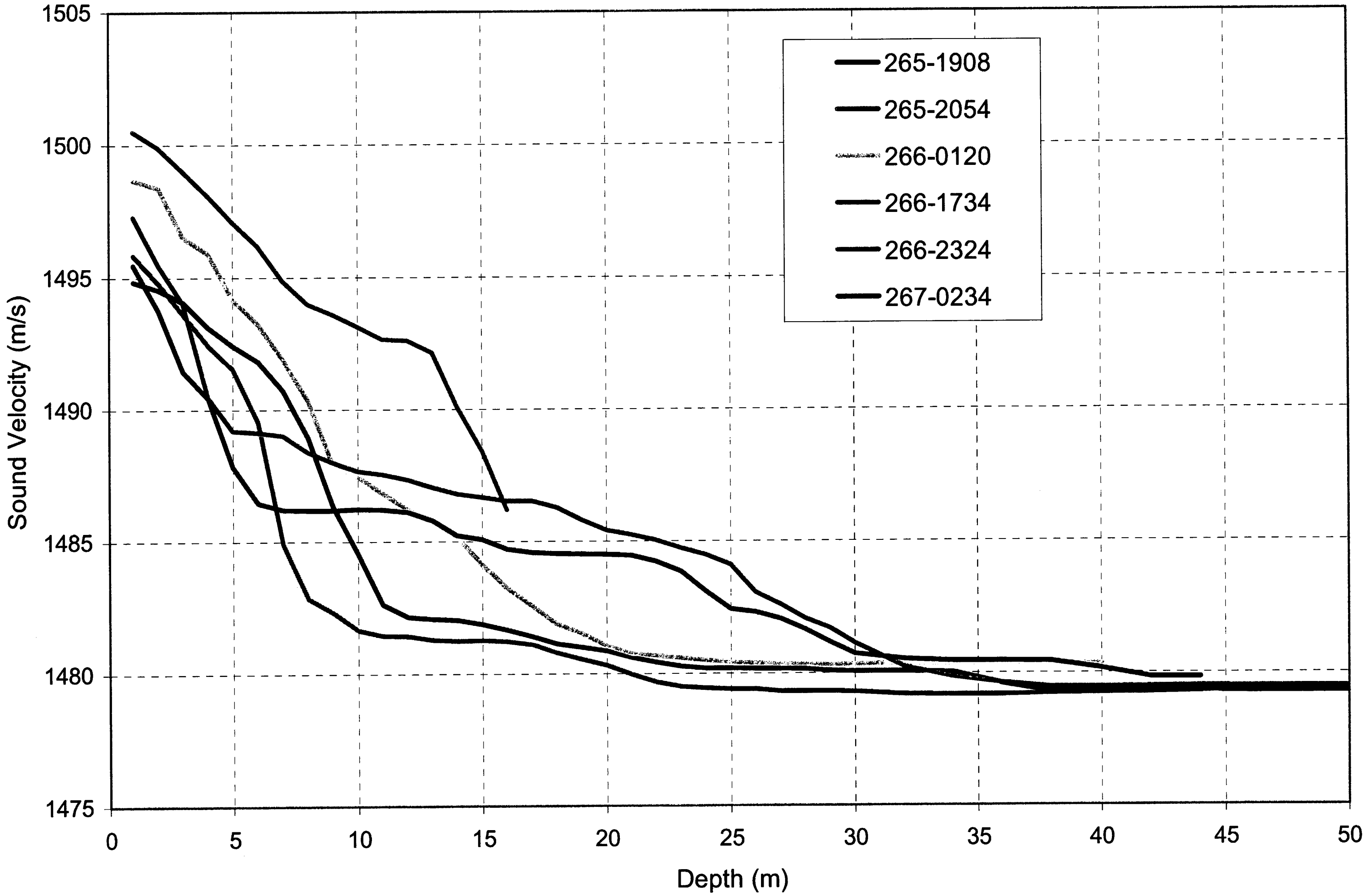


Figure F-1 Sound velocity profiles

Date	Time UTC	Latitude	Longitude	Water Depth (m)
22 Sep 2002	19:08	48° 19.788' N	124° 43.588' W	40
22 Sep 2002	20:54	48° 20.294' N	124° 44.074' W	45
23 Sep 2002	01:20	48° 19.782' N	124° 43.278' W	30
23 Sep 2002	17:34	48° 19.646' N	124° 43.934' W	42
23 Sep 2002	23:24	48° 19.848' N	124° 41.183' W	17
24 Sep 2002	02:34	48° 20.277' N	124° 44.316' W	42

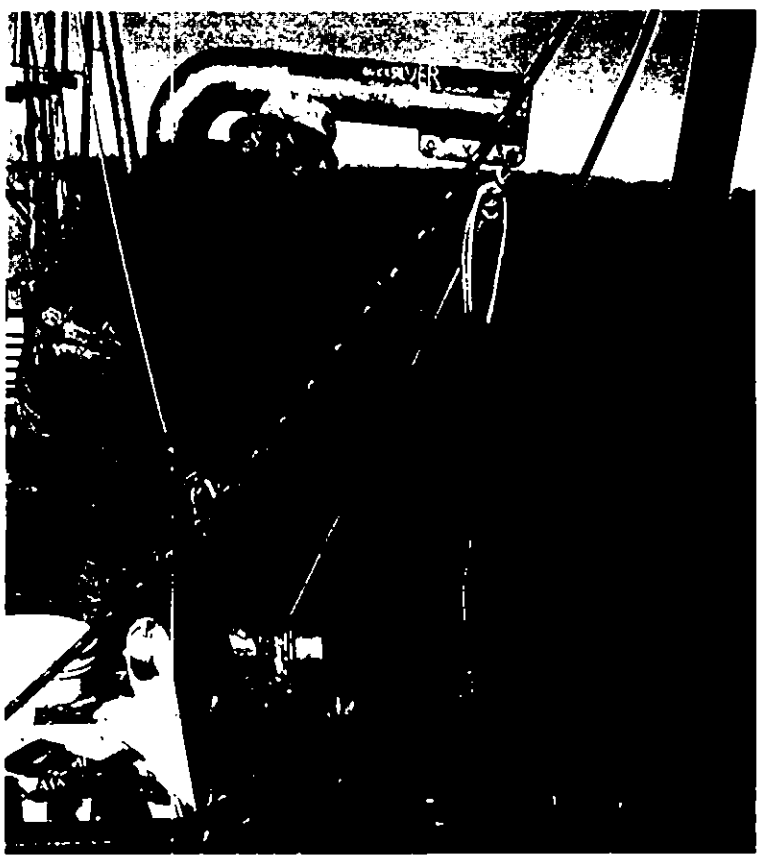


Figure F-1 AML SVP probe being deployed

Appendix G: MBES LOG SHEET EXAMPLES

THALES

RPI Project No.: *2577*
Location:

GEODETICS Horizontal Datum: *WGS84* Projection: *UTM Zone 10*
Vertical Datum: *MLLW*

EQUIPMENT Vessel: *M/V Quicksilver* Sounder: *Reson 8101*
Motion Reference: *HDMS* Positioning: *WinFrog 3.2.7 with USCG DGPS*
Multibeam Acquisition System: *Isis Sonar 5.84*

SURVEY DATA Survey Crew: Vessel Crew: Logged By: DR

Line name:	105
Nav File Name (.raw):	105
Mutlibeam File Name (.xtf):	0105
Weather / Sea State:	calm

Date:	9/23/2002
Julian Day:	266
Heading:	265°
Length of Line:	k
Ping Rate / Sec	10

TIME	RPM	SPEED	HDOP	RANGE	POWER	GAIN	TX PULSE	COMMENT
16:10:52	800	5.8	1.4	40	1	1	83	SOL
16:11:35				75				
16:19:09	800	6	1.5	75	1	1	83	EOL

Comments:

LINE QUALITY [X] GOOD [ ] BAD

PROCESSING

Project:	2577	Date: 2002- 266	Convert: ✓
preProcess - SubDirectory:	2002-266-survey	Load SVP File:	2577
Load Tide File:	2577	Load Draft File:	

LINE EDIT:

GHPR	B(.)	Nav	B(.)	SVP Apply	B(.)

Settings: 2577 65/65 0,1,2 100– Correct Julian Day: Yes [X] No [ ]

Extra Filters:

Slope	Ang	XD	Port	Stbd	Beams

Comments:

Merge:

LINE QUALITY [X] GOOD [ ] BAD

SUBSET EDIT: Session Name: Session Name:

Please refer to relevant subset edit logs for sessions named

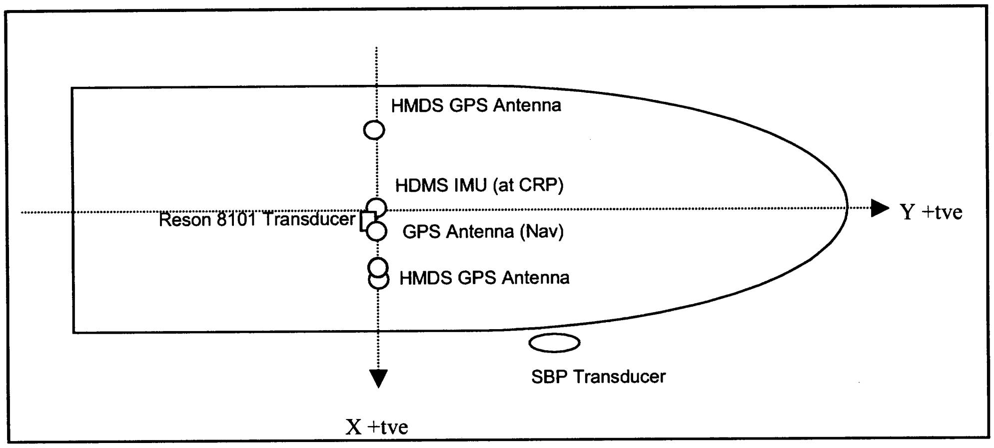
Appendix H : VESSEL OFFSETS

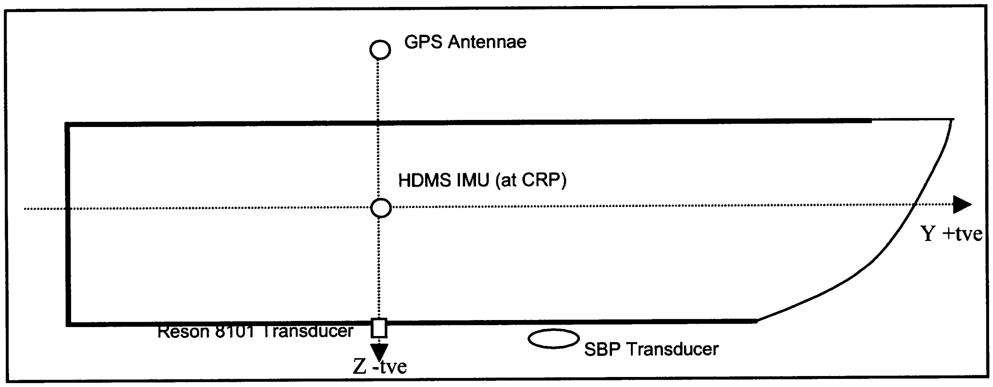
THALES

TGPI Project No.: *2577*
Client: *AquaEnergy*
Location: Makah Bay, WA

DATE: ____________________ **Vessel Name:** M/V Quicksilver

CRP:





EQUIPMENT	*Model*	OFFSET FROM CRP		
		X	Y	Z
IMU:	HDMS	0.00	0.00	0.00
Multi X-DUCER:	Reson 8101	0.03	-0.16	-0.57
GPS 2 Antenna:	Nav	0.05	0.00	4.77
SBP	GeoAcoustics 136	-0.90	2.30	-1.00
GPS 1 Antenna:	Master	-0.55	0.00	4.77
GPS 3 Antenna:	Slave	0.65	0.00	4.76

Notes

Axis to be used: X +tve toward starboard
for WinFrog Y +tve toward bow
Z -tve into water

Appendix I: PATCH TEST ACQUISITION PROCEDURES

PATCH TEST PROCEDURES

RECOMMENDED METHOD: *Using A Point Target*

A patch test over a point target can be completed by running as few as 5 lines.

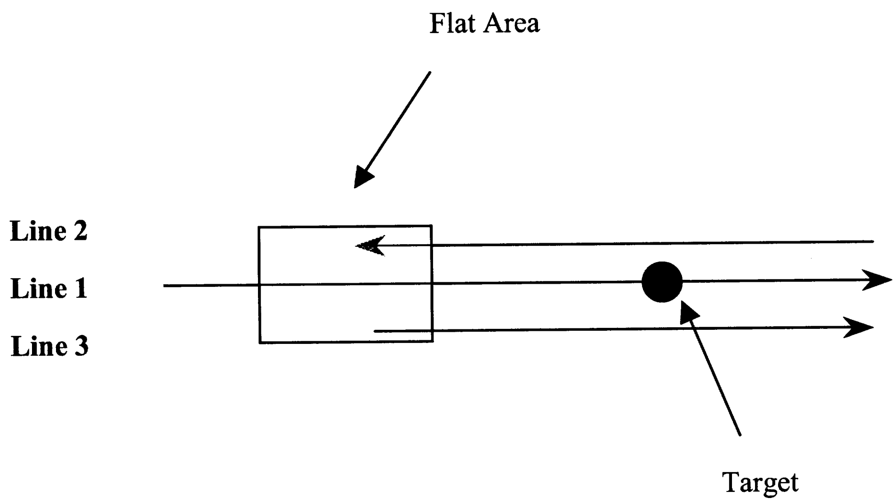
Four of these lines should be run at a slow survey speed to increase sounding density and reduce noise. They need to be run only fast enough to maintain good steerage.

The fifth line, (listed below as Run 3), should be run as fast as practical while still maintaining good data quality. This line is used to calibrate the Navigation (time) latency and will be compared with one of the slower lines. The greater the difference in velocity between the two lines, the more accurate the calibration.

All lines should be run along the same azimuth. Perpendicular lines are not required or desirable.

There are three lines, the center line is run three times, directly over the target. The lines should be run as follows:

Run	Line	Direction	RPM
1	1	Right	Low
2	1	Left	Low
3	1	Right	High
4	2	Left	Low
5	3	Right	Low



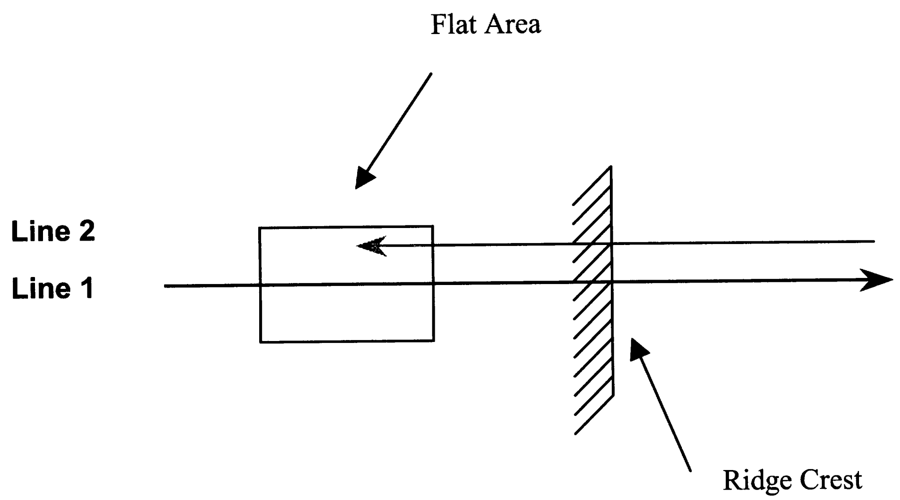
The distance between lines, should be equal to the water depth. If the survey vessel is crabbing, the line spacing must be adjusted to ensure the swaths from Runs 4 & 5 overlap at 45 degrees from nadir.

The runs will be processed as follows.

Calibration	Runs	
Navigation	1	3
Pitch	1	2
Azimuth	4	5
Roll	1	2

ALTERNATIVE METHOD 1: *Using A Ridge As A Target*

A linear target such as a small ridge, dredge cut, or sand ripples can be used in place of a point target. In this case, only 4 lines need to be run. They are all run perpendicular to the ridge or ripple crests.



There are two lines, Line 1 is run three times. The lines should be run as follows:

Run	Line	Direction	RPM
1	1	Right	Low
2	1	Left	Low
3	1	Right	High
4	2	Left	Low

The distance between Lines 1 and 2 should be equal to twice the water depth. If the survey vessel is crabbing, the line spacing must be adjusted to ensure the swaths from Runs 1 and 4 overlap at 45 degrees from nadir.

The runs will be processed as follows.

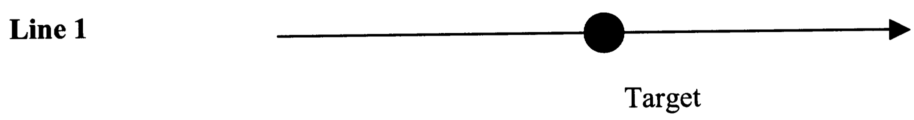
Calibration	Runs	
Navigation	1	3
Pitch	1	2
Azimuth	1	4
Roll	1	2

ALTERNATIVE METHOD 2: *Individual Line Pairs*

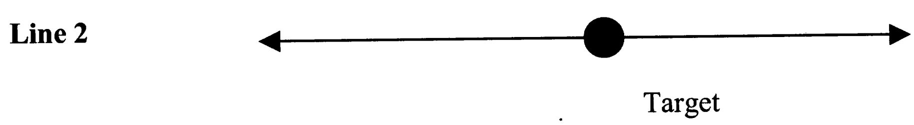
Most documents pertaining to multibeam patch tests suggest that a pair of lines be run for each of the four calibrations. This is generally unnecessary for data quality, takes additional boat time, and takes longer to process than the above techniques. Individual line pairs should be used only if mandated in the contract, or required by local conditions.

Line patterns for each of the four calibrations follow.

NAVIGATION

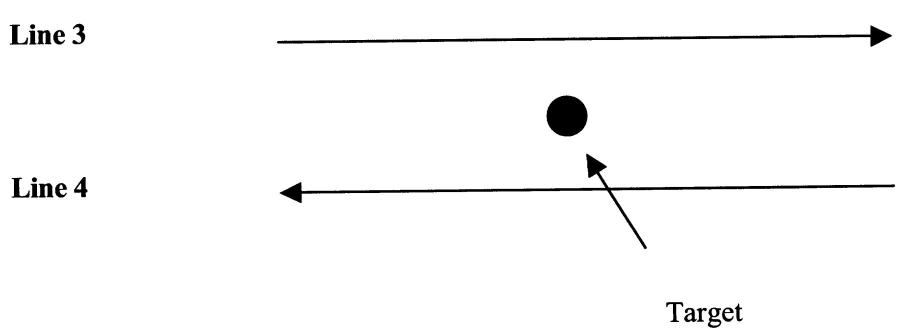


PITCH

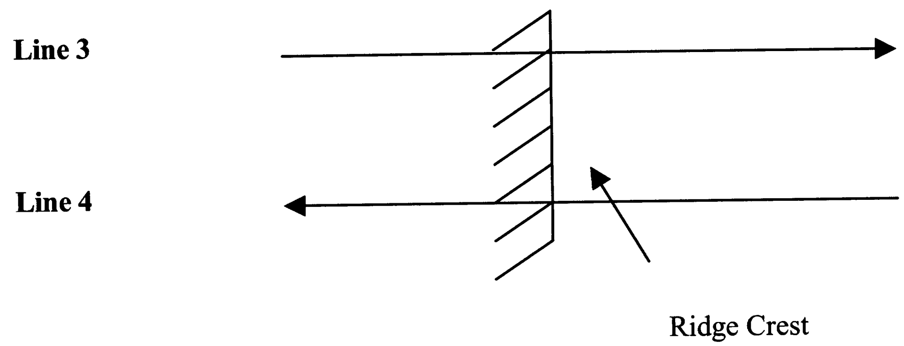


AZIMUTH (YAW)

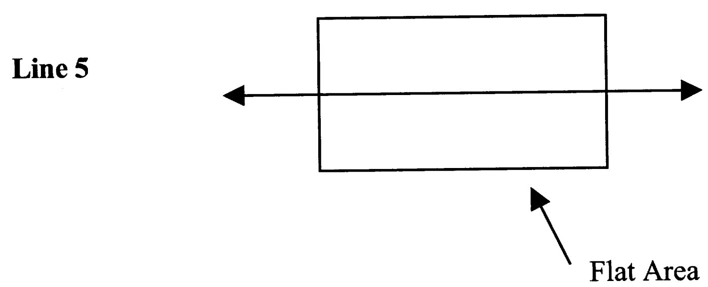
- *Point Target.*
  The distance from the line to the target should be equal to the water depth. The Distance between lines should be twice the water depth.



- *Linear Target.*
  The distance between lines should be equal to twice the water depth.



ROLL

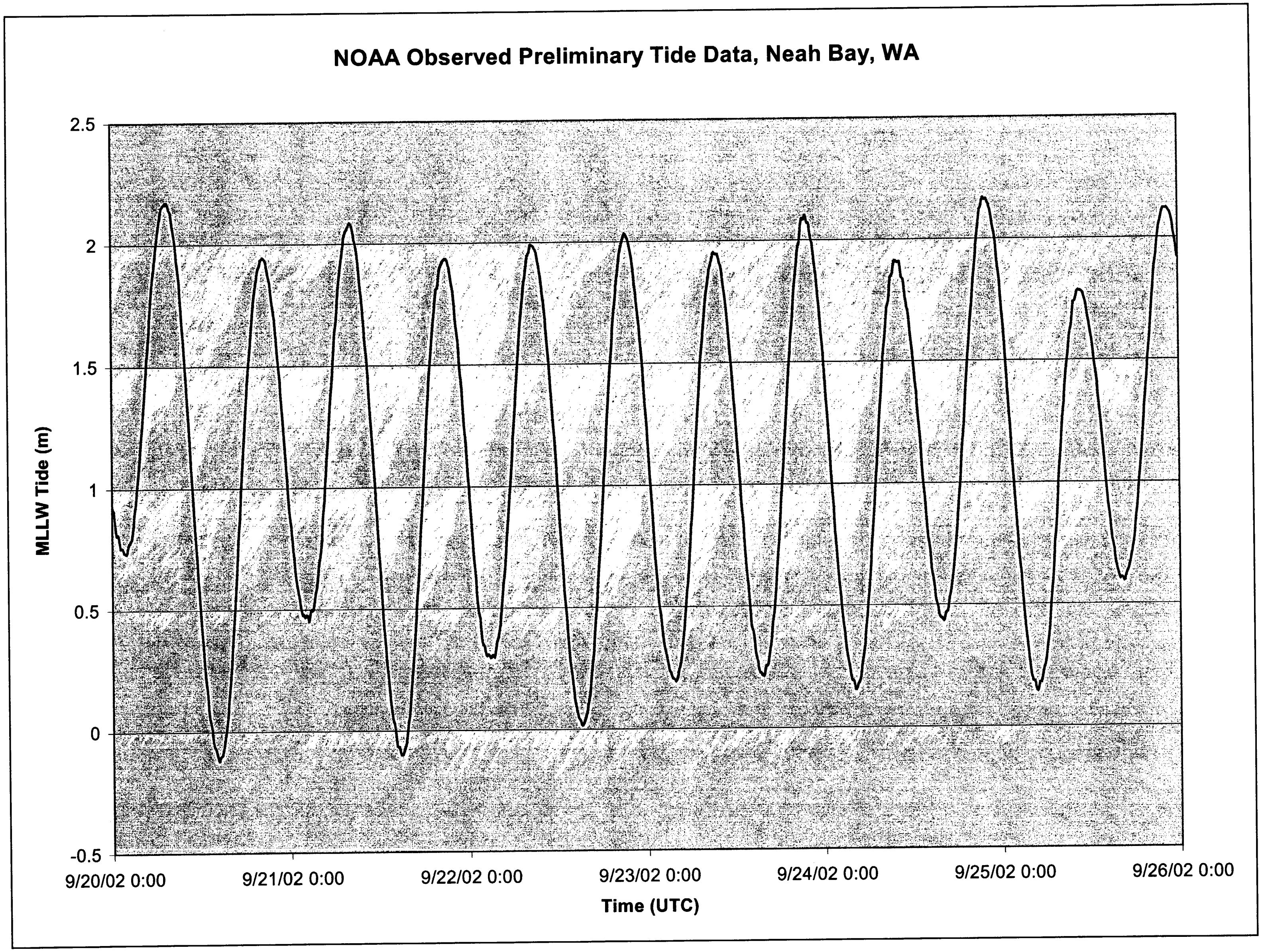


Run	Line	Direction	RPM
1	1	Right	Low
2	1	Right	High
3	2	Left	Low
4	2	Right	Low
5	3	Right	Low
6	4	Left	Low
7	5	Right	Low
8	5	Left	Low

Calibration	Runs	
Navigation	1	2
Pitch	3	4
Azimuth	5	6
Roll	7	8

Appendix J : TIDAL DATA SUMMARY

THALES



NOAA Observed Preliminary Tide Data, Neah Bay, WA
MLLW Tide (m)
2.5
2
1.5
1
0.5
0
-0.5
9/20/02 0:00
9/21/02 0:00
9/22/02 0:00
9/23/02 0:00
9/24/02 0:00
9/25/02 0:00
9/26/02 0:00
Time (UTC)

Appendix K : LIST OF CHARTS

THALES

The following charts were created for this project.

CHART	DESCRIPTION
TGPI-2577-AE-001-NBL-5000	Bathymetry Contours and Sun-illuminated Image
TGPI-2577-AE-002-NBL-5000	
TGPI-2577-AE-003-NF-5000	Seabed Features Interpretation, including Isopachs
TGPI-2577-AE-004-NF-5000	
TGPI-2577-AE-005-NI-5000	Backscatter Mosaic
TGPI-2577-AE-006-NI-5000	
TGPI-2577-AE-007-PBS-5000	Profile along Selected Cable Route

THALES

Appendix L : PERSONNEL

Thales GeoSolutions – Offshore Personnel	
Party Chief / Geophysicist	Roland Poeckert
Surveyor	Peter Pelletier
MBES Operator	Dale Reynolds
Vessel Captain	Marcus Ballweber
Thales GeoSolutions – Onshore Personnel	
Project Manager	James Hailstones
Survey Manager	Bill Gilmour
Data Center Supervisor	Carol McKenzie
Senior Data Analyst	Brian Davidson
Data Analyst	Amey Mount
Geologist	Anne Garcia

Appendix M : DATA EXAMPLES

Sub-bottom Profiler

The figure below shows an example of SBP data from the survey. These data are from a survey run along the center of the survey area, Survey Line 108; the direction to shore is to the left. The data show a seabed with a sediment horizon ~3 meters below the seabed (left), and a ~6-meter high rock outcropping (right). Subcropping of rock is also evident in the center of the figure. The horizontal lines indicate 2 ms, or about 1.6 meters, vertical spacing while the vertical lines indicate 10-second (nominally 60 meters) along-track spacing. The data clearly show the SBP's capability of penetrating several meters into the seabed.

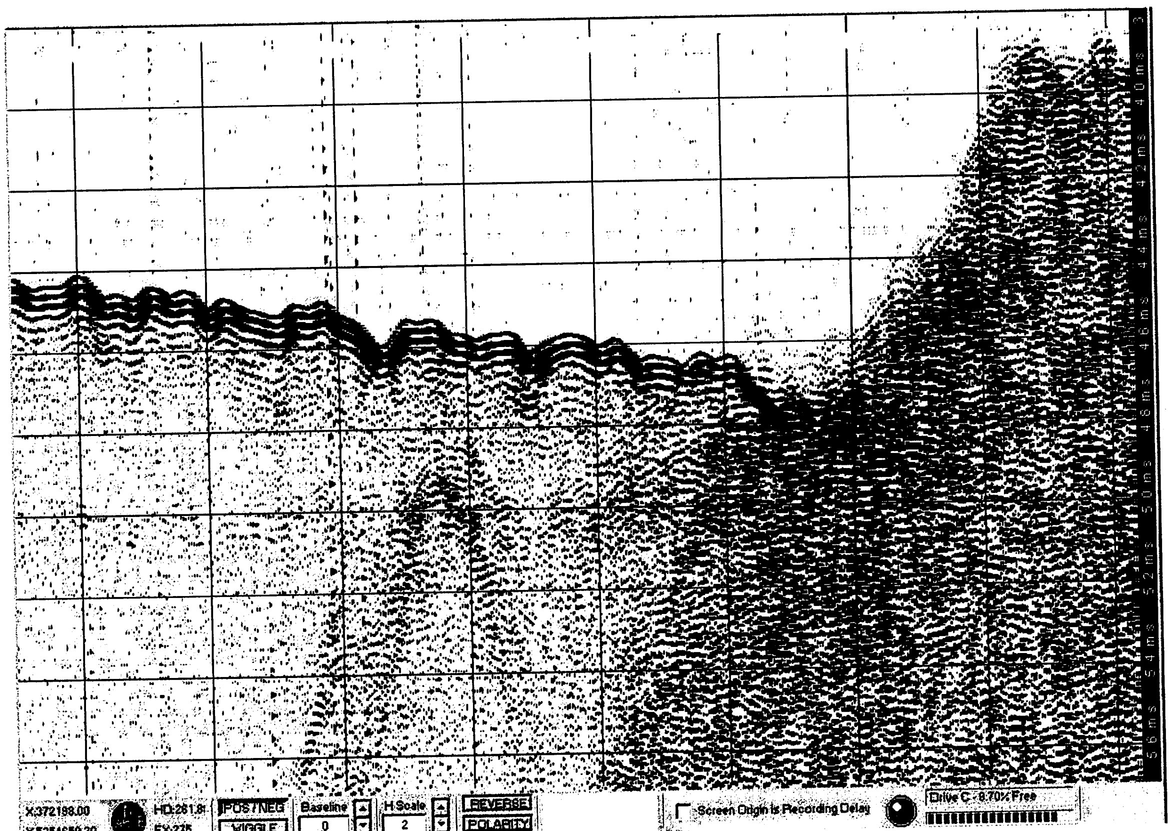


Figure 1 Sample of SBP data

MBES Backscatter

The figure below shows an example of MBES backscatter data from the survey. These data are from the same survey run and area, Survey Line 108, as shown in the SBP example above. The direction to shore is to the bottom. The data show a relatively featureless sandy-silty seabed (bottom) and a rock ridge crossing diagonally across the survey route (top). The full swath width shown is about 190 meters, while the vertical extent is about 230 meters.

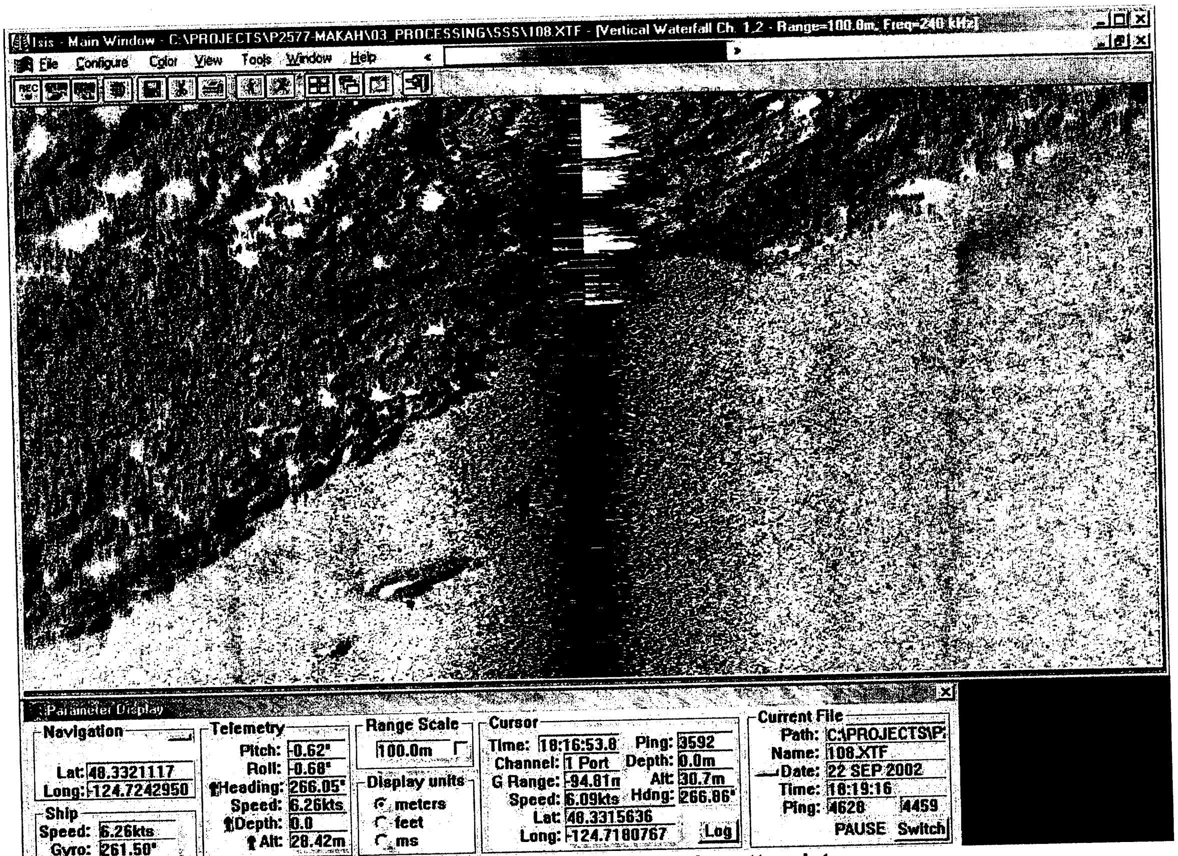


Figure 2 Sample of MBES backscatter data

Appendix K : LIST OF CHARTS

THALES

The following charts were created for this project.

CHART	DESCRIPTION
TGPI-2577-AE-001-NBL-5000	Bathymetry Contours and Sun-illuminated Image
TGPI-2577-AE-002-NBL-5000	
TGPI-2577-AE-003-NF-5000	Seabed Features Interpretation, including Isopachs
TGPI-2577-AE-004-NF-5000	
TGPI-2577-AE-005-NI-5000	Backscatter Mosaic
TGPI-2577-AE-006-NI-5000	
TGPI-2577-AE-007-PBS-5000	Profile along Selected Cable Route

Appendix L : PERSONNEL

THALES

Thales GeoSolutions – Offshore Personnel	
Party Chief / Geophysicist	Roland Poeckert
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Survey Manager	Bill Gilmour
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Senior Data Analyst	Brian Davidson
Data Analyst	Amey Mount
Geologist	Anne Garcia

Appendix M : DATA EXAMPLES

Sub-bottom Profiler

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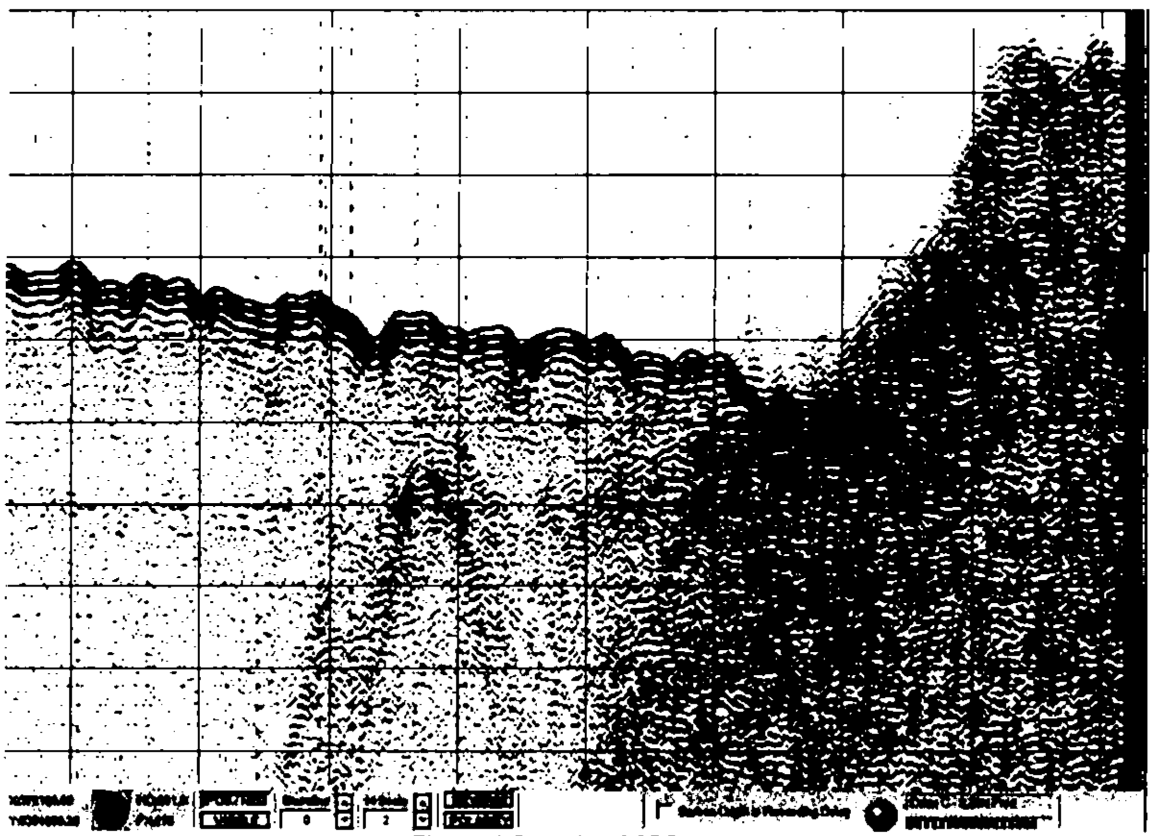

Figure 1 Sample of SBP data

MBES Backscatter

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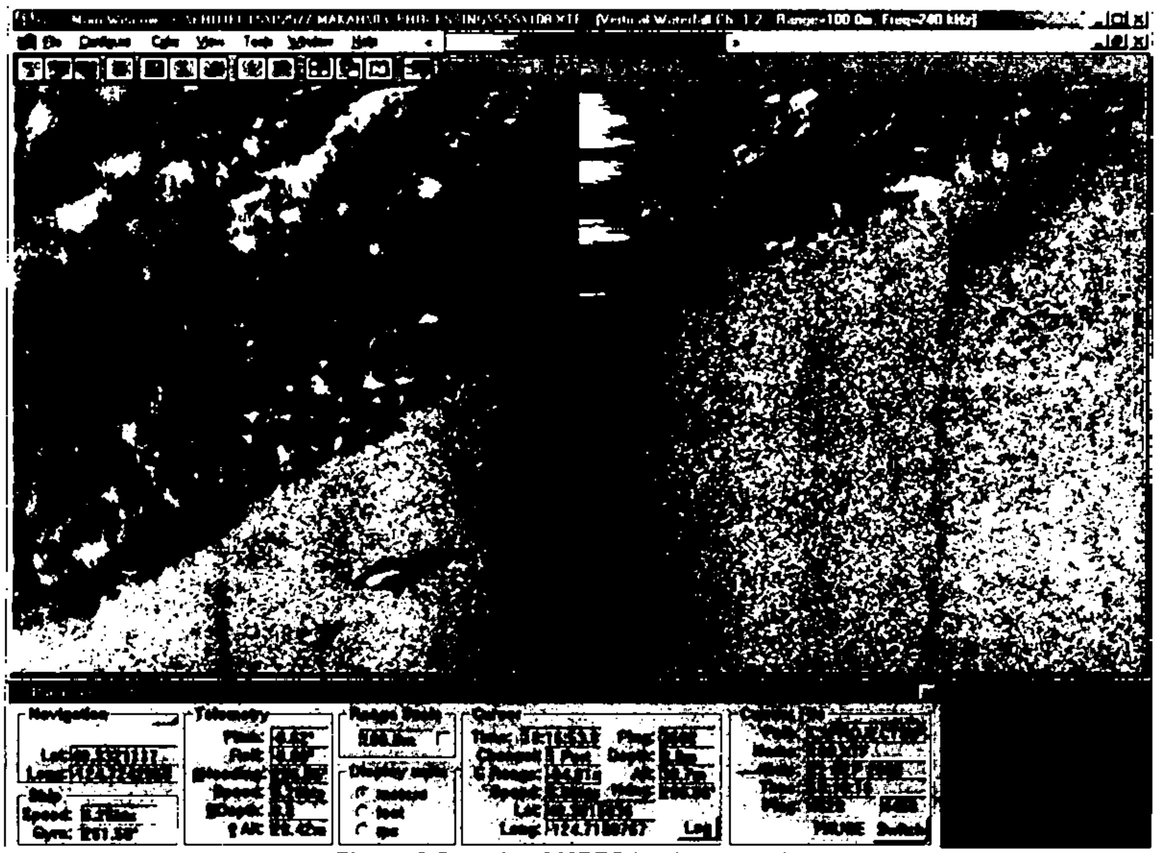

Figure 2 Sample of MBES backscatter data