THALES

ALASKA DEPARTMENT OF FISH AND GAME AND NATIONAL MARINE FISHERIES SERVICE

FISHERY HABITAT MAPPING

DATA ACQUISITION AND PROCESSING REPORT

Thales Document No: TGP-2251-RPT-01-00

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REPORT CERTIFICATION FOR

ALASKA DEPARTMENT OF FISH AND GAME AND NATIONAL MARINE FISHERIES SERVICE

FISHERY HABITAT MAPPING 2251

This issue of the report has been approved by:

1.	Project Manager	Robert Pawlowski	____________________________
2.	Survey Manager	William Gilmour	____________________________

This report has been distributed to:

1.	Alaska Department of Fish & Game	1 Copy
2.	Moss Landing Marine Laboratories	1 Copy
3.	National Marine Fisheries Service	1 Copy
4.	Thales GeoSolutions (Pacific), Inc.	1 Copy

The following versions of this report have been issued:

0	04/10/01	Fishery Habitat Mapping	TG / DA	WG	RP
REV	DATE	DESCRIPTION	APPROVED		

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1. EQUIPMENT

The Data Acquisition and Processing Report describes the hardware and software configurations of the equipment used to perform the multibeam echosounder survey at Cape Ommaney. The R/V Davidson acquired all sounding data at Cape Ommaney. The R/V Davidson was utilized for medium water depth multibeam data and sound velocity profiles. An equipment list and vessel description are included in Appendix A and B, respectively.

The Cape Ommaney survey was completed in 2.8 days, averaging 4.2 square kilometers per hour. Weather conditions remained less than Force 5 for the entire survey, subsiding to less than Force 3 and a one meter sea state for the majority of the survey. The sea state conditions enabled the data collection operations to average 7.5 knots throughout the survey at Cape Ommaney.

Data collection for Block 1 at Cape Ommaney was hindered by intermittent problems with the TSS HDMS sensor. HDMS failure required the vessel to break line and wait until the HDMS stabilized, upon which, the survey line was reacquired, at the point of failure, and the survey continued. Problems with the HDMS system occurred at increasing rates, until 25 May 2001, when the HDMS unit finally failed. Total lost survey time associated with hardware and software was approximately ten minutes.

There were very few problems encountered during the processing of multibeam echosounder data. Any data gaps that occurred, such as those lines interrupted by an HDMS problem, the lines were resurveyed and fitted within the existing data set.

Additional survey areas were allotted as time permitted.

1.1. SOUNDING EQUIPMENT

The R/V Davidson provided the survey platform for the deployed Thales survey team and representatives from the Alaska Department of Fish and Game and Moss Landing Research Institute. The R/V Davidson was equipped with a hull mounted Reson SeaBat 8111 with option 033 (pseudo sidescan). The Reson 8111 system operates at a frequency of 100 kHz with a depth controlled ping rate. The signal is controlled through a Reson 81-P Sonar Processor. The Reson 8111 has 101 horizontal beams, centered 1.5° apart (150° across-track beam width), and has a 1.5° along-track beam width. It transmits and receives a sonar signal to measure the relative water depth over the 150° swath. The system was used in water depths ranging from 30 to 300 meters. The range scale, gain, power level, ping rates, etc. were a function of water depth and data quality. Any changes to these parameters were noted on the survey line logs (see Separate 1).

Average survey speeds at Cape Ommaney were nominally 7.5 knots. Survey lines were orientated roughly parallel to the contours in the area. The line spacing depended on the water depth and data quality, but never exceeded three times the water depth. Line spacing per sheet was as follows:

Table 1-1 MBES Survey Line Spacing for Cape Ommaney Survey

SURVEY SHEET	MINIMUM (m)	MAXIMUM (m)
CO Block 1	210	700
CO Block 2	90	550
CO Block 3	150	350
CO Block 4	350	550

Survey line spacing did not include in-fill line spacing, as line spacing was determined on a feature by feature basis.

1.2. SONAR IMAGERY

No towed side scan sonar data was collected during survey operations at Cape Ommaney, although backscatter data was collected with the Reson 8111 Multibeam systems' option 033 (pseudo sidescan) to allow the creation of the imagery deliverables and to also facilitate the cleaning of bathymetry line data.

Backscatter data was collected at slant ranges up to the total range setting of the multibeam swath system.

The Reson 8111 multibeam sonar produces backscatter records along with range and angle packets used for bathymetry. The 8111 can generate backscatter in one of two distinct modes. For this survey, backscatter data was collected on a beam-by-beam basis. The backscatter from an individual beam is referred to as a snippet.

While a standard sidescan image is produced using one large beam on each side of the sonar, snippets are produced individually from each beam in the multibeam sonar. Snippets can be laced together, end to end, to produce a sidescan type image. The advantage in snippets stems form a large improvement in signal to noise ratio in the image, the result of using a focused beam rather than a broad beam to sample the backscatter.

Snippet data were logged in two formats during survey operations: raw snippets and combined snippets. Both data types are contained within the XTF files. Snippets are combined within the Reson 8111 processor to produce a sidescan like image of superior quality. The Reson 8111 combined snippets were used to produce the backscatter deliverables for this project. Processing software for the raw snippets is still under development.

1.3. POSITIONING EQUIPMENT

The R/V Davidson was equipped with NovAtel GPS antennas and multibeam computers with NovAtel GPS cards. The NovAtel GPS card is a twelve-channel GPS receiver that outputs a WGS84 geographical position and a One Pulse Per Second (1 PPS) timing stamp. The Winfrog Multibeam (WFMB) software package uses the 1 PPS output from the NovAtel card to continually synchronize the PC clock with GPS time.

Two MBX-3 differential receivers that used U.S. Coast Guard (USCG) network of differential beacons were used to supply RTCM corrections. Each MBX-3 receiver used a different USCG beacon, receiving Biorka Island and Annette Island respectively. For USCG beacon station information see the table below:

Table 1-2 USCG Beacon Information

USCG STATION	ID	LATITUDE	LONGITUDE	FREQ.	TX. RATE	RX. NO.
Biorka Island	890	56.855000 N	135.534722 W	305 kHz	100 BPS	1
Annette Island	889	55.068333 N	131.600000 W	323 kHz	100 BPS	2

WFMB was configured to write three separate positions into its .RAW data files. These were the 303 Pseudorange Console (PR-Console), the 303 Console (Console), and the 300 Davidson data files. The 303 records are always raw antenna positions and do not include vessel offsets or Kalman filtering. The 300 records include both antenna offsets and filtering.

The PR-Console and Console are independently calculated pseudorange positions. The PR-Console is generated by WFMB as a weighted arithmetic mean of the pseudorange positions calculated from the two Radio Technical Commission for Maritime Services (RTCM) sources listed above. The Console position is the pseudorange position calculated within the NovAtel card using a single RTCM source.

WFMB attached the PR-Console positions to the associated bathymetry data in the .XTF files. These positions were taken as a reasonable estimate of the true position and were checked against the Console and 300 Davidson positions at the end of every line for gross error. This method of positioning amounts to a real time verification of the RTCM sources since at least two RTCM sources would have to fail independently in a contrived manner to generate an erroneous position that appeared reasonable.

WFMB was configured to let the operator know when GPS positions were out of specified parameters. During periods of high Horizontal Dilution of Position (HDOP) (exceeding 4) or when the number of satellites dropped below four, data acquisition stopped.

1.4. SOFTWARE

1.4.1. Acquisition

The primary data set of positions, attitudes and soundings were collected with Thales GeoSolutions (Pacific) Inc. Winfrog Multibeam (WFMB) integrated navigation software. WFMB operated on a Pentium based PC, running Windows NT and used a NovAtel GPS card for positioning. Digiboard serial interface cards were installed to provide serial ports for all devices.

The WFMB software package uses the 1 PPS output from the NovAtel card to continuously synchronize the PC clock with GPS time. During timing tests prior to the survey, WFMB was shown to have an approximate 4 millisecond RMS error between ping and attitude time stamps.

The following display windows are made available in WFMB for operators to monitor data quality:

1. Devices: The Devices window shows the operator which hardware is attached to the PC. It also allows the operator to configure the devices, determine whether they are functioning properly and view received data.
2. Graphic: The Graphic window shows navigation information in plan view. This includes vessel position, survey lines, background plots and charts.
3. Vehicle: The Vehicle window can be configured to show any tabular navigation information required. Typically, this window displays position, time, line name, heading, HDOP, speed over ground, distance to start of line, distance to end of line, and distance off line. Many other data items are selectable.
4. Calculation: The Calculation window is used to look at specific data items in tabular or graphical format. Operators look here to view 1 PPS performance, monitor nadir of MBES, the GPS satellite constellation, and positional solutions.
5. Waterfall: The Waterfall display can be configured to view backscatter, bathymetric or sidescan data.
6. Profile: The Profile window displays the current multibeam profile and vessel attitude.

7. Ping Scroller: The Ping Scroller window displays the current profile and a short history of profiles. The profile scrolls down the window and can be filtered by beam number and quality.
8. QC View: The QC View window displays binned soundings in plan view. The bin size is user defined and can be filtered by beam number and quality.
9. 3-D View: The 3-D window displays a 3-D mesh of the current line of profiles. The mesh can be rotated to a user-specified angle and can be exaggerated vertically.

Winfrog Multibeam writes Extended Triton Format (XTF), RAW, and DAT files to the hard disc. The XTF files contain all multibeam bathymetry, position, attitude and heading data required by CARIS to process the soundings, as well as the backscatter data required by Triton ISIS to process the pseudo sidescan. The RAW and DAT files contain position, RTCM, HDOP, attitude, heading data and event records. The DAT files were not used in the processing on this survey. The RAW files were used for positioning, heave, pitch and roll QC.

1.4.2. Processing

All soundings were processed using Universal Systems' CARIS Hydrographic Information Processing System (HIPS) and Hydrographic Data Cleaning System (HDCS) on Unix workstations (Sun Solaris V7) and an NT workstation. Processed soundings were then used to create the ASCII formatted data set listings and the sun illuminated Digital Terrain Models (DTM's) deliverables.

HPTools V 8.9.5 was used to calculate zoned tidal correctors using CARIS navigation files that were exported from CARIS NT.

AutoCAD Map R 3.0 was utilized for general survey planning, reviewing coverage plots, creating fill-ins and survey line re-runs, etc.

TritonElics ISIS V 5.0 and DelphMap V 2.5 were utilized for processing backscatter data used to create backscatter strength mosaics.

1.4.3. Sound Velocity Profiles

Sea-Bird CTD Sound Velocity Profile (SVP) data were acquired using SeaTerm V 1.2 and were processed with Thales GeoSolutions (Pacific) Inc.' SVP1 V 1.0 SVP processing software. Complete lists of software and versions used on this project are included in Appendix A.

2. QUALITY CONTROL

Multibeam soundings and backscatter data were acquired in XTF using WFMB. XTF data can be directly processed with the Triton ISIS software. In order for the XTF data to be used by CARIS HDCS and HIPS processing packages, it must be converted to HDCS format using the XTF to HDCS routine.

2.1. SOUNDINGS

Prior to each survey line being converted using the XTF to HDCS function, the vessel offsets, patch test calibration values, static draft and dynamic measurements were entered into the vessel configuration file. Once the data was converted, the SVP and static draft files were loaded into each line and then corrected in HDCS. The attitude, navigation and bathymetry data for individual lines were all examined for noise, as well as ensuring the completeness and correctness of the data set. Filter settings used during processing of the survey line data obtained with the 8111 were set to 65nadir. The 65nadir filter rejected beams greater than 65 degrees on either side of nadir. Note: Rejected does not mean the sounding data were deleted, the data was flagged as being rejected and could have been reinserted into the data set during HDCS line and subset editing. The filter setting used on each line was noted on each line log.

In high noise areas, additional filters may have been applied to specific screens or entire lines. In these instances, the additional filters are noted on the line logs.

After each individual line was examined and cleaned in HDCS swathEdit, the tide file was loaded and the lines merged. Subsets were created in CARIS HDCS Subset Edit mode and adjacent lines of data were examined to identify tidal busts, sound velocity errors, roll errors and clean any remaining noise.

Color and gray scale, sun illuminated DTM's were then created in HIPS to aid in coverage and to help detect any errors in SVP, tides, heave, pitch and roll, etc. The DTM's were created at the specified 5 meter and 10 meter grid intervals. The DTM's were exported to a TIFF format and imported into AutoCAD for final review of coverage and systematic errors.

Statistical analysis of the sounding data was conducted via the CARIS Quality Control Report (QCR) routine. Tie lines were run in each Block and were compared with survey line data acquired from the mainline scheme. The Quality Control Reports are in Separate 3.

2.2. BACKSCATTER

Multibeam echo sounder and backscatter data were collected and initially processed onboard the acquisition vessel. Backscatter products were reviewed by the onboard client representatives and classified for bottom type, geologic characteristics, and physical structure. Initial sun enhanced imagery was provided onboard for the Cape Ommaney area to ensure data quality.

Prior to processing, some adjustments had been made to the XTF files to ensure precise geo-encoding. The XTF files delivered with this project contain these modifications:

1. Sonar range information, stored in the Reson bathymetry packet, was copied to the sidescan channel header. This was required for processing the data in TritonElics Isis software.
2. The position recorded in the XTF file indicated the location of the GPS antenna. A position for the Reson 8111 head was calculated using offsets, from the antenna to the 8111, and vessel attitude (pitch, roll, and heading). The sonar head position was written into the XTF files, replacing the antenna position.

3. CORRECTIONS TO SOUNDINGS

3.1. SOUND VELOCITY PROFILES

Sound velocity casts were performed nominally every five to six hours. Water conditions began as isothermal and isohaline, enabling a constant sound velocity across the entire working area. After establishing the initial sound velocity trends throughout the survey area, sound velocity casts were reduced to intervals from six to ten hours, depending on water depth and the beginning of a new survey area.

The Sea-Bird Model 19-03 Conductivity, Temperature and Depth (CTD) profiler was used for determining sound velocities for the survey. The SBE 19-03 delivered CTD samples at a rate of 2 samples-per-second. For each cast, probes were held at the surface for three minutes for temperature equilibrium. The CTD was then lowered and raised slowly (about 0.2 m/s) to maintain equilibrium. Between casts, the CTD were stored in a barrel of fresh water to minimize salt-water corrosion and to hold them at ambient water temperatures. Refer to Appendix C for Calibration Reports.

Sound velocity profiles were collected at the following times and locations for the Cape Ommaney survey:

Table 3-1 Sound Velocity Profiles for Cape Ommaney Site

DATE	JD	TIME (UTC)	SVP FILE NAME	LATITUDE	LONGITUDE	DEPTH (m)
24/05/01	144	21:29	2001_144-2129.sv1	56.154925 N	135.137094 W	270
25/05/01	145	11:07	2001_145-1113.sv1	56.160136 N	134.872500 W	180
26/05/01	146	04:30	2001_146-0430.sv1	56.198989 N	134.864489 W	164
26/05/01	146	16:50	2001_146-1650.sv1	56.125628 N	134.724475 W	207
27/05/01	147	05:28	2001_147-0528.sv1	56.132672 N	134.863903 W	280

Individual SVP plots can be viewed in Separate 2.

The following graph is an example of sound velocity profiles showing raw data sets from two sound velocity probes in black and processed data in red and blue. Please note that CARIS HDCS has a 0.1 m resolution in depth and a 0.1 m/s resolution in velocity for its SVP calculations. Data was decimated to obtain these values for use in CARIS. That fat green line on the graph below shows the velocity step function that is used by CARIS in its constant velocity model. On all the following graphs, the red and blue lines trace the vertices of the velocity step function.

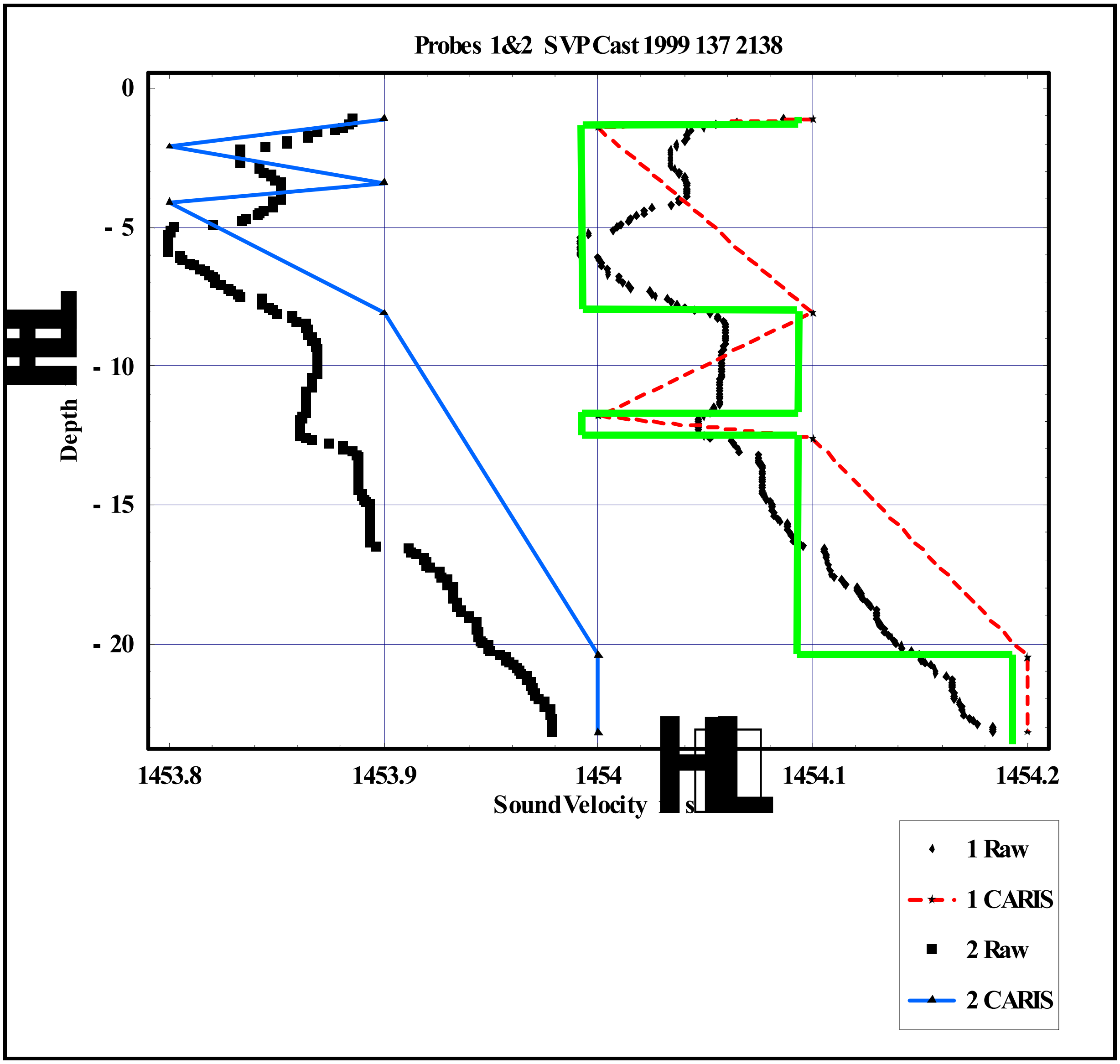

Figure 3-1 Sound Velocity Profiles

3.2. SETTLEMENT CURVE

To perform the squat settlement test, the R/V Davidson was equipped temporarily with Trimble RTK GPS equipment. The squat settlement tests were performed by first establishing a 500 meter line in the direction of the current. The survey vessel occupied the south end of the line for two minutes, logging RTK data. The line was then run heading north at 2 knots and then south at 2 knots. The survey vessel again occupied the south end of the line. This scenario was repeated at various speeds.

Measurements were reduced to the vessel's common reference point (CRP). Consequently, vessel squat had virtually no effect on transducer elevation. Static measurements at the end of the line were used to establish tidal correctors. All data sets were corrected for heave, pitch and roll and reduced to the vessel's CRP.

A settlement curve for the Davidson, with the Reson 8111 installed, was calculated from RTK GPS derived altitude data. The tests were conducted in Puget Sound, off the coast of Seattle on 14 May, 2001 (Julian Day 134). Trimble receivers were used at the base station and remote site. RTK positions and altitudes were logged using Winfrog Multibeam at one second intervals.

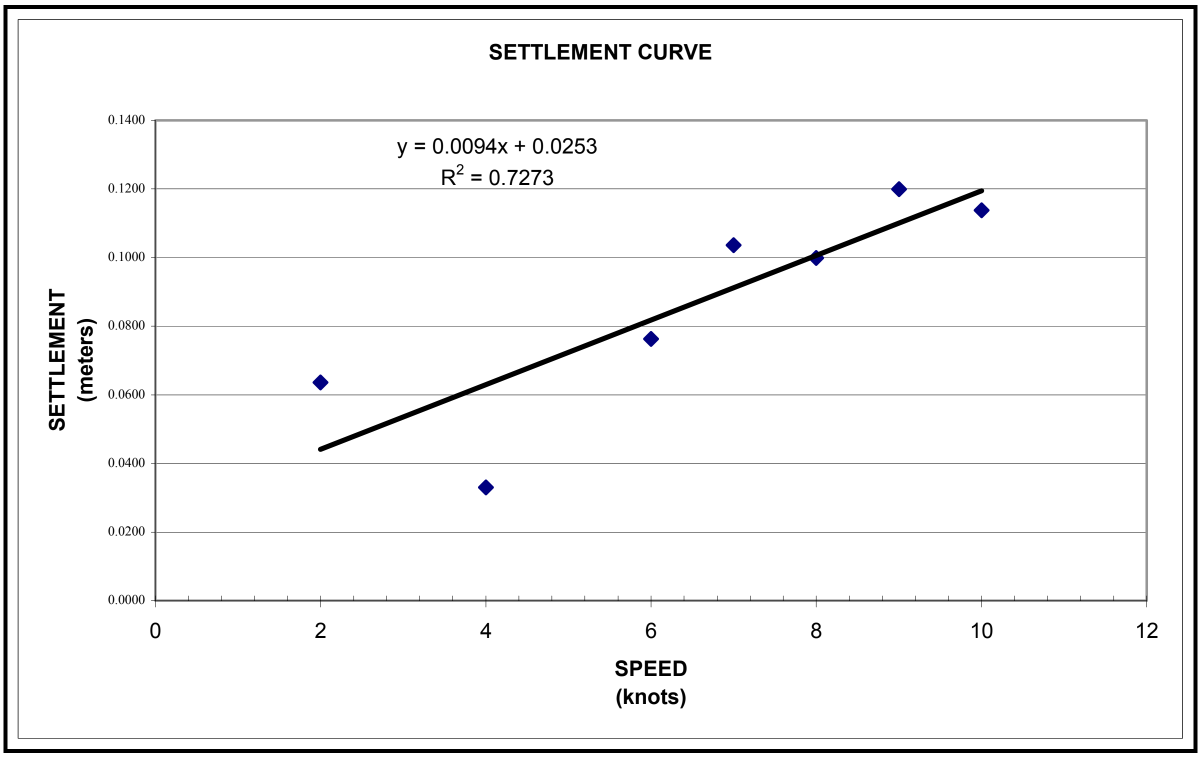

Figure 3-2 R/V Davidson and Reson 8111 Settlement Curve

The results of the squat settlement test for the Reson 8111 are shown in the following table:

Table 3-2 Calculated Settlement

SPEED (kts)	SETTLEMENT (m)
2	0.0635
4	0.0330
6	0.0763
7	0.1036
8	0.0998
9	0.1199
10	0.1138

Note: Vessel speed was noted on the survey line logs.

3.3. STATIC DRAFT

Static draft was measured from tabs on both sides of the vessels, the average was taken, and then the correction to the CRP was applied. The table below shows the draft values for the R/V Davidson used in data processing.

Table 3-3 Static Draft Measurements

Sample #	DATE (UTC)	JULIAN DAY	TIME (UTC)	PORT (m)	STBD (m)	DRAFT (m)
1	25/05/01	145	22:13	-2.16	-2.23	-2.20

3.4. TIDES

Soundings were reduced to MLLW using verified tidal data from NOAA gauge at Sitka, AK. The tidal zoning correctors applied to each block are as follows:

Table 3-4 Tidal Zoning Correctors at Sitka, AK

ZONE	TIME	RANGE RATIO
CO1	-00:06:00	0.99
CO2	-00:12:00	0.99

LCMF Inc. was contracted to provide final tidal zoning for the Cape Ommaney survey area. The verified tidal data were then used to correct acquired bathymetric data. The limits of the tidal zones at Cape Ommaney, as derived by LCMF, can be viewed in the following diagram:

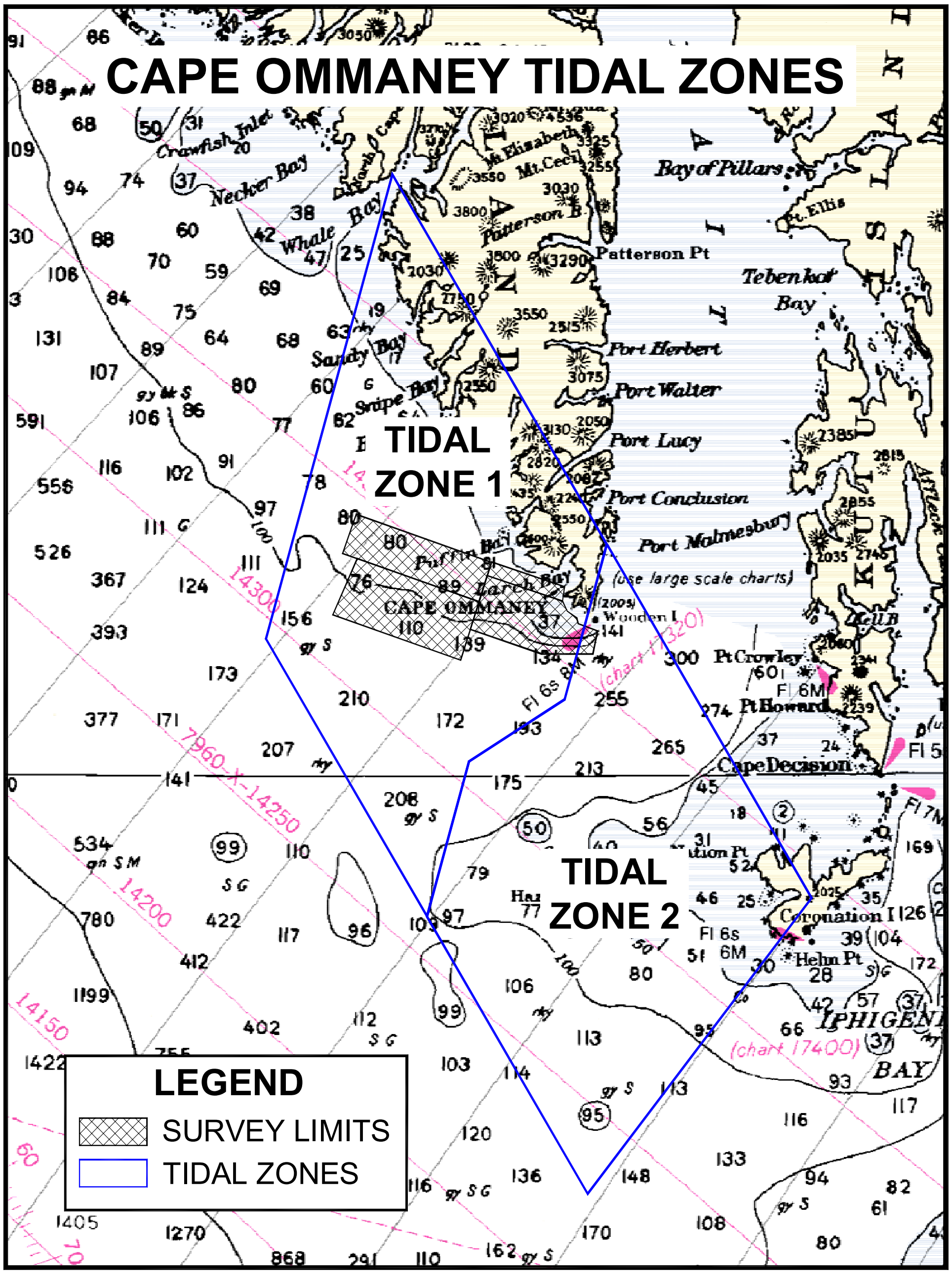

Figure 3-3 Cape Ommaney Tidal Zones

3.5. VESSEL ATTITUDE: HEADING, HEAVE, PITCH, AND ROLL

Vessel heading and dynamic motion were measured by a TSS HDMS system for the survey of Block 1 at Cape Ommaney. The HDMS calculated heading by inversing between two NovAtel GPS generated antennae positions. An accelerometer block mounted in the hull of the vessel, just over the multibeam transducer, measured vessel attitude.

The operational accuracy for this system, as documented by the manufacturer is as follows:

Table 3-5 TSS HDMS Accuracy

MEASUREMENT	ACCURACY
Pitch and Roll	0.035°
Heading	0.05°
Heave	5% or 5 cm over 20 seconds

The heave filter in the HDMS was set to 100 throughout the entire survey at Cape Ommaney.

The patch test calibration values for the HDMS system, used to reduce the soundings in Block 1 for the survey at Cape Ommaney were as follows:

Table 3-6 TSS HDMS Patch Test Results, 14 May 2001

TEST	MEAN CORRECTION
Navigation Timing Error	0.00
Pitch Offset	0.36
Azimuth Offset	0.20
Roll Offset	0.65

Upon the failing of the HDMS system, vessel heading and dynamic motion were measured by a SG Brown Meridian Surveyor Gyrocompass and TSS DMS2-05, respectively, for the remainder of the survey at Cape Ommaney. The SG Brown Gyrocompass was permanently installed within the navigation room, behind the wheelhouse on the R/V Davidson. The TSS DMS2-05 accelerometer block was mounted in the hull of the vessel, slightly aft of the multibeam transducer.

The operational accuracy's for these systems, as documented by the manufacturers, is as follows:

Table 3-7 Heading and Dynamic Motion Sensor Accuracy's

DEVICE	MEASUREMENT	ACCURACY
TSS DMS2-05	Pitch and Roll	0.03°
TSS DMS2-05	Heave	5 cm or 5%
SG Brown Gyro	Heading	0.20°

The heave filter in the DMS2-05 was set to medium throughout the entire survey at Glacier Bay. The majority of survey lines were run with a 4 to 5 minute run-in to ensure that the heave sensor had stabilized. Unfortunately, 4 to 5 minute run-ins were not possible in some of the more aberrant and shallower areas.

The patch test calibration values for the DMS2-05 system, used to reduce the soundings for the remainder of the survey at Cape Ommaney were as follows:

Table 3-8 TSS DMS2-05 Patch Test Results, 26 May 2001

TEST	MEAN CORRECTION
Navigation Timing Error	0.00
Pitch Offset	0.80
Azimuth Offset	1.80
Roll Offset	1.60

When errors were noticed in the vessel attitude data obtained with the DMS2-05, conversion variables were calculated for Pitch and Roll to simulate the HDMS. The equations used to calculate these values are listed below:

$$Roll_{NEW} = 0.751313 + 0.937019 * Roll$$

$$Pitch_{NEW} = -0.586771 + 0.894647 * Pitch$$

Thus, new patch test values were determined from the converted data set. The new patch test calibration values for the DMS2-05 system, applied to the converted soundings at Cape Ommaney were as follows:

Table 3-9 Converted TSS DMS2-05 Patch Test Results

TEST	MEAN CORRECTION
Navigation Timing Error	0.00
Pitch Offset	-0.35
Azimuth Offset	1.70
Roll Offset	2.41

3.6. BACKSCATTER

The digital backscatter data stored in XTF files were processed in Isis Sonar V 5.0 and DelphMap V 2.5. Each line was processed individually. The final mosaic was a merged image of all the individual lines. Notable aspects of the backscatter processing include:

1. Time Varied Gains (TVG) were set to compensate for signal strength variations resulting from power and gain adjustments to the 8111 and grazing angle.
2. Data from outer edges of the scans were clipped, where there was sufficient overlap, leaving only higher quality, near range data.
3. Vessel pitch was used to refine the position of each scan line on the seafloor during geo-encoding.

4. The mosaic was created on a DTM of the bathymetry. Typically, backscatter data is mosaicked using a flat seafloor assumption, resulting in across track errors in the imagery. For this project, the bathymetric DTM was used to refine the geo-referencing of the imagery resulting in a precise and accurate backscatter image of the seafloor.

Appendix A – Equipment List and Software Versions

Equipment

Table A-1 R/V Davidson Equipment

SYSTEM	MANUFACTURER	MODEL	SERIAL NO.
Multibeam Sounder	Reson	SeaBat 8111 Processor	23279
		SeaBat 8111 Transducer Array	Transmit/Receive 0100050/0700016
		8111 Firmware Dry: 8111-2.07-996C Wet: 8111-1.00-CA00	
DMS	TSS	DMS2-05	004104
Gyrocompass	SG Brown	Meridian Surveyor	2165
HDMS	TSS	IMU Processor V5.3/V3.0/V1.2	049 013
GPS Receivers	NovAtel	NovAtel GPS Card, PC Series	450017
GPS Receivers	NovAtel	NovAtel GPS Card, PC Series	96230005
CTD Profiler	Sea-Bird Electronics	SBE 19 Plus	193520-290
RTCM	CSI Inc.	CSI MBX-3	9830-2023-0001
RTCM	CSI Inc.	CSI MBX-3	9834-221-0002

Software

Winfrog Multibeam V 3.23 05/18/01

Winfrog V 3.1

HPTools V 8.9.5

CARIS UNIX V 4.3

CARIS NT V 5.1

World Tides 2001

MapInfo Professional V 5.0

AutoCAD Map Release 3

SeaSave Win32 V 1 .20

SeaTerm V 1.20

DATCNV V 4.248

SVP V1.0

Chart-X V 2.6

MicroStation SE V 05.07.01.14

Ribbit Cable & Pipe V 1.4

ArcView GIS V 3.2

POS/MV Controller V 3.0

TritonElics ISIS SONAR V 5.0

CARIS Version in Use

CARIS version 4.3 installed on 09-24-98.

UPDATES/PATCHES

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xtfToHDCS	-updated 09-24-98
ConvertToHDCS	-updated 09-24-98
hdcs	-updated 09-24-98
hdcsLineMerge	-updated 09-24-98
resontoHDCS	-updated 09-24-98
ConvertToHDCS	-updated 01-21-99
HDCS	-updated 01-21-99
ProgramSettings	-updated 01-21-99
hdcs	-updated 01-21-99
hdcsLineMerge	-updated 01-21-99
xtfToHDCS	-updated 01-21-99
bin/refohdcs	-updated 03-18-99
bin/swathedit	-updated 03-18-99
cld/refohdcs	-updated 03-18-99
refohdcs.com	-updated 03-18-99
refohdcscl.com	-updated 03-18-99
refomany.com	-updated 03-18-99
refomanycl.com	-updated 03-18-99
refohdcs.frm	-updated 03-18-99
refohdcscl.frm	-updated 03-18-99
refomany.frm	-updated 03-18-99
refomanycl.frm	-updated 03-18-99
sys/makehist.cla	-updated 12-06-99
sys/SWATHEDIT	-updated 03-18-99
hips/bin/hdcs	-updated 04-01-99
hips/bin/hdcsLineMerge	-updated 04-01-99

hips/bin/xtftoHDCS	-updated 04-01-99
hips/bin/suppsoun	-updated 03-23-01
hips/sys/HDCS	-updated 04-01-99
hips/sys/ConvertToHDCS	-updated 04-01-99
hips/sys/programSettings	-updated 04-01-99
hips/form/export_dxf.frm	-updated 04-01-99
hips/com/export.com	-updated 04-01-99
hips/com/DXFcorrect.awk	-updated 04-01-99
caris/bin/sun4_2/cared.x	-updated 05-13-99
caris/system/msgfil.dat	-updated 05-13-99
bin/makehist	-updated 06-15-01

Appendix B – Vessel Descriptions

R/V Davidson

The R/V Davidson is a 153 foot 833 GRT survey vessel capable of extended duration offshore survey operations (see Figure B-1). The R/V Davidson accommodates a vessel and survey crew, acquisition hardware, and the processing center for reducing acquired data to field quality products. Additional information about the R/V Davidson can be seen in the table below:

Figure B-1 R/V Davidson

Table B-1 R/V Davidson Specifications

SURVEY LAUNCH	R/V DAVIDSON
Official Number	D1066485
Owner	Venture Pacific Marine Inc.
Year Built	01/02/67
Length	153 ft
Beam	38 ft
Draft	17.75 ft
Gross Ton	250
Net Ton	833
Power	1800 hp

Prior to operations, the keel was cut just aft of mid-ship and the Reson 8111 multibeam sonar was mounted in a 24 inch pipe tapered cowling on the hull (see Figure B-2). The conical cowling protected the sonar head, forward and aft, by a crescent shaped skid. The accelerometer package for the TSS DMS2-05 was mounted in the hull of the vessel just aft of the 8111 multibeam transducer head. The accelerometer package for the TSS HDMS was mounted in the hull, over the 8111 multibeam transducer head.

Figure B-2 Hull Mounted Reson 8111

Three NovAtel antennas were mounted on the ship's mast for positioning and heading. The central antenna was used for vessel position. The two HDMS antennas were offset 2.0 meters, fore and aft, of one another. The forward antenna functioned as the HDMS master antenna while the aft antenna functioned as the HDMS secondary (see Figure B-3). A spare NovAtel GPS antenna was mounted between two differential antennas behind the ship's mast (see Figure B-3).

The SBE CTD was deployed from an A-Frame on the stern using a hydraulic line hauler.

Figure B-3 Primary GPS and HDMS Antennas

Figure B-4 Spare GPS and Differential Antennas

Offsets are used in Winfrog for display purposes only. Offset values were applied to the data in CARIS HDCS as specified in the vessel configuration file. The vessel offsets used are shown in the following table:

Table B-2 R/V Davidson Vessel Offsets

FROM	TO	X	Y	Z
CRP	DMS2-05 Motion Sensor	0.010	-2.62	-2.310
CRP	8111 Transducer	0.000	0.000	2.040
CRP	Primary Navigation GPS Antenna	0.010	3.820	-23.280
CRP	Backup Navigation GPS Antenna	0.050	-5.950	-14.360
CRP	HDMS Master Antenna	0.150	5.070	-23.450
CRP	HDMS Slave Antenna	0.150	3.070	-23.450
CRP	HDMS Accelerometer	0.000	0.000	0.000
CRP	Draft Measuring Point, Port	-5.790	0.000	-5.260
CRP	Draft Measuring Point, Starboard	5.790	0.000	-5.280

Note: All units are meters.

Axis used: X positive toward starboard
Y positive toward bow
Z positive into the water

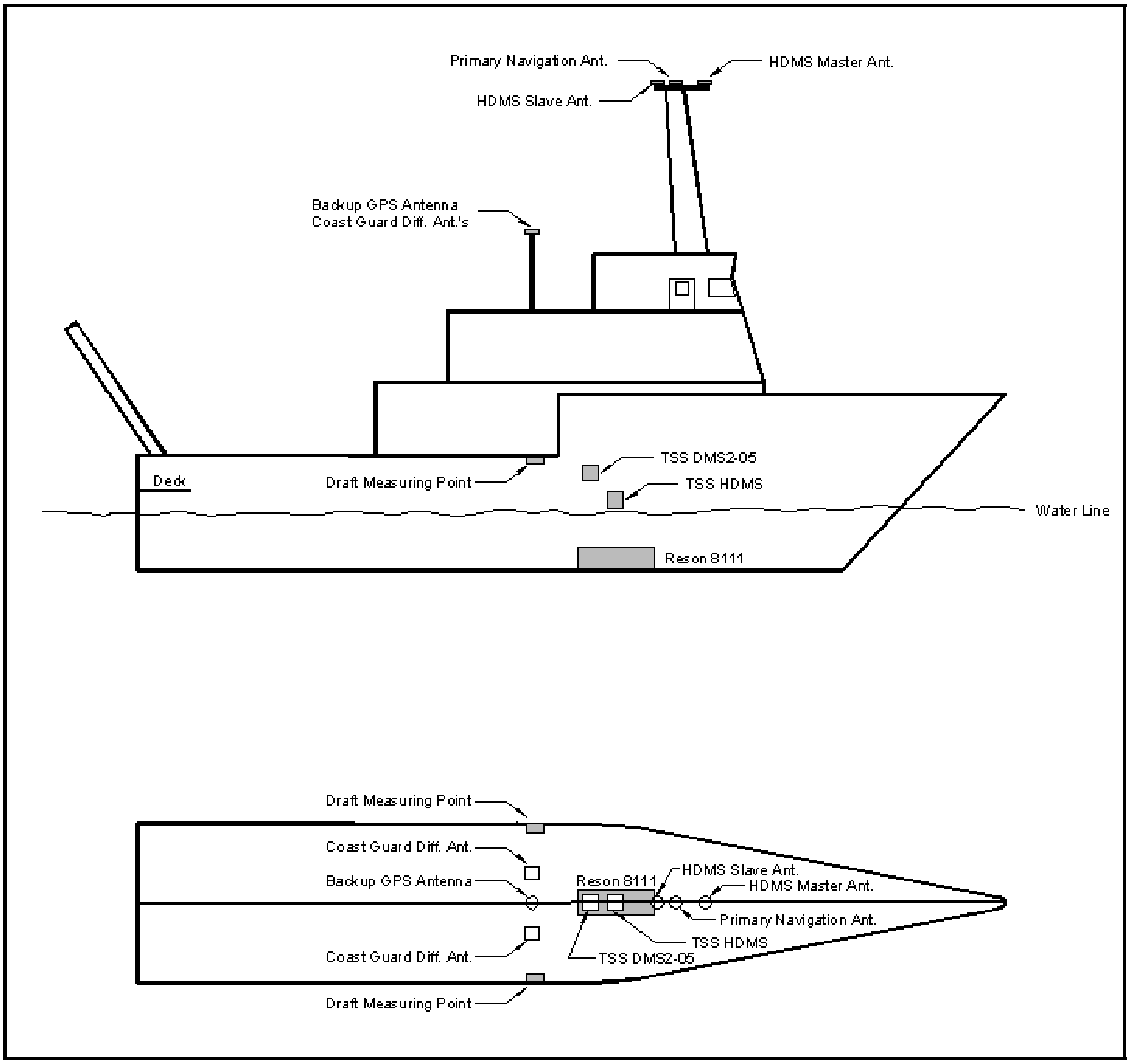

Figure B-5 R/V Davidson Equipment Layout

Appendix C – Calibration Data