D00144

NOAA FORM 76-35A

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL OCEAN SERVICE

DESCRIPTIVE REPORT

Type of Survey Hydrographic Survey

Field No. N/A

Registry No. D00144

LOCALITY

State Alaska

General Locality West of Prince Wales Island

Sublocality Amarilla Pt. to Cape Bartolome

2008

CHIEF OF PARTY

Scott Ramsay

LIBRARY & ARCHIVES

DATE

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

HYDROGRAPHIC TITLE SHEET

REGISTRY No

D00144

INSTRUCTIONS – The Hydrographic Sheet should be accompanied by this form, filled in as completely as possible, when the sheet is forwarded to the Office.

FIELD No: N/A

State **Alaska**

General Locality **West of Prince of Wales Island**

Sub-Locality **Amarilla Pt. to Cape Bartolome**

Scale **1:10,000** Date of Survey **June 19 to September 03, 2008**

Instructions dated **3/25/2008** Project No. **OPR-O190-KRL-08**

Vessel **Tenix LADS Aircraft, call sign VH-LCL**

Hydrographer **M.J. Sinclair** Chief of Party **S.R. Ramsay**

Surveyed by **J.G. Gilford, M.S. Hawkins, W.T. Newsham, K.J. Oberhofer, J.K. Young, B.C. McWilliam, D.J. Stubbing, K.C. Kelly**

Soundings by **Laser Airborne Depth Sounder**

SAR by **Toshi Wozumi** Compilation by **N/A**

Soundings compiled in **N/A**

REMARKS: **All times are UTC. UTM Zone 08**

The purpose of this survey is to provide reconnissance data coverage for future surface vessel surveys in the vicinity. All separates are filed with the hydrographic data. Page numbering may be interrupted or non sequential.

All pertinent records for this survey, including the Descriptive Report, are archived at the National Geophysical Data Center (NGDC) and can be retrieved via http://www.ngdc.noaa.gov/.

DESCRIPTIVE REPORT TO ACCOMPANY

HYDROGRAPHIC SURVEY D00144

SCALE 1:10,000, SURVEYED IN 2008

TENIX LADS AIRCRAFT, VH-LCL

TENIX LADS, INC. (TLI)

MARK SINCLAIR, HYDROGRAPHER

PROJECT

Project Number: OPR-O190-KRL-08
Original: DG 133C-06-CQ-0066
Date of Instructions: March 25, 2008
Task Order: T0003

Date of Supplemental Instructions:

- November 6, 2008 – Email and attachment from David Scharff (NOAA COTR) regarding Lidar Reconnaissance coverage deliverables.

Registry Number: D00144
Sheet: E

A. AREA SURVEYED

Survey operations covered seven registered sheets over the OPR-O190-KRL-08 project area, West of Prince of Wales Island, AK (see Figure 1 and Figure 2).

For this project Standard Hydrographic Survey Lidar coverage was employed for 3 of the registered sheets, with the remaining 4 being covered by Lidar Reconnaissance coverage. Data coverage details for D00144 are described in Section B.2.4.2.

A total of 1240 lineal nautical miles were illuminated in the process of flying 215 main scheme survey lines. An additional 566 lineal nautical miles were illuminated flying 87 reflies and 108 lineal nautical miles flying 26 crosslines / investigations. The total seabed area surveyed across the project area, from the Mean High Water (MHW) line to lidar extinction depth, was 13.9 square nautical miles (see the Final Progress Sketch at Appendix III for further information).

Between June 20 and July 10, 2008, the LADS Mk II aircraft conducted 7 sorties West of Prince of Wales Island, based out of Ketchikan. An additional 3 sorties were flown between August 29 and August 31, 2008. The LADS Mk II aircraft was deployed to Florida between July 11 and August 28 to support data collection for OPR-H328-KRL-08. The specific dates of data acquisition for OPR-O190-KRL-08, hours flown and time on task were as follows:

Date	Sortie No.	Hours Flown	Time on Task
20-Jun-08	6	06:57	06:11
21-Jun-08	7	05:38	04:50
22-Jun-08	8	07:28	06:38
28-Jun-08	11	06:14	05:24
29-Jun-08	12	05:44	05:07
02-Jul-08	13	03:45	02:42
10-Jul-08	16	02:30	01:37
29-Aug-08	17	01:14	00:00
30-Aug-08	18	05:41	04:49
31-Aug-08	23	06:29	05:45

Table 1: Specific Dates of Data Acquisition

Environmental factors such as water clarity, tide, wind strength and direction, daylight hours, cloud base height and clouds over high terrain influenced the area and duration of data acquisition on a daily basis. See Section B.2.3 for further details.

This Descriptive Report describes Sheet E, which covers Amarilla Pt. to Cape Bartolome (see Figure 2).

The sheet limits are as follows for Sheet E:

D00144 (E)	Latitude (N)	Longitude (W)
NW corner	55° 18' 26.55"	133° 38' 53.55"
SW corner	55° 12' 46.97"	133° 39' 05.07"
SE corner	55° 12' 42.01"	133° 31' 55.21"
NE corner	55° 18' 21.57"	133° 31' 42.68"

Figure 1 – General Locality of OPR-O190-KRL-08

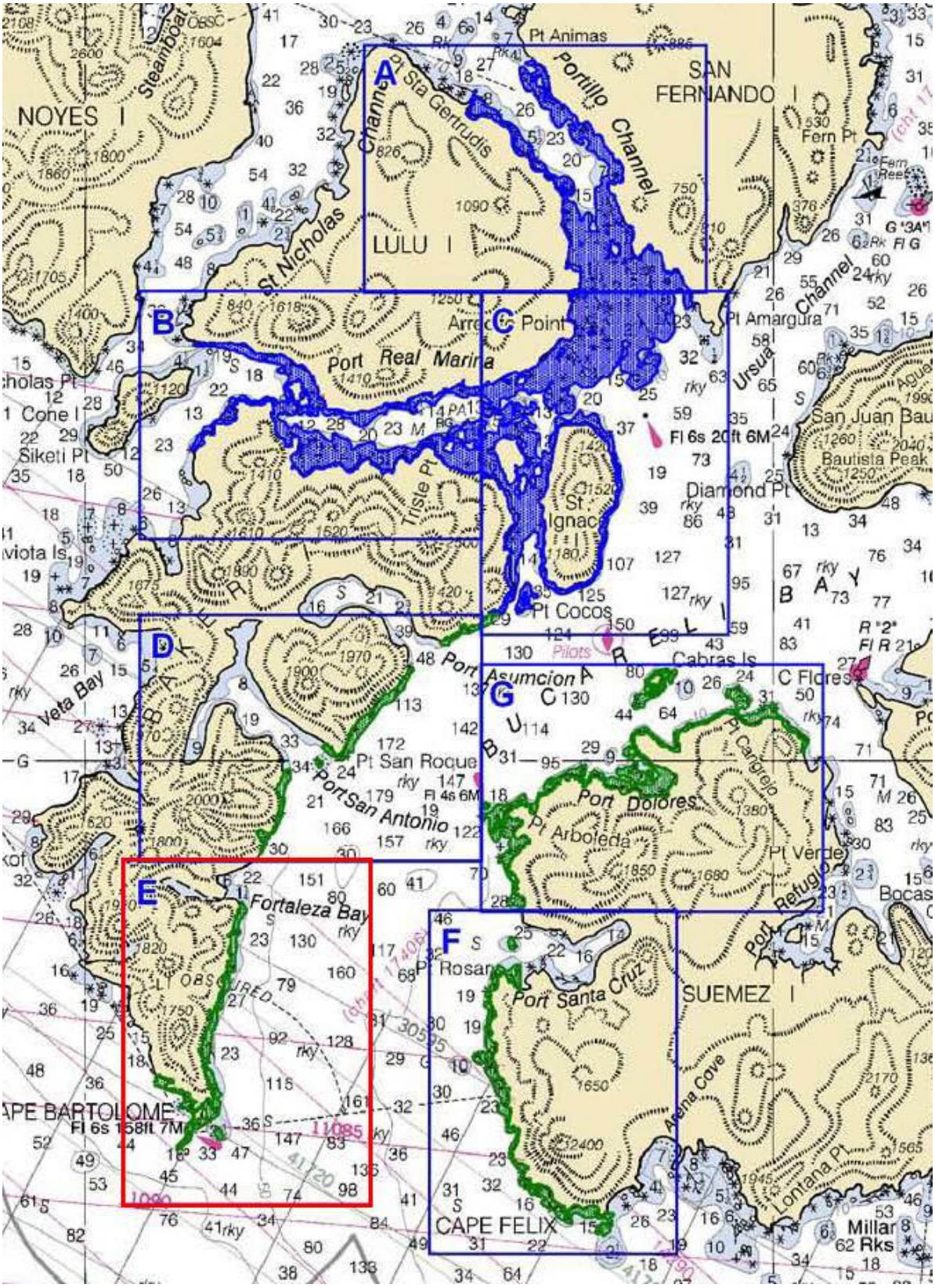

Figure 2 – Sub-Locality of D00144 (Sheet E)

B. DATA ACQUISITION AND PROCESSING

Refer to the Data Acquisition and Processing Report for a detailed description of the equipment, processing, and quality control procedures used during LADS surveys. A general description and items specific to this survey are discussed in the following sections.

B.1 EQUIPMENT

Data collection was conducted using the LADS Mk II Airborne System (AS), data processing using the LADS Mk II Ground System (GS), and data visualization, quality control and final products using CARIS HIPS and SIPS 6.1 and CARIS BASE Editor 2.1.

B.1.1 Airborne System

The LADS Mk II AS platform consists of a De Havilland Dash 8-200 Series aircraft, which has a transit speed of 250kts at altitudes of up to 25,000ft, and an endurance of up to eight hours. Survey operations are conducted from heights between 1,200 and 2,200ft, at ground speeds of between 140 and 210kts. The aircraft is fitted with an Nd: YAG laser, which is eye safe in accordance with ANSI Z136.1-2000, American National Standard for Safe Use of Lasers. The laser operates at 900 Hertz from a stabilized platform to provide a number of different spot spacings across the seabed.

Green laser pulses are scanned beneath the aircraft in a rectilinear pattern. The pulses are reflected from the land, sea surface, within the water column and from the seabed. The height of the aircraft is determined by the infrared laser return, which is supplemented by the inertial height from the Attitude and Heading Reference System (AHRS) and a Global Positioning System (GPS) receiver. Real-time positioning is obtained by an Ashtech GG24 GPS receiver providing autonomous GPS, or is combined with WADGPS (Fugro Omnistar), to provide a differentially corrected position, when coverage is available. Ashtech Z12 GPS receivers are also provided as part of the AS and GS to log data on the aircraft and at a locally established GPS base station.

A digital camera was installed on the LADS Mk II system platform in 2007. This allows high quality images to be captured in real-time, georeferenced and overlaid with the processed survey data. These images are also combined into a georeferenced image deliverable across the extent of the survey area. The specifications for the Redlake MegaPlus II ES 2020 digital camera are provided in the Data Acquisition and Processing Report.

B.1.2 Ground System

The LADS Mk II GS ‘Frodo’ was used to conduct data processing in the field. Frodo consists of a portable Compaq Alpha ES40 Series 3 processor server with 1 GB EEC RAM, 764 GB disk space, digital linear tape (DLT) drives and magazines, a digital audio tape (DAT) drive, a CD ROM drive, and is networked to up to 12 Compaq 1.5 GHz PCs and a HP 800ps Design Jet Plotter, printers and QC workstations. The GS supports survey planning, data processing, quality control and data export. The GS also includes a KGPS base station, which provides independent post-processed position and height data.

Quality control checks and editing of the data were conducted on GS 'Katrina', at the TLI office in Biloxi, MS, upon completion of the data collection phase of the survey.

B.2 QUALITY CONTROL

B.2.1 Quality Control Checks

The internal relative consistency of the survey data was checked with crossline depth comparisons, dynamic position checks, navigation position checks and by observing position confidence quality factors on the GS. System integrity was checked, in an absolute sense, with depth benchmark comparisons in the Gulf of Esquibel, San Alberto Bay and San Christoval Channel, the local GPS base station site confirmation and the static position check.

B.2.1.1 Crosslines

No specific crosslines were planned due to a significant number of investigation / additional coverage lines being flown perpendicular to main scheme survey runs. Additionally, main scheme lines flown perpendicular to each other, were used in these comparisons. Below are the overall depth comparison results for the 150 crossline / main scheme line intersections. A complete summary is presented in the Separates Report.

Total Number of Comparisons	Mean Depth Difference (m)	Mean Standard Deviation (m)
264351	-0.01 +/- 0.11	0.17 +/- 0.05

B.2.1.2 Depth Benchmarks

The depth benchmark area from the 2004 lidar survey in the Gulf of Esquibel (OPR-O167-KRL-04) was used to check the absolute depth accuracy of the LADS Mk II system for the D00144 survey. An additional 5 benchmark areas were created from the 2007, West of Prince of Wales Island lidar survey data (OPR-0190-KRL-07) to assess absolute depth accuracy. Center coordinates for the benchmark areas are as follows:

Gulf of Esquibel Benchmark (Maurelle Islands)

		UTM (N) Zone 8	
Benchmark Name	**Nominal Depth**	**Easting**	**Northing**
BM_1	15m	586 250	6 172 300

San Alberto Bay Benchmark

		UTM (N) Zone 8	
Benchmark Name	**Nominal Depth**	**Easting**	**Northing**
BM_2	10m	614 071	6 149 352
BM_3	11m	614 495	6 148 854

San Christoval Channel Benchmark

		UTM (N) Zone 8	
Benchmark Name	**Nominal Depth**	**Easting**	**Northing**
BM_4	13m	606 960	6 159 706
BM_5	11m	607 732	6 159 828
BM_6	3m	609 776	6 160 152

Survey lines were attempted over each of the depth benchmark areas during each sortie. The soundings were reduced to MLLW using Sitka verified tides with time and range correctors as specified in Section C.2.

The LADS survey data is compared against the gridded benchmark surface in the GS, and statistics are generated which include the number of points compared, the mean depth difference (MDD) and the standard deviation (SD) between the data sets. The benchmark comparison function compares the data against the benchmark surface, and as this data is unedited, it may contain noise normally removed during the validation process. These noisy outliers are flagged as the shoalest and deepest differences.

A summary of the average of the MDD and SD for all depth benchmark area comparisons is presented below. Refer to the Separates Report for detailed results of the depth benchmark comparison results.

Gulf of Esquibel Benchmark

GS ID	BM Name	Nominal Depth	Mean MDD (m)	Mean SD (m)
10	BM_1	15m	-0.06 +/- 0.09	0.29 +/- 0.03

San Alberto Bay Benchmark

GS ID	BM Name	Nominal Depth	Mean MDD (m)	Mean SD (m)
11	BM_2	10m	0.04 +/- 0.09	0.25 +/- 0.03
12	BM_3	11m	-0.01 +/- 0.08	0.18 +/- 0.01

San Alberto Bay Benchmark

GS ID	BM Name	Nominal Depth	Mean MDD (m)	Mean SD (m)
7	BM_4	13m	0.01 +/- 0.09	0.32 +/- 0.06
8	BM_5	11m	-0.03 +/- 0.08	0.16 +/- 0.02
9	BM_6	3m	-0.12 +/- 0.08	0.12 +/- 0.01

The depth benchmark comparison results and the crossline comparisons results are within expected tolerances and show that the LADS Mk II depth performance was within specifications throughout the survey period.

B.2.1.3 Positioning Checks

Two independent positioning systems were used during the survey. Real-time positions were determined by autonomous GPS. Post-processed KGPS positions were determined relative to a local GPS base station that was established by John Oswald and Associates (JOA) on the rooftop of the Best Western Hotel in Ketchikan. The post-processed KGPS positions were applied to each sounding during processing and the KGPS height was used in the topographic datum filter.

Position checks were conducted prior to, during, and following data collection as follows:

a. Local GPS Base Station Site Confirmation. A 24-hour certification of the local GPS base station established was conducted on June 29-30, 2008. The results reveal that the local GPS base station is free from site specific problems such as multipath and obstructions. Details are provided in the Horizontal and Vertical Control Report and scatter plots in the Separates Report.

b. Static Position Check. Prior to commencing data collection, the coordinates of the aircraft GPS antenna were determined relative to three marks, which were surveyed by JOA on the tarmac at the Ketchikan Airport. Data was logged by each LADS Mk II positioning system while the aircraft was static, enabling the positions to be checked against the known GPS antenna point. The absolute accuracy of the post-processed KGPS solution during the static position check was 0.160m (95% confidence). The results and details of the static position check are enclosed in the Horizontal and Vertical Control Report and Separates Report.

c. Dynamic Position Check. During each sortie, GPS data was logged on the aircraft and at the local GPS base station. This provided a check between the real-time and post-processed GPS positions. The mean difference between the real-time and post-processed positions was 2.434m, with an average SD of 0.176m. Details are provided in the Horizontal and Vertical Control Report.

d. Navigation Position Check. Navigation checks were also conducted over a JOA coordinated point on the SE corner of the Petro Marine dock at Craig, AK. This enabled the known position of the structure to be checked against the downward-looking digital image. This provided a gross error check of position. The mean error in Eastings was 2.51 +/- 0.59m and –0.03 +/- 1.78m in the Northings. Further details are provided in the Separates Report.

e. Position Confidence. The position quality was also monitored on the GS by checking a post-processed position confidence (C3), which is determined from the AS platform error, GPS error, and residual errors between the actual GPS positions and aircraft position, as determined from the line of best fit. No position anomalies were detected.

The position checks were within the expected tolerances and demonstrated that the positioning systems were functioning correctly throughout the survey period.

B.2.2 Uncertainty Values

For this survey area, global horizontal and vertical uncertainties have been assigned based on the defined horizontal and vertical error budget, as stated in the Horizontal and Vertical Control Report. The assigned horizontal uncertainty is 2.51m and the assigned vertical uncertainty is 0.46m.

However, when the calculated grid node SD is greater than the assigned vertical uncertainty, the SD is used as the uncertainty value. This has occurred in areas of high relief, which is common throughout the survey area. In some cases the SD may exceed IHO Order-1 limits. This could be attributed to the seabed gradient and a 4m grid resolution being used.

B.2.3 Environmental Factors

B.2.3.1 Sea Conditions - Sea State, White Water, Calm Seas, Swell

The sea state generally ranged from 1 to 2 on the Beaufort Scale throughout the survey period. The exposed coastlines in the south-west of the project area occasionally exhibited expansive regions of white water due to swell. These areas were typically reflown during calmer conditions to improve final lidar coverage.

Calm seas were also experienced on occasions, particularly in the center of the project area. Under such calm conditions the sea became glassy, which degraded the sea surface model, and resulted in gaps at nadir, where the sea surface returns were completely saturated and seabed returns attenuated.

Long period swell was not considered significant during the survey. However, an allowance has been made in the assessment of vertical accuracy.

B.2.3.2 Water Clarity

The water clarity in the survey area varied significantly during the period of data collection, and this required careful management to achieve the best possible seabed coverage across the project area. Water clarity varied from extremely poor to excellent.

The water clarity during the first two and last two survey flights was considered very good to excellent across the majority of the project area. Significant degradation of water clarity was observed in late June / early July and operations were subsequently suspended until late August, once the OPR-H328-KRL-08 survey in Florida had been completed. The final flights exhibited excellent water clarity, with depths beyond 35m recorded in some areas. Generally, water clarity was sufficient to enable full seabed coverage to between 15 and 20m depth.

A total of 4 secchi disk reconnaissances were conducted throughout the survey area prior to survey flights, to determine optimal times of data collection. Water clarity reconnaissance reports and secchi disk measurement results are provided in the Separates Report.

B.2.3.3 Kelp

Kelp is one of the factors that increases the complexity of a particular survey area. It is one of the reasons why 200% coverage is typically recommended in Alaskan waters. Kelp reduces laser penetration and the resultant seabed coverage achieved by lidar. Kelp also increases the amount of data processing that is required. Large areas of kelp exist throughout the survey area.

Kelp areas can be recognized in the data by the following indicators:

- Mid-water column returns are of low amplitude.
- Waveforms have poorly defined leading edges.
- Returns from the seabed are highly attenuated.
- Soundings in shallow water are very sparse.
- Soundings may not correlate with overlapping data from adjacent lines.

Kelp areas appear as data gaps in the BASE Surface. In such areas of partial bottom coverage, kelp area polygons (WEDKLP) have been defined in the S-57 feature file at the boundaries of data gaps attributed to kelp. Where kelp is present, but seabed coverage was still achieved, kelp point objects (WEDKLP) have been defined in the S-57 feature file (US500144.000).

Rocks detected by the system in kelp areas may be difficult to discriminate as rock or kelp returns. When it is uncertain if the return is from rock or kelp, a decision whether the feature has 'least depth found' (LDF) by lidar is provided in Section D.1.6. If it is determined that the LDF on a significant feature has not been achieved by lidar, due to the presence of kelp, a charting recommendation is not provided in the Chart Comparison Spreadsheet. If the feature is considered a hazard to follow-up boat work, it has been submitted as a Caution Area (refer to Section D.2.2).

B.2.3.4 Topography

The LADS Mk II system can measure topographic heights up to 50m elevation, subject to the depth / topographic logging window selected. For this survey, a 20m topographic height logging window was selected. As a result, the coastline was surveyed and elevations up to 20m were measured. During the processing stage, a maximum height of 5m above the sea surface was generally used to remove areas where large spruce trees grow near the high waterline. For areas of exposed rock that were greater than 5m above chart datum, the topographic heights were retained to ensure that the rock or islet height is correct. In areas where the MHW line could not be determined due to spruce trees, a 'gap tree' tag was inserted in the GS and with the use of the georeferenced imagery and exported tags, the MHW line has been dashed to indicate an approximate location.

The maximum topographic heights achieved in this area are limited by the topographic logging window and by spruce tree foliage. This can be seen as gaps in the BASE Surface, indicating areas of no coverage in the center of islands and along the coastline. As a result of

the restricted topographic window and spruce trees, some island heights will exist above the delivered survey data range.

B.2.3.5 High Ground

For this survey high ground was a significant issue, and the majority of the survey lines were flown at 2,200ft. Low cloud coverage was often prevalent along the edge of high terrain. During periods of adverse weather, lines were flown through the middle of the survey area at altitudes between 1,200 and 1,600ft, below the cloud ceiling.

B.2.3.6 Wind

Survey operations were conducted in wind strengths of up to 20kts during the survey. In general, the wind strength during sorties was between 5 and 15kts from the SW. In certain areas, wind strengths above 10kts generated turbulence that made data collection difficult. In circumstances when wind speeds were forecast to be greater than 20kts, no flights were planned due to the possibility of dangerous levels of turbulence.

B.2.3.7 Cloud

Low cloud coverage and rain was a significant factor during the survey. The wind direction affected the cloud base in the survey area. For example, in southerly or easterly conditions a low cloud base was experienced. Poor weather was monitored using, and decisions on the flying program were based on:

- Real-time satellite imagery
- Radar data
- Aviation reports
- Reports from local contacts in Craig
- Pilot weather reports
- Images viewed from a webcam located S of Craig

Two Internet sites proved to be invaluable for forecasting the weather. An aviation site, http://adds.aviationweather.gov, provided METAR data, actual wind speed and direction, cloud base and satellite cloud data. The observations were updated every twenty minutes. A NOAA weather site, http://pafc.arh.noaa.gov, provided aviation and general weather forecasts.

B.2.4 Data Coverage and Object Detection

B.2.4.1 Nature of the Seabed

The nature of the seabed along the southeast coast of Baker Island is quite complex. The coastline is covered with spruce trees, which made the delineation of the MHW line difficult in some areas.

Throughout the sheet there are numerous rocks, islets and shoals, often surrounded by thick areas of kelp. Typically, kelp grows from the MLLW line to 10m water depth. It is often

visible on, or just below the sea surface, in the downward-looking digital imagery. Most gaps in lidar data coverage, in less than 10m depth, are directly attributed to the presence of kelp.

The seabed gradient is generally high along the southeast coast of Baker Island, with the seabed dropping from the coastline to beyond 20m depth quickly. The steeply sloped seabed in this region was the primary consideration in selecting D00144 as a Lidar Reconnaissance coverage sheet.

B.2.4.2 Data Coverage

The survey area was illuminated at 4x4m laser spot spacing, resulting in a 192m swath width. Mainlines of sounding were spaced at 170m across D00144, which provided the required 100% Lidar Reconnaissance coverage.

The gain levels automatically set by the AS accommodate for changes in the sea surface, water column and seabed conditions. In some areas, after long overland passages, low gain levels were initialized when passing back over the water. Where this has been identified in the data, additional lines have been flown to improve the coverage.

The raw laser waveform returns from the areas that were covered with kelp are considerably attenuated. In order to detect the seabed in such areas, the threshold in the GS was lowered to detect pulses with low signal-to-noise ratios (SNR). This often enabled the seabed depth to be extracted from the waveform, but also resulted in increased false bottom detects, which in turn increased data validation times.

The variable water clarity observed throughout the survey period resulted in maximum lidar extinction depths of 35m for the project, but typically full seabed coverage to 20m depth was achieved for D00144.

B.2.4.3 Object Detection

At the sea surface the footprint of the laser beam is approximately 2.5m in diameter. As the beam passes through the water column, it slowly diverges due to scattering. It should be noted that at 4x4m laser spot spacing, there is a gap of 1.0 to 1.5m between the illuminated area of adjacent soundings at the sea surface. There is a possibility that small objects in shallow water along the coastline may fall between consecutive 4x4m soundings, and not be detected. A description of the Bottom Object Detection (BOD) algorithm used in data processing is presented in the Data Acquisition and Processing Report.

B.3 CORRECTIONS TO SOUNDINGS

Refer to the Data Acquisition and Processing Report for a description of corrections to soundings. There were no deviations from the corrections described therein.

B.4 DATA PROCESSING

B.4.1 Data Management

The database is identified as follows:

Database Name	Sub-Locality	Sheet
08_3ak	Amarilla Pt. to Cape Bartolome	E

A detailed table of survey line identifiers is presented in the Data Acquisition and Processing Report.

B.4.2 Data Processing Sites

The data acquired during survey flights was processed at the operating site in Ketchikan following each sortie. Final validation, checking, approving, reports and products were conducted at the office in Biloxi, MS. The quality control of the data was completed using LADS QC Tools software and was conducted in the Adelaide, Australia office.

B.4.3 CARIS BASE Surface

One BASE Surface covers the entire survey area. The Shoal layer of the BASE Surface should be used as the official hydrographic record of the survey. A grid resolution of 4m was used for the Lidar Reconnaissance coverage BASE Surface. Grid resolution does not change relative to depth, as the laser pulse footprint stays relatively constant regardless of depth, and the laser spot spacing is constant irrespective of aircraft altitude. The 4m grid provides the largest amount of detail that can be supported by the lidar density (4x4m laser spot spacing at 100% coverage).

B.4.4 Gap and Feature Tagging

During data processing on the GS, the operators have the ability to assign S-57 and user-defined tags to gaps and features in the data. This enables accurate delineation and attribution of unsurveyed polygons for the S-57 feature file (US500144.000).

For this survey, the following user-defined tags were used to delineate the seaward extent of gaps in the lidar seabed coverage, typically at a 50m interval:

GK	Bathymetry data gap due to kelp.
GW	Bathymetry data gap due to white water.

Detailed descriptions of these gaps in seabed coverage are presented in Section B.8 of the Data Acquisition and Processing Report.

The following tags were used in the GS for uncertain lidar features:

FEK	Feature for examination in kelp, as the least depth has not been determined.
FERK	Feature for examination of a submerged rock, as the least depth has not been determined, or a higher density of data is required to adequately define the feature.
FERA	Feature for examination of a rock awash, as the feature has not been surveyed adequately due to the presence of white water.
FEDR	Feature for examination of a drying rock, as a higher density of data is required to adequately define the potentially drying feature.
FE	Feature for examination, generally in deep water, as the least depth has not been found due to poor water clarity.

The tags associated with uncertain lidar features have been compiled to produce a set of Caution Areas, as described in Section D.2.2.

B.4.5 Georeferenced Imagery

Digital imagery was captured on each sortie. The imagery was used in the validating, checking, and approval stages of survey data cleaning. The images were also combined to produce a georeferenced mosaic of the survey area using LADS Mosaic Build Tool (MBT). MBT allows for the selection of images based on user preferences such as tide value and lighting conditions. The mosaic images can be produced in either geo-TIFF or JPEG format, and include a world file with the georeferenced data.

The georeferenced imagery in *.tif format was compressed into Enhanced Compression Wavelet (*.ecw) files using ER Mapper software version 7.1. ECW is an open standard file format developed by Earth Resource Mapping. The file format is optimized for aerial and satellite imagery, and efficiently compresses very large images. Typical compression ratios of between 20:1 and 100:1 are achieved.

During the final sortie for OPR-O190-KRL-08 a malfunction with the Redlake digital camera was experienced, resulting in a gap in the final georeferenced mosaic. This gap in imagery is located west of Cape Bartolome, at position 55° 14' 35" N, 133° 37' 37" W.

B.4.6 Progress Sketches

Progress sketches were provided to NOAA on a monthly basis. The final progress sketch can be found in Appendix III.

B.4.7 Deliverables Data Formats

Data is provided in the following formats:

- Digital S-57 feature file
- CARIS BASE Surface
- Lidar coverage and Lidar uncertainty images in geo .tif format

- CARIS Caution Areas and Chart Comparison files in .hob format and corresponding GS screen captures in .jpg format
- Chart Comparison Spreadsheet in .xls format
- CARIS compatible data – HDCS Format – LADS soundings in CARIS HIPS native format
- Tidal data provided in ASCII, .xls and .csv formats
- Digital georeferenced image in .ecw format

Refer to the Data Acquisition and Processing Report for specific details.

C. VERTICAL AND HORIZONTAL CONTROL

Refer to the Horizontal and Vertical Control Report for a detailed description of the horizontal and vertical control used during this survey. A summary of horizontal and vertical control used for the survey follows.

C.1 VERTICAL CONTROL

Vertical control for this survey was based on MLLW at the National Water Level Observation Network (NWLON) station at Sitka, AK (9451600).

Station details are as follows:

		NAD83	
Gauge	**Location**	**Latitude (N)**	**Longitude (W)**
9451600	Sitka Sound Seafood Dock	57° 03.1'	135° 20.5'

C.2 ZONING

Tide zones that cover the extent of the survey were derived from tide zone coordinates supplied by NOAA. Each of these tide zones use time and range correctors relative to the Sitka tide station. These are as follows:

Tide Zone	GS Identifier	Time Corrector	Range Corrector	Reference Station
PAC296	TA1	-6 minutes	x1.04	9451600
SA227	TA2	-12 minutes	x1.06	9451600
SA250	TA3	-12 minutes	x1.03	9451600
SA267	TA4	-12 minutes	x1.03	9451600
SA250A	TA5	-12 minutes	x1.02	9451600

For final tide application, the time and range correctors were applied to the smoothed tidal data provided by JOA. Soundings were then reduced to MLLW using these corrected tides. An analysis of depth benchmark and crossline comparisons, and overlaps of the mainlines of sounding concluded that final tide zoning was adequate.

The derived value for the difference between MLLW and MHW at the Sitka tide gauge is 2.79m. From the final zoning, a range factor of 1.03 and 1.04 was applicable for Sheet E, resulting in a MHW value of 2.884m.

C.3 HORIZONTAL CONTROL

Data collection and processing were conducted on the AS and GS in World Geodetic System (WGS84) on Universal Transverse Mercator (Northern Hemisphere) projection UTM (N) in Zone 8, Central Meridian 135° W. This data was post-processed and all soundings are positioned relative to the North American Datum 1983 (NAD83). All units are in meters.

C.3.1 LADS Local GPS Base Station – Ketchikan

Real-time positions were determined using an Ashtech GG24 GPS receiver on the aircraft, operating in autonomous GPS mode. A local GPS base station was established by JOA on the roof of the Best Western Hotel in Ketchikan, AK on April 10, 2007, in order to post-process KGPS positions following survey flights.

The derived NAD83 coordinates for the local GPS base station are:

NAD83		**UTM (N) Zone 8**		
Latitude (N)	**Longitude (W)**	**Easting (m)**	**Northing (m)**	**Ellipsoidal Height (m)**
55° 21' 18.1747"	131° 41' 28.1482"	709 747.774	6 139 286.936	12.85

Post-processed KGPS positions were determined offline using data logged at the local GPS base station and on the aircraft. This data was processed with Waypoint GrafNav software to calculate a KGPS position solution for the survey flights. The post-processed KGPS positions were imported into the GS and applied to all soundings. This provided increased sounding position accuracy from the real-time autonomous GPS.

D. RESULTS AND RECOMMENDATIONS

The results for the D00144 survey are submitted separately to this Descriptive Report as the S-57 feature file, BASE Surface, CARIS .hob files, georeferenced imagery, Chart Comparison Spreadsheet, etc. on the USB hard drive. Refer to Appendix I of the Data Acquisition and Processing Report for a list of all the deliverable files from D00144.

Below is a table listing the S-57 feature objects found in the S-57 feature file (US500144.000):

S-57 Object Class	S-57 Object Acronym	Geometry	Description	Spatial Attribute	Attribute 1	Attribute 2	Attribute 3	Attribute 4	Comments
Coastline	COALNE	L	The high waterline. Where depth equals 0 relative to MHW.	Quality of position (QUAPOS)	Category of Coastline (CATCOA)				The spatial attribute QUAPOS is used when coastline is interpolated from the (GTR) tags or the georeferenced imagery.
Depth Contour	DEPCNT	L	The approximate location of the line of equal depth. Also referred to as a depth curve.		Value of depth contour (VALDCO)				Tenix has delivered the 4, 8, and 12m curve. 0 curve is not delivered for recon sheets due to lack of coverage.
Land Area	LNDARE	P	The solid portion of the Earth's surface, as opposed to sea, water.						Used for defining islet point features.
Land Elevation	LNDELV	P	The vertical distance of a point or level measured from a specified vertical datum.		Elevation (ELEVAT)				Used for defining islet heights related to MLLW.
Underwater / Awash Rock	UWTROC	P	A concreted mass of stony material or coral which dries, is awash or is below the water surface.		Water level effect (WATLEV)	Quality of sounding measurement (QUASOU)	Technique of sounding measurement (TECSOU)	Value of sounding (VALSOU)	

S-57 Object Class	S-57 Object Acronym	Geometry	Description	Spatial Attribute	Attribute 1	Attribute 2	Attribute 3	Attribute 4	Comments
Water Turbulence	WATTUR	A	The disturbance of water caused by the interaction of any combination of waves, currents, tidal streams, wind, shoal patches and obstructions.		Category of water turbulence (CATWAT)				Used for delineating gaps due to white water, defined by (GW) tags exported from the GS.
Weed / Kelp	WEDKLP	P, A	Usually large, blade-shaped or vine-like brown algae.		Category of weed / kelp (CATWED)				Polygon limits defined using the (GK) tags exported from the GS. Kelp point features defined using the (GKP) tags exported from the GS and georeferenced imagery.

Table 2: S-57 Attribution for the S-57 feature file (US500144.000)

Recommendations for charting action for registry number D00144 are provided in Sections D.1.1 to D.1.6 below. In the case of Lidar Reconnaissance surveys, features for examination are not provided as part of the deliverables. All features that appear in the chart comparison that have not accurately had least depth determined by lidar are populated with an "N" in the Least Depth Found column of the Chart Comparison Spreadsheet. In these cases "N/A" has been populated in the Charting Recommendations column. Thus, where the least depth has not been found by lidar, no recommended charting action has been specified. The determination of least depth is at the discretion of the ships conducting junctioning to the Lidar Reconnaissance coverage, and their results should be reported for charting action to MCD in due course.

In the case of areas where least depth has not been found by lidar, that may pose a hazard to surface vessels conducting junctioning, a "Caution Area" has been defined. A list of Caution Areas has been supplied as one of the deliverables for Lidar Reconnaissance sheets and is contained in a CARIS .hob file (D00144_Caution.hob).

A summary of recommended charting actions is provided in Section D.3.

D.1 CHART COMPARISON

D00144 LADS survey deliverables were compared to:

ENC US5AK4CM Edition 5, compiled from Raster Charts 17406 6th Edition. ENC issue date August 12, 2008 at scale 1:40,000.

These charts were downloaded from the NOAA Office of Coast Survey – NOAA Electronic Navigational Charts download website on November 3, 2008.
(http://www.nauticalcharts.noaa.gov/mcd/enc/index.htm)

D.1.1 Dangers to Navigation

Danger to Navigation (DTON) reports were submitted to Pacific Hydrographic Branch (PHB) following field operations. This coincided with the delivery of the final progress sketch at the end of September, 2008, prior to the commencement of data approval. Four additional DTONs were identified during data approval and product compilation for D00144. The DTON report submitted to PHB for D00144 is provided at Appendix I.

D.1.2 AWOIS

No AWOIS were assigned to this Task Order.

D.1.3 Aids to Navigation

Cape Bartolome Light was not detected by lidar as it has an elevation outside of the topographic logging window, but was observed in the georeferenced digital imagery at position 55° 13' 50.49" N, 133° 36' 58.66" W. This observed position is approximately 40m to the west of the charted coordinates of the navigation aid.

D.1.4 Charted Depths and Features

Registry number D00144 covers parts of NOAA Raster Chart 17406. No Source Diagram is present on the chart, so no inferences concerning previous survey dates, survey technique or coverage can be made for the charted area covered by survey area D00144.

The area surveyed is represented by the BASE Surface and S-57 feature file in considerably more detail than is currently shown on the chart. The following general recommendations are relevant:

a. Coastline. The charted coastline agrees well with the surveyed coastline for the larger islands and islets. The surveyed coastline differs from the charted position by a maximum of 110m in some parts of the survey area. There are a few locations where the charted coastline has been surveyed as drying shelf. It is recommended that the coastline on the chart be amended to match the LADS surveyed and extrapolated MHW line.

b. Inshore Islets. A large number of islets have been surveyed close to the coastline. Generally, there is good agreement between the charted data and the surveyed data. It is recommended that the chart be amended to match the LADS survey deliverables. Where significant these islets are detailed in the Chart Comparison Spreadsheet in Section D.1.6.

c. Rocks. Many rocks and drying rocks have been surveyed along the coastline, which are not presently shown on the chart. It is recommended that the chart be amended to match the LADS survey deliverables. Where significant, these rocks are detailed in the Chart Comparison Spreadsheet in Section D.1.6.

D.1.5 Detailed Chart Comparison

In addition to the general recommendations above, some 38 specific differences between the chart and the LADS survey have been identified and are described in Section D.1.6. An expanded version of the spreadsheet is included digitally on the USB hard drive (D00144_Chartcomp.xls). A CARIS .hob file containing just the chart comparison items has also been compiled and is provided as part of survey deliverables (D00144_Chartcomp.hob). The attribution methodology for this file is presented below:

S-57 Object Class	S-57 Object Acronym	Geometry	Description	Attribute 1	Attribute 2	Attribute 3	Attribute 4
Built-up area	BUAARE	P	An area containing a concentration of buildings and infrastructure.	INFORM (used for storing a unique chart comparison ID)	NINFOM (used for storing the charting recommendation)		PICREP (used for storing a link to GS screen captures)

The chart comparison was conducted by reviewing the chart, the LADS survey deliverables and the digital georeferenced imagery. For each item identified, screen captures of the Local Area Display, Raw Waveform Display and Digital Image Window were extracted from the LADS Mk II GS.

These have been reviewed in order to make the following assessments:

a. Type of Feature
b. Kelp Area
c. Least Depth Found
d. Charting Recommendation
e. Remarks

When the least depth over a feature has been adequately surveyed by lidar, the LDF Column is populated with a 'Y' for yes. The charting recommendation for a feature that has an adequately surveyed least depth will be either 'Insert' for a new feature, 'Replace' for an amendment to an existing charted feature, or 'Remove' for a disproved charted feature. When the least depth has NOT been found by lidar (populated with an 'N'), the Charting Recommendation column will be populated with "N/A" for Lidar Reconnaissance sheets.

Each chart comparison was categorized as follows:

1. New shoal found
2. Charted shoal disproved / not found

The fields in the Chart Comparison Spreadsheet have been developed from experience learned and feedback received from previous lidar surveys in Alaska, witnessing survey operations aboard NOAA ship Rainier, from meetings at PHB and UNH and the 2007 NOAA Field

Procedures Workshop. They have been designed for ease of use and to minimize double handling of data and transcription. Continued feedback is welcomed in order to develop these formats to achieve further efficiencies in data handling.

D.1.6 Chart Comparison Spreadsheet

			CHARTED			SURVEYED							
Sequence No	**Shoal No**	**Category**	**Charted Depth (meters)**	**NAD83 Latitude N (Degrees)**	**NAD83 Longitude W (Degrees)**	**Surveyed Depth (meters)**	**NAD83 Latitude N (Degrees)**	**NAD83 Longitude W (Degrees)**	**Type of Feature**	**Kelp Area**	**Least Depth Found**	**Charting Recommendation**	**Remarks** **All items covered by 4x4m laser spot spacing at 100% lidar coverage.**
1	E1	2	26.5	55° 14' 18.3"	133° 37' 48.11"	7.21	55° 14' 19.19"	133° 37' 45"	Rk	N	Y	Insert	See Danger to Navigation Report. Item 1. Submitted following field operations.
2	E2	1				4.77	55° 14' 11.3"	133° 37' 15.9"	Rk	Y	Y	Insert	See Danger to Navigation Report. Item 2. Submitted following field operations.
3	E3	1				3.78	55° 13' 58.88"	133° 36' 33.02"	Rk	Y	Y	Insert	See Danger to Navigation Report. Item 3. Submitted following field operations.
4	E5	1				7.37	55° 13' 52.18"	133° 36' 32.92"	Rk	N	Y	Insert	See Danger to Navigation Report. Item 4. Submitted following field operations.
5	E6	1				3.91	55° 14' 7.93"	133° 37' 9.23"	Rk	Y	Y	Insert	See Danger to Navigation Report. Item 5. Submitted following field operations.
6	E7	1				3.33	55° 18' 12.28"	133° 35' 25.31"	Rk	Y	N	N/A	Possible Rk in kelp.
7	E8	1				-0.19	55° 18' 11.68"	133° 35' 29.89"	Rk Awash	Y	Y	Insert	
8	E9	2	12.8	55° 17' 8.18"	133° 35' 33.65"	3.46	55° 17' 9.02"	133° 35' 33.18"	Rk	Y	N	N/A	Possible Rk in kelp. See Danger to Navigation Report. Item 6.
9	E10	2	Drying Rk	55° 17' 9.09"	133° 35' 38.55"				Slope	Y	Y	Remove	Not detected by lidar, not observed in digital imagery.
10	E11	2	Drying Rk	55° 17' 5.89"	133° 35' 43.99"				Slope	Y	Y	Remove	Not detected by lidar, not observed in digital imagery.

Shoal Categories
1-New Shoal Found
2-Charted Shoal Disproved / Not Found

			CHARTED			SURVEYED							
Sequence No	**Shoal No**	**Category**	**Charted Depth (meters)**	**NAD83 Latitude N (Degrees)**	**NAD83 Longitude W (Degrees)**	**Surveyed Depth (meters)**	**NAD83 Latitude N (Degrees)**	**NAD83 Longitude W (Degrees)**	**Type of Feature**	**Kelp Area**	**Least Depth Found**	**Charting Recommendation**	**Remarks** **All items covered by 4x4m laser spot spacing at 100% lidar coverage.**
11	E12	2	6.4	55° 16' 32.01"	133° 35' 42.73"	3.97	55° 16' 32.43"	133° 35' 44.18"	Rk	Y	Y	Replace	
12	E13	2	Drying Rk	55° 16' 16.62"	133° 35' 52.4"				Slope	Y	Y	Remove	Not detected by lidar, not observed in digital imagery.
13	E15	1				4.12	55° 16' 8.11"	133° 35' 57.16"	Rk	Y	Y	Insert	
14	E16	1				0.37	55° 16' 4.58"	133° 35' 59.66"	Rk Awash	Y	N	N/A	Possible rock awash in kelp.
15	E17	2	Islet	55° 15' 52.92"	133° 36' 7.22"				Intertidal Area	Y	Y	Remove	Not detected by lidar, not observed in digital imagery.
16	E18	1				-0.15	55° 15' 50.76"	133° 36' 11.38"	Rk Awash	Y	Y	Insert	
17	E19	1				1.91	55° 15' 44.8"	133° 36' 15.19"	Rk	Y	Y	Insert	
18	E20	1				0.15	55° 15' 41.2"	133° 36' 17.59"	Rk Awash	Y	Y	Insert	
19	E21	1				2.77	55° 15' 30.76"	133° 36' 20.21"	Rk	Y	N	N/A	Possible Rk in kelp.
20	E22	1				-0.21	55° 15' 27.47"	133° 36' 26.89"	Rk Awash	Y	Y	Insert	
21	E23	1				-0.22	55° 15' 23.9"	133° 36' 31.55"	Rk Awash	Y	Y	Insert	

Shoal Categories
1-New Shoal Found
2-Charted Shoal Disproved / Not Found

			CHARTED			SURVEYED							
Sequence No	**Shoal No**	**Category**	**Charted Depth (meters)**	**NAD83 Latitude N (Degrees)**	**NAD83 Longitude W (Degrees)**	**Surveyed Depth (meters)**	**NAD83 Latitude N (Degrees)**	**NAD83 Longitude W (Degrees)**	**Type of Feature**	**Kelp Area**	**Least Depth Found**	**Charting Recommendation**	**Remarks** **All items covered by 4x4m laser spot spacing at 100% lidar coverage.**
22	E24					2.97	55° 15' 25.02"	133° 36' 22.7"	Rk	Y	N	N/A	Possible Rk in kelp.
23	E25	2	12.8	55° 15' 18.33"	133° 36' 28.15"	5.25	55° 15' 18.41"	133° 36' 23.81"	Rk	Y	N	N/A	Possible Rk in kelp. See Danger to Navigation Report. Item 7.
24	E26	1				-0.18	55° 14' 43.39"	133° 36' 19.6"	Rk Awash	Y	Y	Insert	
25	E27	1				0.23	55° 14' 32.64"	133° 36' 14.18"	Rk Awash	Y	N	N/A	Possible rock awash in kelp.
26	E28	1				0.10	55° 14' 23.35"	133° 36' 13.54"	Rk Awash	Y	Y	Insert	
27	E29	1				2.25	55° 14' 17.61"	133° 36' 11.88"	Rk	Y	N	N/A	Possible Rk in kelp.
28	E30	1				-0.03	55° 14' 8.57"	133° 36' 10.98"	Rk Awash	Y	N	N/A	Possible rock awash in kelp.
29	E31	2	18.2	55° 14' 14.72"	133° 36' 15.6"	-0.44	55° 14' 13.87"	133° 36' 15.8"	Rk Awash	Y	Y	Replace	See Danger to Navigation Report. Item 8.
30	E32	1				0.12	55° 14' 4"	133° 36' 27.04"	Rk Awash	Y	N	N/A	Possible rock awash in kelp. See Danger to Navigation Report. Item 9.
31	E33	1				13.93	55° 13' 49.64"	133° 35' 59.68"	Rk	N	N	N/A	Sparse lidar coverage in deep water.
32	E34	1				3.47	55° 13' 48.97"	133° 36' 6.17"	Rk	Y	Y	Insert	

Shoal Categories
1-New Shoal Found
2-Charted Shoal Disproved / Not Found

			CHARTED			SURVEYED							
Sequence No	**Shoal No**	**Category**	**Charted Depth (meters)**	**NAD83 Latitude N (Degrees)**	**NAD83 Longitude W (Degrees)**	**Surveyed Depth (meters)**	**NAD83 Latitude N (Degrees)**	**NAD83 Longitude W (Degrees)**	**Type of Feature**	**Kelp Area**	**Least Depth Found**	**Charting Recommendation**	**Remarks** **All items covered by 4x4m laser spot spacing at 100% lidar coverage.**
33	E35	1				6.47	55° 13' 54.95"	133° 36' 41.08"	Rk	Y	N	N/A	Possible Rk in kelp.
34	E36	1				-1.94	55° 14' 28.91"	133° 37' 11.41"	Drying Rk	Y	Y	Insert	
35	E37	1				6.91	55° 14' 14.84"	133° 37' 1.52"	Rk	Y	Y	Insert	
36	E38	1				13.26	55° 14' 27.06"	133° 37' 37.88"	Rk	N	N	N/A	Sparse lidar coverage in deep water.
37	E39	1				4.35	55° 14' 38.31"	133° 37' 42.13"	Rk	Y	Y	Insert	
38	E40	1				-0.25	55° 14' 44.7"	133° 37' 43.82"	Rk Awash	Y	N	N/A	Possible rock awash in kelp.

Table 3: Chart Comparison Spreadsheet

Shoal Categories
1-New Shoal Found
2-Charted Shoal Disproved / Not Found

D.2 ADDITIONAL RESULTS

D.2.1 Seaward Limit of Lidar Coverage

The survey area D00144 consists of a large number of islands, islets and many kelp covered submerged rocks close to the coast. Heavy kelp is present throughout the survey area, especially along the Baker Island coastline. As a result of periods of poor water clarity and glassy seas experienced during lidar data acquisition, and the presence of expansive kelp beds, several areas across the sheet have poor seabed coverage. This is reflected by gaps in the BASE Surface rendered as part of the survey deliverables.

In particular, the areas of poor lidar seabed coverage include:

- Along the SW coast of Baker Island, at position 55° 14’ 47” N, 133° 37’ 52” W, due to kelp and white water.
- NW of Cape Bartolome, at position 55° 13’ 54” N, 133° 37’ 07” W, due to white water.
- Along the SE coast of Baker Island, at position 55° 14’ 47” N, 133° 36’ 24” W, due to kelp.

Another noteworthy area of limited lidar seabed coverage is to the northwest of Cape Bartolome, in the vicinity of 55° 14' 22" N, 133° 37' 34" W. Coverage is incomplete in this region due to the variable nature of water clarity throughout the survey period. Shoals with least depths of less than 10m may occur in this area.

It should be noted that TLI is not providing a recommended junctioning line for Lidar Reconnaissance surveys. The determination of where multibeam survey lines need to be conducted is at the discretion of PHB and the ships conducting the junctioning.

The areas of good lidar seabed coverage include:

- S of Point Fortaleza, at position 55° 17’ 21” N, 133° 35’ 30” W.
- N of Cape Bartolome, at position 55° 15’ 10” N, 133° 36’ 26” W.
- NE of Cape Bartolome, at position 55° 14’ 15” N, 133° 36’ 25” W.

D.2.2 Caution Areas

A list of Caution Areas was collated during data processing and is presented in a CARIS .hob file. Caution Areas were designated in poor lidar coverage regions, where depths shoaler than 4m may exist, but least depth was uncertain as a result of thick kelp.

Tagging in the GS was used to flag features for which the least depth has not been found. Typically this meant that there were less than 4 supporting soundings, within 0.5 – 1.0m of the depth, on the primary and overlapping lines. Tags falling within poor lidar coverage areas potentially shoaler than 4m depth, and deemed a threat to surface vessels, were exported from the GS and compiled as polygons in CARIS BASE Editor. Caution Areas have been captured

within the D00144_Caution.hob file as M_NPUB polygon feature objects. The S-57 attribution methodology for lidar Caution Areas is presented below:

S-57 Object Class	S-57 Object Acronym	Geometry	Description	Attribute 1
Nautical publication information	M_NPUB	A	Used to relate additional nautical information or publications to the data.	PICREP (used for storing a link to GS screen captures)

Refer to Section B.4.4 for the descriptions of the GS tagging philosophy used for lidar seabed coverage gaps on D00144.

Ten (10) Caution Areas have been captured in the CARIS D00144_Caution.hob file, as being considered a potential hazard to surface vessel junctioning.

D.2.3 Recommended Junctioning with Unsurveyed Lidar Areas

The 'unsurveyed' gaps in lidar seabed coverage are defined as polygons in the S-57 feature file. They were constructed utilizing the export of the operator assigned gap tags covered in Section B.4.4. In the case of 'unsurveyed' areas for kelp, white water and SEZ, junctioning is not recommended for the obvious risks to surface vessels.

D.2.4 Comparison with Prior Surveys

Comparison with prior surveys was not required under this Task Order. See Section D.1 for comparison to the nautical charts.

D.3 SUMMARY OF CHARTING ACTIONS – D00144

Total number of new significant islets recommended for insertion on chart: 0
Total number of new significant drying rocks recommended for insertion on chart: 1
Total number of new significant rocks awash recommended for insertion on chart: 7
Total number of new significant rocks recommended for insertion on chart: 10
Total number of charted features disproved by lidar (Remove): 4
Total number of charted features recommended for amendment by lidar (Replace): 2
Total number of chart comparison items where least depth has not been found by lidar: 14

Total number of DTONs submitted to PHB following field operations: 5
Total number of DTONs submitted to PHB during product compilation: 4
Total number of DTONs submitted to PHB for D00144: 9

E. APPROVAL SHEET

LETTER OF APPROVAL – OPR-O190-KRL-08

This report and the accompanying LADS survey deliverables are respectfully submitted.

Field operations contributing to the accomplishment of this survey were conducted under my direct supervision with frequent personal checks of progress and adequacy. This report and the accompanying LADS survey deliverables have been closely reviewed and are considered complete and adequate as per the Statement of Work.

Report	Submission Date
Descriptive Report – D00144	January 9, 2009

Mark Sinclair
Hydrographer
Tenix LADS, Incorporated

Date: January 9, 2009

APPENDIX I – DANGERS TO NAVIGATION

DTONS Submitted to PHB

I.1.1 Danger to Navigation Report

Hydrographic Survey Registry Number: D00144

State: Alaska

Locality: West of Prince of Wales Island

Sub-locality: Amarilla Pt. to Cape Bartolome

Project Number: OPR-O190-KRL-08

Survey Dates: June – September 2008

Depths are in meters and reduced to Mean Lower Low Water using final verified tides. Drying heights are in meters relative to MLLW. Islets are related to MHW. Positions are based on the NAD83 horizontal datum. All times and dates are relative to UTC.

Number	Edition	Date	Scale
US5AK4CM	5th	8/12/2008	1:40,000

The following items were found during hydrographic survey operations:

No.	Feature	Depth (m)	Latitude (N)	Longitude (W)	Time, Date, Year	Investigate
1	Rk	7.2	55° 14' 19.19"	133° 37' 45.00"	15:41:24, Aug 31, 2008	No
2	Rk	4.8	55° 14' 11.30"	133° 37' 15.90"	18:36:25, Aug 31, 2008	No
3	Rk	3.8	55° 13' 58.88"	133° 36' 33.02"	15:45:36, Aug 31, 2008	No
4	Rk	7.4	55° 13' 52.18"	133° 36' 32.92"	15:45:33, Aug 31, 2008	No
5	Rk in kelp	3.9	55° 14' 07.93"	133° 37' 09.23"	18:36:23, Aug 31, 2008	No
6	Rk	3.4	55° 17' 09.02"	133° 35' 33.18"	17:20:22, June 20, 2008	Yes
7	Rk	5.2	55° 15' 18.41"	133° 36' 23.81"	17:09:47, Jun 20, 2008	Yes

No.	Feature	Depth (m)	Latitude (N)	Longitude (W)	Time, Date, Year	Investigate
8	Rk Awash	-0.4	55° 14' 13.87"	133° 36' 15.80"	17:25:24, June 22, 2008	No
9	Rk Awash	0.1	55° 14' 04.00"	133° 36' 27.04"	15:45:38, Aug 31, 2008	Yes

COMMENTS: Final verified tides have been applied from the Sitka tide gauge (9451600). The shoals were found using LIDAR. DTON items 1 through 5 were submitted following data collection. DTON items 6 through 9 were submitted during product compilation.

Questions concerning this report should be directed to the Survey Manager, Mr. Scott Ramsay, in the Tenix LADS, Inc. office in Biloxi, MS at (228) 594-6800.

APPENDIX V – SUPPLEMENTAL SURVEY RECORDS AND CORRESPONDENCE

Correspondence Regarding Lidar Reconnaissance Coverage Deliverables

-----Original Message-----
From: David.Scharff [mailto:David.Scharff@noaa.gov]
Sent: Thursday, November 06, 2008 10:03 AM
To: RAMSAY Scott; Toshi Wozumi
Subject: Feedback on lidar recon deliverables

Scott,

I've attached comments to each of your recommendations concerning the lidar recon surveys which came out of yesterdays requirements and deliverables meeting. When compiling these sheets keep in mind how they are being used. As with any recon survey, sheets D-G (OPR-O190-KRL-08) are for planning purpose only to increase the safety and efficiency of the work being conducted by our field units. Therefore the data compiled from these sheets will not be applied to any nautical chart. Instead these surveys will give us a much needed picture of what to expect from the near shore environment so we can work more efficiently.

I realize these types of projects will be considerably different (from a post processing standpoint) from the standalone surveys you are use to. However I hope by continuing to customize our deliverables for bathy lidar we will ultimately increase its effectiveness throughout the program.

Also please be aware these comments pertain only to the recon sheets assigned to OPR-O190-KRL-08. We are looking at additional changes to the recon deliverables but for now we want to limit our comment to this project only. Hope the attached comments help. Let me know if you have any questions.

Regards,
Dave

Tenix LADS, Inc.
Recommendations for
NOAA Lidar Reconnaissance Coverage Deliverables

Prepared by Scott Ramsay, James Guilford and Brett Weidman
November 4, 2008

Tenix LADS, Inc. appreciates that Lidar Reconnaissance Coverage is achieved for the intent purpose of planning safe and efficient NOAA multi-beam junctioning in complex near-shore coastal areas. The following is a very brief summary of the recommended NOAA specifications for Lidar Reconnaissance Coverage deliverables:

- In addition to the Descriptive Report, the **CARIS Base Surface** is the primary record of the survey. A 4m gridded surface is the optimum resolution for the 4m laser spot spacing, at 100% coverage, acquired over reconnaissance survey areas, and is recommended for final deliverables.

Agreed, we may consider tighter spot spacing on future recon projects in select more complex areas depending on the results of this project, however when possible we would prefer to stick to the 4m gridded surface.

- The **S-57 File** is a similarly imperative deliverable of the survey record. The only recommended change to this deliverable would be a reduction in the requirement for attributing cultural features. Significant drying and submerged features, DToNs, Navigation Aides, depth curves, coverage gaps etc. will still need to be rendered as part of the S-57 compliant deliverable.

Agreed, we defiantly want to keep these simple. Keeping in mind these types of surveys will be used to help the ships with planning and safety, not charting. So they will only really need to depict the most significant features.

- The digital **Imagery Mosaic** from the LADS MkII digital camera system is a supplemental, but integral deliverable of Lidar Reconnaissance Coverage.

This is a somewhat of a new deliverable for us and would like to exam it in more detail so we can outline our requirements. We do feel the imagery is important but the field units have commented that digital imagery delivered in the past has been too large to be practical. As our SOW did not define file size requirements we will experiment with your standard deliverable and provide more details in the 2009 SOW.

- Under the Standard Lidar Coverage deliverable specifications the MLLW and MHW line curves are required. It is recommended that only the **MHW curve** be rendered as part of the Lidar Reconnaissance deliverable, as the MLLW line is often incomplete with 100% Lidar coverage, due to very shallow water coverage

limitations (full 200% coverage generally eliminates this gap). It has been proposed that a 4m or 12m **Additional Depth Curve** would be advantageous for multi-beam junction planning. The 4m curve will often be incomplete due to the presence of kelp (in AK waters) and this would require a level of interpretation from TLI staff, with respect to coverage gaps due to kelp / white water. The 4m depth curve would only be generated from the bathymetry where sufficient coverage exists, so no interpolation would be conducted through kelp / white water gap areas. Rather, in these areas the seaward extent of the kelp / white water gap polygon, where Lidar coverage was not fully achieved, should take precedence. Generation of depth curves >10m from the CARIS Base Surface is a relatively simple task (due to the typical absence of kelp) and does not often require interpolation. TLI recommends that any shallow water curve (<10m depth) desired by NOAA should be part of the Lidar Reconnaissance deliverables.

We would like to receive the MHW line and the 4m, 8m, and 12m contours when possible. As you indicated these are important for near shore planning. We also recognize gaps are inevitable in our kelp infested waters of Alaska, but every bit of information does help. Many of the areas we assign were previously surveyed by lead-line at beast; therefore the charts are not always showing us the true morphology of the bottom.

- **Attributed Lidar Coverage Gaps** are an important deliverable, specifically for kelp and white water, but gap attribution for very shallow water (~MLLW) and overhanging spruce tree (~MHW) gaps is deemed not pertinent for Lidar Reconnaissance deliverables.

Agreed, we are not as concerned with gaps in the MHW with recon. As Jeff stated in our meeting “don’t lose sight of the forest through the gaps in the trees” which means we are more concerned with significant offsets in the charted shoreline or placement of significant features (i.e. Chirikof Island) for these types of surveys.

- The level of **Feature Attribution** should be minimized from the Standard Lidar deliverables, with just the pertinent drying features attributed (islets, drying rocks and rocks awash) and those submerged features deemed to be Dangers to Navigation (DToNs).

Agreed, as I mention above regarding the S-57 files, keep it simple. We don’t need points identifying each individual rock just a good general representation of what the field units can expect when they start working near shore.

- Thus, the **Chart Comparison** will also be minimized to reflect only the drying features not currently or incorrectly represented on the relevant chart, recommended submerged DToNs and at locations where the chart differs significantly from the BASE Surface.

We agree on all points, only significant changes need to be addressed.

- **Lidar Features Requiring Further Investigation** should be minimized to reflect only those features with incomplete coverage (least depth not found), considered to be < 10m depth. Priority should be given to seaward features with incomplete Lidar coverage, typically <5m depth.

As these are not stand alone surveys we do not feel it is necessary identifying features for further investigation. Therefore no list of items requiring further investigation will be required.

- The **Limit of Good Lidar Coverage** should not be included in Lidar Reconnaissance deliverables, as the CARIS Base surface adequately represents where Lidar coverage ends due to depth limitations (Lidar extinction depth). The sheet limits should be provided in lieu of the limit of good Lidar coverage polyline.

Agreed, no lidar good line is required.

APPROVAL PAGE

D00144

Data did not meet current specifications as determined by the OCS survey acceptance review process. D00144 is a reconnaissance survey and therefor has inadequate data density to be compiled to the chart. The survey will not be applied to NOAA charting products.

The following products will be sent to NGDC for archive:

- D00144_DR.pdf
- Collection of depth varied resolution BAGS
- Processed survey data and records
- D00144_GeoImage.pdf

The survey evaluation and verification has been conducted according to current OCS specifications and procedures.

Approved: Digitally signed by Peter Holmberg
DN: cn=Peter Holmberg, o, ou=signing for Annie Raymond, email=annemieke.raymond@noaa.gov, c=US
Date: 2012.10.31 13:45:31 -07'00'

Peter Holmberg
Cartographic Team Lead, Pacific Hydrographic Branch

The survey has not been approved for chart updates. The data will be archived at NGDC so that it can be made available for other uses.

Approved: David Zezula
2012.10.31 14:09:28 -07'00'

L**CDR David Zezula, NOAA**
Chief, Pacific Hydrographic Branch