

H11867

NOAA Form 76-35A

U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Ocean Survey

DESCRIPTIVE REPORT

Type of Survey: Hydrographic /Lidar

Registry Number: H11867

LOCALITY

State: Alaska

General Locality: West Prince of Wales Island

Sub-locality: St. Ignace Island

2008

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NOAA FORM 77-28 (11-72)		U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION		REGISTRY NUMBER:	
HYDROGRAPHIC TITLE SHEET				H11867	
INSTRUCTIONS: The Hydrographic Sheet should be accompanied by this form, filled in as completely as possible, when the sheet is forwarded to the Office.					
State:		Alaska			
General Locality:		West Prince of Wales Island			
Sub-Locality:		St. Ignace Island			
Scale:		1: 10,000			
Dates of Survey:		06/18/2008 to 09/04/2008			
Instructions Dated:		03/25/2008			
Project Number:		OPR-O190-KRL-08			
Field Unit:		Tenix LADS Aircraft			
Chief of Party:		Scott R Ramsay			
Soundings by:		Laser Airborne Depth Sounder			
Imagery by:					
Verification by:		Pacific Hydrographic Branch			
Soundings Acquired in:		Meters at Mean Lower Low Water			
H-Cell Compilation Units:		Meters at Mean Lower Low Water			
Remarks: <i>Horizontal Coordinate System: UTM Zone 8N. The purpose of this survey is to provide contemporary survey to update National Ocean Service (NOS) charts. All separates are filed with the hydrographic data. Revisions and notes in red were generated during office processing. The processing branch concurs with all information and recommendations in the DR unless otherwise noted. 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/.</i>					

DESCRIPTIVE REPORT TO ACCOMPANY

HYDROGRAPHIC SURVEY H11867

SCALE 1:10,000, SURVEYED IN 2008

TENIX LADS AIRCRAFT, VH-LCL

TENIX LADS, INC. (TLI)

MARK SINCLAIR, HYDROGRAPHER

PROJECT¹

Project Number: OPR-O190-KRL-08

Original: DG 133C-06-CQ-0066

Date of Instructions: March 25, 2008

Task Order: T0003

Registry Number: H11867

Sheet: C

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 H11867 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 reflines 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 C, which covers Ignace Island (see Figure 2).

The sheet limits are as follows for Sheet C (Coordinates are NAD83):

H11867 (C)	Latitude (N)	Longitude (W)
NW corner	55° 27' 48.81"	133° 28' 19.13"
SW corner	55° 22' 09.30"	133° 28' 32.22"
SE corner	55° 22' 03.71"	133° 21' 20.71"
NE corner	55° 27' 43.20"	133° 21' 06.59"



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

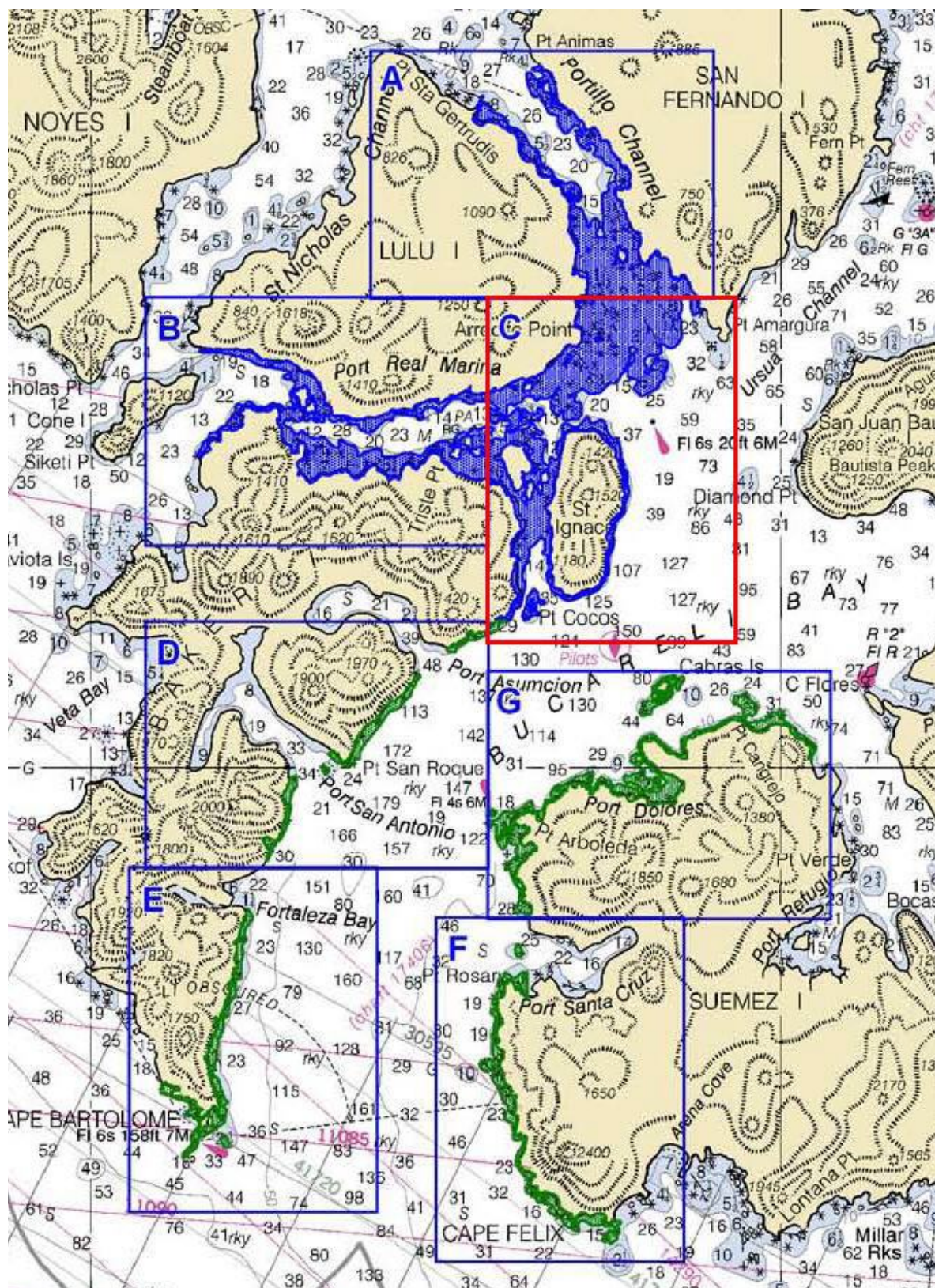


Figure 2 – Sub-Locality of H11867 (C)

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 prior to commencement of this survey. This allowed high quality images to be captured in real-time, georeferenced and overlaid with the processed survey data. These images were 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 investigation / additional coverage lines 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 H11867 survey. Five benchmark areas were also created from the 2007, West of Prince of Wales Island lidar survey data (OPR-O190-KRL-07) to assess absolute depth accuracy. Center coordinates for the benchmark areas are as follows:

Gulf of Esquibel Benchmark (Maurelle Islands)

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

San Alberto Bay Benchmark

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

San Christoval Channel Benchmark

Benchmark Name	Nominal Depth	UTM (N) Zone 8	
		Easting	Northing
BM_4	13 m	606 960	6 159 706
BM_5	11 m	607 732	6 159 828
BM_6	3 m	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 southwest of the project area occasionally exhibited expansive regions of white water due to swell. These areas were typically reflighted 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 (US511867.000).

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, the item will appear as a feature for examination in the chart comparison file (H11867_ChartComp.hob).

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 in the vicinity of St. Ignace Island is quite complex. The coastline is covered with spruce trees, which made the delineation of the MHW line difficult in some areas.

The seabed along the east coast of St. Ignace Island is very steep, falling quickly from the coastline to lidar extinction depth. The seabed between St. Ignace and Baker Islands is generally shallow and undulating. In the northern area of Sheet C there are numerous rocks

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.

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 85m, which provided the required Standard Hydrographic Survey Lidar 200% 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, these lines were re flown from the opposite direction to improve the coverage. In some inshore areas, reciprocal lines could not be flown due to the proximity of high ground at the start / end of the line. This adversely affected seabed coverage along some coastlines.

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 beyond 15m depth was achieved for H11867.

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	St. Ignace Island	C

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 done using CARIS software and was conducted in the Biloxi, MS 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 3m was used for the Standard Hydrographic Survey Lidar 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 3m grid provides the largest amount of detail that can be supported by the lidar density (4x4m laser spot spacing at 200% 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 (US511867.000).

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.
GLS	Bathymetry data gap due to glassy seas.
GS	Bathymetry / topography data gap due to the secondary exclusion zone (SEZ).
GTR	Topography data gap due to the detection of foliage in spruce trees.

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 features that require further examination:

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 features requiring further examination have been compiled in the H11867_Inv.hob file, and each have been given certain priority and a suggested examination method for the undertaking of additional boatwork.

In most cases the least depth has deemed not to be found on a tagged feature, and further examination by boat is required to determine the least depth.

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.

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 features for investigation 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:

Gauge	Location	NAD83	
		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 was applicable for Sheet A, resulting in a MHW value of 2.875m.

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 both a DGPS and 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 H11867 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 H11867.

Below is a table listing the S-57 feature objects found in the S-57 feature file (US511867.000):

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 is only responsible for defining the 0m curve.
Lake	LAKARE	A	A large body of water entirely surrounded by land.						
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
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.
Unsurveyed Areas	UNSARE	A	Unsurveyed area.		Information (INFORM)				Used to define gaps in data coverage. INFORM has been identified as SEZ or Glassy Seas based on (GS) tags.
<i>Meta Objects</i>									
Coverage	M_COVR	A	A geographical area that describes the coverage and the extent of spatial objects.		Category of coverage (CATCOV)				M_COVR: CATCOV = 1 polygons define the extents of good LIDAR data coverage.
Quality of Data	M_QUAL	A	An area within which a uniform assessment of the quality of the data exists.		Category of zone of confidence in data (CATZOC)				

Table 2: S-57 Attribution for the S-57 feature file (US511867.000)

Recommendations for registry number H11867 are divided into 2 components:

1. Recommended charting action, primarily for MCD.
2. Recommended further boatwork to sufficiently junction with lidar seabed coverage and examine uncertain lidar features.

Recommendations for charting action for registry number H11867 are provided in Sections D.1.1 to D.1.6 below. The Chart Comparison Spreadsheet has historically been one of the sources for the lidar features for examination list. In order to provide just one list of features for examination to field units, the Chart Comparison Spreadsheet has had some minor adjustments for this survey (H11867_ChartComp.xls). All features that appear in the chart comparison, but have not accurately had least depth determined by lidar, appear in the features for examination file. Where the least depth has not been found by lidar, no recommended charting action has been specified. Instead, a vessel-based verification method is suggested. The determination of least depth is at the discretion of the ships conducting junctioning / investigations and their results should be reported for charting action to MCD in due course.

Recommendations for ship junctioning and investigations are provided in Section D.2.1. In order to minimize the historical double handling of reporting uncertain lidar soundings on features, the features for examination are now contained exclusively in the CARIS .hob file (H11867_Inv.hob). The features for examination have been prioritized with respect to multibeam junctioning, investigating features in ‘coastal’ foul areas and within the NALL. A summary of charting actions and investigations is provided in Section D.2.2.

D.1 CHART COMPARISON

H11867 LADS survey deliverables were compared to:

ENC US5AK4CM Edition 12, compiled from Raster Charts 17406 7th Edition. ENC issue date January 22, 2009 at scale 1:40,000.

These charts were downloaded from the NOAA Office of Coast Survey – NOAA Electronic Navigational Charts download website on March 30, 2009.
(<http://chartmaker.ncd.noaa.gov/mcd/ENC/download.htm>)

D.1.1 Dangers to Navigation

Danger to Navigation (DTON) reports were submitted to Pacific Hydrographic Branch (PHB) following field operations and then during deliverables compilation. This coincided with the delivery of the final progress sketch at the end of September, 2008, prior to the commencement of data approval. Final DTON recommendations were provided to PHB, as part of the preliminary survey delivery, during March, 2009.

D.1.2 AWOIS

No AWOIS were assigned to this Task Order.

D.1.3 Aids to Navigation

1 Aid to Navigation was detected by lidar in the survey area for H11867.

Navaid Name	Charted Position		Surveyed Position		Difference in Position (m)	Lidar Hits
	Latitude (N)	Longitude (W)	Latitude (N)	Longitude (W)		
St. Ignace Rock Light	55° 25' 41.10"	133° 23' 42.70"	55° 25' 41.19"	133° 23' 42.67"	3	4
Point Amargura Ledge Buoy 1*	55° 26' 34.88"	133° 21' 41.57"				0

*Buoy position is within Sheet H11867 limits, but is outside the area surveyed.

D.1.4 Charted Depths and Features

Registry number H11867 lies over part of NOAA chart 17406, which includes the southeast coast of Lulu Island, the southwest coast of San Fernando Island, the northeast coast of Baker Island from Point Santa Rosa to Point Capones, Santa Rita Island, Saint Ignace Island. From the Source Diagrams, the area covered by H11867 was covered by NOS surveys between 1900 and 1939, presumably by leadline. Partial bottom coverage was achieved. The chart in

this area was inadequately surveyed, with a generalized coastline and drying features being portrayed.

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 very well with the surveyed coastline for the larger islands and islets. The surveyed coastline differs from the charted position by a maximum of 60m 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 137 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 (H11867_ChartComp.xls). A CARIS .hob file containing just the chart comparison items has also been compiled and is provided as part of survey deliverables (H11867_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	Used as a placeholder to store information relating to the chart comparison	OBJNAM (used for storing a unique chart comparison ID)	INFORM (used for storing the charting recommendation)	NINFOM (used for storing a reference to a Feature for Investigation)	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 dumps 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 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 chart comparison number has been used as the identifier within the S-57 feature file that contains the features for examination. If a chart comparison item had previously been identified as a feature for examination during data processing, a reference is made in the 'Remarks' column to the S-57 feature for examination item. For all chart comparison items that have not had least depth surveyed adequately, a suggested boatwork examination method acronym has been assigned. The description of these is provided in Section D.2.1.4.

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

Sequence No	Shoal No	Category	CHARTED			SURVEYED			Type of Feature	Kelp Area	Least Depth Found	Charting Recommendation	Remarks
			Charted Depth (meters)	NAD83 Latitude N (Degrees)	NAD83 Longitude W (Degrees)	Surveyed Depth (meters)	NAD83 Latitude N (Degrees)	NAD83 Longitude W (Degrees)					
1	C2	2	25.6			14.49	55° 26' 40.46"	133° 21' 30.21"	Rk	N	Y	Replace	See Danger to Navigation Report. Item 1. Submitted following field operations. Note: Charted 25.6 has been replaced by submitted DTON.
2	C4	2	10.9			5.65	55° 26' 34.81"	133° 24' 37.58"	Rk	Y	Y	Replace	See Danger to Navigation Report. Item 2. Submitted following field operations. Note: Charted 10.9 has been replaced by submitted DTON.
3	C5	1				4.50	55° 25' 59.89"	133° 27' 49.03"	Rk	Y	N	BV	See Danger to Navigation Report. Item 3. Submitted following field operations. Possible Rk in kelp. Refer to FEC4.
4	C6	1				7.00	55° 25' 47.24"	133° 27' 10.49"	Rk	N	Y	Insert	See Danger to Navigation Report. Item 4. Submitted following field operations. Note: 6.7 sounding has been inserted on chart.
5	C7	2	10.4			3.56	55° 25' 47.49"	133° 27' 38.36"	Rk	Y	Y	Replace	See Danger to Navigation Report. Item 5. Submitted following field operations. Note: Charted 10.4 has been replaced by submitted DTON.
6	C8	1				9.37	55° 25' 34.88"	133° 27' 48.74"	Rk	N	Y	Insert	See Danger to Navigation Report. Item 6. Submitted following field operations. Note: 9.1 sounding has been inserted on chart.
7	C9	2	18.2			8.79	55° 22' 32.86"	133° 27' 5.29"	Rk	Y	Y	Replace	See Danger to Navigation Report. Item 7. Submitted following field operations. Note: Charted 18.2 has been replaced by submitted DTON.

Shoal Categories:

1 = New Shoal Found

2 = Charted Shoal Disproved / Not Found

Recommended Further Investigation Method:

VV = visual verification

BV = bathymetric verification

JV = junctioning verification

Sequence No	Shoal No	Category	CHARTED			SURVEYED			Type of Feature	Kelp Area	Least Depth Found	Charting Recommendation	Remarks
			Charted Depth (meters)	NAD83 Latitude N (Degrees)	NAD83 Longitude W (Degrees)	Surveyed Depth (meters)	NAD83 Latitude N (Degrees)	NAD83 Longitude W (Degrees)					
8	C10	2	9.5			2.19	55° 22' 19.08"	133° 28' 17.81"	Rk	Y	Y	Replace	See Danger to Navigation Report. Item 8. Submitted following field operations. Note: Charted 9.5 has been replaced by submitted DTON.
9	C11	1				5.39	55° 25' 59.39"	133° 28' 20.37"	Rk	N	Y	Insert	See Danger to Navigation Report. Item 9. Submitted following field operations. Note: 5.4 Rk has been inserted on chart.
10	C12	1				5.15	55° 25' 42.33"	133° 27' 47.2"	Rk	N	Y	Insert	See Danger to Navigation Report. Item 10. Submitted following field operations. Note: 4.5 Rk has been inserted on chart.
11	C13	2	3.1	55° 27' 37.96"	133° 24' 4.34"	2.12	55° 27' 36.23"	133° 24' 4.72"	Rk	Y	Y	Replace	
12	C16	1				4.97	55° 27' 31.61"	133° 23' 27.98"	Rk	N	Y	Insert	
13	C17	2	14.6	55° 27' 36.2"	133° 23' 7.18"	10.51	55° 27' 35.14"	133° 23' 1.97"	Rk	N	Y	Replace	
14	C18	2	16.4	55° 27' 26.88"	133° 23' 0.96"	14.50	55° 27' 29.93"	133° 22' 55.15"	Rk	N	Y	Replace	
15	C19	2	16.4	55° 27' 29.29"	133° 22' 29.38"	11.31	55° 27' 31.79"	133° 22' 31.26"	Rk	N	Y	Replace	
16	C20	1				2.86	55° 27' 22.54"	133° 22' 12.74"	Rk	Y	N	VV/BV	Possible Rk in kelp.
17	C21	2	Islet	55° 27' 29.22"	133° 22' 13.96"	-2.64	55° 27' 29.29"	133° 22' 13.93"	Drying Rk	Y	Y	Replace	
18	C22	2	Drying Rk	55° 27' 10.77"	133° 21' 50.28"				Slope	Y	Y	Remove	Not detected by lidar, not observed in digital imagery.
19	C23	2	5.4	55° 27' 1.24"	133° 22' 5.31"	2.87	55° 27' 0.4"	133° 22' 3.23"	Rk	Y	Y	Replace	
20	C24	1				4.28	55° 27' 4.66"	133° 22' 3.54"	Rk	Y	Y	Insert	
21	C25	2	11.8	55° 27' 10.77"	133° 22' 23.88"	5.59	55° 27' 11.54"	133° 22' 24.96"	Rk	Y	Y	Replace	See Danger to Navigation Report. Item 11.
22	C26	2	2.7	55° 27' 19.17"	133° 23' 8.32"	1.21	55° 27' 16.74"	133° 23' 8.02"	Rk	Y	Y	Replace	

Shoal Categories:

1 = New Shoal Found

2 = Charted Shoal Disproved / Not Found

Recommended Further Investigation Method:

VV = visual verification

BV = bathymetric verification

JV = junctioning verification

Sequence No	Shoal No	Category	CHARTED			SURVEYED			Type of Feature	Kelp Area	Least Depth Found	Charting Recommendation	Remarks
			Charted Depth (meters)	NAD83 Latitude N (Degrees)	NAD83 Longitude W (Degrees)	Surveyed Depth (meters)	NAD83 Latitude N (Degrees)	NAD83 Longitude W (Degrees)					
23	C27	2	5.8	55° 27' 29.92"	133° 24' 10.55"	3.20	55° 27' 29.84"	133° 24' 12.55"	Rk	Y	Y	Replace	All items covered by 4x4m laser spot spacing at 200% lidar coverage.
24	C28	2	4.9	55° 27' 27.19"	133° 24' 37.11"	3.40	55° 27' 28.1"	133° 24' 33.73"	Rk	N	Y	Replace	
25	C29	2	Islet	55° 27' 29.58"	133° 24' 49.39"				Intertidal Area	Y	Y	Remove	
26	C30	1				-0.46	55° 27' 8.37"	133° 24' 59.13"	Rk Awash	Y	Y	Insert	
27	C31	2	Islet	55° 26' 59.8"	133° 25' 1.35"	-2.06	55° 26' 59.78"	133° 25' 1.16"	Drying Rk	Y	Y	Replace	
28	C32	2	Islet	55° 27' 1.65"	133° 25' 3.09"	-2.12	55° 27' 1.48"	133° 25' 3.09"	Drying Rk	Y	Y	Replace	
29	C33	1				-1.49	55° 27' 6.55"	133° 25' 9.3"	Drying Rk	N	Y	Insert	
30	C34	1				-2.17	55° 26' 47.04"	133° 26' 2.09"	Drying Rk	N	Y	Insert	
31	C35	2	Drying Rk	55° 26' 53.64"	133° 25' 40.58"				Intertidal Area	N	Y	Remove	Not detected by lidar, not observed in digital imagery. Note: Several charted drying rocks in vicinity surveyed as intertidal zone.
32	C36	2	Drying Rk	55° 26' 51.19"	133° 25' 22.03"				Slope	Y	Y	Remove	Not detected by lidar, not observed in digital imagery.
33	C37	1				-1.72	55° 26' 55.12"	133° 25' 10.47"	Drying Rk	N	Y	Insert	
34	C38	2	2.1	55° 26' 43.38"	133° 25' 6.81"	-0.83	55° 26' 44.03"	133° 25' 8.56"	Drying Rk	Y	Y	Replace	
35	C40	1				1.11	55° 26' 44.61"	133° 24' 51.61"	Rk	Y	N	VV/BV	Possible Rk in kelp. Refer to FEC13.

Shoal Categories:

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Recommended Further Investigation Method:

VV = visual verification

BV = bathymetric verification

JV = junctioning verification

Sequence No	Shoal No	Category	CHARTED			SURVEYED			Type of Feature	Kelp Area	Least Depth Found	Charting Recommendation	Remarks
			Charted Depth (meters)	NAD83 Latitude N (Degrees)	NAD83 Longitude W (Degrees)	Surveyed Depth (meters)	NAD83 Latitude N (Degrees)	NAD83 Longitude W (Degrees)					
36	C41	2	7.6	55° 26' 56.1"	133° 24' 5.35"	5.67	55° 26' 56.36"	133° 24' 8.73"	Rk	N	Y	Replace	All items covered by 4x4m laser spot spacing at 200% lidar coverage.
37	C42	2	3.1	55° 26' 55.51"	133° 21' 58.62"	2.37	55° 26' 55.1"	133° 21' 57.22"	Rk	Y	Y	Replace	
38	C43	2	10.4	55° 26' 51.43"	133° 22' 1.54"	5.38	55° 26' 52.49"	133° 22' 1.4"	Rk	Y	Y	Replace	
39	C44	1				6.56	55° 26' 32.82"	133° 24' 9.47"	Rk	Y	Y	Insert	
40	C45	2	23.7	55° 26' 28.39"	133° 24' 31.92"	10.37	55° 26' 29.83"	133° 24' 35.42"	Rk	N	Y	Replace	See Danger to Navigation Report. Item 12.
41	C46	2	2.7	55° 26' 36.72"	133° 25' 0.8"	0.10	55° 26' 35.38"	133° 25' 1.18"	Rk Awash	Y	Y	Replace	
42	C47	1				4.49	55° 26' 28.57"	133° 26' 2.69"	Rk	Y	N	BV	
43	C48	2	12.8	55° 26' 28.67"	133° 26' 10.29"	8.65	55° 26' 28.61"	133° 26' 13.85"	Rk	N	Y	Replace	
44	C49	2	11.8	55° 26' 34.16"	133° 26' 29.36"	7.31	55° 26' 32.91"	133° 26' 26.74"	Rk	N	Y	Replace	Not detected by lidar, not observed in digital imagery.
45	C50	2	Islet	55° 26' 22.1"	133° 27' 1.52"				Intertidal Area	N	Y	Remove	
46	C51	2	7.9	55° 26' 18.44"	133° 26' 51.32"	5.10	55° 26' 16.66"	133° 26' 51.65"	Rk	Y	N	BV	
47	C52	2	6.4	55° 26' 16.87"	133° 26' 36.39"	4.61	55° 26' 15.76"	133° 26' 36.42"	Rk	Y	N	BV	
48	C53	1				4.58	55° 26' 14.19"	133° 26' 46.73"	Rk	Y	N	BV	Possible Rk in kelp. Refer to FEC6.
49	C54	2	7.6	55° 26' 24.82"	133° 25' 43.77"	3.83	55° 26' 24.38"	133° 25' 42.89"	Rk	Y	N	BV	Possible Rk in kelp. Refer to FEC10.
50	C55	2	10.9	55° 26' 18.03"	133° 25' 40.06"	8.23	55° 26' 19.81"	133° 25' 35.54"	Rk	Y	N	BV	Possible Rk in kelp.
51	C56	2	9.1	55° 26' 16.5"	133° 25' 23.83"	6.79	55° 26' 17.36"	133° 25' 28.65"	Rk	Y	N	BV	Possible Rk in kelp. Refer to FEC11.
52	C57	1				10.68	55° 26' 26.72"	133° 23' 52.24"	Rk	N	Y	Insert	
53	C58	1				10.59	55° 26' 25.91"	133° 23' 33.63"	Rk	N	Y	Insert	

Shoal Categories:

1 = New Shoal Found

2 = Charted Shoal Disproved / Not Found

Recommended Further Investigation Method:

VV = visual verification

BV = bathymetric verification

JV = junctioning verification

Sequence No	Shoal No	Category	CHARTED			SURVEYED			Type of Feature	Kelp Area	Least Depth Found	Charting Recommendation	Remarks
			Charted Depth (meters)	NAD83 Latitude N (Degrees)	NAD83 Longitude W (Degrees)	Surveyed Depth (meters)	NAD83 Latitude N (Degrees)	NAD83 Longitude W (Degrees)					
54	C59	1				7.84	55° 26' 6.56"	133° 26' 44.38"	Rk	Y	Y	Insert	All items covered by 4x4m laser spot spacing at 200% lidar coverage.
55	C60	1				12.71	55° 26' 3.39"	133° 27' 11.14"	Rk	N	Y	Insert	
56	C61	2	16.4	55° 26' 4.99"	133° 27' 7.04"	12.46	55° 26' 4.99"	133° 27' 7.04"	Rk	N	Y	Replace	
57	C62	1				3.01	55° 26' 8.18"	133° 27' 26.55"	Rk	Y	Y	Insert	
58	C63	1				-3.50	55° 26' 12.46"	133° 27' 42.01"	Islet	Y	Y	Insert	
59	C64	2	10.4	55° 26' 3.69"	133° 27' 38.04"	6.04	55° 26' 1.39"	133° 27' 38.54"	Rk	N	Y	Replace	
60	C65	1				6.02	55° 26' 9.47"	133° 28' 2.73"	Rk	N	Y	Insert	
61	C66	1				8.47	55° 25' 58.6"	133° 28' 0.3"	Rk	N	Y	Insert	
62	C67	1				5.78	55° 25' 58.78"	133° 28' 9.82"	Rk	N	Y	Insert	
63	C68	2	8.5	55° 26' 2.37"	133° 28' 9.41"	5.17	55° 26' 2.2"	133° 28' 10.87"	Rk	N	Y	Replace	
64	C69	2	Drying Rk	55° 25' 49.59"	133° 28' 16.8"				Slope	Y	Y	Remove	
65	C70	2	10.9	55° 25' 53.15"	133° 28' 3.18"	7.34	55° 25' 55.29"	133° 28' 5.27"	Rk	N	Y	Replace	
66	C71	1				14.82	55° 25' 41.99"	133° 28' 1.81"	Rk	N	Y	Insert	
67	C72	1				7.57	55° 25' 44.2"	133° 27' 55.98"	Rk	N	Y	Insert	
68	C73	1				5.38	55° 25' 46.09"	133° 27' 44.62"	Rk	N	Y	Insert	
69	C74	1				11.61	55° 25' 48.16"	133° 27' 48.64"	Rk	N	Y	Insert	
70	C75	1				11.09	55° 25' 51.44"	133° 27' 26.03"	Rk	N	Y	Insert	
71	C76	2	14.6	55° 25' 42.46"	133° 27' 29.58"	8.88	55° 25' 41.05"	133° 27' 25.27"	Rk	N	Y	Replace	
72	C77	2	13.7	55° 25' 44.57"	133° 27' 10.56"	11.96	55° 25' 43.57"	133° 27' 13.28"	Rk	N	Y	Replace	
73	C78	2	12.2	55° 25' 50.96"	133° 26' 58.76"	10.96	55° 25' 48.52"	133° 27' 1.08"	Rk	N	Y	Replace	

Shoal Categories:

1 = New Shoal Found

2 = Charted Shoal Disproved / Not Found

Recommended Further Investigation Method:

VV = visual verification

BV = bathymetric verification

JV = junctioning verification

Sequence No	Shoal No	Category	CHARTED			SURVEYED			Type of Feature	Kelp Area	Least Depth Found	Charting Recommendation	Remarks
			Charted Depth (meters)	NAD83 Latitude N (Degrees)	NAD83 Longitude W (Degrees)	Surveyed Depth (meters)	NAD83 Latitude N (Degrees)	NAD83 Longitude W (Degrees)					
74	C79	1				14.76	55° 25' 40.46"	133° 27' 1.64"	Rk	N	Y	Insert	All items covered by 4x4m laser spot spacing at 200% lidar coverage.
75	C80	2	Drying Rk	55° 25' 50.05"	133° 26' 7.99"				Slope	Y	Y	Remove	Not detected by lidar, not observed in digital imagery.
76	C81	2	Drying Rk	55° 25' 51.93"	133° 26' 5.87"				Slope	Y	N	Remove	Not detected by lidar, not observed in digital imagery.
77	C82	2	Drying Rk	55° 25' 50.79"	133° 26' 1.7"				Slope	Y	Y	Remove	Not detected by lidar, not observed in digital imagery.
78	C83	2	10.0	55° 25' 39.17"	133° 25' 42.92"	7.58	55° 25' 39.63"	133° 25' 41"	Rk	N	Y	Replace	
79	C84	1				-2.04	55° 25' 46.61"	133° 25' 58.15"	Drying Rk	Y	Y	Insert	
80	C85	1				-2.34	55° 25' 50.63"	133° 25' 52.48"	Drying Rk	Y	Y	Insert	
81	C86	2	2.1	55° 25' 45.96"	133° 23' 42.04"	1.37	55° 25' 45.3"	133° 23' 38.6"	Rk	Y	Y	Replace	
82	C87	1				11.03	55° 25' 46.29"	133° 23' 33.9"	Rk	N	Y	Insert	
83	C88	1				-2.08	55° 25' 26.04"	133° 25' 6.29"	Drying Rk	Y	Y	Insert	
84	C89	2	3.6	55° 25' 34.8"	133° 25' 38.36"	2.22	55° 25' 34.66"	133° 25' 36.62"	Rk	Y	Y	Replace	
85	C90	1				1.89	55° 25' 34.05"	133° 25' 56.68"	Rk	Y	Y	Insert	
86	C91	2	12.8	55° 25' 37.21"	133° 26' 12.94"	10.36	55° 25' 37.52"	133° 26' 16.6"	Rk	N	Y	Replace	
87	C92	2	14.6	55° 25' 30.61"	133° 26' 58.14"	12.03	55° 25' 31.44"	133° 26' 55.5"	Rk	N	Y	Replace	
88	C93	2	16.4	55° 25' 37.79"	133° 27' 12.99"	10.01	55° 25' 36.91"	133° 27' 14.51"	Rk	N	Y	Replace	See Danger to Navigation Report. Item 13.
89	C94	2	10.9	55° 25' 30.92"	133° 27' 10.68"	8.69	55° 25' 29.6"	133° 27' 10.53"	Rk	N	Y	Replace	
90	C95	2	12.8	55° 25' 31.58"	133° 27' 19.87"	8.95	55° 25' 32.48"	133° 27' 21.4"	Rk	N	Y	Replace	

Shoal Categories:

1 = New Shoal Found

2 = Charted Shoal Disproved / Not Found

Recommended Further Investigation Method:

VV = visual verification

BV = bathymetric verification

JV = junctioning verification

Sequence No	Shoal No	Category	CHARTED			SURVEYED			Type of Feature	Kelp Area	Least Depth Found	Charting Recommendation	Remarks
			Charted Depth (meters)	NAD83 Latitude N (Degrees)	NAD83 Longitude W (Degrees)	Surveyed Depth (meters)	NAD83 Latitude N (Degrees)	NAD83 Longitude W (Degrees)					
91	C96	2	Drying Rk	55° 25' 27.76"	133° 27' 16.26"				Slope	N	Y	Remove	Not detected by lidar, not observed in digital imagery.
92	C97	2	Drying Rk	55° 25' 25.91"	133° 27' 25.71"				Slope	N	Y	Remove	Not detected by lidar, not observed in digital imagery.
93	C98	2	10.9	55° 25' 26.5"	133° 27' 33.47"	3.20	55° 25' 27.1"	133° 27' 32.8"	Rk	Y	Y	Replace	See Anti-Danger to Navigation Report. Item 1.
94	C99	2	10.9	55° 25' 32.04"	133° 27' 33.62"	6.78	55° 25' 30.54"	133° 27' 35.15"	Rk	Y	Y	Replace	
95	C100	2	Drying Rk	55° 25' 25.29"	133° 27' 40.76"				Slope	Y	Y	Remove	Not detected by lidar, not observed in digital imagery.
96	C101	1				4.32	55° 25' 23.95"	133° 27' 45.68"	Rk	N	Y	Insert	
97	C102	2	8.2	55° 25' 25.99"	133° 27' 49.89"	4.85	55° 25' 26.38"	133° 27' 45.99"	Rk	N	Y	Replace	
98	C103	1				9.43	55° 25' 38.95"	133° 27' 31.52"	Rk	N	Y	Insert	
99	C104	2	12.8	55° 25' 38.08"	133° 27' 41.06"	10.19	55° 25' 36.71"	133° 27' 39.44"	Rk	N	Y	Replace	
100	C105	1				10.21	55° 25' 33.85"	133° 27' 56.52"	Rk	N	Y	Insert	
101	C106	1				2.02	55° 25' 14.57"	133° 28' 11.6"	Rk	N	Y	Insert	
102	C107	2	9.5	55° 25' 20.51"	133° 27' 15.69"	2.06	55° 25' 19.85"	133° 27' 17.42"	Rk	Y	Y	Replace	
103	C108	2	Drying Rk	55° 25' 21.51"	133° 24' 51.67"				Slope	N	Y	Remove	Not detected by lidar, not observed in digital imagery.
104	C109	2	14.6	55° 24' 56.9"	133° 26' 37.56"	7.04	55° 24' 55.01"	133° 26' 34.15"	Rk	N	Y	Replace	
105	C110	1				1.14	55° 25' 5.81"	133° 27' 3.24"	Rk	N	Y	Insert	
106	C111	2	4.0	55° 25' 3.16"	133° 27' 6.6"	0.07	55° 25' 3.49"	133° 27' 9.56"	Rk Awash	N	Y	Replace	
107	C112	1				3.88	55° 24' 47.65"	133° 27' 59.13"	Rk	N	Y	Insert	

Shoal Categories:

1 = New Shoal Found

2 = Charted Shoal Disproved / Not Found

Recommended Further Investigation Method:

VV = visual verification

BV = bathymetric verification

JV = junctioning verification

Sequence No	Shoal No	Category	CHARTED			SURVEYED			Type of Feature	Kelp Area	Least Depth Found	Charting Recommendation	Remarks
			Charted Depth (meters)	NAD83 Latitude N (Degrees)	NAD83 Longitude W (Degrees)	Surveyed Depth (meters)	NAD83 Latitude N (Degrees)	NAD83 Longitude W (Degrees)					
108	C113	2	10.4	55° 24' 46.3"	133° 27' 20.04"	1.45	55° 24' 47.63"	133° 27' 18.63"	Rk	N	Y	Replace	
109	C114	2	Islet	55° 24' 31.77"	133° 26' 39.01"				Intertidal Area	Y	Y	Remove	Not detected by lidar, not observed in digital imagery.
110	C115	2	Islet	55° 24' 26.34"	133° 26' 44.25"				Slope	Y	Y	Remove	Not detected by lidar, not observed in digital imagery.
111	C116	2	5.8	55° 24' 25.66"	133° 27' 8.69"	3.63	55° 24' 25.25"	133° 27' 7.47"	Rk	Y	Y	Replace	
112	C117	1				9.27	55° 24' 22.27"	133° 27' 8.42"	Rk	N	Y	Insert	
113	C118	1				2.86	55° 24' 21.51"	133° 27' 30.91"	Rk	Y	Y	Insert	
114	C119	1				3.54	55° 24' 24.43"	133° 27' 34.61"	Rk	Y	Y	Insert	
115	C120	1				3.02	55° 24' 15.91"	133° 27' 13.32"	Rk	Y	Y	Insert	
116	C121	1				-0.47	55° 23' 50.05"	133° 27' 32.9"	Rk Awash	Y	Y	Insert	
117	C122	2	Drying Rk	55° 23' 42.73"	133° 27' 31.85"				Slope	Y	Y	Remove	Not detected by lidar, not observed in digital imagery.
118	C123	1				3.46	55° 23' 43.06"	133° 24' 51.3"	Rk	Y	Y	Insert	
119	C124	1				-2.79	55° 23' 21.82"	133° 27' 38.41"	Drying Rk	Y	Y	Insert	
120	C125	1				4.52	55° 23' 6.02"	133° 27' 36.23"	Rk	Y	Y	Insert	
121	C126	1				9.32	55° 23' 3.8"	133° 25' 6.06"	Rk	Y	Y	Insert	
122	C127	1				7.95	55° 22' 46.29"	133° 26' 7.08"	Rk	Y	Y	Insert	
123	C128	2	12.8	55° 16' 43.41"	133° 26' 54.33"	11.66	55° 22' 42.31"	133° 26' 53.7"	Rk	N	Y	Replace	
124	C129	2	9.1	55° 22' 49.65"	133° 27' 6.26"	7.76	55° 22' 48.54"	133° 27' 8.1"	Rk	Y	Y	Replace	
125	C130	1				6.74	55° 22' 53.98"	133° 27' 30.29"	Rk	Y	Y	Insert	

Shoal Categories:

1 = New Shoal Found

2 = Charted Shoal Disproved / Not Found

Recommended Further Investigation Method:

VV = visual verification

BV = bathymetric verification

JV = junctioning verification

Sequence No	Shoal No	Category	CHARTED			SURVEYED			Type of Feature	Kelp Area	Least Depth Found	Charting Recommendation	Remarks
			Charted Depth (meters)	NAD83 Latitude N (Degrees)	NAD83 Longitude W (Degrees)	Surveyed Depth (meters)	NAD83 Latitude N (Degrees)	NAD83 Longitude W (Degrees)					
126	C131	2	Drying Rk	55° 22' 33.75"	133° 27' 25.56"				Slope	N	Y	Remove	Not detected by lidar, not observed in digital imagery.
127	C132	2	Drying Rk	55° 22' 34.38"	133° 27' 20.63"				Slope	N	Y	Remove	Not detected by lidar, not observed in digital imagery.
128	C133	1				4.49	55° 22' 31.89"	133° 27' 11.43"	Rk	Y	Y	Insert	
129	C134	1				0.04	55° 22' 38.68"	133° 27' 6.53"	Rk Awash	Y	Y	Insert	
130	C135	2	42.0	55° 22' 35.87"	133° 26' 47.11"	21.26	55° 22' 35.65"	133° 26' 46.99"	Rk	N	Y	Replace	
131	C136	1				8.22	55° 22' 22.12"	133° 28' 6.98"	Rk	Y	Y	Insert	
132	C137	1				2.87	55° 22' 21.07"	133° 28' 12.14"	Rk	Y	Y	Insert	
133	C138	1				3.38	55° 22' 12.7"	133° 28' 29.1"	Rk	Y	Y	Insert	
134	C139	2	16.4	55° 26' 0.65"	133° 27' 53.59"	12.90	55° 26' 1.25"	133° 27' 55.19"	Rk	N	Y	Replace	
135	C140	2	3.6	55° 25' 55.15"	133° 26' 4.87"	1.94	55° 25' 54.41"	133° 26' 4.52"	Rk	Y	N	VV/BV	Possible Rk in kelp. Refer to FEC5.
136	C141	2	5.4	55° 26' 10.26"	133° 26' 37.79"	4.18	55° 26' 11.31"	133° 26' 36.51"	Rk	Y	N	BV	Possible Rk in kelp. Refer to FEC7.
137	C142	2	9.1	55° 26' 10.73"	133° 26' 13.68"	3.31	55° 26' 12.55"	133° 26' 13.42"	Rk	Y	N	VV/BV	Possible Rk in kelp. Refer to FEC8.

Table 3: Chart Comparison Spreadsheet

Shoal Categories:

1 = New Shoal Found

2 = Charted Shoal Disproved / Not Found

Recommended Further Investigation Method:

VV = visual verification

BV = bathymetric verification

JV = junctioning verification

D.2 ADDITIONAL RESULTS

D.2.1 Supplemental Information for Boatwork

For the H11867 survey, the supplemental information for further boatwork was compiled by:

1. Defining the seaward limit of good lidar seabed coverage as a M_COVR, CATCOV=1 polygon.
2. Reviewing the features for investigation compiled during data processing and adding the uncertain soundings identified during the chart comparison to this examination list.
3. Prioritizing all features for investigation with respect to the M_COVR polygon and dangers to safe vessel-based examination.
4. Recommending the vessel-based method of disproving ‘suspicious’ lidar features or confirming ‘real’ lidar feature detections and determining least depth.

D.2.1.1 Seaward Limit of Lidar Coverage

The survey area H11867 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 around the sheltered islands and islets. As a result of periods of poor water clarity experienced during lidar data acquisition and the presence of heavy kelp, 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:

- NE of Arrecife Point, at position 55° 27’ 12” N, 133° 24’ 45” W, due to kelp.
- W of Point Amargura, at position 55° 27’ 12” N, 133° 23’ 19” W, due to kelp.
- E of Pine Island, at position 55° 26’ 19” N, 133° 26’ 47” W, due to kelp.
- N of Rana Reef, at position 55° 26’ 20” N, 133° 25’ 34” W, due to marginal water clarity.
- E of Coposo Island, at position 55° 25’ 49” N, 133° 27’ 45” W, due to marginal water clarity.
- S of Arrecife Pt., at position 55° 26’ 52” N, 133° 25’ 55” W, due to poor water clarity.
- W of Pine Island, at position 55° 26’ 11” N, 133° 27’ 56” W, due to poor water clarity.

Traditionally, the suggested lidar-ship junctioning polyline was drawn too far to seaward, across areas of sparse, ‘noisy’ lidar coverage. For this survey, the polyline submitted as an S-57 M_COVR CATCOV=1 polygon is the seaward extent of good lidar coverage. When there is poor lidar coverage due to poor water clarity, the presence of kelp, or expansive white water, the polyline has been drawn just to seaward of the MLLW line. It should be noted that TLI is not providing a recommended junctioning line. The determination of where multibeam survey lines need to be conducted is at the discretion of the PHB and the ships conducting the junctioning.

When planning multibeam junctioning with lidar seabed coverage, the NALL and the following must be taken into consideration:

- Lidar / georeferenced imagery derived MHW line, MLLW line.
- Drying, awash and shallow features detected by lidar.
- Features for examination.
- ‘Unsurveyed’ polygons due to kelp, poor water clarity and the SEZ.

These are all provided in the S-57 feature file (US511867.000) and the H11867_Inv.hob file for H11867.

The areas of good lidar seabed coverage include:

- In Portillo Channel, at position 55° 26’ 21” N, 133° 23’ 47” W.
- Surrounding Santa Rita Island, at position 55° 25’ 13” N, 133° 27’ 03” W.
- NE of Punishment Point, at position 55° 23’ 43” N, 133° 27’ 05” W.

The seaward limit of good lidar data coverage has been described by the S-57 feature object M_COVR in the S-57 feature file (US511867.000).

D.2.1.2 Lidar Features Requiring Further Investigation

A list of uncertain lidar soundings was collated during data processing and is presented in an S-57 feature file. For example, some detections on isolated rocks in thick kelp beds were difficult to correctly classify as either rock or 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. These tags were then exported from the GS and compiled in CARIS BASE Editor. Features for examination have been captured within the H11867_Inv.hob as M_NPUB feature objects. Where these features correlate with an item listed in the Chart Comparison Spreadsheet, a reference has been made in the H11867_Inv.hob file. The S-57 attribution methodology for lidar features requiring further investigation 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	Used as a placeholder to store information relating to the feature for investigation	OBJNAM (used for storing a unique investigation ID)	INFORM (used for storing the investigation method)	NINFOM (used for storing a reference to a chart comparison)	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 all lidar seabed coverage gaps and recommended features for investigation.

In circumstances where least depth has not been found over a significant feature, a recommendation for investigation by boat for 19 uncertain soundings has been made in the CARIS H11867_Inv.hob file. All features in the chart comparison that have not had least depth adequately surveyed also appear in this file.

D.2.1.3 Prioritization of Features Requiring Further Investigation

All features for investigation have been assigned a priority, based on location with respect to the lidar coverage polyline, the coastal foul areas, and the NALL. In addition, they have been attributed with a recommended examination method, as specified in the following section. The priorities are assigned using the following table:

Priority	Location w.r.t. Polyline	Coastal Foul Area / NALL	Examination Method	Remarks
1	Seaward	No	Typically BV or VV / BV for shallow features	MUST be examined prior to multibeam junctioning.
2	Inshore	No NALL Possibly within Foul	Typically BV or VV / BV for shallow features	Investigation at ships discretion. Typically for uncertain shallow features.
3	Inshore / Seaward	NALL Coastal kelp	VV / BV	Investigation at ships discretion. Typically for drying rocks or rocks awash.
4	Seaward	No	JV	Can be safely navigated over during multibeam. Post acquisition comparison required.
5	Inshore / Seaward	Generally No	Typically BV or VV / BV for shallow features	Doubtful sounding. Possibly floating kelp / whale or fish strikes.

Note: All features recommended for investigation are reported as possible hazards when conducting survey work by boat.

Table 4: Prioritization Hierarchy for Features Requiring Further Investigation

D.2.1.4 Recommended Examination Method of Features Requiring Further Investigation

Each feature for investigation has been attributed with a recommended examination method, based on the general depth around the feature, the least depth as detected by lidar and the nature of the feature (kelp, white water etc.). The examination methods are categorized as follows:

Acronym	Examination Method
VV	Visual Verification - may be hazardous to approach even with shallow draft vessel running single beam.
VV / BV	Visual Verification required prior to Bathymetric Verification - potentially shoaler than 3m depth.
BV	Bathymetric Verification, generally greater than 3m depth.
JV	Junctioning Verification, generally greater than 6m depth.

Table 5: Recommended Examination Methods for Features Requiring Further Investigation

D.2.1.5 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 and SEZ, junctioning is not recommended for the obvious risks to surface vessels.

D.2.1.6 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.2.2 Summary of Charting Actions and Investigations – H11867**D.2.2.1 Summary of Charting Actions – H11867*

Total number of new significant islets recommended for insertion on chart: 1

Total number of new significant drying rocks recommended for insertion on chart: 7

Total number of new significant rocks awash recommended for insertion on chart: 3

Total number of new significant rocks recommended for insertion on chart: 42

Total number of charted features disproved by lidar (Remove): 18

Total number of charted features recommended for amendment by lidar (Replace): 53

Total number of chart comparison items requiring further investigation: 13

Total number of DTONs submitted to PHB following field operations: 10

Total number of Anti-DTONs submitted to PHB following field operations: 0

Total number of DTONs submitted to PHB during product compilation: 3

Total number of Anti-DTONs submitted to PHB during product compilation: 1

Total number of DTONs submitted to PHB for H11867: 13

Total number of Anti-DTONs submitted to PHB for H11867: 1

D.2.2.2 Summary of Lidar Features Requiring Further Investigation – H11867

Total number of Priority 1 investigations identified: 1

Total number of Priority 2 investigations identified: 12

Total number of Priority 3 investigations identified: 6

Total number of Priority 4 investigations identified: 0

Total number of Priority 5 investigations identified: 0

Total number of investigations recommended during data processing: 14

Total number of investigations recommended from georeferenced imagery review: 0

Total number of investigations recommended from chart comparison compilation: 5

Total number of recommended feature investigations: 19

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

Descriptive Report – H11867

Submission Date

April 10, 2009



Mark Sinclair
Hydrographer
Tenix LADS, Incorporated

Date April 10, 2009

¹ The LIDAR survey referenced in this Descriptive Report has been applied to multibeam survey H12289. No stand-alone LIDAR information was compiled to the HCell. For information concerning the compilation of LIDAR features and soundings see the Descriptive Report H12289_DR. LIDAR was not used to supersede shoaler charted soundings or to disprove charted features.

The Data Acquisition and Processing Report and Horizontal and Vertical Control Report have been filed with the project records.

Dangers to Navigation for Lidar Survey H11867

Registry Number: H11867
State: Alaska
Locality: West of Prince of Wales Island
Sub-locality: St. Ignace
Project Number: OPR-P135-KRL-07
Survey Dates: June 19, 2008 - September 3, 2008

Charts Affected

Number	Edition	Date	Scale (RNC)	RNC Correction(s)*
17405	15th	05/01/2006	1:40,000 (17405_1)	[L]NTM: ?
17406	7th	02/01/2004	1:40,000 (17406_1)	USCG LNM: 05/24/2005 (09/16/2008) CHS NTM: None (08/29/2008) NGA NTM: None (09/27/2008)
17400	17th	03/01/2007	1:229,376 (17400_1)	[L]NTM: ?
16016	21st	10/01/2007	1:969,756 (16016_1)	[L]NTM: ?
531	24th	07/01/2007	1:2,100,000 (531_1)	[L]NTM: ?
500	8th	06/01/2003	1:3,500,000 (500_1)	[L]NTM: ?
501	12th	11/01/2002	1:3,500,000 (501_1)	[L]NTM: ?
530	32nd	06/01/2007	1:4,860,700 (530_1)	[L]NTM: ?
50	6th	06/01/2003	1:10,000,000 (50_1)	[L]NTM: ?

* Correction(s) - source: last correction applied (last correction reviewed--"cleared date")

Features

No.	Feature Type	Survey Depth	Survey Latitude	Survey Longitude
1.1	GP	14.50 m	55° 26' 40.4" N	133° 21' 30.2" W
1.2	GP	5.60 m	55° 26' 34.8" N	133° 24' 37.5" W
1.3	GP	4.50 m	55° 25' 59.9" N	133° 27' 49.1" W
1.4	GP	7.00 m	55° 25' 47.3" N	133° 27' 10.3" W
1.5	GP	3.60 m	55° 25' 47.5" N	133° 27' 38.3" W
1.6	GP	9.40 m	55° 25' 34.9" N	133° 27' 48.7" W
1.7	GP	8.80 m	55° 22' 32.9" N	133° 27' 05.1" W

1.8	GP	2.20 m	55° 22' 19.1" N	133° 28' 17.8" W
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1 - Danger To Navigation

1.1) GP No. - 1 from H11867_dton1.xls**DANGER TO NAVIGATION****Survey Summary**

Survey Position: 55° 26' 40.4" N, 133° 21' 30.2" W
Least Depth: 14.50 m (= 47.57 ft = 7.929 fm = 7 fm 5.57 ft)
TPU ($\pm 1.96\sigma$): THU (TPEh) [None] ; TVU (TPEv) [None]
Timestamp: 2008-244.16:23:22.000 (08/31/2008)
GP Dataset: H11867_dton1.xls
GP No.: 1
Charts Affected: 17405_1, 17406_1, 17400_1, 16016_1, 531_1, 500_1, 501_1, 530_1, 50_1

Remarks:

This feature was found during Lidar hydrographic survey operation. Depth was reduced to Mean Lower Low Water using verified tides from the Sitka tide gauge (9450460).

Feature Correlation

Address	Feature	Range	Azimuth	Status
H11867_dton1.xls	1	0.00	000.0	Primary

Hydrographer Recommendations

Chart as surveyed.

Cartographically-Rounded Depth (Affected Charts):

7 ¾fm (17405_1, 17406_1, 17400_1, 16016_1, 530_1)

7fm 5ft (531_1)

14.5m (500_1, 501_1, 50_1)

S-57 Data

Geo object 1: Underwater rock / awash rock (UWTROC)
Attributes: SORDAT - 20080903
 SORIND - US,US,nsurf,H11867
 TECSOU - 7:found by laser

VALSOU - 14.5 m

VERDAT - 12:Mean lower low water

WATLEV - 3:always under water/submerged

1.2) GP No. - 2 from H11867_dton1.xls**DANGER TO NAVIGATION****Survey Summary**

Survey Position: 55° 26' 34.8" N, 133° 24' 37.5" W
Least Depth: 5.60 m (= 18.37 ft = 3.062 fm = 3 fm 0.37 ft)
TPU ($\pm 1.96\sigma$): THU (TPEh) [None] ; TVU (TPEv) [None]
Timestamp: 2008-173.23:22:07.000 (06/21/2008)
GP Dataset: H11867_dton1.xls
GP No.: 2
Charts Affected: 17405_1, 17406_1, 17400_1, 16016_1, 531_1, 500_1, 501_1, 530_1, 50_1

Remarks:

This feature was found during Lidar hydrographic survey operation. Depth was reduced to Mean Lower Low Water using verified tides from the Sitka tide gauge (9450460).

Feature Correlation

Address	Feature	Range	Azimuth	Status
H11867_dton1.xls	2	0.00	000.0	Primary

Hydrographer Recommendations

Chart as surveyed.

Cartographically-Rounded Depth (Affected Charts):

3fm (17405_1, 17406_1, 17400_1, 16016_1, 530_1)

3fm 0ft (531_1)

5.6m (500_1, 501_1, 50_1)

S-57 Data

Geo object 1: Sounding (SOUNDG)
Attributes: SORDAT - 20080903
 SORIND - US,US,nsurf,H11867
 TECSOU - 7:found by laser

VERDAT - 12:Mean lower low water

1.3) GP No. - 3 from H11867_dton1.xls**DANGER TO NAVIGATION****Survey Summary**

Survey Position: 55° 25' 59.9" N, 133° 27' 49.1" W
Least Depth: 4.50 m (= 14.76 ft = 2.461 fm = 2 fm 2.76 ft)
TPU ($\pm 1.96\sigma$): THU (TPEh) [None] ; TVU (TPEv) [None]
Timestamp: 2008-174.01:34:43.000 (06/22/2008)
GP Dataset: H11867_dton1.xls
GP No.: 3
Charts Affected: 17406_1, 17400_1, 16016_1, 531_1, 500_1, 501_1, 530_1, 50_1

Remarks:

This feature was found during Lidar hydrographic survey operation. Depth was reduced to Mean Lower Low Water using verified tides from the Sitka tide gauge (9450460). Further investigation for least depth determination is recommended for this feature. The S-57 attribute QUASOU is set to '3' for doubtful sounding.

Feature Correlation

Address	Feature	Range	Azimuth	Status
H11867_dton1.xls	3	0.00	000.0	Primary

Hydrographer Recommendations

Chart as surveyed.

Cartographically-Rounded Depth (Affected Charts):

2 ½fm (17406_1, 17400_1, 16016_1, 530_1)

2fm 3ft (531_1)

4.5m (500_1, 501_1, 50_1)

S-57 Data

Geo object 1: Underwater rock / awash rock (UWTROC)

Attributes: QUASOU - 3:doubtful sounding

SORDAT - 20080803

SORIND - US,US,nsurf,H11867

TECSOU - 7:found by laser

VALSOU - 4.5 m

VERDAT - 12:Mean lower low water

WATLEV - 3:always under water/submerged

1.4) GP No. - 4 from H11867_dton1.xls**DANGER TO NAVIGATION****Survey Summary**

Survey Position: 55° 25' 47.3" N, 133° 27' 10.3" W
Least Depth: 7.00 m (= 22.97 ft = 3.828 fm = 3 fm 4.97 ft)
TPU ($\pm 1.96\sigma$): THU (TPEh) [None] ; TVU (TPEv) [None]
Timestamp: 2008-181.00:45:28.000 (06/29/2008)
GP Dataset: H11867_dton1.xls
GP No.: 4
Charts Affected: 17406_1, 17400_1, 16016_1, 531_1, 500_1, 501_1, 530_1, 50_1

Remarks:

This feature was found during Lidar hydrographic survey operation. Depth was reduced to Mean Lower Low Water using verified tides from the Sitka tide gauge (9450460).

Feature Correlation

Address	Feature	Range	Azimuth	Status
H11867_dton1.xls	4	0.00	000.0	Primary

Hydrographer Recommendations

Chart as surveyed.

Cartographically-Rounded Depth (Affected Charts):

3 ¾fm (17406_1, 17400_1, 16016_1, 530_1)

3fm 5ft (531_1)

7.0m (500_1, 501_1, 50_1)

S-57 Data

Geo object 1: Underwater rock / awash rock (UWTROC)
Attributes: SORDAT - 20080903
 SORIND - US,US,nsurf,H11867
 TECSOU - 7:found by laser

VALSOU - 7.0 m

VERDAT - 12:Mean lower low water

WATLEV - 3:always under water/submerged

1.5) GP No. - 5 from H11867_dton1.xls**DANGER TO NAVIGATION****Survey Summary**

Survey Position: 55° 25' 47.5" N, 133° 27' 38.3" W
Least Depth: 3.60 m (= 11.81 ft = 1.969 fm = 1 fm 5.81 ft)
TPU ($\pm 1.96\sigma$): THU (TPEh) [None] ; TVU (TPEv) [None]
Timestamp: 2008-174.00:43:22.000 (06/22/2008)
GP Dataset: H11867_dton1.xls
GP No.: 5
Charts Affected: 17406_1, 17400_1, 16016_1, 531_1, 500_1, 501_1, 530_1, 50_1

Remarks:

This feature was found during Lidar hydrographic survey operation. Depth was reduced to Mean Lower Low Water using verified tides from the Sitka tide gauge (9450460).

Feature Correlation

Address	Feature	Range	Azimuth	Status
H11867_dton1.xls	5	0.00	000.0	Primary

Hydrographer Recommendations

Chart as surveyed.

Cartographically-Rounded Depth (Affected Charts):

2fm (17406_1, 17400_1, 16016_1, 530_1)

2fm 0ft (531_1)

3.6m (500_1, 501_1, 50_1)

S-57 Data

Geo object 1: Underwater rock / awash rock (UWTROC)
Attributes: SORDAT - 20080903
 SORIND - US,US,nsurf,H11867
 TECSOU - 7:found by laser

VALSOU - 3.6 m

VERDAT - 12:Mean lower low water

WATLEV - 3:always under water/submerged

1.6) GP No. - 6 from H11867_dton1.xls**DANGER TO NAVIGATION****Survey Summary**

Survey Position: 55° 25' 34.9" N, 133° 27' 48.7" W
Least Depth: 9.40 m (= 30.84 ft = 5.140 fm = 5 fm 0.84 ft)
TPU ($\pm 1.96\sigma$): THU (TPEh) [None] ; TVU (TPEv) [None]
Timestamp: 2008-174.01:40:54.000 (06/22/2008)
GP Dataset: H11867_dton1.xls
GP No.: 6
Charts Affected: 17406_1, 17400_1, 16016_1, 531_1, 500_1, 501_1, 530_1, 50_1

Remarks:

This feature was found during Lidar hydrographic survey operation. Depth was reduced to Mean Lower Low Water using verified tides from the Sitka tide gauge (9450460).

Feature Correlation

Address	Feature	Range	Azimuth	Status
H11867_dton1.xls	6	0.00	000.0	Primary

Hydrographer Recommendations

Chart as surveyed.

Cartographically-Rounded Depth (Affected Charts):

5fm (17406_1, 17400_1, 16016_1, 530_1)

5fm 1ft (531_1)

9.4m (500_1, 501_1, 50_1)

S-57 Data

Geo object 1: Underwater rock / awash rock (UWTROC)
Attributes: SORDAT - 20080903
 SORIND - US,US,nsurf,H11867
 TECSOU - 7:found by laser

VALSOU - 9.4 m

VERDAT - 12:Mean lower low water

WATLEV - 3:always under water/submerged

1.7) GP No. - 7 from H11867_dton1.xls**DANGER TO NAVIGATION****Survey Summary**

Survey Position: 55° 22' 32.9" N, 133° 27' 05.1" W
Least Depth: 8.80 m (= 28.87 ft = 4.812 fm = 4 fm 4.87 ft)
TPU ($\pm 1.96\sigma$): THU (TPEh) [None] ; TVU (TPEv) [None]
Timestamp: 2008-172.20:53:56.000 (06/20/2008)
GP Dataset: H11867_dton1.xls
GP No.: 7
Charts Affected: 17406_1, 17400_1, 16016_1, 531_1, 500_1, 501_1, 530_1, 50_1

Remarks:

This feature was found during Lidar hydrographic survey operation. Depth was reduced to Mean Lower Low Water using verified tides from the Sitka tide gauge (9450460).

Feature Correlation

Address	Feature	Range	Azimuth	Status
H11867_dton1.xls	7	0.00	000.0	Primary

Hydrographer Recommendations

Chart as surveyed.

Cartographically-Rounded Depth (Affected Charts):

4 ¾fm (17406_1, 17400_1, 16016_1, 530_1)

4fm 5ft (531_1)

8.8m (500_1, 501_1, 50_1)

S-57 Data

Geo object 1: Underwater rock / awash rock (UWTROC)
Attributes: SORDAT - 20080903
 SORIND - US,US,nsurf,H11867
 TECSOU - 7:found by laser

VALSOU - 8.8 m

VERDAT - 12:Mean lower low water

WATLEV - 3:always under water/submerged

1.8) GP No. - 8 from H11867_dton1.xls**DANGER TO NAVIGATION****Survey Summary**

Survey Position: 55° 22' 19.1" N, 133° 28' 17.8" W
Least Depth: 2.20 m (= 7.22 ft = 1.203 fm = 1 fm 1.22 ft)
TPU ($\pm 1.96\sigma$): THU (TPEh) [None] ; TVU (TPEv) [None]
Timestamp: 2008-244.16:29:59.000 (08/31/2008)
GP Dataset: H11867_dton1.xls
GP No.: 8
Charts Affected: 17406_1, 17400_1, 16016_1, 531_1, 500_1, 501_1, 530_1, 50_1

Remarks:

This feature was found during Lidar hydrographic survey operation. Depth was reduced to Mean Lower Low Water using verified tides from the Sitka tide gauge (9450460).

Feature Correlation

Address	Feature	Range	Azimuth	Status
H11867_dton1.xls	8	0.00	000.0	Primary

Hydrographer Recommendations

Chart as surveyed.

Cartographically-Rounded Depth (Affected Charts):

1 ¼fm (17406_1, 17400_1, 16016_1, 530_1)

1fm 1ft (531_1)

2.2m (500_1, 501_1, 50_1)

S-57 Data

Geo object 1: Underwater rock / awash rock (UWTROC)
Attributes: SORDAT - 20080903
 SORIND - US,US,nsurf,H11867
 TECSOU - 7:found by laser

VALSOU - 2.2 m

VERDAT - 12:Mean lower low water

WATLEV - 3:always under water/submerged

Danger to Navigation Report for Lidar Survey H11867

Registry Number: H11867
State: Alaska
Locality: West of Prince of Wales Island
Sub-locality: St. Ignace Island
Project Number: OPR-O190-KRL-08
Survey Dates: June 18, 2008 - September 04, 2008

Charts Affected

Number	Edition	Date	Scale (RNC)	RNC Correction(s)*
17405	16th	10/01/2008	1:40,000 (17405_1)	USCG LNM: 10/23/2007 (03/24/2009) NGA NTM: None (03/28/2009)
17406	7th	02/01/2004	1:40,000 (17406_1)	USCG LNM: 05/24/2005 (03/24/2009) NGA NTM: None (03/28/2009)
17400	17th	03/01/2007	1:229,376 (17400_1)	[L]NTM: ?
16016	21st	10/01/2007	1:969,756 (16016_1)	[L]NTM: ?
531	24th	07/01/2007	1:2,100,000 (531_1)	[L]NTM: ?
500	8th	06/01/2003	1:3,500,000 (500_1)	[L]NTM: ?
501	12th	11/01/2002	1:3,500,000 (501_1)	[L]NTM: ?
530	32nd	06/01/2007	1:4,860,700 (530_1)	[L]NTM: ?
50	6th	06/01/2003	1:10,000,000 (50_1)	[L]NTM: ?

* Correction(s) - *source: last correction applied (last correction reviewed--"cleared date")*

Features

No.	Feature Type	Survey Depth	Survey Latitude	Survey Longitude
1.1	Rock	5.60 m	55° 27' 11.5" N	133° 22' 25.0" W
1.2	Rock	6.50 m	55° 26' 32.8" N	133° 24' 09.5" W
1.3	Rock	10.00 m	55° 25' 36.9" N	133° 27' 14.5" W
1.4	Shoal	10.90 m	55° 25' 26.5" N	133° 27' 33.5" W

1 - Danger To Navigation

1.1) GP No. - 1 from H11867_pydro_dtons.xls**DANGER TO NAVIGATION****Survey Summary**

Survey Position: 55° 27' 11.5" N, 133° 22' 25.0" W
Least Depth: 5.60 m (= 18.37 ft = 3.062 fm = 3 fm 0.37 ft)
TPU ($\pm 1.96\sigma$): THU (TPEh) [None] ; TVU (TPEv) [None]
Timestamp: 2008-243.14:57:14.000 (08/30/2008)
GP Dataset: H11867_pydro_dtons.xls
GP No.: 1
Charts Affected: 17405_1, 17406_1, 17400_1, 16016_1, 531_1, 500_1, 501_1, 530_1, 50_1

Remarks:

This feature was found during Hydrographic Lidar survey operation by Tenix LADS. Depth was reduced to Mean Lower Low Water using verified tides from Sitka tide guage (9451600).

Feature Correlation

Address	Feature	Range	Azimuth	Status
H11867_pydro_dtons.xls	1	0.00	000.0	Primary

Hydrographer Recommendations

Update chart with new depth.

Cartographically-Rounded Depth (Affected Charts):

3fm (17405_1, 17406_1, 17400_1, 16016_1, 530_1)

3fm 0ft (531_1)

5.6m (500_1, 501_1, 50_1)

S-57 Data

Geo object 1: Underwater rock / awash rock (UWTROC)
Attributes: SORDAT - 20080831
 SORIND - US,US,nsurf,H11867
 TECSOU - 7:found by laser

VALSOU - 5.6 m

VERDAT - 12:Mean lower low water

WATLEV - 3:always under water/submerged

1.2) GP No. - 2 from H11867_pydro_dtons.xls**DANGER TO NAVIGATION****Survey Summary**

Survey Position: 55° 26' 32.8" N, 133° 24' 09.5" W
Least Depth: 6.50 m (= 21.33 ft = 3.554 fm = 3 fm 3.33 ft)
TPU ($\pm 1.96\sigma$): THU (TPEh) [None] ; TVU (TPEv) [None]
Timestamp: 2008-173.22:41:44.000 (06/21/2008)
GP Dataset: H11867_pydro_dtons.xls
GP No.: 2
Charts Affected: 17405_1, 17406_1, 17400_1, 16016_1, 531_1, 500_1, 501_1, 530_1, 50_1

Remarks:

This feature was found during Hydrographic Lidar survey operation by Tenix LADS. Depth was reduced to Mean Lower Low Water using verified tides from Sitka tide guage (9451600).

Feature Correlation

Address	Feature	Range	Azimuth	Status
H11867_pydro_dtons.xls	2	0.00	000.0	Primary

Hydrographer Recommendations

Update chart with new depth.

Cartographically-Rounded Depth (Affected Charts):

3 ½fm (17405_1, 17406_1, 17400_1, 16016_1, 530_1)

3fm 3ft (531_1)

6.5m (500_1, 501_1, 50_1)

S-57 Data

Geo object 1: Underwater rock / awash rock (UWTROC)
Attributes: SORDAT - 20080831
 SORIND - US,US,nsurf,H11867
 TECSOU - 7:found by laser

VALSOU - 6.5 m

VERDAT - 12:Mean lower low water

WATLEV - 3:always under water/submerged

1.3) GP No. - 3 from H11867_pydro_dtons.xls**DANGER TO NAVIGATION****Survey Summary**

Survey Position: 55° 25' 36.9" N, 133° 27' 14.5" W
Least Depth: 10.00 m (= 32.81 ft = 5.468 fm = 5 fm 2.81 ft)
TPU ($\pm 1.96\sigma$): THU (TPEh) [None] ; TVU (TPEv) [None]
Timestamp: 2008-174.01:40:46.000 (06/22/2008)
GP Dataset: H11867_pydro_dtons.xls
GP No.: 3
Charts Affected: 17406_1, 17400_1, 16016_1, 531_1, 500_1, 501_1, 530_1, 50_1

Remarks:

This feature was found during Hydrographic Lidar survey operation by Tenix LADS. Depth was reduced to Mean Lower Low Water using verified tides from Sitka tide guage (9451600).

Feature Correlation

Address	Feature	Range	Azimuth	Status
H11867_pydro_dtons.xls	3	0.00	000.0	Primary

Hydrographer Recommendations

Update chart with new depth.

Cartographically-Rounded Depth (Affected Charts):

5 ½fm (17406_1, 17400_1, 16016_1, 530_1)

5fm 3ft (531_1)

10.0m (500_1, 501_1, 50_1)

S-57 Data

Geo object 1: Underwater rock / awash rock (UWTROC)
Attributes: SORDAT - 20080831
 SORIND - US,US,nsurf,H11867
 TECSOU - 7:found by laser

VALSOU - 10.0 m

VERDAT - 12:Mean lower low water

WATLEV - 3:always under water/submerged

1.4) GP No. - Depth 8 from ChartGPs - ENC US5AK4CM

ANTI-DANGER TO NAVIGATION

Survey Summary

Survey Position: 55° 25' 26.5" N, 133° 27' 33.5" W
Least Depth: 10.90 m (= 35.76 ft = 5.960 fm = 5 fm 5.76 ft)
TPU ($\pm 1.96\sigma$): THU (TPEh) [None] ; TVU (TPEv) [None]
Timestamp: [None]
GP Dataset: ChartGPs - ENC US5AK4CM
GP No.: Depth 8
Charts Affected: 17406_1, 17400_1, 16016_1, 531_1, 500_1, 501_1, 530_1, 50_1

Remarks:

Shoaler soundings were found in the vicinity by Lidar survey.

Feature Correlation

Address	Feature	Range	Azimuth	Status
ChartGPs - ENC US5AK4CM	Depth 8	0.00	000.0	Primary

Hydrographer Recommendations

Remove charted sounding.

Cartographically-Rounded Depth (Affected Charts):

6fm (17406_1, 17400_1, 16016_1, 530_1)

6fm 0ft (531_1)

10.9m (500_1, 501_1, 50_1)

S-57 Data

Geo object 1: Sounding (SOUNDG)

Attributes: SORDAT - 20040200

SORIND - US,US,graph,chart 17406

APPROVAL PAGE

H11867

Data partially meet current specifications as certified by the OCS survey acceptance review process. Descriptive Report and survey data are adequate to supplement inshore data adjacent to survey H12289 where new and shoaler than currently charted soundings and features were surveyed.

The following products will be sent to NGDC for archive:

- H11867_DR.pdf
- Collection of depth varied resolution BAGS
- Processed survey data and records
- H11867_GeoImage.pdf

The survey evaluation and verification has been conducted according current OCS Specifications.

Approved: _____

Peter Holmberg

Cartographic Team Lead, Pacific Hydrographic Branch

The survey has been approved for dissemination and limited usage of updating NOAA's suite of nautical charts.

Approved: _____

Russ Davies

Cartographer, Pacific Hydrographic Branch