

H12104

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: H12104

LOCALITY

State: Alaska

General Locality: Shumagin Islands

Sub-locality: South of Simeonof Island

2009

CHIEF OF PARTY
Scott Ramsay, Tenix LADS, Inc.

LIBRARY & ARCHIVES

Date:

HYDROGRAPHIC TITLE SHEET

H12104

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: **Shumagin Islands**

Sub-Locality: **South of Simeonof Island**

Scale: **1: 10,000**

Dates of Survey: **05/30/2009 to 08/16/2009**

Instructions Dated: **April 2009**

Project Number: **OPR-P183-KRL-09**

Field Unit: **Tenix LADS Aircraft, VH-LCL**

Chief of Party: **Scott Ramsay, Tenix LADS, Inc.**

Soundings by: **LADS Mk II**

Imagery by: **Redlake MegaPlus II ES 2020**

Verification by: **Pacific Hydrographic Branch**

Soundings Acquired in: **meters at Mean Lower Low Water**

HCell Compilation Units: ***meters at Mean Lower Low Water***

Remarks:

Horizontal Coordinate System: UTM Zone 4N. 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/>.

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DESCRIPTIVE REPORT TO ACCOMPANY**HYDROGRAPHIC SURVEY H12104****SCALE 1:10,000, SURVEYED IN 2009****FUGRO LADS AIRCRAFT, VH-LCL****FUGRO LADS, INC. (FLI)****MARK SINCLAIR, HYDROGRAPHER****PROJECT****Project Number:** OPR-P183-KRL-09**Original:** DG 133C-06-CQ-0066**Date of Instructions:** April 2009**Task Order:** T0005**Registry Number:** H12104**Sheet:** D**A. AREA SURVEYED¹**

Survey operations covered four registered sheets over the OPR-P183-KRL-09 project area, Shumagin Islands, AK (see Figure 1 and Figure 2).

A total of 2346 lineal nautical miles were illuminated in the process of flying 259 main scheme survey lines. An additional 1472 lineal nautical miles were illuminated flying 163 reflies and 587 lineal nautical miles flying 54 crosslines / investigations. The total seabed area surveyed across the project area, from the Mean High Water (MHW) line to lidar extinction depth, was 42.6 square nautical miles (see Appendix III for further information).

The Fugro LADS aircraft first attempted to land at the main base of operations in Sand Point, AK on May 29, 2009. However, due to adverse weather conditions on the Alaskan Peninsula and the absence of an ILS landing approach at the Sand Point airport, the aircraft was unable to land on this date. The aircraft was stationed in Kodiak, and then Anchorage awaiting improvement in weather conditions, until it was finally able to complete the ferry to Sand Point on June 8, 2009. Very poor weather continued throughout the week following the arrival of the aircraft. The official mobilization day, despite the aircraft being absent for the first week, was May 30, 2009.

Survey operations commenced in the project area on June 13, 2009 and were conducted concurrently with the OPR-P184-KRL-09, Southwest Alaska Peninsula – Pavlof Islands project and the Bering Sea Reconnaissance flights to Nunivak and St. Lawrence Islands. The final flight to the Shumagin Islands area was conducted on August 11, 2009. Demobilization of the site was conducted on August 16, 2009 and the aircraft departed Sand Point on August 17, 2009.

Survey work at the Shumagin Islands project area was attempted on 19 separate flights. Due to adverse weather and / or poor water clarity, the aircraft sometimes diverted to the P184 project area, or the sortie was aborted altogether.

During a flight to the Shumagin Islands on 26 July 2009, low cloud coverage prevented any operations being conducted, resulting in 0:00 time on task. The aircraft diverted to the P184 project area for the remainder of this flight. In order to optimize periods of good weather and water clarity conditions at the Shumagin Islands, 'double flights' were conducted to the project area(s) on 15 July, 29 July and 9 August 2009, requiring a refuel at Sand Point between successive sorties.

The specific dates of data acquisition, hours flown and time on task for the Shumagin Islands project were as follows:

Date	Sortie No.	Hours Flown	Time on Task
13-Jun-09	1	3:37	1:09
15-Jun-09	11	5:43	3:31
20-Jun-09	12	5:14	2:13
21-Jun-09	13	6:16	5:26
23-Jun-09	15	7:00	6:10
25-Jun-09	16	6:49	6:00
26-Jun-09	17	2:39	0:33
27-Jun-09	19	6:31	5:32
08-Jul-09	23	5:18	0:35
15-Jul-09	25	4:45	3:31
15-Jul-09	26	5:30	4:48
19-Jul-09	27	6:26	2:39
23-Jul-09	29	6:52	1:19
26-Jul-09	30	2:05	0:00
29-Jul-09	31	5:59	5:16
29-Jul-09	32	3:44	3:06
8-Aug-09	35	6:13	2:12
9-Aug-09	36	5:31	5:02
11-Aug-09	39	5:31	5:05

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 D, which covers South of Simeonof Island (see Figure 2).

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

H12104 (D)	Latitude (N)	Longitude (W)
NW corner	54° 59' 00.77"	159° 17' 34.77"
SW corner	54° 47' 41.39"	159° 17' 29.86"
SE corner	54° 47' 42.36"	159° 08' 23.93"
NE corner	54° 59' 01.75"	159° 08' 26.29"

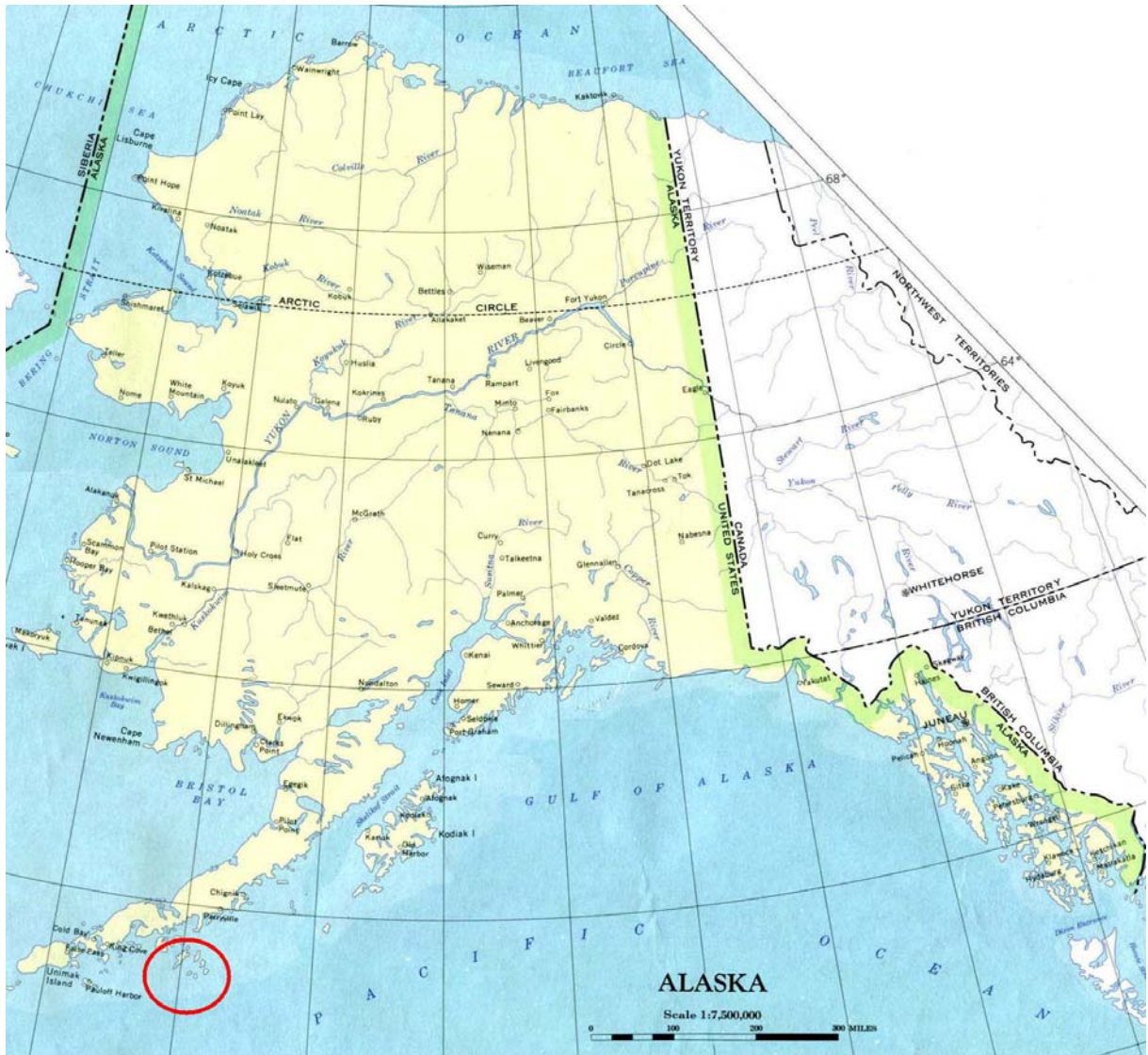


Figure 1 – General Locality of OPR-P183-KRL-09

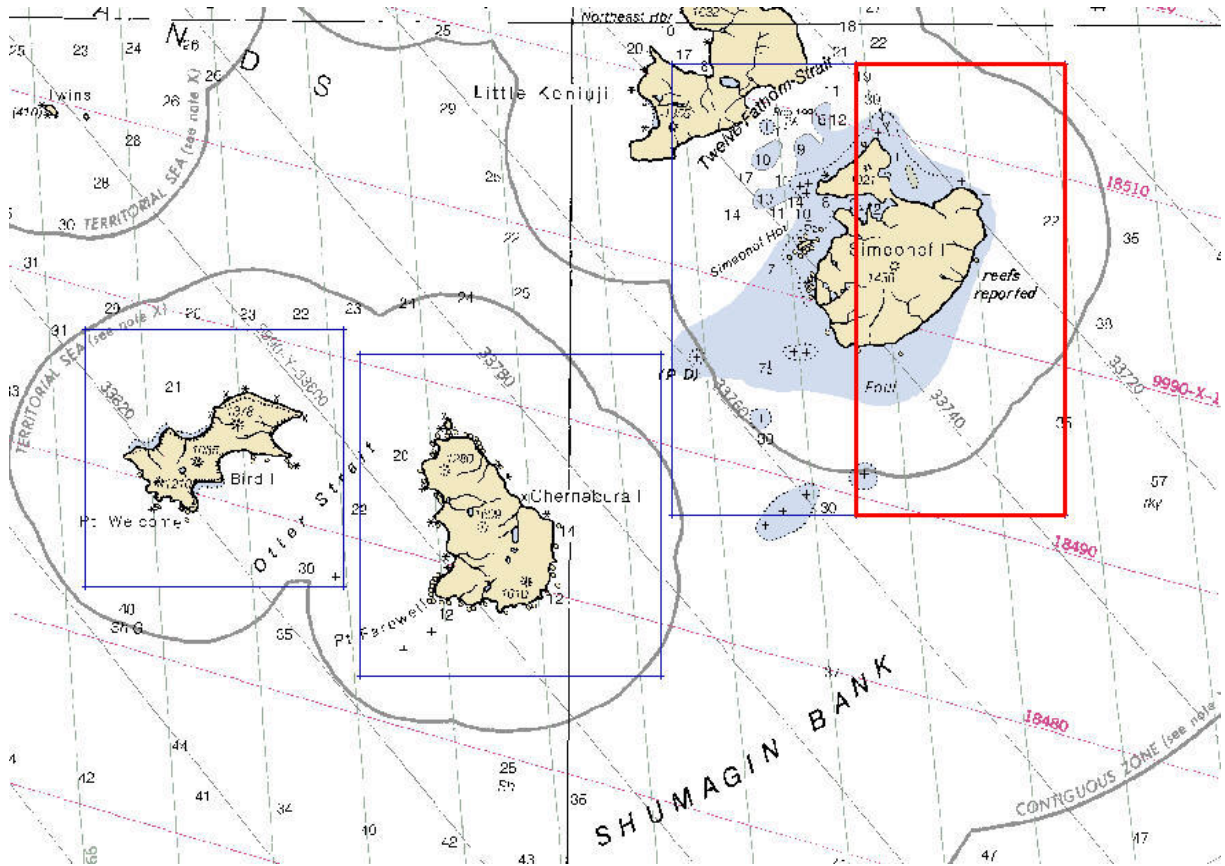


Figure 2 – Sub-Locality of H12104

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 allowed 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 'hydra' was used to conduct data processing in the field. Hydra, a newly developed distributed processing and shared storage system, replaces the portable Compaq Alpha ES40 Series 3 processor server. The hydra system is a cluster of networked PC's (nodes). The individual nodes are HP Compaq dc7900 Small Form Factor PC's consisting of Core 2 Duo E8400 processors, 4GB DDR-2 RAM, with 1 TB of storage. The controlling node is connected to SDLT, DLT and DAT drives to allow backups of data, and is networked to plotters and printers for producing documents and plots. The number of nodes networked is dependant on the requirements of the survey. Upon completion of the data

collection phase of the survey, when operations returned to the FLI office in Biloxi, MS, the controlling node was Nas2, an HP Proliant DL380 Generation 4 server consisting of a dual core 3.20GHz processor, 4GB DDR-2 RAM, with 2.3TB of storage. Quality control checks and editing of the data were conducted on Nas2 at the FLI office in Biloxi, MS.

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.

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 Popof Strait, the local GPS base station site confirmation and the static position check.

B.2.1.1 Crosslines

No specific crosslines were planned due to the high number of investigation / additional coverage lines (54) flown perpendicular to main scheme survey runs (259). Additionally, main scheme lines flown perpendicular to each other were used in these comparisons. Below are the overall depth comparison results for the 61 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)
167170	0.04 +/- 0.12	0.29 +/- 0.16

B.2.1.2 Depth Benchmarks

The depth benchmark areas in Popof Strait were derived from the 2003 lidar survey, Shumagin Islands and Vicinity (OPR-P183-KR-03). These pre-surveyed benchmark areas were utilized for system checks again in 2004 and 2005 and were used to check the absolute depth accuracy of the LADS Mk II system for the H12104 survey in 2009. Center coordinates for the benchmark areas are as follow:

Popof Strait

Benchmark Name	Nominal Depth	UTM (N) Zone 4	
		Easting	Northing
BM_1	15m	404 100	6 135 080
BM_2	5m	403 090	6 133 140

Benchmark lines flown during sorties were reduced to MLLW using Sand Point final tides.

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.

Popof Strait

GS ID	BM Name	Nominal Depth	Mean MDD (m)	Mean SD (m)
1	BM_1	15m	-0.09 +/- 0.04	0.16 +/- 0.02
2	BM_2	5m	-0.11 +/- 0.05	0.16 +/- 0.03

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 JOA on the rooftop of the Popof Pizza Building in Sand Point. 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 2–3, 2009. 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 single point that was surveyed by Fugro LADS Inc. on the tarmac of Sand Point 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 0.185m (95% confidence). The results and details of the static position check are enclosed in the Horizontal and Vertical Control Report and Separates Report.

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- 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 2.227m, with an average SD of 0.172m. Details are provided in the Horizontal and Vertical Control Report.
 - d. **Navigation Position Check.** Navigation checks were also conducted over the GPS Base Station on top of the Popof Pizza Building in Sand Point, AK. This enabled the known position of the GPS base station to be checked against the downward-looking digital image. This provided a gross error check of position. The mean error in Eastings was observed to be -0.32 +/- 1.38m and -1.40 +/- 3.03m 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 3.17m and the assigned vertical uncertainty is 0.44m.

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 5m grid resolution being used.

B.2.3 Environmental Factors

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

The survey area is exposed to the North Pacific Ocean and was affected by swell from the SE through to the NW. The sea state ranged from 1 to 3 on the Beaufort Scale throughout the survey period. During periods of high sea state, expansive areas of white water were observed along the coast and over shallow features. When such conditions were observed, operations were either suspended, or redirected to alternate or offshore areas, to minimize lidar coverage gaps due to white water.

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

Long period swell was experienced during the survey and 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 good.

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 and the amount of boatwork that is recommended, as described in Section D.2.1. 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 can 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 (US512104.000).

Rocks or shoals detected by the system in kelp areas may be difficult to discriminate as true bottom or kelp returns. When it is uncertain if the return is from seabed 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 investigation file (H12104_Inv.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.

B.2.3.5 High Ground

For this survey high ground was an issue, and a number of survey lines over Bird, Chernabura and Simeonof Islands were required to be flown at 2,200ft. Low cloud coverage was often prevalent over high terrain which forced operations to be carried out in areas that could be flown at between 1,200 and 1,800ft.

B.2.3.6 Wind

Survey operations were conducted in wind strengths of up to 25kts during the survey. In general, the wind strength during sorties was between 10 and 15kts. In certain areas, wind strengths above 20kts 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. When the cloud base was below 2,000ft, only offshore areas and survey lines over low terrain could be executed, at operational altitudes between 1,200 and 1,800ft. Poor weather was monitored using, and decisions on the flying program were based on:

- Local weather conditions at Sand Point
- Real-time satellite imagery
- Aviation reports

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 surrounding Simeonof Island is diverse. The area contains numerous islands and islets. The SE coast is rugged with many drying features and an undulating bottom, while to the N of the sheet the seabed is relatively featureless.

Throughout the area there are numerous rocks, islets and shoals, often surrounded by thick areas of kelp. Typically, kelp grows from the MLLW line to 20m 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 20m depth, are directly attributed to the presence of kelp.

The seabed gradient is generally low in the bays towards the N of the sheet, with the seabed dropping from the coastline to beyond 25m depth slowly. For the most part, the remainder of Simeonof Island has a rocky, gradually sloping seabed.

B.2.4.2 Data Coverage

The survey area was illuminated at 5x5m laser spot spacing, resulting in a 240m swath width. Mainlines of sounding were spaced at 110m, which provided the required 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 reflowed from the opposite direction 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 30m for the project, but typically full seabed coverage to 25m depth was achieved for H12104.

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 5x5m laser spot spacing, there is a gap of 2.0 to 2.5m 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 5x5m 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
09_5shum	South of Simeonof Island	D

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 Sand Point 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 conducted using CARIS software and was conducted in the Biloxi 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 5m was used for the 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 5m grid provides the largest amount of detail that can be supported by the lidar density (5x5 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 (US512104.000).

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:

GC	Topography data gap due to extremely steep coastline.
GK	Bathymetry data gap due to kelp.
GS	Bathymetry / topography data gap due to the secondary exclusion zone (SEZ).
GW	Bathymetry data gap due to white water.
GLS	Bathymetry data gap due to glassy seas.

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.
FERA	Feature for examination of a rock awash, as the feature has not been surveyed adequately due to the presence of white water or limitations of the SEZ.

The tags associated with features requiring further examination have been compiled in the H12104_Inv.hob file, and each have been given certain priority and a suggested examination method for the undertaking of additional boatwork. Each feature investigation within this file has not had least depth determined by lidar and required further examination by boat to survey accurately.

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 covering each of the registered sheets.

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
- CARIS compatible data – CAF Format – LADS soundings and waveforms, which can be imported into CARIS HIPS
- 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. Refer to Appendix IV for specific times and dates of relevant tide data. 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 Sand Point, AK (9459450).

Station details are as follows:

Gauge	Location	NAD83	
		Latitude (N)	Longitude (W)
9459450	Sand Point	55° 19.9'	160° 30.2'

C.2 ZONING

Tide zones covering the extent of the survey area were derived from tide zone coordinates supplied by NOAA. Each of these tide zones use time and range correctors relative to the Sand Point tide station. An additional tide zone was established over Popof Strait for the reduction of soundings over the depth benchmark areas. These are as follows:

Tide Zone	GS Identifier	Time Corrector	Range Corrector	Reference Station
SWA193	TA1	-6 minutes	x1.02	9459450
SWA204	TA2	-6 minutes	x0.98	9459450
Sand Point	TA3	0 minutes	x1.00	9459450

For final tide application, the time and range correctors were applied to NOAA verified tide data, smoothed by JOA. Soundings were then reduced to MLLW using these final 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 Sand Point tide gauge is 1.99m. From the final zoning, a range factor of 0.98 and 1.02 was applicable for Sheet D, resulting in a MHW value of 1.99m.

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 4, Central Meridian 159° 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 – Sand Point

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 Popof Pizza building, Sand Point on March 28 and 29, 2004, and this site was reoccupied 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 4		
Latitude (N)	Longitude (W)	Easting (m)	Northing (m)	Ellipsoidal Height (m)
55° 20' 42.544"	160° 28' 53.447"	406 048.735	6 134 199.851	72.980

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 H12104 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 flash drive. Refer to Appendix II of the Data Acquisition and Processing Report for a list of all the deliverable files from H12104.

Below is a table listing the S-57 feature objects found in the S-57 feature file (US512104.000):

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 (GC) 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)				Fugro is only responsible for defining the 0m curve.
Lake Area	LAKARE	A	A large body of water entirely surrounded by land.						Lidar returns from a lake's surface are removed from the final data set.
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)	For H12104 drying rocks are between -2.59m and -0.60m above MLLW, awash rocks are between -0.59m and 0.60m relative to MLLW, and all submerged rocks are 0.61m and deeper relative to MLLW.

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 (GK) tags exported from the GS and georeferenced imagery.
Unsurveyed Area	UNSARE	A	An area for which no bathymetric survey information is available.		Information (INFORM)				Used to define gaps in data coverage due to areas of secondary exclusion zone, as tagged GS in the GS.
<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 (US512104.000)

Recommendations for registry number H12104 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 H12104 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 (H12104_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 (H12104_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

H12104 LADS survey deliverables were compared to:

ENC US3AK50M Edition 12, compiled from Raster Charts 16540. ENC issue date December 1, 2009 at scale 1:300,000.

These charts were downloaded from the NOAA Office of Coast Survey – NOAA Electronic Navigational Charts download website on December 4, 2009. (<http://chartmaker.ncd.noaa.gov/mcd/ENC/download.htm>)

Recommendations for charting action are described in Sections D.1.4 to D.1.6.

D.1.1 Dangers to Navigation

Danger to Navigation (DTON) reports were submitted to Pacific Hydrographic Branch (PHB) from the field and during deliverables compilation. The first DTON submission from the field coincided with the delivery of the monthly progress sketch at the end of July 2009. Final DTON recommendations were provided to PHB, as part of the preliminary survey delivery, during October 2009. However, no additional DTONs were selected by PHB for submission to MCD, as part of this preliminary PHB review.

The DTON report submitted to PHB for H12104 is provided at Appendix I.

D.1.2 AWOIS

No AWOIS were assigned to this Task Order.

D.1.3 Aids to Navigation

No Aids to Navigation exist within the survey area for H12104.

D.1.4 Charted Depths and Features

Registry number H12104 covers parts of NOAA ENC US3AK50M and Raster Chart 16540. From the Source Diagram, the H12104 survey area was covered by NOS surveys between 1940 and 1969, presumably by single beam echosounder. Partial bottom coverage was achieved. However, the chart in this area was inadequately surveyed, with only the coastline and a number of rocks and islets along the coast portrayed. It should be noted that large differences exist between the coastline and drying features in the ENC and the coastline and drying features on the Raster Chart.

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

- 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 an average of 25m and 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 interpolated 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 there is a significant difference, these islets are detailed in the Chart Comparison Spreadsheet in Section D.1.6.
- c. **Rocks.** Many drying rocks and submerged shoals 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 items 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 46 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 flash drive (H12104_ChartComp.xls). A CARIS .hob file containing just the chart comparison items has also been compiled and is provided as part of survey deliverables (H12104_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 electronic and raster charts, 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 (DMS)	NAD83 Longitude W (DMS)	Surveyed Depth (meters)	NAD83 Latitude N (DMS)	NAD83 Longitude W (DMS)					
1	D1	1				5.79	54° 55' 34.56"	159° 11' 21.31"	Rk	Y	Y	Insert	See Danger to Navigation Report. Item 1. Submitted from the field.
2	D2	1				11.51	54° 51' 59.1"	159° 12' 59.58"	Rk	Y	Y	Insert	See Danger to Navigation Report. Item 2. Submitted from the field.
3	D3	1				2.54	54° 51' 14.31"	159° 16' 49.25"	Sndg	Y	Y	Insert	
4	D4	1				2.17	54° 51' 25.13"	159° 15' 23.19"	Sndg	Y	Y	Insert	
5	D5	1				12.86	54° 49' 58.03"	159° 17' 27.39"	Shoal	Y	Y	Insert	See Danger to Navigation Report. Item 3. Submitted from the field.
6	D6	1				13.87	54° 54' 52.44"	159° 10' 5.62"	Rk	Y	Y	Insert	See Danger to Navigation Report. Item 4. Submitted from the field.
7	D7	2	Islet	54° 57' 0.76"	159° 11' 16.55"				Kelp Area	Y	N	Remove	Not detected by lidar, not observed in downward looking imagery.
8	D8	1				6.60	54° 57' 4.74"	159° 16' 22.3"	Rk	Y	N	BV	Possible Rk in kelp. Refer to FEKD6.
9	D9	2	Islet	54° 56' 13"	159° 16' 24.59"				Coast	Y	Y	Remove	
10	D10	1				0.56	54° 55' 59.85"	159° 15' 24.51"	Rk Awash	Y	Y	Insert	
11	D11	1				-0.56	54° 55' 50.78"	159° 13' 8.61"	Rk Awash	Y	Y	Insert	
12	D12	2	3.6	54° 55' 21.68"	159° 16' 38.12"				Intertidal Area	N	Y	Remove	
13	D13	1				9.96	54° 54' 32.98"	159° 10' 52.23"	Rk	Y	N	BV	Possible Rk in kelp. Refer to FEKD5.

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 (DMS)	NAD83 Longitude W (DMS)	Surveyed Depth (meters)	NAD83 Latitude N (DMS)	NAD83 Longitude W (DMS)					
14	D14	2	Drying Rk	54° 54' 36.28"	159° 12' 1.66"	-3.48	54° 54' 35.92"	159° 12' 1.75"	Islet	Y	Y	Replace	All items covered by 5x5m laser spot spacing at 200% lidar coverage.
15	D15	1				9.18	54° 54' 1.55"	159° 11' 22.68"	Sndg	Y	Y	Insert	
16	D16	1				8.60	54° 53' 59.73"	159° 11' 50.18"	Sndg	Y	Y	Insert	
17	D17	2	Islet	54° 54' 5.48"	159° 12' 20.18"				Slope	Y	Y	Remove	Not detected by lidar, not observed in downward looking imagery.
18	D18	1				-1.31	54° 53' 56.58"	159° 12' 31.71"	Drying Rk	N	Y	Insert	
19	D19	2	Drying Rk	54° 53' 54.08"	159° 12' 38.7"				Coast	N	Y	Remove	Note: An additional charted drying rock in vicinity surveyed as coastline.
20	D20	1				7.01	54° 53' 52.92"	159° 11' 56.04"	Rk	Y	N	BV	Possible Rk in kelp. Refer to FEKD4.
21	D21	1				1.91	54° 53' 38.85"	159° 11' 58.78"	Sndg	Y	Y	Insert	
22	D22	1				5.29	54° 53' 44.27"	159° 11' 2.67"	Rk	Y	N	BV	Possible Rk in kelp.
23	D23	1				2.28	54° 53' 29.36"	159° 11' 22.81"	Sndg	Y	Y	Insert	
24	D24	1				1.51	54° 53' 37.35"	159° 12' 24.03"	Rk	Y	N	BV	Possible Rk in kelp. Refer to FEKD3.
25	D25	1				-1.42	54° 53' 10.64"	159° 13' 14.49"	Drying Rk	Y	Y	Insert	
26	D26	2	Drying Rk	54° 53' 18.45"	159° 13' 7.07"	-2.65	54° 53' 17.69"	159° 13' 6.35"	Islet	Y	Y	Replace	
27	D27	1				0.03	54° 53' 19.5"	159° 12' 56.77"	Rk Awash	Y	Y	Insert	
28	D29	1				3.38	54° 53' 7.18"	159° 11' 34.77"	Sndg	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 (DMS)	NAD83 Longitude W (DMS)	Surveyed Depth (meters)	NAD83 Latitude N (DMS)	NAD83 Longitude W (DMS)					
29	D30	1				10.34	54° 53' 18.61"	159° 10' 24.67"	Sndg	Y	Y	Insert	All items covered by 5x5m laser spot spacing at 200% lidar coverage.
30	D31	1				11.78	54° 52' 55.12"	159° 10' 50.11"	Sndg	Y	Y	Insert	
31	D32	1				-0.98	54° 53' 0.19"	159° 13' 24.75"	Drying Rk	Y	Y	Insert	
32	D33	1				-1.71	54° 52' 54.01"	159° 13' 44.61"	Drying Rk	Y	Y	Insert	
33	D34	1				-0.23	54° 52' 47.05"	159° 13' 47.38"	Rk Awash	Y	Y	Insert	
34	D35	1				-0.34	54° 52' 41.13"	159° 13' 56.11"	Rk Awash	Y	Y	Insert	
35	D36	1				15.23	54° 52' 25.56"	159° 12' 2.62"	Sndg	Y	Y	Insert	
36	D37	1				-1.96	54° 52' 14.68"	159° 14' 52.46"	Drying Rk	Y	Y	Insert	
37	D38	1				0.33	54° 51' 58.78"	159° 15' 40.13"	Rk Awash	Y	Y	Insert	
38	D39	2	Islet	54° 51' 45.28"	159° 15' 37.54"				Slope	Y	Y	Remove	
39	D40	1				0.22	54° 51' 53.05"	159° 16' 12.62"	Rk Awash	Y	Y	Insert	
40	D41	1				0.16	54° 51' 48.1"	159° 17' 2.18"	Rk Awash	Y	Y	Insert	
41	D42	1				-1.60	54° 51' 40.91"	159° 17' 28.69"	Drying Rk	Y	Y	Insert	
42	D43	1				0.51	54° 51' 35.11"	159° 16' 17.16"	Rk Awash	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 (DMS)	NAD83 Longitude W (DMS)	Surveyed Depth (meters)	NAD83 Latitude N (DMS)	NAD83 Longitude W (DMS)					
43	D44	1				2.72	54° 51' 31.66"	159° 16' 31.27"	Rk	Y	N	BV	Possible Rk in kelp. Refer to FEKD2.
44	D45	1				13.00	54° 51' 0.02"	159° 15' 58.53"	Sndg	Y	Y	Insert	
45	D46	1				13.43	54° 50' 37.34"	159° 17' 23.59"	Sndg	Y	Y	Insert	
46	D47	1				10.36	54° 49' 36.35"	159° 17' 27.64"	Rk	Y	N	JV	Possible Rk in kelp. Refer to FEKD1.

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 H12104 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 H12104 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. 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 coast of Simeonof Island, at position 54° 56' 09" N, 159° 15' 41" W, due to kelp.
- SE coast of Simeonof Island, at position 54° 53' 43" N, 159° 11' 15" W, due to kelp.
- S coast of Simeonof Island, at position 54° 51' 23" N, 159° 16' 55" W, due to kelp.

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, or expansive white water, the polyline has been drawn just to seaward of the MLLW line. It should be noted that FLI 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, and white water.

These are all provided in the S-57 feature file (US512104.000) and the H12104_Inv.hob file for H12104.

The areas of good lidar seabed coverage include:

- NE coast of Simeonof Island, at position 54° 55' 53" N, 159° 14' 32" W.
- SE coast of Simeonof Island, at position 54° 54' 02" N, 159° 09' 56" W.
- S coast of Simeonof Island, at position 54° 52' 11" N, 159° 13' 06" 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 (US512104.000).

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 H12104_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 H12104_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 chart comparison	OBJNAM (used for storing a unique Feature for Investigation ID)	INFORM (used for storing the recommended examination method)	NINFOM (used for storing a reference to a Chart Comparison)	PICREP (used for storing a link to waveform 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 9 uncertain soundings has been made in the CARIS H12104_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 white water, 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 – H12104**D.2.2.1 Summary of Charting Actions – H12104*

Total number of new significant islets recommended for insertion on chart: 0

Total number of new significant drying rocks recommended for insertion on chart: 6

Total number of new significant rocks awash recommended for insertion on chart: 9

Total number of new significant shoals recommended for insertion on chart: 16

Total number of charted features disproved by lidar (Remove): 6

Total number of charted features recommended for amendment by lidar (Replace): 2

Total number of chart comparison items requiring further investigation: 7

Total number of DTONs submitted to PHB during field operations: 4

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

Total number of DTONs submitted to PHB during product compilation: 0

Total number of Anti-DTONs submitted to PHB during product compilation: 0

Total number of DTONs submitted to PHB for H12104: 4

Total number of Anti-DTONs submitted to PHB for H12104: 0

D.2.2.2 Summary of Lidar Features Requiring Further Investigation – H12104

Total number of Priority 1 investigations identified: 1

Total number of Priority 2 investigations identified: 5

Total number of Priority 3 investigations identified: 1

Total number of Priority 4 investigations identified: 2

Total number of Priority 5 investigations identified: 0

Total number of investigations recommended during data processing: 8

Total number of investigations recommended from georeferenced imagery review: 0

Total number of investigations recommended from chart comparison compilation: 1

Total number of recommended feature investigations: 9

E. APPROVAL SHEET**LETTER OF APPROVAL – OPR-P183-KRL-09**

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.

ReportSubmission Date

Descriptive Report – H12104

January 29, 2010



Mark Sinclair
Hydrographer
Fugro LADS, Incorporated

Date January 29, 2010

Revisions and Corrections Compiled During Office Processing and Certification

¹ Select bathymetry and features from the LIDAR survey referenced in this Descriptive Report have been applied to the junctioning multibeam surveys H12473, H12474 and H12475. No stand-alone LIDAR information was compiled to chart update products. LIDAR does not meet IHO object detection requirements. LIDAR was not used to supersede shoaler charted soundings or to disprove charted features.

APPENDIX I – DANGERS TO NAVIGATION

DTONS Submitted to PHB

I.1.1 Danger to Navigation Report

Hydrographic Survey Registry Number: H12104

State: Alaska

Locality: Vicinity of Shumagin Islands

Sub-locality: East of Simeonof Island

Project Number: OPR-P183-KRL-09

Survey Dates: June – August, 2009

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
US3AK50M	12 th	12/1/2009	1:300,000

The following items were found during hydrographic survey operations:

No.	Feature	Depth (m)	Latitude (N)	Longitude (W)	Time, Date, Year	Investigate
1	Rk	5.8	54° 55' 34.56"	159° 11' 21.31"	22:15:57, July 29, 2009	No
2	Rk	11.5	54° 51' 59.10"	159° 12' 59.58"	03:23:41, July 30, 2009	No
3	Shoal	12.8	54° 49' 58.03"	159° 17' 27.39"	03:22:35, July 30, 2009	No
4	Rk	13.9	54° 54' 52.44"	159° 10' 05.62"	20:58:40, July 19, 2009	No

COMMENTS: Final verified tides have been applied from the Sand Point tide gauge (9459450). The shoals were found using LIDAR. DTON items 1 through 4 were submitted during data collection from the field. No further DTON's were submitted following product compilation from the Biloxi MS office.

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

DTONS Submitted to MCD**I.1.2 Danger to Navigation Report (Submitted during field operations)****Danger to Navigation Report for Lidar Survey H12104**

Registry Number: H12104
State: Alaska
Locality: Vicinity of Shumagin Islands
Sub-locality: East of Simeonof Island
Project Number: OPR-P183-KRL-09
Survey Dates: June 13, 2009 - August 11, 2009

Charts Affected

Number	Edition	Date	Scale (RNC)	RNC Correction(s)*
16540	12th	01/01/2005	1:300,000 (16540_1)	USCG LNM: 02/24/2009 (07/21/2009) NGA NTM: 01/21/2006 (08/01/2009)
16013	30th	07/01/2006	1:969,761 (16013_1)	[L]NTM: ?
16011	37th	11/01/2007	1:1,023,188 (16011_1)	[L]NTM: ?
16006	35th	04/01/2008	1:1,534,076 (16006_1)	[L]NTM: ?
500	8th	06/01/2003	1:3,500,000 (500_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	5.80 m	54° 55' 34.6" N	159° 11' 21.3" W
1.2	Rock	11.50 m	54° 51' 59.1" N	159° 12' 59.6" W
1.3	Shoal	12.80 m	54° 49' 58.0" N	159° 17' 27.4" W
1.4	Rock	13.90 m	54° 54' 52.4" N	159° 10' 05.6" W

1 - Danger To Navigation

1.1) GP No. - 1 from H12104_Pydro.xls**DANGER TO NAVIGATION****Survey Summary**

Survey Position: 54° 55' 34.6" N, 159° 11' 21.3" W
Least Depth: 5.80 m (= 19.03 ft = 3.171 fm = 3 fm 1.03 ft)
TPU ($\pm 1.96\sigma$): THU (TPEh) [None] ; TVU (TPEv) [None]
Timestamp: 2009-210.22:15:57.000 (07/29/2009)
GP Dataset: H12104_Pydro.xls
GP No.: 1
Charts Affected: 16540_1, 16013_1, 16011_1, 16006_1, 500_1, 530_1, 50_1

Remarks:

This feature was found during Lidar hydrographic survey operation by Fugro LADS Inc. Depth was reduced to Mean Lower Low Water using preliminary tides from the King Cove tide gauge (9459881). Least depth determination by field investigation is recommended for this feature. The S-57 attribute QUASOU is set to '3' for doubtful sounding.

Hydrographer Recommendations

Chart as surveyed.

Cartographically-Rounded Depth (Affected Charts):

3fm (16540_1, 16013_1, 16011_1, 16006_1, 530_1)
 5.8m (500_1, 50_1)

S-57 Data

Geo object 1: Underwater rock / awash rock (UWTROC)
Attributes: QUASOU - 3:doubtful sounding
 SORDAT - 20090811
 SORIND - US,US,nsurf,H12104
 TECSOU - 7:found by laser
 VALSOU - 5.8 m
 VERDAT - 12:Mean lower low water
 WATLEV - 3:always under water/submerged

1.2) GP No. - 2 from H12104_Pydro.xls

DANGER TO NAVIGATION

Survey Summary

Survey Position: 54° 51' 59.1" N, 159° 12' 59.6" W
Least Depth: 11.50 m (= 37.73 ft = 6.288 fm = 6 fm 1.73 ft)
TPU ($\pm 1.96\sigma$): THU (TPEh) [None] ; TVU (TPEv) [None]
Timestamp: 2009-211.03:23:41.000 (07/30/2009)
GP Dataset: H12104_Pydro.xls
GP No.: 2
Charts Affected: 16540_1, 16013_1, 16011_1, 16006_1, 500_1, 530_1, 50_1

Remarks:

This feature was found during Lidar hydrographic survey operation by Fugro LADS Inc. Depth was reduced to Mean Lower Low Water using preliminary tides from the King Cove tide gauge (9459881).

Hydrographer Recommendations

Chart as surveyed.

Cartographically-Rounded Depth (Affected Charts):

6 ¼fm (16540_1, 16013_1, 16011_1, 16006_1, 530_1)

11.5m (500_1, 50_1)

S-57 Data

Geo object 1: Underwater rock / awash rock (UWTROC)
Attributes: SORDAT - 20090811
SORIND - US,US,nsurf,H12104
TECSOU - 7:found by laser
VALSOU - 11.5 m
VERDAT - 12:Mean lower low water
WATLEV - 3:always under water/submerged

1.3) GP No. - 3 from H12104_Pydro.xls

DANGER TO NAVIGATION

Survey Summary

Survey Position: 54° 49' 58.0" N, 159° 17' 27.4" W
Least Depth: 12.80 m (= 41.99 ft = 6.999 fm = 6 fm 5.99 ft)
TPU ($\pm 1.96\sigma$): THU (TPEh) [None] ; TVU (TPEv) [None]
Timestamp: 2009-211.03:22:35.000 (07/30/2009)
GP Dataset: H12104_Pydro.xls
GP No.: 3
Charts Affected: 16540_1, 16013_1, 16011_1, 16006_1, 500_1, 530_1, 50_1

Remarks:

This sounding was found during Lidar hydrographic survey operation by Fugro LADS Inc. Depth was reduced to Mean Lower Low Water using preliminary tides from the King Cove tide gauge (9459881).

Hydrographer Recommendations

Chart as surveyed.

Cartographically-Rounded Depth (Affected Charts):

7fm (16540_1, 16013_1, 16011_1, 16006_1, 530_1)

12.8m (500_1, 50_1)

S-57 Data

Geo object 1: Sounding (SOUNDG)
Attributes: SORDAT - 20090811
SORIND - US,US,nsurf,H12104
TECSOU - 7:found by laser
VERDAT - 12:Mean lower low water

1.4) GP No. - 4 from H12104_Pydro.xls

DANGER TO NAVIGATION**Survey Summary**

Survey Position: 54° 54' 52.4" N, 159° 10' 05.6" W
Least Depth: 13.90 m (= 45.60 ft = 7.601 fm = 7 fm 3.60 ft)
TPU ($\pm 1.96\sigma$): THU (TPEh) [None] ; TVU (TPEv) [None]
Timestamp: 2009-200.20:58:40.000 (07/19/2009)
GP Dataset: H12104_Pydro.xls
GP No.: 4
Charts Affected: 16540_1, 16013_1, 16011_1, 16006_1, 500_1, 530_1, 50_1

Remarks:

This feature was found during Lidar hydrographic survey operation by Fugro LADS Inc. Depth was reduced to Mean Lower Low Water using preliminary tides from the King Cove tide gauge (9459881).

Hydrographer Recommendations

Chart as surveyed.

Cartographically-Rounded Depth (Affected Charts):

7 ½fm (16540_1, 16013_1, 16011_1, 16006_1, 530_1)
 13.9m (500_1, 50_1)

S-57 Data

Geo object 1: Underwater rock / awash rock (UWTROC)
Attributes: SORDAT - 20090811
 SORIND - US,US,nsurf,H12104
 TECSOU - 7:found by laser
 VALSOU - 13.9 m
 VERDAT - 12:Mean lower low water
 WATLEV - 3:always under water/submerged

APPROVAL PAGE

H12104

Data meet or exceed current specifications as certified by the OCS survey acceptance review process. Descriptive Report and survey data except where noted are adequate to supersede prior surveys and nautical charts in the common area.

The following products will be sent to NGDC for archive

- H12104_DR.pdf
- Collection of depth varied resolution BAGS
- Processed survey data and records
- H12104_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 usage of updating NOAA's suite of nautical charts.

Approved: _____

LCDR Benjamin K. Evans, NOAA

Chief, Pacific Hydrographic Branch