H12105

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: H12105

LOCALITY

State: Alaska

General Locality: Sandman Reefs

Sub-locality: Vicinity of Cherni Island

2009

CHIEF OF PARTY
Scott Ramsay

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Date:

NOAA FORM 77-28 (11-72)	U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION	REGISTRY NUMBER:
HYDROGRAPHIC TITLE SHEET		**H12105**

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:	**Sandman Reefs**
Sub-Locality:	**Vicinity of Cherni Island**
Scale:	**1: 10,000**
Dates of Survey:	**06/13/2009 to 08/12/2009**
Instructions Dated:	**June 2009**
Project Number:	**OPR-P184-KRL-09**
Field Unit:	**Fugro Lads Aircraft, VH-LCL**
Chief of Party:	**Scott Ramsay**
Soundings by:	**LADS Mk II AS**
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:

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/.

DESCRIPTIVE REPORT TO ACCOMPANY

HYDROGRAPHIC SURVEY H12105

SCALE 1:10,000, SURVEYED IN 2009

FUGRO LADS AIRCRAFT, VH-LCL

FUGRO LADS, INC. (FLI)

MARK SINCLAIR, HYDROGRAPHER

PROJECT

Project Number: OPR-P184-KRL-09
Date of Instructions: June 2009
Original: DG 133C-06-CQ-0066
Task Order: T0006

Registry Number: H12105
Sheet: A

A. AREA SURVEYED

Survey operations covered four registered sheets over the OPR-P184-KRL-09 project area, Southwest Alaska Peninsula – Pavlof Islands, AK (see Figure 1 and Figure 2).

A total of 4736 lineal nautical miles were illuminated in the process of flying 217 main scheme survey lines. An additional 2028 lineal nautical miles were illuminated flying 86 reflies and 878 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 27.4 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-P183-KRL-09, Southwest Alaska Peninsula – Shumagin Islands project and the Bering Sea Reconnaissance flights to Nunivak and St. Lawrence Islands. The final flight to the Pavlof Islands area was conducted on August 12, 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 Pavlof Islands project area was attempted on 22 separate flights. Due to adverse weather and / or poor water clarity, the aircraft sometimes diverted to the P183 project area, or the sortie was aborted altogether.

The specific dates of data acquisition, hours flown and time on task for the Southwest Alaska Peninsula - Pavlof Islands project were as follows:

Date	Sortie No.	Hours Flown	Time on Task
13-Jun-09	1	3:37	0:55
15-Jun-09	2	5:43	0:27
18-Jun-09	11	1:57	0:50
20-Jun-09	13	5:14	0:39
22-Jun-09	14	7:17	6:26
26-Jun-09	15	2:39	0:25
28-Jun-09	16	5:56	5:15
29-Jun-09	17	7:06	6:22
30-Jun-09	18	6:37	5:22
8-Jul-09	21	5:18	3:01
9-Jul-09	22	6:22	5:33
14-Jul-09	24	6:58	6:15
15-Jul-09	25	4:45	0:04
19-Jul-09	27	6:26	2:00
23-Jul-09	29	6:52	4:27
25-Jul-09	30	6:04	5:15
26-Jul-09	31	2:05	0:35
30-Jul-09	32	7:03	6:22
8-Aug-09	33	6:13	3:09
9-Aug-09	35	4:06	3:32
11-Aug-09	38	1:36	0:28
12-Aug-09	40	6:38	5:25

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 A, which covers the Vicinity of Cherni Island (see Figure 2).

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

H12105 (A)	Latitude (N)	Longitude (W)
NW corner	54° 47' 54.56"	162° 30' 16.50"
SW corner	54° 35' 04.02"	162° 29' 10.19"
SE corner	54° 35' 27.55"	162° 15' 05.87"
NE corner	54° 48' 18.27"	162° 16' 07.73"

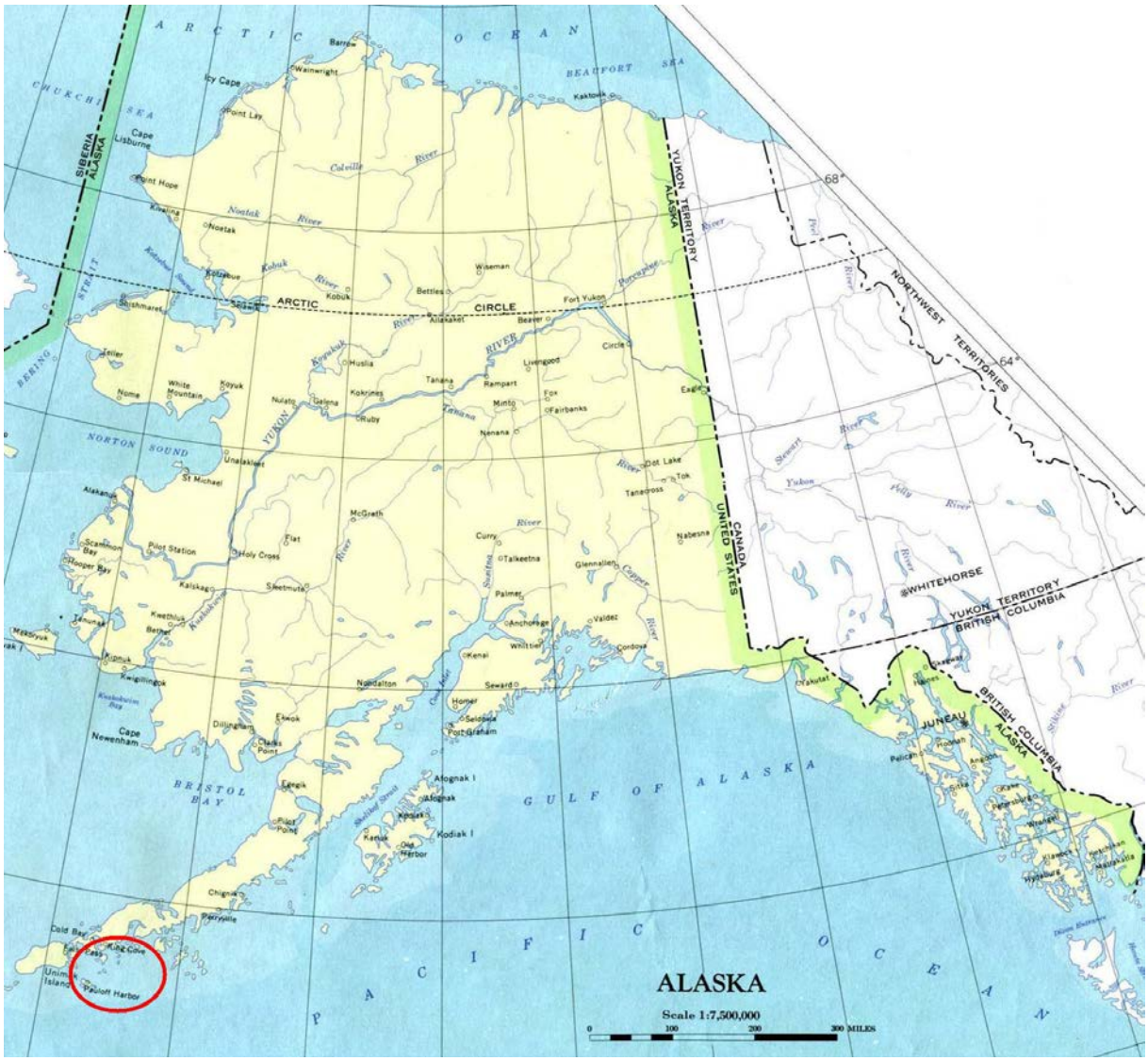

Figure 1 – General Locality of OPR-P184-KRL-09

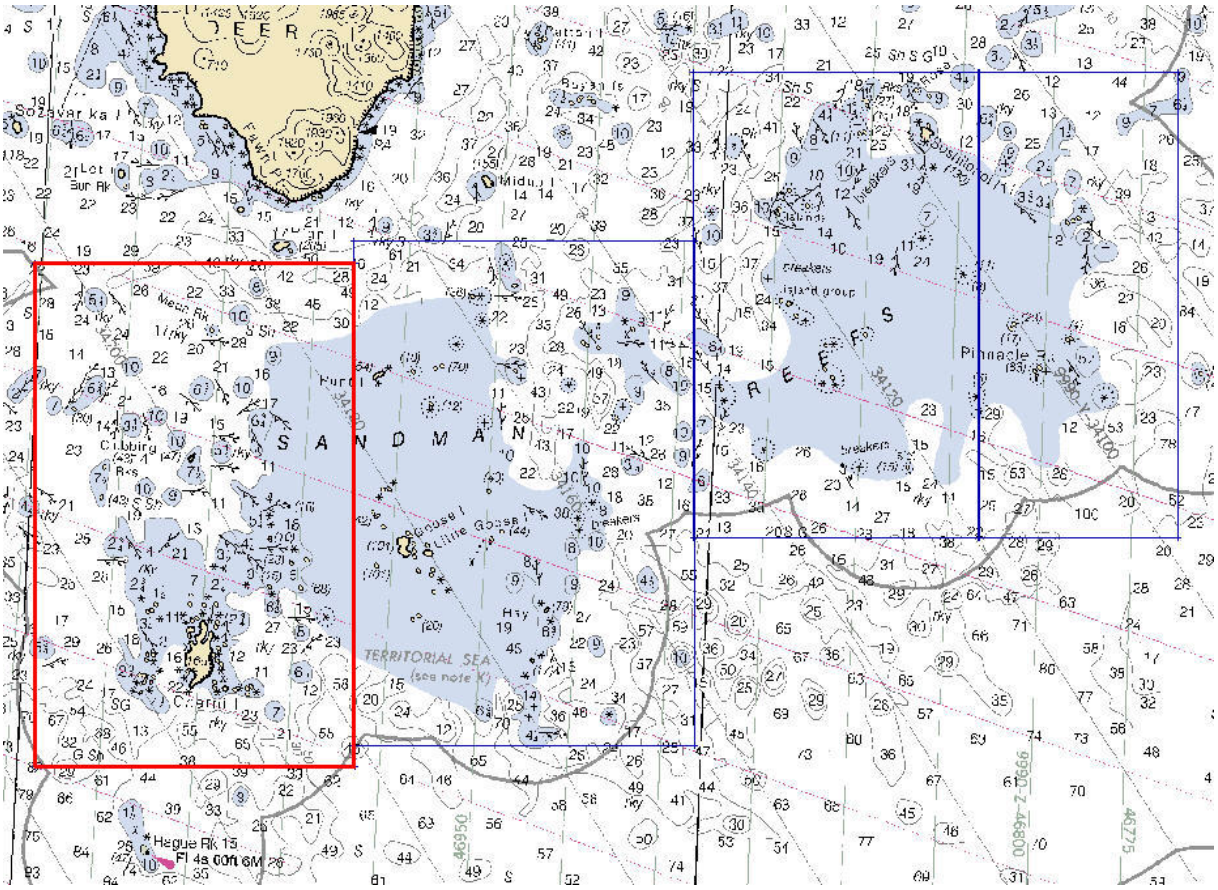

Figure 2 – Sub-Locality of H12105

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 7.0 and CARIS BASE Editor 2.3.

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 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, the static position check and navigation position checks.

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 (217). Below are the overall depth comparison results for 124 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)
207229	0.03 +/- 0.12	0.31 +/- 0.08

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 H12105 survey in 2009. Center coordinates for the benchmark areas are as follow:

<u>Popof Strait</u>

		UTM (N) Zone 4	
Benchmark Name	**Nominal Depth**	**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	-0.08 +/- 0.05	0.15 +/- 0.01
2	BM_2	5m	-0.10 +/- 0.05	0.16 +/- 0.02

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.

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 2.295m, with an average SD of 0.212m. 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 1.18 +/- 1.36m and -2.72 +/- 3.38m 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 3.18m and the assigned vertical uncertainty is 0.49m.

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.[1] 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 completely exposed to the sea conditions of the North Pacific Ocean. Swell was a constant factor during data acquisition. 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 around drying areas and over shallow features. When such conditions were observed, operations were either suspended, or redirected to alternate 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. The expansive areas of kelp present across this survey area made successful lidar coverage extremely difficult to achieve, particularly as kelp grew as deep as 25m in many areas. As lidar extinction depth was often between 20 and 25m, discerning the edge of kelp beds from deep water lidar extinction gaps proved extremely difficult.

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 are very sparse.
- Soundings may not correlate with overlapping data from adjacent lines.

Kelp areas often 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 the presence of kelp was observed in the imagery from the digital camera, but adequate seabed coverage was still achieved, kelp point objects (WEDKLP) have been defined in the S-57 feature file (US512105.000).

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 (H12105_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 not an issue, and nearly all survey lines were flown at 1,200ft.

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 dropped below 1200ft, operations were diverted to the P183 Shumagin Islands project area, or suspended altogether. 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 Cherni Island is extremely complex. The area contains numerous islands, islets and drying features. The S coast of Cherni Island is rugged with a steep seabed gradient dropping beyond 25m relatively quickly, while to the N and NE of the island, the seabed is relatively flat and undulating with scattered islets and drying features. For the most part, the remainder of the sheet is comprised of limited lidar coverage over small shoals.

Throughout the sheet the numerous islets, drying features and shoals are often surrounded by thick areas of kelp. Typically, kelp grows from the MLLW line to 25m 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 25m depth, are directly attributed to the presence of kelp.[2]

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. For H12105 two investigation lines were flown beyond the main scheme coverage and shallow features were observed in the resultant data. This data was retained in the final dataset and has been delivered as part of the survey. At positions 54° 43’ 47” N, 162° 25’ 41” W and 54° 43’ 33” N, 162° 25’ 51” W, only 100% coverage at 5x5m laser spot spacing was acquired over the shallow features from the investigation lines flown.

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 reflown 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 thresholds during data processing were 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 seabed coverage to 25m depth was achieved for H12105 where kelp was not present.

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 to discriminate small features from the surrounding seabed 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_4sand	Vicinity of Cherni Island	A

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 (US512105.000).

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

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

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

The following tags were used in the GS for features that require further examination:

FE	Feature for examination, generally in deep water, as the least depth has not been found due to poor water clarity.
FEK	Feature for examination, as the least depth has not been determined due to the presence of kelp.
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.
FEGI	Feature for examination, possible feature observed in georeferenced digital imagery.

The tags associated with features requiring further examination have been compiled in the H12105_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 two georeferenced mosaics covering each of the registered sheets. H12105_GI_low.ecw is a mosaic of lowest tide imagery and H12105_GI_kelp.ecw is a mosaic of imagery that highlights the presence of kelp.

B.4.6 Progress Sketches

Progress sketches were provided to NOAA on a monthly basis. The final progress sketch can be found at 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 geotif 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 – CAF Format – LADS soundings and waveforms, which can be imported into CARIS HIPS
- CARIS compatible data – HDCS Format – LADS soundings in CARIS HIPS native format
- Tidal data provided in ASCII, .xls and .csv formats
- Digital georeferenced imagery mosaics 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) stations at King Cove, AK (9459881) and Sand Point, AK (9459450).

Station details are as follows:

		NAD83	
Gauge	**Location**	**Latitude (N)**	**Longitude (W)**
9459881	King Cove	55° 03.7'	162° 19.6'
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 King Cove tide station. An additional tide zone, relative to the Sand Point tide station, 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
SWA218	TA1	0 minutes	x0.97	9459881
SWA219	TA2	+6 minutes	x0.93	9459881
SWA220	TA3	0 minutes	x0.93	9459881
Sand Point	TA4	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 King Cove tide gauge is 1.88m. From the final zoning, a range factor of 0.93 was applicable for Sheet A, resulting in a MHW value of 1.74m.

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 H12105 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 H12105.

Below is a table listing the S-57 feature objects found in the S-57 feature file (US512105.000):

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.
Building	BUISGL	P	A relatively permanent structure, roofed and usually walled.						
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.

S-57 Object Class	S-57 Object Acronym	Geometry	Description	Spatial Attribute	Attribute 1	Attribute 2	Attribute 3	Attribute 4	Comments
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 H12105 drying rocks are between -2.34m 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.
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.
Meta Objects									
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 (US512105.000)

Recommendations for registry number H12105 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 H12105 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 (H12105_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 (H12105_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

H12105 LADS survey deliverables were compared to:[3]

ENC US3AK61M Edition 11, compiled from Raster Charts 16520. ENC issue date October 1, 2009 at scale 1:300,000. Raster Chart 16547 9th Edition January 2004, at scale 1:81,326. Corrected through NTM on May 15, 2009.

These charts were downloaded from the NOAA Office of Coast Surveys – Nautical Charts and Publications website on April 29, 2010 and May 26, 2009 respectively. (http://www.nauticalcharts.noaa.gov/staff/chartspubs.html)

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, at the end of April 2010. One additional DTON was selected by PHB for submission to MCD, as part of the preliminary PHB review.[4]

The DTON report submitted to PHB for H12105 is provided at Appendix I.[5]

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 H12105.

D.1.4 Charted Depths and Features

Registry number H12105 covers parts of NOAA ENC US3AK61M and Raster Chart 16547. From the Source Diagram, the H12105 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 a generalized portrayal of Cherni Island and drying features. It should be noted that differences exist between the Cherni Island 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 of Cherni Island is generalized when compared with the surveyed coastline. The surveyed coastline differs from the charted position by an average of 30m and a maximum of 90m. It is recommended that the coastline on the chart be amended to match the LADS surveyed and interpolated MHW line.

b. Islets. A large number of islets have been surveyed within the sheet limits. As a result of the generalization of the chart due to chart scale, there was one instance where two charted islets were surveyed as one islet. 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 within the sheet limits, 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 93 specific differences between the chart and the LADS survey have been identified and are described in Section D.1.6.[6] An expanded version of the spreadsheet is included digitally on the USB flash drive (H12105_ChartComp.xls). A CARIS .hob file containing just the chart comparison items has also been compiled and is provided as part of survey deliverables (H12105_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

			CHARTED			SURVEYED							
Sequence No	**Shoal No**	**Category**	**Charted Depth (meters)**	**NAD83 Latitude N (DMS)**	**NAD83 Longitude W (DMS)**	**Surveyed Depth (meters)**	**NAD83 Latitude N (DMS)**	**NAD83 Longitude W (DMS)**	**Type of Feature**	**Kelp Area**	**Least Depth Found**	**Charting Recommendation**	**Remarks** **All items covered by 5x5m laser spot spacing at 200% lidar coverage.**
1	A1	1				10.11	54° 46' 15.67"	162° 16' 58.16"	Rk	Y	Y	Insert	
2	A2	1				6.91	54° 46' 25.46"	162° 18' 8.25"	Rk	Y	Y	Insert	See Danger to Navigation Report. Item 1. Submitted from the field.
3	A3	2	16.4	54° 45' 52.28"	162° 19' 34.7"	10.66	54° 45' 41.7"	162° 19' 31.59"	Rk	Y	Y	Replace	See Danger to Navigation Report. Item 2. Submitted from the field.
4	A4	1				14.44	54° 44' 16.12"	162° 22' 30.12"	Rk	Y	Y	Insert	See Danger to Navigation Report. Item 3. Submitted from the field.
5	A5	1				9.47	54° 41' 26.22"	162° 24' 56.98"	Rk	Y	Y	Insert	See Danger to Navigation Report. Item 4. Submitted from the field.
6	A6	1				4.22	54° 45' 44.69"	162° 15' 59.27"	Sndg	Y	Y	Insert	
7	A7	2	21.9	54° 45' 7.68"	162° 24' 46.79"	19.20	54° 45' 4.84"	162° 24' 48.84"	Sndg	N	Y	Replace	Note: Sparse lidar coverage in deep water.
8	A8	1				15.84	54° 45' 6.07"	162° 17' 50.61"	Sndg	Y	Y	Insert	
9	A9	2	12.2	54° 44' 46.7"	162° 22' 36.65"	10.61	54° 44' 46.7"	162° 22' 36.65"	Sndg	Y	Y	Replace	
10	A12	2	12.2	54° 44' 9.38"	162° 19' 56.34"	9.64	54° 44' 9.38"	162° 19' 56.34"	Sndg	Y	Y	Replace	
11	A13	2	23.7	54° 44' 16.99"	162° 19' 27.22"	9.41	54° 44' 24.95"	162° 19' 25.45"	Sndg	N	Y	Replace	See Danger to Navigation Report. Item 5.
12	A14	1				13.28	54° 44' 14.05"	162° 16' 53.23"	Sndg	Y	Y	Insert	
13	A15	1				2.96	54° 43' 40.85"	162° 15' 59.92"	Rk	Y	N	BV	Possible Rk in kelp. Refer to FEKA18.
14	A16	1				5.29	54° 43' 26.68"	162° 15' 57.39"	Sndg	Y	Y	Insert	
15	A17	1				15.65	54° 43' 29.54"	162° 19' 4.14"	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

			CHARTED			SURVEYED							
Sequence No	**Shoal No**	**Category**	**Charted Depth (meters)**	**NAD83 Latitude N (DMS)**	**NAD83 Longitude W (DMS)**	**Surveyed Depth (meters)**	**NAD83 Latitude N (DMS)**	**NAD83 Longitude W (DMS)**	**Type of Feature**	**Kelp Area**	**Least Depth Found**	**Charting Recommendation**	**Remarks** **All items covered by 5x5m laser spot spacing at 200% lidar coverage.**
16	A18	1				10.76	54° 43' 36.23"	162° 20' 6.77"	Sndg	Y	Y	Insert	
17	A19	2	Islet	54° 43' 1.5"	162° 23' 1.84"					N	Y	Remove	Note: 2 charted islets surveyed as 1 large islet.
18	A20	1				11.98	54° 43' 4.74"	162° 22' 36"	Sndg	Y	Y	Insert	
19	A21	2	18.2	54° 42' 58.38"	162° 19' 30.66"	15.19	54° 42' 58.38"	162° 19' 30.66"	Sndg	Y	Y	Replace	
20	A22	1				9.17	54° 43' 7.86"	162° 18' 22.38"	Sndg	Y	Y	Insert	
21	A23	1				9.60	54° 42' 52.18"	162° 17' 28.27"	Sndg	Y	Y	Insert	
22	A24	1				5.84	54° 43' 9.64"	162° 16' 11.12"	Sndg	Y	N	BV	Possible Rk in kelp. Refer to FEKA20.
23	A25	1				3.06	54° 42' 35.15"	162° 16' 47.47"	Sndg	Y	Y	Insert	
24	A27	1				5.32	54° 42' 28.01"	162° 20' 50.91"	Sndg	Y	Y	Insert	
25	A28	2	13.7	54° 42' 38.02"	162° 22' 45.21"	10.27	54° 42' 43.21"	162° 22' 42.03"	Sndg	Y	Y	Replace	
26	A29	2	20.1	54° 41' 50.3"	162° 21' 36.41"	16.15	54° 41' 50.8"	162° 21' 31.16"	Sndg	N	N	JV	Sparse lidar coverage in deep water. Refer to FEA2.
27	A30	2	10.9	54° 42' 4.43"	162° 19' 21.14"	2.28	54° 42' 1.82"	162° 19' 21.56"	Sndg	Y	Y	Replace	
28	A32	2	10.5	54° 41' 47.42"	162° 18' 34.38"	1.11	54° 41' 50.35"	162° 18' 39.54"	Sndg	Y	Y	Replace	
29	A33	1				1.24	54° 41' 57.46"	162° 17' 16.85"	Sndg	Y	Y	Insert	
30	A34	1				4.88	54° 41' 31.91"	162° 17' 51.66"	Sndg	Y	Y	Insert	
31	A35	1				0.52	54° 41' 41.32"	162° 19' 16.32"	Rk Awash	Y	Y	Insert	
32	A36	2	9.5	54° 41' 33.58"	162° 20' 6.9"	7.77	54° 41' 30.9"	162° 19' 51.16"	Sndg	Y	Y	Replace	
33	A37	2	27.4	54° 41' 15.2"	162° 22' 47.57"	15.11	54° 41' 31.89"	162° 22' 57.34"	Rk	Y	N	JV	Possible Rk in kelp.

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

			CHARTED			SURVEYED							
Sequence No	**Shoal No**	**Category**	**Charted Depth (meters)**	**NAD83 Latitude N (DMS)**	**NAD83 Longitude W (DMS)**	**Surveyed Depth (meters)**	**NAD83 Latitude N (DMS)**	**NAD83 Longitude W (DMS)**	**Type of Feature**	**Kelp Area**	**Least Depth Found**	**Charting Recommendation**	**Remarks** **All items covered by 5x5m laser spot spacing at 200% lidar coverage.**
34	A38	1				12.32	54° 41' 12.87"	162° 23' 23.41"	Sndg	Y	Y	Insert	
35	A40	1				7.89	54° 40' 39.15"	162° 25' 26.29"	Sndg	Y	Y	Insert	
36	A41	2	7.3	54° 40' 35.2"	162° 24' 36.8"	5.13	54° 40' 35.2"	162° 24' 36.8"	Sndg	Y	Y	Replace	
37	A42	2	8.7	54° 41' 0.15"	162° 24' 35.c82"	5.43	54° 41' 0.15"	162° 24' 35.82"	Sndg	Y	N	BV	Possible Rk in kelp. Refer to FEKA19.
38	A43	2	7.6	54° 40' 53.47"	162° 20' 16.1"	3.60	54° 40' 52.12"	162° 20' 12.29"	Sndg	Y	Y	Replace	
39	A44	1				1.17	54° 40' 48.58"	162° 18' 43.45"	Rk	Y	N	VV/BV	Possible Rk Awash in kelp. Refer to FERAA1.
40	A45	1				-0.06	54° 41' 0.49"	162° 18' 2.52"	Rk Awash	Y	Y	Insert	
41	A46	1				14.94	54° 40' 35.77"	162° 16' 3.21"	Sndg	Y	Y	Insert	
42	A47	1				16.39	54° 40' 10.12"	162° 16' 36.05"	Sndg	Y	Y	Insert	
43	A49	2	10.5	54° 40' 14.63"	162° 18' 21.74"	5.42	54° 40' 1c1.89"	162° 18' 23.43"	Sndg	Y	Y	Replace	
44	A50	1				6.73	54° 40' 8.41"	162° 20' 24.34"	Sndg	Y	Y	Insert	See Danger to Navigation Report. Item 6.
45	A51	2	6.4	54° 40' 32.29"	162° 21' 19.65"	4.64	54° 40' 32.29"	162° 21' 19.65"	Sndg	Y	Y	Replace	
46	A52	1				4.22	54° 40' 15.37"	162° 23' 25.04"	Sndg	Y	Y	Insert	
47	A53	1				3.43	54° 40' 18.09"	162° 24' 46.54"	Sndg	Y	Y	Insert	
48	A54	2	14.6	54° 40' 12.37"	162° 25' 43.99"	7.40	54° 40' 15.85"	162° 25' 48.63"	Rk	Y	N	BV	Possible Rk in kelp. Refer to FEKA14.
49	A55	2	11.9	54° 39' 23.05"	162° 25' 22.53"	5.57	54° 39' 25.87"	162° 25' 19"	Rk	Y	N	BV	Possible Rk in kelp. Refer to FEKA10.
50	A56	1				-2.51	54° 39' 24.44"	162° 24' 47.65"	Islet	Y	Y	Insert	

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Recommended Further Investigation Method:
VV = visual verification
BV = bathymetric verification
JV = junctioning verification

			CHARTED			SURVEYED							
Sequence No	**Shoal No**	**Category**	**Charted Depth (meters)**	**NAD83 Latitude N (DMS)**	**NAD83 Longitude W (DMS)**	**Surveyed Depth (meters)**	**NAD83 Latitude N (DMS)**	**NAD83 Longitude W (DMS)**	**Type of Feature**	**Kelp Area**	**Least Depth Found**	**Charting Recommendation**	**Remarks** **All items covered by 5x5m laser spot spacing at 200% lidar coverage.**
51	A58	2	12.8	54° 39' 53.44"	162° 22' 35.04"	9.78	54° 39' 53.24"	162° 22' 31.26"	Sndg	Y	Y	Replace	
52	A60	1				8.60	54° 39' 53.5"	162° 21' 58.61"	Sndg	Y	Y	Insert	
53	A62	2	4.1	54° 39' 52.99"	162° 21' 30.88"	0.86	54° 39' 54.18"	162° 21' 28.23"	Sndg	Y	Y	Replace	
54	A63	1				11.01	54° 39' 36.53"	162° 20' 18.37"	Sndg	Y	Y	Insert	
55	A64	2	Drying Rk	54° 39' 39.4"	162° 19' 9.37"	-2.96	54° 39' 39.4"	162° 19' 9.37"	Islet	Y	Y	Replace	
56	A65	2	16.4	54° 39' 55.12"	162° 19' 12.5"	6.14	54° 39' 57.53"	162° 19' 15.31"	Sndg	Y	Y	Replace	See Danger to Navigation Report. Item 7.
57	A68	1				0.10	54° 39' 23.04"	162° 21' 54.38"	Rk Awash	Y	Y	Insert	
58	A70	1				-1.30	54° 39' 2.86"	162° 22' 54.7"	Drying Rk	Y	Y	Insert	
59	A71	2	Drying Rk	54° 39' 18.52"	162° 24' 11.08"	-3.24	54° 39' 16.22"	162° 24' 13.71"	Islet	Y	Y	Replace	
60	A72	1				-2.64	54° 39' 8.41"	162° 24' 26.45"	Islet	Y	Y	Insert	
61	A80	2	14.6	54° 38' 46.55"	162° 17' 44.63"	13.34	54° 38' 39.2"	162° 17' 52.17"	Rk	Y	N	JV	Possible Rk in kelp. Refer to FEKA7.
62	A82	1				0.10	54° 38' 11.96"	162° 21' 19.98"	Rk Awash	Y	Y	Insert	
63	A85	2	3.6	54° 37' 42.52"	162° 23' 29.96"	2.15	54° 38' 19.31"	162° 23' 48.3"	Sndg	Y	Y	Replace	
64	A86	1				-4.45	54° 38' 0.92"	162° 24' 14.27"	Islet	Y	Y	Insert	
65	A87	1				0.05	54° 38' 6.92"	162° 24' 33.93"	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

			CHARTED			SURVEYED							
Sequence No	**Shoal No**	**Category**	**Charted Depth (meters)**	**NAD83 Latitude N (DMS)**	**NAD83 Longitude W (DMS)**	**Surveyed Depth (meters)**	**NAD83 Latitude N (DMS)**	**NAD83 Longitude W (DMS)**	**Type of Feature**	**Kelp Area**	**Least Depth Found**	**Charting Recommendation**	**Remarks** **All items covered by 5x5m laser spot spacing at 200% lidar coverage.**
66	A88	2	6.4	54° 38' 23.58"	162° 24' 27.09"	2.86	54° 38' 19.94"	162° 24' 29.09"	Rk	Y	N	BV	Possible Rk in kelp. Refer to FEKA9.
67	A89	2	12.8	54° 38' 12.8"	162° 24' 49.11"	9.56	54° 38' 11.02"	162° 24' 52.62"	Sndg	Y	Y	Replace	
68	A90	1				7.22	54° 37' 53.09"	162° 25' 14"	Rk	Y	N	BV	Possible Rk in kelp. Refer to FEKA1.
69	A93	2	10.5	54° 37' 35.7"	162° 24' 30.35"	8.14	54° 37' 39.31"	162° 24' 35.18"	Rk	Y	N	BV	Possible Rk in kelp.
70	A94	1				-3.46	54° 37' 31.41"	162° 24' 5.22"	Islet	Y	Y	Insert	
71	A98	2	5.9	54° 37' 51.56"	162° 20' 48.05"	2.35	54° 37' 52.59"	162° 20' 48.63"	Rk	Y	Y	Replace	
72	A100	1				2.66	54° 36' 59.51"	162° 24' 22.92"	Sndg	Y	Y	Insert	
73	A102	1				7.54	54° 42' 0.54"	162° 20' 31.6"	Sndg	Y	Y	Insert	
74	A103	2	Rk	54° 40' 51.28"	162° 19' 24.59"	0.43	54° 40' 49.1"	162° 19' 25.01"	Rk Awash	Y	Y	Replace	
75	A104	2	9.6	54° 39' 43.61"	162° 21' 40.32"	2.33	54° 39' 43.11"	162° 21' 48.26"	Sndg	Y	Y	Replace	
76	A105	2	2.7	54° 39' 34.43"	162° 24' 10.76"	1.66	54° 39' 34.43"	162° 24' 10.76"	Sndg	Y	Y	Replace	
77	A107	2	27.4	54° 45' 9.09"	162° 21' 13.2"	17.51	54° 45' 10.95"	162° 21' 10.24"	Sndg	N	Y	Replace	
78	A108	2	25.6	54° 44' 32.9"	162° 22' 8.2"	16.92	54° 44' 30.24"	162° 22' 11.5"	Sndg	Y	Y	Replace	
79	A109	2	27.4	54° 43' 39.34"	162° 21' 2.09"	18.37	54° 43' 46.09"	162° 21' 0.15"	Sndg	N	Y	Replace	
80	A110	2	16.4	54° 41' 12.03"	162° 24' 1.73"	13.68	54° 41' 10.27"	162° 24' 4.26"	Sndg	Y	Y	Replace	
81	A111	2	18.2	54° 41' 15.82"	162° 25' 48.1"	15.44	54° 41' 14.37"	162° 25' 48.18"	Rk	Y	N	Replace	Possible Rk in kelp. Refer to FEKA8.
82	A112	2	13.7	54° 40' 40.67"	162° 25' 5.31"	8.83	54° 40' 37.44"	162° 25' 0.73"	Sndg	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

			CHARTED			SURVEYED							
Sequence No	**Shoal No**	**Category**	**Charted Depth (meters)**	**NAD83 Latitude N (DMS)**	**NAD83 Longitude W (DMS)**	**Surveyed Depth (meters)**	**NAD83 Latitude N (DMS)**	**NAD83 Longitude W (DMS)**	**Type of Feature**	**Kelp Area**	**Least Depth Found**	**Charting Recommendation**	**Remarks** **All items covered by 5x5m laser spot spacing at 200% lidar coverage.**
83	A113	2	11.9	54° 40' 41.21"	162° 20' 41.07"	8.56	54° 40' 38.63"	162° 20' 43.3"	Rk	Y	N	Replace	Possible Rk in kelp. Refer to FEK13.
84	A114	2	9.1	54° 40' 48.6"	162° 18' 27.44"	4.22	54° 40' 43.94"	162° 18' 23.52"	Sndg	Y	Y	Replace	
85	A115	2	Islet	54° 39' 38.34"	162° 21' 51.35"		54° 39' 38.34"	162° 21' 51.35"	Slope	Y	Y	Remove	Not detected by lidar, not observed in digital imagery.
86	A116	2	4.1	54° 39' 5.89"	162° 21' 12.09"	2.20	54° 39' 7.54"	162° 21' 11.54"	Sndg	Y	Y	Replace	
87	A117	2	7.3	54° 38' 50.71"	162° 23' 46.22"	3.07	54° 38' 49.45"	162° 23' 52.77"	Sndg	Y	Y	Replace	
88	A118	2	5.4	54° 39' 12.11"	162° 24' 39.91"	1.78	54° 39' 11.82"	162° 24' 43.49"	Sndg	Y	Y	Replace	
89	A119	2	14.6	54° 38' 33.89"	162° 24' 38.48"	2.16	54° 38' 38.65"	162° 24' 37.08"	Sndg	Y	Y	Replace	
90	A122	2	6.8	54° 38' 42.2"	162° 23' 7.26"	2.04	54° 38' 39.73"	162° 23' 6.74"	Sndg	Y	Y	Replace	
91	A123	2	7.8	54° 38' 21.42"	162° 20' 47.79"	3.18	54° 38' 22.74"	162° 20' 46.92"	Sndg	Y	Y	Replace	
92	A126	2	10.5	54° 37' 22.12"	162° 22' 9.6"	-2.25	54° 37' 23.6"	162° 22' 8.41"	Drying Rk	Y	Y	Replace	
93	A127	2	5.0	54° 37' 37.73"	162° 23' 2.43"	2.68	54° 37' 36.51"	162° 23' 10.41"	Sndg	Y	Y	Replace	

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 H12105 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 for H12105 consists of a large number of islands, islet, drying features and many kelp covered submerged rocks. 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:

- W of Cherni Island, at position 54° 37' 37" N, 162° 25' 13" W, due to kelp.
- NW of Cherni Island, at position 54° 39' 17" N, 162° 24' 40" W, due to kelp.
- NE of Cherni Island, at position 54° 41' 58" N, 162° 18' 20" 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.[7]

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 (US512105.000) and the H12105_Inv.hob file for H12105.

The areas of good lidar seabed coverage include:

- NNE of Cherni Island, at position 54° 43’ 32” N, 162° 20’ 07” W.
- NNW of Cherni Island, at position 54° 40’ 54” N, 162° 24’ 22” W.
- E coast of Cherni Island, at position 54° 38’ 04” N, 162° 21’ 18” 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 (US512105.000).

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 H12105_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 H12105_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 27 uncertain soundings has been made in the CARIS H12105_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 – H12105

D.2.2.1 Summary of Charting Actions – H12105

Total number of new significant islets recommended for insertion on chart: 4
Total number of new significant drying rocks recommended for insertion on chart: 1
Total number of new significant rocks awash recommended for insertion on chart: 5
Total number of new significant shoals recommended for insertion on chart: 33
Total number of charted features disproved by lidar (Remove): 2
Total number of charted features recommended for amendment by lidar (Replace): 34
Total number of chart comparison items requiring further investigation: 14

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: 3
Total number of Anti-DTONs submitted to PHB during product compilation: 0
Total number of DTONs submitted to PHB for H12105: 7
Total number of Anti-DTONs submitted to PHB for H12105: 0

D.2.2.2 Summary of Lidar Features Requiring Further Investigation – H12105

Total number of Priority 1 investigations identified: 2
Total number of Priority 2 investigations identified: 12
Total number of Priority 3 investigations identified: 2
Total number of Priority 4 investigations identified: 11
Total number of Priority 5 investigations identified: 0

Total number of investigations recommended during data processing: 24
Total number of investigations recommended from georeferenced imagery review: 1
Total number of investigations recommended from chart comparison compilation: 2
Total number of recommended feature investigations: 27

E. APPROVAL SHEET

LETTER OF APPROVAL – OPR-P184-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.

Report	Submission Date
Descriptive Report – H12105	June 23, 2010

Mark Sinclair
Hydrographer
Fugro LADS, Incorporated

Date June 23, 2010

Revisions Compiled During Office Processing and Certification

[1] Higher uncertainty values are expected in areas of steep slopes. The data is adequate for charting except in areas where the data density is both sparse and deeper that the charted depths.
[2] Gaps in the lidar data are expected in areas of thick kelp.
[3] Details of the chart comparison to the largest scale charts conducted during office processing are as follows:
Chart 16547 (9th Edition, March 1, 2004, NTM Update January 26, 2013)
Soundings from survey H12105 generally agreed within 2 fathoms of the charted depths. However isolated shoal soundings throughout the survey were up to 6 fathoms shoaler than the charted depths. The surveyed contours were generally consistent with charted depth curves.

US4AK54M (1st Edition, January 21, 2011)
The chart comparison details for chart 16547 are applicable to this ENC.

[4] Seven DTONs were submitted by the field and three additional DTONs submitted during office processing. All DTONs have been applied to the chart and are included in the chart update product.
[5] The DTON report is attached.
[6] All features were reviewed during office processing. By order of navigational significance and appropriate depiction at chart scale, a subset of the most prominent features has been selected and recommended for charting.
[7] The planned junctioning multibeam surveys are no longer scheduled. The LIDAR surveys in this project are being compiled and applied to the charts without junctioning multibeam data.

APPENDIX I – DANGERS TO NAVIGATION

DTONS Submitted to PHB

I.1.1 Danger to Navigation Report

Hydrographic Survey Registry Number: H12105

State: Alaska

Locality: Southwest Alaska Peninsula – Pavlof Islands

Sub-locality: Vicinity of Cherni Island

Project Number: OPR-P184-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
US3AK61M	11th	1/10/2009	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	6.9	54° 46' 25.46"	162° 18' 08.25"	01:52:13, June 30, 2009	No
2	Rk	10.6	54° 45' 41.66"	162° 19' 31.74"	18:08:53, July 19, 2009	No
3	Rk	14.4	54° 44' 16.12"	162° 22' 30.12"	17:22:52, July 19, 2009	No
4	Rk	9.5	54° 41' 26.21"	162° 24' 56.98"	20:21:11, June 28, 2009	No
5	Rk	9.4	54° 44' 24.95"	162° 19' 25.45"	22:44:48, June 28, 2009	No
6	Rk	6.7	54° 40' 08.41"	162° 20' 24.34"	02:44:17, July 10, 2009	No
7	Rk	6.14	54° 39' 57.53"	162° 19' 15.31"	22:50:29, August 8, 2009	No

COMMENTS: Final verified tides have been applied from the King Cove tide gauge (9459881). The shoals were found using LIDAR. DTON items 1 through 4 were submitted during data collection from the field. DTON items 5 through 7 were submitted following product compilation from the Biloxi 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)

Dangers to Navigation for Lidar Survey H12105

Registry Number: H12105
State: Alaska
Locality: Southwest Alaska Peninsula - Pavlof Islands, Alaska
Sub-locality: Vicinity of Cherni Island
Project Number: OPR-P184-KRL-09
Survey Dates: June 13, 2009 - August 12, 2009

Charts Affected

Number	Edition	Date	Scale (RNC)	RNC Correction(s)*
16547	9th	03/01/2004	1:81,326 (16547_1)	USCG LNM: 08/30/2005 (07/21/2009) CHS NTM: None (06/26/2009) NGA NTM: 05/01/2004 (08/01/2009)
16520	23rd	08/01/2008	1:300,000 (16520_1)	[L]NTM: ?
16540	12th	01/01/2005	1:300,000 (16540_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: ?
513	7th	06/01/2004	1:3,500,000 (513_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.	Name	Feature Type	Survey Depth	Survey Latitude	Survey Longitude
1.1	Rk 6.9m	Rock	6.90 m	54° 46' 25.2" N	162° 18' 09.7" W
1.2	Rk 10.60m	Rock	10.60 m	54° 45' 41.7" N	162° 19' 31.6" W
1.3	Rk 14.40m	Rock	14.40 m	54° 44' 16.0" N	162° 22' 30.3" W
1.4	Rk	Rock	9.50 m	54° 41' 26.2" N	162° 24' 57.0" W

Generated by Pydro v9.6 (r2698) on Wed Aug 26 20:31:35 2009 [UTC]

1 - Danger To Navigation

1.1) GP No. - 1 from H12105_dton.xls

DANGER TO NAVIGATION

Survey Summary

Survey Position:	54° 46' 25.2" N, 162° 18' 09.7" W
Least Depth:	6.90 m (= 22.64 ft = 3.773 fm = 3 fm 4.64 ft)
TPU (±1.96σ):	**THU (TPEh)** [None] ; **TVU (TPEv)** [None]
Timestamp:	2009-204.16:28:01.000 (07/23/2009)
GP Dataset:	H12105_dton.xls
GP No.:	1
Charts Affected:	16547_1, 16520_1, 16540_1, 16011_1, 16006_1, 500_1, 513_1, 530_1, 50_1

Remarks:

This feature was found during lidar hydrographic survey operation. Depth was reduced to Mean Lower Low Water using preliminary tides from the Sand Pont tide gauge (9459450).

Hydrographer Recommendations

Chart as surveyed.

Cartographically-Rounded Depth (Affected Charts):

3 ¾fm (16547_1, 16520_1, 16540_1, 16011_1, 16006_1, 530_1)

6.9m (500_1, 513_1, 50_1)

S-57 Data

Geo object 1:	Underwater rock / awash rock (UWTROC)
Attributes:	OBJNAM - Rk
	SORDAT - 20090812
	SORIND - US,US,nsurf,H12105
	TECSOU - 7:found by laser
	VALSOU - 6.9 m
	VERDAT - 12:Mean lower low water
	WATLEV - 3:always under water/submerged

1.2) GP No. - 2 from H12105_dton.xls

DANGER TO NAVIGATION

Survey Summary

Survey Position:	54° 45' 41.7" N, 162° 19' 31.6" W
Least Depth:	10.60 m (= 34.78 ft = 5.796 fm = 5 fm 4.78 ft)
TPU (±1.96σ):	**THU (TPEh)** [None] ; **TVU (TPEv)** [None]
Timestamp:	2009-200.18:08:53.000 (07/19/2009)
GP Dataset:	H12105_dton.xls
GP No.:	2
Charts Affected:	16547_1, 16520_1, 16540_1, 16011_1, 16006_1, 500_1, 513_1, 530_1, 50_1

Remarks:

This feature was found during lidar hydrographic survey operation. Depth was reduced to Mean Lower Low Water using preliminary tides from the Sand Pont tide gauge (9459450).

Hydrographer Recommendations

Chart as surveyed

Cartographically-Rounded Depth (Affected Charts):

5 ¾fm (16547_1, 16520_1, 16540_1, 16011_1, 16006_1, 530_1)

10.6m (500_1, 513_1, 50_1)

S-57 Data

Geo object 1:	Underwater rock / awash rock (UWTROC)
Attributes:	OBJNAM - Rk
	SORDAT - 20090812
	SORIND - US,US,nsurf,H12105
	TECSOU - 7:found by laser
	VALSOU - 10.6 m
	VERDAT - 12:Mean lower low water
	WATLEV - 3:always under water/submerged

1.3) GP No. - 3 from H12105_dton.xls

DANGER TO NAVIGATION

Survey Summary

Survey Position:	54° 44' 16.0" N, 162° 22' 30.3" W
Least Depth:	14.40 m (= 47.24 ft = 7.874 fm = 7 fm 5.24 ft)
TPU (±1.96σ):	**THU (TPEh)** [None] ; **TVU (TPEv)** [None]
Timestamp:	2009-200.17:22:52.000 (07/19/2009)
GP Dataset:	H12105_dton.xls
GP No.:	3
Charts Affected:	16547_1, 16520_1, 16540_1, 16011_1, 16006_1, 500_1, 513_1, 530_1, 50_1

Remarks:

This feature was found during lidar hydrographic survey operation. Depth was reduced to Mean Lower Low Water using preliminary tides from the Sand Pont tide gauge (9459450).

Hydrographer Recommendations

Chart as surveyed.

Cartographically-Rounded Depth (Affected Charts):

7 ¾fm (16547_1, 16520_1, 16540_1, 16011_1, 16006_1, 530_1)

14.4m (500_1, 513_1, 50_1)

S-57 Data

Geo object 1:	Underwater rock / awash rock (UWTROC)
Attributes:	OBJNAM - Rk
	SORDAT - 20090812
	SORIND - US,US,nsurf,H12105
	TECSOU - 7:found by laser
	VALSOU - 14.4 m
	VERDAT - 12:Mean lower low water
	WATLEV - 3:always under water/submerged

1.4) GP No. - 4 from H12105_dton.xls

DANGER TO NAVIGATION

Survey Summary

Survey Position:	54° 41' 26.2" N, 162° 24' 57.0" W
Least Depth:	9.50 m (= 31.17 ft = 5.195 fm = 5 fm 1.17 ft)
TPU (±1.96σ):	**THU (TPEh)** [None] ; **TVU (TPEv)** [None]
Timestamp:	2009-179.20:21:11.000 (06/28/2009)
GP Dataset:	H12105_dton.xls
GP No.:	4
Charts Affected:	16547_1, 16520_1, 16540_1, 16011_1, 16006_1, 500_1, 513_1, 530_1, 50_1

Remarks:

This feature was found during lidar hydrographic survey operation. Depth was reduced to Mean Lower Low Water using preliminary tides from the Sand Pont tide gauge (9459450).Further investigation for least depth determination is recomended for this feature. The S-57 attribute QUASOU is set to '3' for doubtful sounding.

Hydrographer Recommendations

Replace chd 7-1/2 fm with 9.5m as surveyed

Cartographically-Rounded Depth (Affected Charts):

5 ¼fm (16547_1, 16520_1, 16540_1, 16011_1, 16006_1, 530_1)

9.5m (500_1, 513_1, 50_1)

S-57 Data

Geo object 1:	Underwater rock / awash rock (UWTROC)
Attributes:	OBJNAM - Rk
	QUASOU - 3:doubtful sounding
	SORDAT - 20090812
	SORIND - US,US,nsurf,H12105
	TECSOU - 7:found by laser
	VALSOU - 9.5 m
	VERDAT - 12:Mean lower low water
	WATLEV - 3:always under water/submerged

DTONS Submitted to MCD

I.1.3 Danger to Navigation Report (Submitted following field operations)

Danger to Navigation Report for Lidar Survey H12105

Registry Number: H12105
State: Alaska
Locality: Sandman Reefs
Sub-locality: Vicinity of Cherni Island
Project Number: OPR-P184-KRL-09
Survey Dates: 6/12/2009 - 08/11/2009

Charts Affected

Number	Edition	Date	Scale (RNC)	RNC Correction(s)*
16547	9th	03/01/2004	1:81,326 (16547_1)	USCG LNM: 08/30/2005 (07/21/2009) CHS NTM: None (06/26/2009) NGA NTM: 05/01/2004 (08/01/2009)
16520	23rd	08/01/2008	1:300,000 (16520_1)	[L]NTM: ?
16540	12th	01/01/2005	1:300,000 (16540_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: ?
513	7th	06/01/2004	1:3,500,000 (513_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

Feature Type	Survey Depth	Survey Latitude	Survey Longitude
Rock	9.40 m	54° 44' 25.0" N	162° 19' 25.4" W
Rock	6.70 m	54° 40' 08.4" N	162° 20' 24.3" W
Rock	6.14 m	54° 39' 57.5" N	162° 19' 15.3" W

Generated by Pydro v9.10 (r2824) on Thu May 27 21:33:01 2010 [UTC]

1 - Danger To Navigation

1.1) GP No. - 1 from H12105_Dton_Pydro.xls

DANGER TO NAVIGATION

Survey Summary

Survey Position:	54° 44' 25.0" N, 162° 19' 25.4" W
Least Depth:	9.40 m (= 30.84 ft = 5.140 fm = 5 fm 0.84 ft)
TPU (±1.96σ):	**THU (TPEh)** [None] ; **TVU (TPEv)** [None]
Timestamp:	2009-179.22:44:48.000 (06/28/2009)
GP Dataset:	H12105_Dton_Pydro.xls
GP No.:	1
Charts Affected:	16547_1, 16520_1, 16540_1, 16011_1, 16006_1, 500_1, 513_1, 530_1, 50_1

Remarks:

The feature was found during Lidar hydrographic survey operation. Depth was reduced to Mean Lower Low Water using verified tides from the King Cove tide gauge (9459881).

Feature Correlation

Address	Feature	Range	Azimuth	Status
H12105_Dton_Pydro.xls	1	0.00	000.0	Primary

Hydrographer Recommendations

Chart as surveyed.

Cartographically-Rounded Depth (Affected Charts):

5fm (16547_1, 16520_1, 16540_1, 16011_1, 16006_1, 530_1)

9.4m (500_1, 513_1, 50_1)

S-57 Data

Geo object 1:	Underwater rock / awash rock (UWTROC)
Attributes:	SORDAT - 20090811
	SORIND - US,US,graph,H12105
	TECSOU - 7:found by laser
	VALSOU - 9.4 m

VERDAT - 12:Mean lower low water

WATLEV - 3:always under water/submerged

1.2) GP No. - 2 from H12105_Dton_Pydro.xls

DANGER TO NAVIGATION

Survey Summary

Survey Position:	54° 40' 08.4" N, 162° 20' 24.3" W
Least Depth:	6.70 m (= 21.98 ft = 3.664 fm = 3 fm 3.98 ft)
TPU (±1.96σ):	**THU (TPEh)** [None] ; **TVU (TPEv)** [None]
Timestamp:	2009-191.02:44:17.000 (07/10/2009)
GP Dataset:	H12105_Dton_Pydro.xls
GP No.:	2
Charts Affected:	16547_1, 16520_1, 16540_1, 16011_1, 16006_1, 500_1, 513_1, 530_1, 50_1

Remarks:

The feature was found during Lidar hydrographic survey operation. Depth was reduced to Mean Lower Low Water using verified tides from the King Cove tide gauge (9459881).

Feature Correlation

Address	Feature	Range	Azimuth	Status
H12105_Dton_Pydro.xls	2	0.00	000.0	Primary

Hydrographer Recommendations

Chart as surveyed.

Cartographically-Rounded Depth (Affected Charts):

3 ½fm (16547_1, 16520_1, 16540_1, 16011_1, 16006_1, 530_1)

6.7m (500_1, 513_1, 50_1)

S-57 Data

Geo object 1:	Underwater rock / awash rock (UWTROC)
Attributes:	SORDAT - 20090811
	SORIND - US,US,graph,H12105
	TECSOU - 7:found by laser
	VALSOU - 6.7 m

VERDAT - 12:Mean lower low water

WATLEV - 3:always under water/submerged

1.3) GP No. - 3 from H12105_Dton_Pydro.xls

DANGER TO NAVIGATION

Survey Summary

Survey Position:	54° 39′ 57.5″ N, 162° 19′ 15.3″ W
Least Depth:	6.14 m (= 20.14 ft = 3.357 fm = 3 fm 2.14 ft)
TPU (±1.96σ):	**THU (TPEh)** [None] ; **TVU (TPEv)** [None]
Timestamp:	2009-220.22:50:29.000 (08/08/2009)
GP Dataset:	H12105_Dton_Pydro.xls
GP No.:	3
Charts Affected:	16547_1, 16520_1, 16540_1, 16011_1, 16006_1, 500_1, 513_1, 530_1, 50_1

Remarks:

The feature was found during Lidar hydrographic survey operation. Depth was reduced to Mean Lower Low Water using verified tides from the King Cove tide gauge (9459881).

Feature Correlation

Address	Feature	Range	Azimuth	Status
H12105_Dton_Pydro.xls	3	0.00	000.0	Primary

Hydrographer Recommendations

Chart as surveyed.

Cartographically-Rounded Depth (Affected Charts):

3 ¼fm (16547_1, 16520_1, 16540_1, 16011_1, 16006_1, 530_1)

6.1m (500_1, 513_1, 50_1)

S-57 Data

Geo object 1:	Underwater rock / awash rock (UWTROC)
Attributes:	SORDAT - 20090811
	SORIND - US,US,graph,H12105
	TECSOU - 7:found by laser
	VALSOU - 6.14 m

VERDAT - 12:Mean lower low water

WATLEV - 3:always under water/submerged

Danger to Navigation Report for Lidar Survey H12105

Registry Number: H12105

State: Alaska

Locality: Sandman Reefs

Sub-locality: Vicinity of Cherni Island

Project Number: OPR-P184-KRL-09

Survey Dates: 6/13/2009 - 08/12/2009

Charts Affected

Number	Edition	Date	Scale (RNC)	RNC Correction(s)*
16547	9th	03/01/2004	1:81,326 (16547_1)	USCG LNM: 08/30/2005 (07/21/2009) CHS NTM: None (06/26/2009) NGA NTM: 05/01/2004 (08/01/2009)
16520	23rd	08/01/2008	1:300,000 (16520_1)	[L]NTM: ?
16540	12th	01/01/2005	1:300,000 (16540_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: ?
513	7th	06/01/2004	1:3,500,000 (513_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

Feature Type	Survey Depth	Survey Latitude	Survey Longitude
Shoal	2.66 m	54° 36' 59.6" N	162° 24' 22.9" W
Shoal	3.18 m	54° 38' 22.8" N	162° 20' 46.9" W
Shoal	2.35 m	54° 37' 52.5" N	162° 20' 48.7" W

1 - Danger To Navigation

1.1) GP No. - 1 from H12105_Dton_Pydro_3.xls

DANGER TO NAVIGATION

Survey Summary

Survey Position: 54° 36' 59.6" N, 162° 24' 22.9" W

Least Depth: 2.66 m (= 8.73 ft = 1.455 fm = 1 fm 2.73 ft)

TPU (±1.96σ): **THU (TPEh)** [None] ; **TVU (TPEv)** [None]

Timestamp: 2009-195.23:19:55.000 (07/14/2009)

GP Dataset: H12105_Dton_Pydro_3.xls

GP No.: 1

Charts Affected: 16547_1, 16520_1, 16540_1, 16011_1, 16006_1, 500_1, 513_1, 530_1, 50_1

Remarks:

The feature was found during Lidar hydrographic survey operation. Depth was reduced to Mean Lower Low Water using verified tides from the King Cove tide gauge (9459881).

Feature Correlation

Address	Feature	Range	Azimuth	Status
H12105_Dton_Pydro_3.xls	1	0.00	000.0	Primary

Hydrographer Recommendations

Chart as surveyed.

Cartographically-Rounded Depth (Affected Charts):

1 ½fm (16547_1, 16520_1, 16540_1, 16011_1, 16006_1, 530_1)

2.7m (500_1, 513_1, 50_1)

S-57 Data

Geo object 1: Sounding (SOUNDG)

Attributes: SORDAT - 20090812

SORIND - US,US,graph,H12105

TECSOU - 7:found by laser

VERDAT - 12:Mean lower low water

1.2) GP No. - 2 from H12105_Dton_Pydro_3.xls

DANGER TO NAVIGATION

Survey Summary

Survey Position: 54° 38' 22.8" N, 162° 20' 46.9" W

Least Depth: 3.18 m (= 10.43 ft = 1.739 fm = 1 fm 4.43 ft)

TPU (±1.96σ): **THU (TPEh)** [None] ; **TVU (TPEv)** [None]

Timestamp: 2009-181.22:20:12.000 (06/30/2009)

GP Dataset: H12105_Dton_Pydro_3.xls

GP No.: 2

Charts Affected: 16547_1, 16520_1, 16540_1, 16011_1, 16006_1, 500_1, 513_1, 530_1, 50_1

Remarks:

The feature was found during Lidar hydrographic survey operation. Depth was reduced to Mean Lower Low Water using verified tides from the King Cove tide gauge (9459881).

Feature Correlation

Address	Feature	Range	Azimuth	Status
H12105_Dton_Pydro_3.xls	2	0.00	000.0	Primary

Hydrographer Recommendations

Chart as surveyed.

Cartographically-Rounded Depth (Affected Charts):

1 ¾fm (16547_1, 16520_1, 16540_1, 16011_1, 16006_1, 530_1)

3.2m (500_1, 513_1, 50_1)

S-57 Data

Geo object 1: Sounding (SOUNDG)

Attributes: SORDAT - 20090812

SORIND - US,US,graph,H12105

TECSOU - 7:found by laser

VERDAT - 12:Mean lower low water

1.3) GP No. - 3 from H12105_Dton_Pydro_3.xls

DANGER TO NAVIGATION

Survey Summary

Survey Position: 54° 37' 52.5" N, 162° 20' 48.7" W

Least Depth: 2.35 m (= 7.71 ft = 1.285 fm = 1 fm 1.71 ft)

TPU (±1.96σ): **THU (TPEh)** [None] ; **TVU (TPEv)** [None]

Timestamp: 2009-225.13:32:52.000 (08/13/2009)

GP Dataset: H12105_Dton_Pydro_3.xls

GP No.: 3

Charts Affected: 16547_1, 16520_1, 16540_1, 16011_1, 16006_1, 500_1, 513_1, 530_1, 50_1

Remarks:

The feature was found during Lidar hydrographic survey operation. Depth was reduced to Mean Lower Low Water using verified tides from the King Cove tide gauge (9459881).

Feature Correlation

Address	Feature	Range	Azimuth	Status
H12105_Dton_Pydro_3.xls	3	0.00	000.0	Primary

Hydrographer Recommendations

Chart as surveyed.

Cartographically-Rounded Depth (Affected Charts):

1 ¼fm (16547_1, 16520_1, 16540_1, 16011_1, 16006_1, 530_1)

2.4m (500_1, 513_1, 50_1)

S-57 Data

Geo object 1: Sounding (SOUNDG)

Attributes: SORDAT - 20090812

SORIND - US,US,graph,H12105

TECSOU - 7:found by laser

VERDAT - 12:Mean lower low water

APPROVAL PAGE

H12105

Data partially meet 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

- H12105_DR.pdf
- Collection of depth varied resolution BAGS
- Processed survey data and records
- H12105_GeoImage.pdf

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

Digitally signed by
HOLMBERG.PETER.SCOTT.1365886101
DN: c=US, o=U.S. Government, ou=DoD,
ou=PKI, ou=OTHER,
cn=HOLMBERG.PETER.SCOTT.1365886101
Date: 2013.04.29 09:00:32 -07'00'

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.

Digitally signed by
DAVIES.CHARLES.R.1365839782
DN: c=US, o=U.S. Government, ou=DoD, ou=PKI,
ou=OTHER, cn=DAVIES.CHARLES.R.1365839782
Date: 2013.04.29 08:53:56 -07'00'

Approved:_____

Russ Davies
Cartographer, Pacific Hydrographic Branch