H11092

NOAA FORM 76-35A

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

DESCRIPTIVE REPORT

Type of Survey HYDROGRAPHIC

Field No.

Registry No. H-11092

LOCALITY

State ALASKA

General Locality Bering Sea, Pribilof Islands

Sublocality Southwest of Saint Paul Island

2002

CHIEF OF PARTY
RICHARD C. NADEAU

LIBRARY & ARCHIVES

DATE

NOAA FORM 77-28 (11-72)

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

REGISTER NO.

HYDROGRAPHIC TITLE SHEET

H11092

INSTRUCTIONS The hydrographic sheet should be accompanied by this form, filled in as completely as possible, when the sheet is forwarded to the office.

FIELD NO.

State **Alaska**

General Locality **Bering Sea, Pribilof Islands**

Sublocality **Southwest of Saint Paul Island**

Scale **1:25,000** Date of Survey **4/24/2002-6/19/2002**

Instructions Date **12/7/2001** Project No. **OPR-R144-KR-02**

Vessel **SHOALS Twin Otter**

Chief of Party **Richard C. Nadeau**

Surveyed by **Nadeau, Sipos, Jalbctx (USACE), Et Al**

Soundings taken by echo sounder **Laser Airborne - SHOALS 400**

Graphic record scaled by **Thales Geosolutions Personnel**

Graphic record checked by **Thales Geosolutions Personnel**

Evaluation by **R. Davies** Automated plot by **HP Designjet 1055**

Verification by **R. Davies**

Soundings in **Fathoms and tenths** at **MLLW**

REMARKS: **Time in UTC. UTM Projection Zone 2**

Revisions and annotations appearing as endnotes were generated during office processing.

All separates are filed with the hydrographic data.

As a result, page numbering may be interrupted or non-sequential

A - Area Surveyed

H11092 (Sheet A) which is bounded by the coordinate listings below and is located in the middle of the Bering Sea in the Pribilof Islands, specifically around the west side of St. Paul Island. This report describes the survey data collected around Otter Island and the shoal off the northwest coast of Saint Paul. The area surveyed was from the 10 fathoms curve on the current chart to the shoreline. If the 10-fathom curve, in reality, extended farther than the contour on the chart and the survey bounds, data were collected to the extinction of the laser return.

Hydrographic data collection began on April 24, 2002 and ended on June 19th, 2002. The survey was aborted on June 19th prior to completion of the survey due to the summer fog arriving. While equipment problems in the SHOALS-400 system contributed to some lost survey time, the weather that was experienced during the perceived project window was substantially worse than in recent previously documented years. An additional consideration was the impact on the bird population in the area after warnings from the National Fish and Wildlife Service (a digital video of a fly over St. George is submitted with this report). After spending longer than planned on site and entering the time of the year that the weather is expected to be at it's worst for conducting this type of survey (fog) the decision was made to pull out without completing the entire survey. The requirement for the survey was 200% coverage, but only approximately 100% coverage was attained on the survey. It is also possible that there were gaps between lines due to line following.[1] There is additional information on the reasons for demobilization prior to completion in Appendix G.[2] As of the submittal of this report, no decision had been made on when the survey should be completed or what method should be used to do so.

Table 1 H11092 Survey Limits (Sheet A)

Survey Limits [3] Work Order # 1 Sheet A Scale 1:25,000		
Point #	Positions on NAD83	
	Latitude (N)	Longitude (W)
1	57 11 55.95 N	170 44 42.95 W
2	56 56 59.81 N	170 32 06.22 W
3	57 00 47.83 N	170 16 49.98 W
4	57 15 45.49 N	170 29 21.82 W

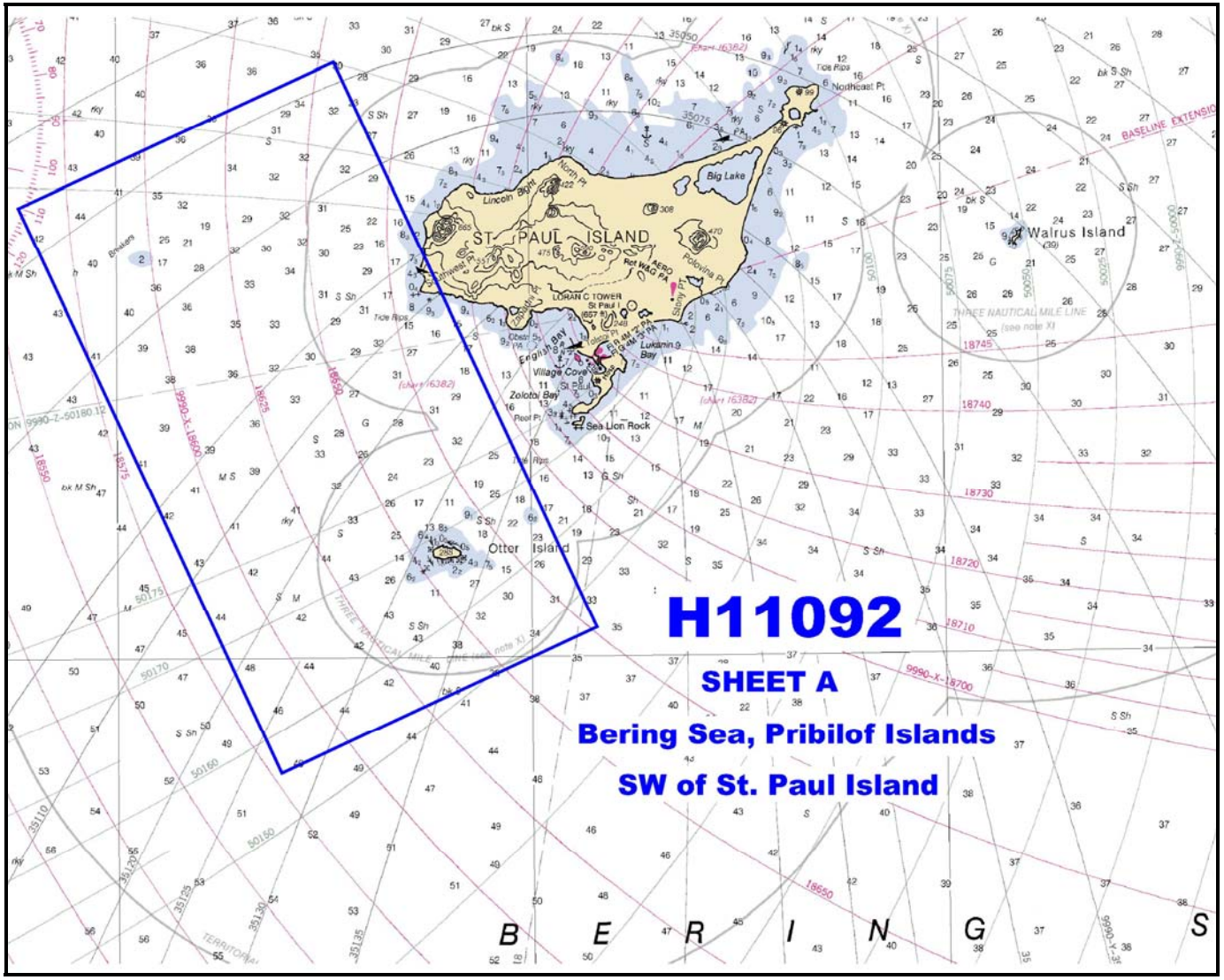
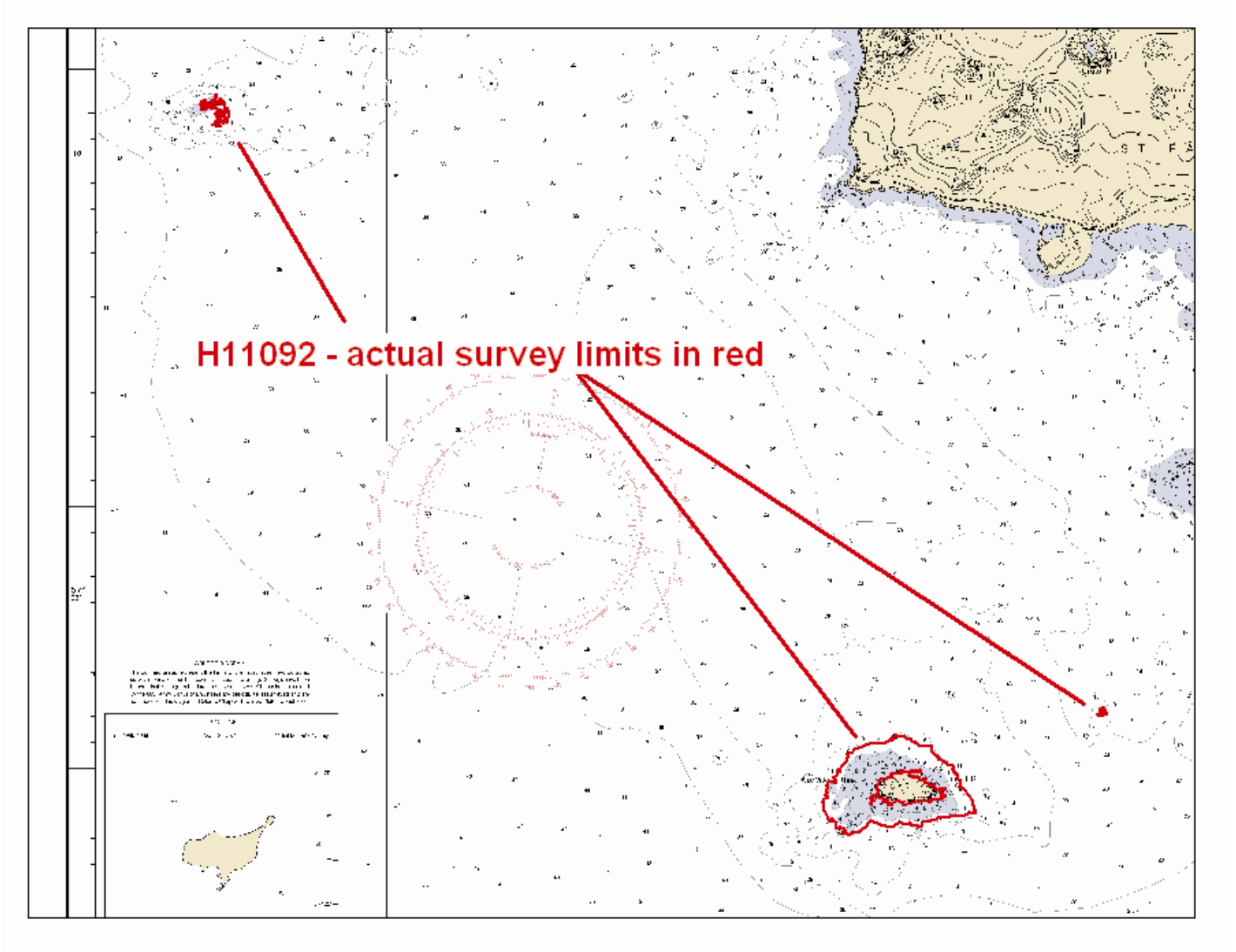


Figure 1 H11092 Lidar Survey Limits (Sheet A)

Figure 1a Actual Survey limits for H11095



B – Data Acquisition & Processing

Refer to the OPR-R144-KR-02 Data Acquisition and Processing Report[4] for a detailed description of all equipment, survey vessels, processing procedures and quality control features. Items specific to this survey and any deviations from the Data Acquisition and Processing Report are discussed in the following sections.

Equipment & Vessels

Thales GeoSolutions (Pacific) Inc. (TGPI) subcontracted the United States Army Corps of Engineers (USACE) to use the Scanning Hydrographic Operational Airborne Lidar Survey (SHOALS) system, owned by JALBTCX (Joint Airborne Lidar Bathymetry Technical Center of Expertise), to conduct data collection and initial data processing.

Lidar data were collected using the SHOALS-400 bathymetric lidar system made by Optech of Ontario, Ca. The system acquired data using a deHavilland DH-6 Twin Otter airplane.

The data delivered by the SHOALS team to Thales had been put through the SHOALS processing and quality control process. These data were then put through the Thales processing and quality control procedures specifically designed to meet NOAA's hydrographic specifications. Thales then generated all final products including the smooth sheet and the descriptive report.[5]

This report describes the processing of the output data from the SHOALS system. These output data files (OUT, WAVE, and FL) were imported into TGPI hydrographic data processing workflow in CARIS HIPS and GIS. A new converter program denominated convert_shoals.dll was developed by CARIS (Fredericton, Canada) and TGPI to allow data integration. The converter is able to manipulate the SHOALS output file into a format familiar to the HIPS environment. The ability to view the individual waveforms, confidence values, and other useful information for LIDAR surveying was also integrated into the HIPS NT system by TGPI and CARIS.

Quality Control

Crosslines

TGPI performed a series of QC tests using the intersections formed by the SHOALS lines.

IHO statistics were generated using the makehist Quality Control Report (QCR) utility in CARIS GIS. This creates a report of the comparison between a triangulated irregular DTM created with a checkline and the soundings of a survey line. QC reports were created based on the given IHO depth accuracy specification of:

$$\pm\sqrt{a^2 + (b * d)^2}$$

where d is water depth and values for a and b are:

IHO Order	a	b
1	0.5	0.013
2	1.0	0.023

However, since a variance of a difference rather than a variance from a mean was used for these crossline checks, the values of a and b were multiplied by a factor of √2 in the makehist file for the QCR utility:

IHO Order	a*√2	b*√2
1	0.707	0.018
2	1.414	0.033

One tie line, crossing all of the main-scheme lines around Otter Island, was examined using the CARIS HIPS Q/C report. All QC tests performed for the SHOALS 4x4 laser beam spot spacing crossings were conducted using IHO Order 1 and 2. At IHO Order 1 all of these beams passed at a higher than 90% confidence level with 9 of the 29 beams having higher than 95%. With respect to IHO Order 2, all beams had higher than 99% confidence levels. The ability to attain only 90% instead of 95% was largely due to a combination of sounding spacing and relief on the seafloor. Depicted in Figure 2 is an example of the sort of relief seen on the tie line. The small hills and rocks are characteristic of the area and often lead to the seafloor depth changing by over 0.5m with respect to 4m over the ground. This corresponds with a standard deviation that was often near 0.3 meters on all beams (refer to Separate 5 for QC Reports).

On Sheet B (H11093) of the same task order in the Pribilof Islands, a qc report was generated for a tie line /main scheme crossing which contained high density data over a relatively flat bottom. This report showed all beams meeting IHO Order 1 accuracy requirements. This also helped prove that using the calibration values from the Seattle test was valid.[6]

Directly before the commencement of the survey in the Pribilof Islands a series of tests, under the NOAA contract, were performed over a ground truth dataset in Seattle. A report of these tests were submitted to NOAA and showed that the system could meet IHO Order 1 requirements to 95% confidence over relatively smooth bottom.[7]

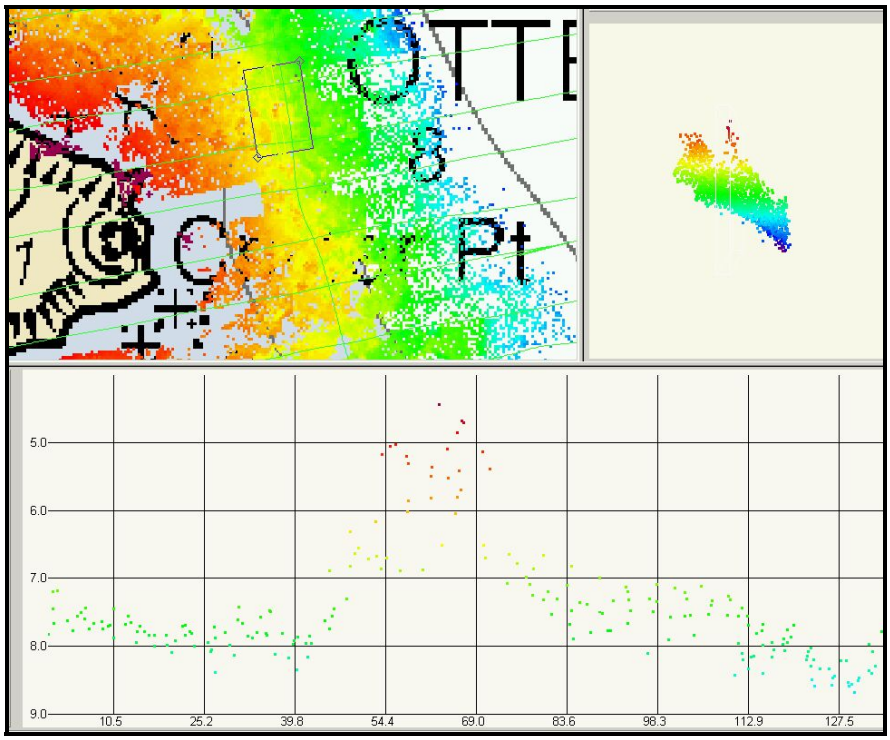


Figure 2 Rough Bottom Over Tie Line Around Otter Island

Junctions

There were no contemporary junctions under this survey.[8]

Data Quality

In general it was difficult to find suitable periods of both clear skies and good water clarity. The Pribilof Islands are notorious for having low ceilings and high winds, such that if the skies are clear, it is likely due to high winds, which in turn cause turbulence. The inaccurate and noisy returns caused by poor environmental conditions were removed from the dataset. For these reasons the data density of valid soundings is less than a typical lidar survey.

Data Density

The SHOALS system was operated at 4x4 meter spot spacing throughout the entire survey. Line spacing was set to provide 200% coverage (i.e. a line spacing equal to half of what would be required for 100% coverage). This resulted in a line spacing of 80m, allowing for errors in the ability to follow the planned line. There were still gaps in between lines that would have been filled if the survey had not been aborted. The operational plan was to run every other line first to attain 100% coverage and once completed follow with the remaining lines. The survey was aborted after completion of the first set of 100% lines and before any

of the remaining lines were completed.

The footprint (illumination major axis) is approximately 2.4m on the surface based on an 8-mrad divergence at 300m altitude. The footprint continues expanding such that it is approximately 5m at 10m water depth and equal to about ½ the water depth in water deeper than 10m. As mentioned above, the data density of valid soundings was less than typical due to abnormally poor environmental conditions.

Water Clarity

The water clarity around the Pribilof Islands generally was very poor. This was largely due to the high winds characteristic of the Bering Sea. The result was both a turbid surface and a significant level of turbidity, in the water column, due to mechanical wave action on the seabed inshore.

Localized plankton growth was not a problem but there were several areas of kelp. It is difficult to determine from the lidar data or the video the position of the kelp areas good enough to place any cartographic symbols on the smooth sheet.[9]

Sea Conditions – Sea State, Waves, Swell, White Water

The sea state ranged from 1 to 5 throughout the survey and was generally between 2 and 3 for significant wave height. The swell however was typically sea state 3 to 4 as there was generally a long period swell which upon interaction with the shallower water caused turbulence. This adversely affected the survey due to causing lower efficiency survey operations while looking for good environmental conditions.

Another effect of the swell on survey operations is that the SHOALS raster calibration pattern that was desired to be run in the Pribilof Islands could not be performed. The calibration relies on having a sea state of 1 or 2 with a short period sea surface. This did not adversely affect actual depth soundings that were used in smooth sheet compilation. [10]

Fish and Birds

The Pribilof Islands had some of the highest concentrations of birds in the Pacific Ocean. This didn't cause significant data loss via false detections, but did cause operations to be moved to the offshore shoals due to eggs in the nests. The fear by US Fish and Wildlife was that as the airplane flew buy and scared the nesting birds, the egg could fall out of the nest on the cliffs and break. This could be described as a "take" and therefore a violation of regulations.

Fish did not pose a significant problem and any false returns from fish were removed from the dataset. When fish are detected by the system, they usually show up as obviously erroneous mid water column second depths.

Effects of High Ground

The operating height of the SHOALS aircraft was nominally 300m (984 ft) during the survey. On this survey there was nowhere that this hindered survey planning, as the highest point that was flown over was 300ft on Otter Island. As mentioned above, there was a problem with the plane flying by over areas of birds past mid-May/early June. The US Fish & Wildlife's recommendation was to fly at least 1000 feet above the highest land elevation within one nautical mile of the island coast. Therefore, the 300 ft cliffs were a problem with impacting the nesting birds.

Shoreline

Shoreline data quality in general was fairly poor in the Pribilof Islands. The SHOALS system had difficulty detecting the black sandy beaches. It was found that the system could not get as good shoreline data coming off land as going on to land. This corresponds with the systems inability to look forward enough in time for a sea surface datum. There was also a problem with data clipping due to shoreline data falling below SHOALS accuracy criteria for land data. This criterion was put in place to ensure that surface waves would not be detected as a bottom. These problems encountered should be solved for future surveys. The shoreline is only depicted on the smooth sheet where the hydrographer believes the system was able to detect the shoreline with better than 20m horizontal accuracy. [11]

The methodology of determining shoreline on the smooth sheet involved first letting the CARIS contouring algorithm generate a MHW contour. That contour was then broken anywhere the generated contour was greater than 20m away (horizontally) from land data collect by the system.

Smooth Sheet Histograms

The histograms are fairly evenly distributed, but a symmetrical trend around beam numbers 9 and 20 is noticeable (Figure 3). These can be explained by the very regular swath widths and consistent overlap between survey lines producing denser regions around the beam numbers mentioned.

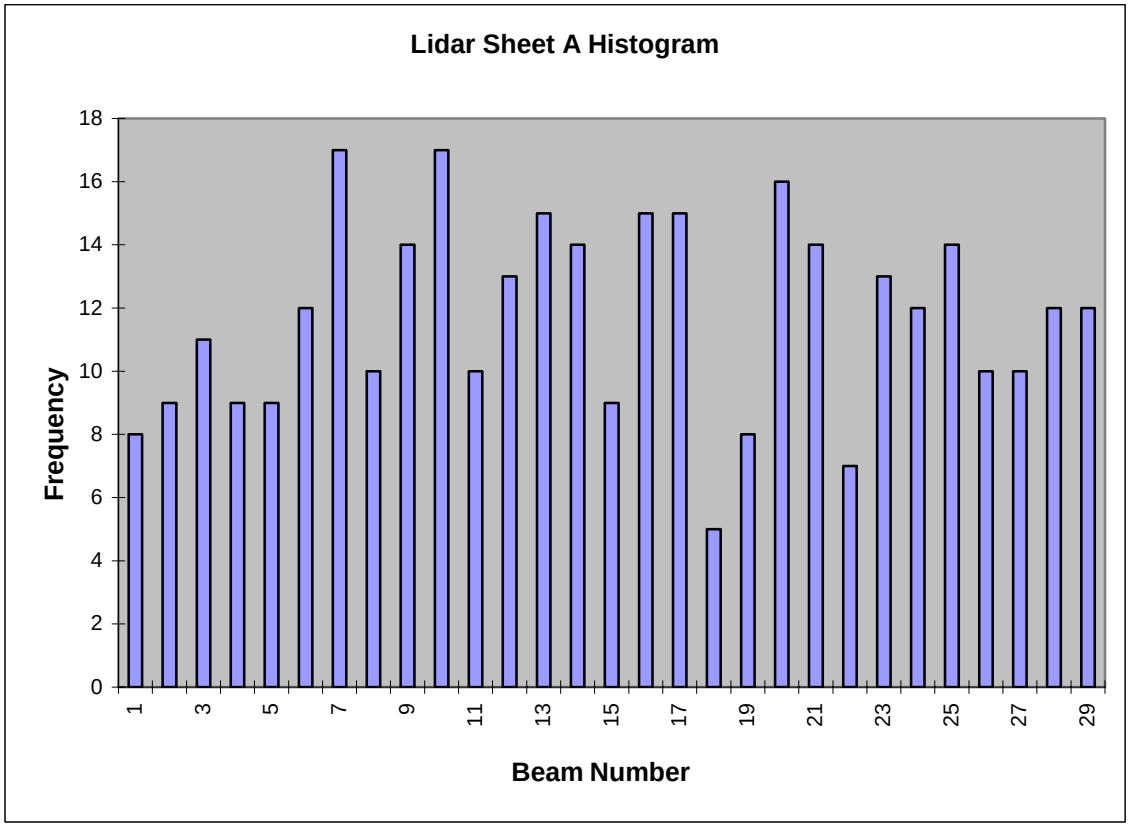


Figure 3 Histogram for Lidar (Smooth Sheet H11092)

Quality Control Checks

During the hydrographic survey H11092, the SHOALS system conducted a number of quality control checks. The system itself generates numerous warnings to the operator and gives information that helps delineate reasons either the auto processing routine or the user should consider rejecting (flag) each sounding.

The real time acquisition system displays GPS lockups and gives warnings (GPS OK/NOT OK) if it stops receiving a signal from the GPS receiver. The information in the downlook video may also freeze if GPS loss occurs. The age of differential corrections were also monitored and if the correctors were greater than 10 seconds old the operator would abort the line and hold until new corrections were received. The primary position monitoring parameter was PDOP since it is directly relevant to the quality of the data. The general rule for SHOALS is to reject any data associated with a PDOP of 4 or higher.

The operator is to continuously monitor position quality in the air, and flightlines are re-flown if any of the following additional specifications are exceeded:

The semi-major axis of the positional error ellipse exceeds 3.5m at the 95% confidence level.

The number of satellites being tracked for continued sounding is less than 4 healthy SV's.

The elevation for a SV is less than 10°angle from the horizontal.

To ensure accuracy of the system SHOALS requires both a hard target test and a calibration flight for calibration of the system. The hard target test was performed in Calgary, Ca. on March 28, 2002 by Optech and Fugro Chance personnel with good results. The data for the calibration was originally collected at Boston Harbor on April 2, 2002 and the calibration was processed on April 3, 2002. However, it was observed that those angles were not properly correcting for the small offsets, requiring new angles be determined from data previously collected in Seattle, WA. The new angles provided the necessary accurate offset correction, producing a flat surface in the observed results.

In preparation for, and during the Alaska survey, three new raster calibrations were attempted but it was again observed that the angles derived were not properly correcting the frame to optical axes offsets. The reason for this is because environmental conditions at the Pribilofs are not ideal (major swell, surf, and high winds). This data corrupted the calibration program's wave corrector rendering the calibration invalid. A standard, rather than raster flightline was used to derive a new set of angles. The new angles successfully corrected the offset.

Final proof of the correct calibration angles is the plotting of a flat water surface (scanner azimuth versus wave height). Since the use of standard survey lines for the calibration does produce the proper angles, Optech considers it perfectly acceptable to use standard lines for calibration, as done in the first six years of SHOALS operations. Further verification was found when the CARIS QC reports on the tie lines were performed.

Corrections to Echo Soundings

Corrections of soundings details are presented in the OPR-R144-KR-02 Data Acquisition and Processing Report. There were no deviations from that report on this survey.[12]

C – Horizontal & Vertical Control

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

Horizontal Control

Horizontal control datum for this survey was the North American Datum of 1983 (NAD83). All positions were originally collected in WGS84 and transformed to NAD83 during HIPS workfile creation.

An onboard CSI differential receiver that used the U.S. Coast Guard (USCG) network of differential beacons was the main source of RTCM. The primary beacon was located in Cold Bay, AK.

As a backup to the USCG beacon, SHOALS set up it's own differential base station using published monuments on St. Paul Island. Using an Ashtech Z-12 receiver set as a base station in conjunction with a Freewave DGR-115R 900MHz spread spectrum data transceiver, differential corrections were broadcast to the aircraft. A 24-hour verification survey was collected to prove the accuracy of the corrections from the base station.

Several GPS survey techniques were employed by SHOALS personnel and LCMF personnel to ensure accurate geodetic determinations. Thorough explanations and results are presented in the Horizontal and Vertical Control Report.[13]

Vertical Control

Preliminary observed tides were used for the initial correction of soundings from the Saint Paul tidal gauge. LCMF provided the tides, which did not need to be further adjusted due to there being a total of one zone and the gauge being in that zone.

Table 2 Tide Gauges

Gauge	Model	Gauge Type	Location	Latitude	Longitude	Operational
946-4212	H350/355	Digital Bubbler	Village Cove, St. Paul	57° 07' 31" N	170° 17' 07" W	04/12/02–06/20/02

In August 26, 2002 LCMF issued verified tidal data and final zoning for OPR-R144-KR-02 and all sounding data was re-applied with the verified tides. For the Preliminary Smooth Sheet verified tidal data were used. Refer to the Vertical and Horizontal Control Report for additional tidal information and station descriptions.

D – Results and Recommendations

General

In general the soundings compared well with the chart. The areas denoted as "breakers", the surf zone, or any other areas where turbulence was likely, caused data gaps and corresponding lack of detection of rocks and the seafloor. Many of these gaps are not obvious at the scale of smooth sheet. Because there is only 100% over the majority of the survey, there is a less likely chance of detecting a target compared with the survey attaining full 200% coverage. It is the recommendation of the hydrographer not to remove any soundings on the chart that are shoaler than the survey data submitted.[14]

D1. Chart Comparison

Comparison of Soundings

H11092 (SW of Saint Paul) survey was compared with chart 16382, 10th Edition (Aug. 19, 2000, 1:50,000 & 1:5,000), chart 16380, 13th Edition (June 2nd, 1990, 1:200,000), and chart 16011, 35th Edition (Dec. 2nd, 2000, 1:1,023,188) with all chart corrections from the latest Notice to Mariners applied.

H11092 was compared with chart 16382, 10th Edition (Aug. 19, 2000. 1:50,000). The soundings and contours in general compare well with the existing chart, but a few areas to note are:

- It appears the shoreline should be extended seaward 50 to 60m around the southern coast of Otter Island. [15]
- The 3-fathom and 5-fathom contours should likely be extended seaward on the east side of the island to include the new survey soundings.[16]
- The charted 6 fathom-2 foot shoal at 57-03-38.3 N 170-19-51.0 W should be replaced by the 6.0-fathom sounding collected nearby. This modification should also be made to chart 16380. [17]

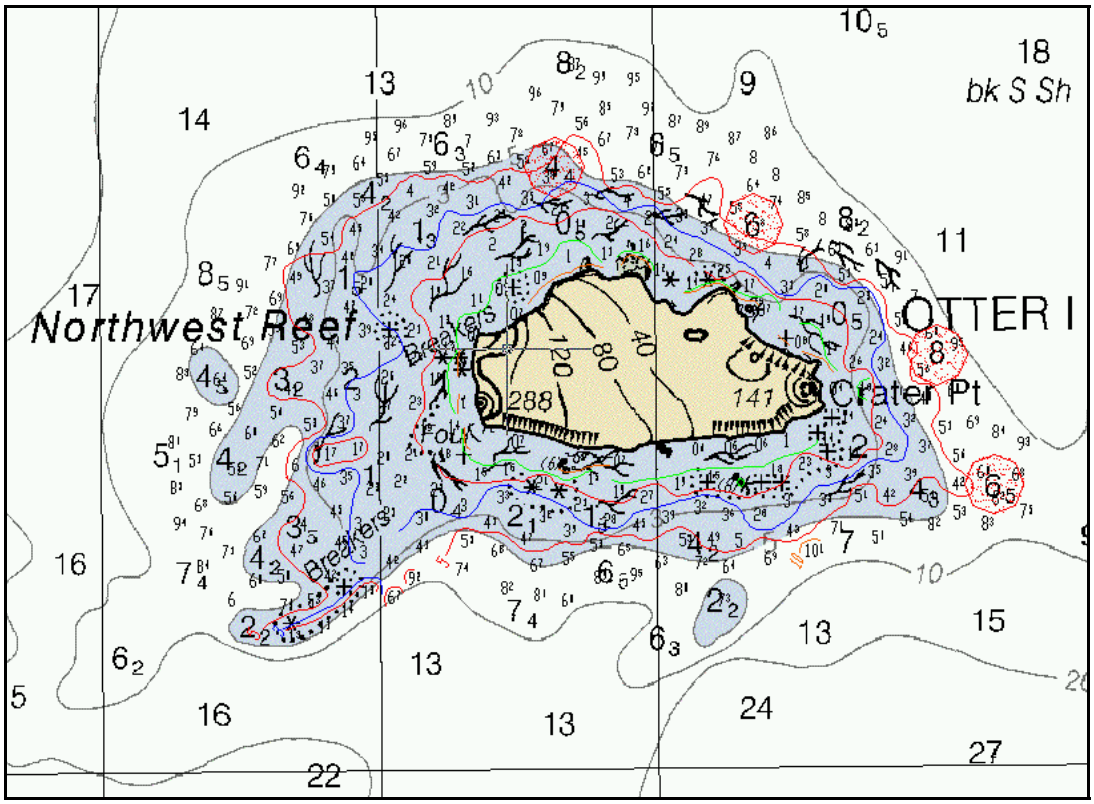


Figure 4 Otter Island Chart Comparison

Soundings from hydrographic survey H11092 that are shoaler than the charted soundings are highlighted in red on the chart comparison sheet included in the *Charts, Plots and Graphics* Separates.[18]

Danger to Navigation

No dangers to navigation were filed as a result of this survey.[19]

D2. Additional Results

Investigation Recommendations

Since lidar technology at 4x4 spot spacing has difficulty getting a least depth on small (relative to the footprint) irregular shaped objects with the accuracy of other methods, it is necessary to perform additional work via either an echosounder or tighter spot spacing lidar. The general criteria used for obtaining the follow list of items (Table 3) was that there was less than 5 soundings delineating a object greater than 2m shallower than surrounding depths and the waveforms for the object showed a obvious bottom. The table lists whether or not the sounding has made it to the smooth sheet via the selection algorithms within the processing software. These objects have not necessarily been labeled as obstructions, etc. on the smooth sheet due to the lack of certainty on what they are (ie natural bottom, shoal, rock, etc.) [20]

Table 3 H11092 Item Investigations

Position		Depth	Surrounding	Line Name	Julian Day	Timestamp	Confidence	On Smooth	Comment
Latitude (N)	Longitude (W)	(m)	Depth (m)					Sheet	
57-02-44.96N	170-25-19.67W	8.105	11	ds020605a_10	2002-156	38435590	76	Y	
57-02-55.10N	170-23-15.35W	4.322	7	ds020605a_10	2002-156	38512181	96	Y	Possibly charted 0-5 in wrong place. Charted Contours off.
57-02-36.63N	170-25-40.40W	9.414	15	ds020605a_12	2002-156	39776682	80	Y	Noisy waveforms but clearly shallow bottom return
57-02-37.11N	170-25-39.36W	10.64	15	ds020605a_13	2002-156	40523014	77	N	
57-02-37.34N	170-25-11.25W	3.207	10	ds020605a_13	2002-156	40504041	96	Y	Scouring. Charted as Kelp symbol
57-02-37.90N	170-25-05.29W	3.151	6	ds020605a_13	2002-156	40499987	96	Y	Single sounding. SHOALS recommends rejecting due to borderline waveform.
57-02-26.36N	170-24-51.39W	7.544	11	ds020605a_18	2002-156	43352778	96	Y	Three soundings building up, other two waveforms cleaner. SHOALS comment to reject based on borderline waveform..
57-02-31.15N	170-22-56.29W	9.289	13	ds020605a_20	2002-156	44616695	83		Contour around this area off by >80m
57-02-19.89N	170-24-20.06W	12.534	>14m	ds020605a_22	2002-156	45813921	95	Y	Would likely be part of sonar vessel survey, due to water depth. SHOALS recommends rejecting all soundings associated.
57-02-46.93N	170-25-28.30W	9.573	13	ds020605a_9	2002-156	37997816	77	Y	
57-02-47.44N	170-25-31.58W	9.687	12	ds020605a_9	2002-156	37995631	76	N	

The lead hydrographer does not necessarily agree with the SHOALS team recommendation. The SHOALS recommendation is only given to aid NOAA in the prioritization of potential items.[21]

Broken Contours on Smooth Sheet

There are several broken contours on the smooth sheet. The most significant reason for this are the data gaps, mentioned previously, due to turbulence. Turbulence has a tendency to occur mostly where the seafloor is shoaling as waves begin breaking. Other areas where this is likely to happen is around areas of breakers and often offshore of necks of land. The characteristics of lidar prohibit attaining the shoalest sounding in these instances. In some places contours have been made dashed where there is not a significant quantity of bottom data, but there is other information to support the contours location. An example of this might be that the water clarity on certain lines allowed for deeper soundings to be attained than neighboring lines. If this appears to be due to a change in weather and the soundings that were obtained indicate a relatively smooth bottom, then a broken contour was depicted on the smooth sheet. Contours where connected with a solid line if there was simply a data gap in collection (not due to turbulence) of less than 1 cm at scale of smooth sheet.

E – Approval Sheet

Approval Sheet

For

H11092

Standard field surveying and processing procedures were followed in producing this survey in accordance with the following documents:

OPR-R144-KR statement of work and hydrographic specifications;
Thales GeoSolutions (Pacific) Inc. Acquisition Procedures (AP-2156-01);
Thales GeoSolutions (Pacific) Inc. Processing Procedures (OP-2437-01);
Technical Report for Tides, Pribilof Islands;
Shoals Safety Manual;

This report has been reviewed and approved. All records are forwarded for final review and processing to the Chief, Pacific Hydrographic Branch.

The data were reviewed daily during acquisition and processing.

Approved and forwarded,

Richard Nadeau

Richard C. Nadeau, Thales GeoSolutions (Pacific) Inc.
Lead Hydrographer
TGPI Survey Party

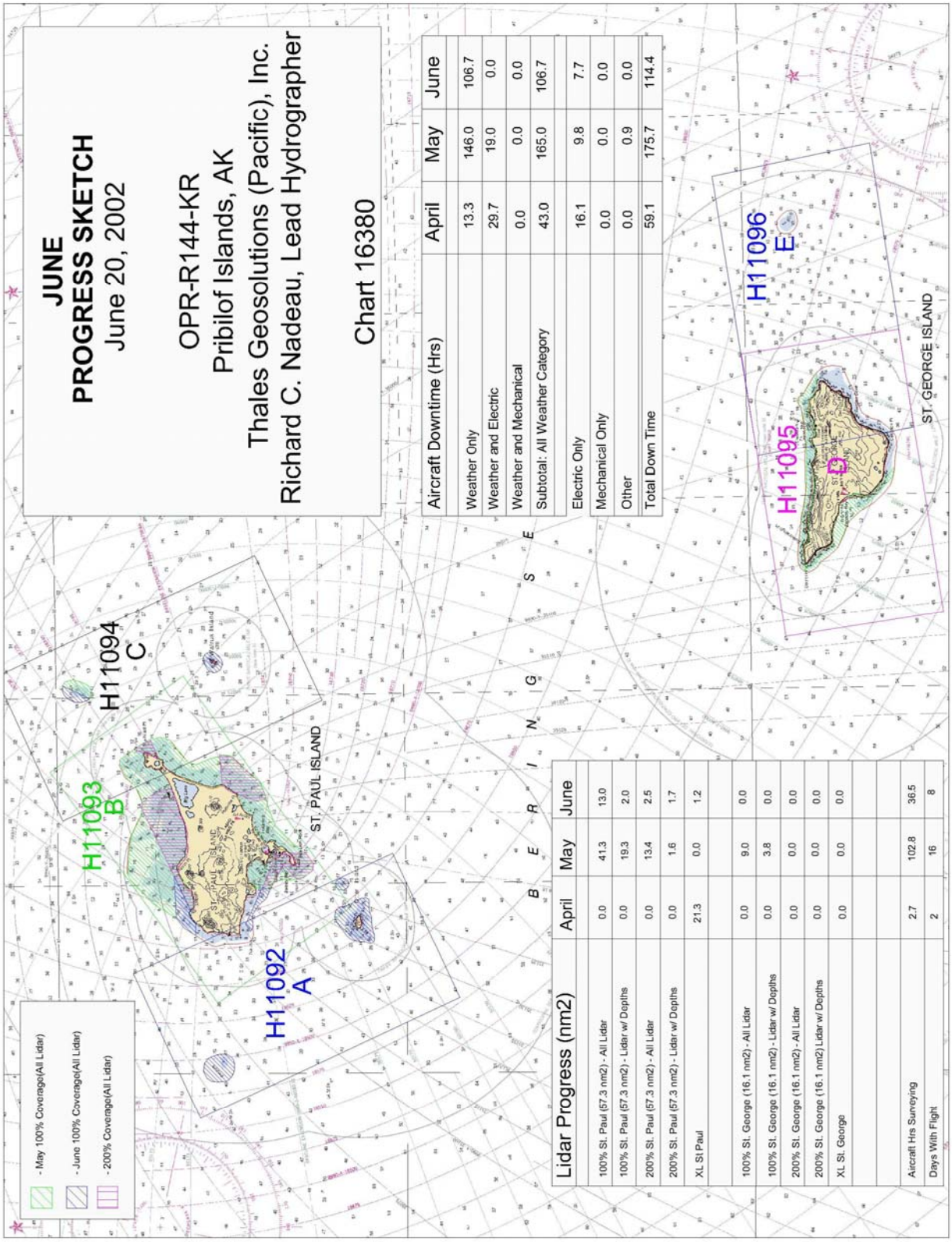
Appendix A - Danger to Navigation

No Dangers to Navigation were located in the survey.[22]

Appendix B - List of Geographic Names

No new geographic names in the survey were discovered.[23]

Appendix C – Progress Sketch



Appendix D - Tides and Water Levels

Abstract of Times of Hydrography For Smooth Tides
Project Number: OPR-R144-KR-02 Registry Number: H11092
Contractor Name: Thales GeoSolutions (Pacific) Inc. Date: Jan 28th, 2003
Sheet Letter: A
Inclusive Dates: June 3, 2002 to June 10, 2002
Verified tides were applied for the production of the smooth sheet. Refer to LCMF's final verified tides report for additional information.

Table 4 Abstract of Times of Hydrography for SHOALS Aircraft

YEAR	DAY	START TIME (UTC)	END TIME (UTC)	COMMENTS
2002	154	06:21:08	07:36:39	
2002	155	02:12:56	02:53:33	
2002	156	04:28:36	07:46:28	
2002	160	18:14:10	23:59:59	
2002	161	00:00:00	00:03:30	
2002	161	07:03:09	07:17:56	

2002 FIELD and FINAL TIDE NOTE

Hydrographic Sheet: H11092 (LIDAR)

Sheet A
SW of St. Paul Island
Bering Sea, Pribilof Islands

NOAA Project No:	OPR-R144-KR-2002 Alaska					
NOAA Contract No:	50-DGNC-0-90017					
The NOS Unalaska, AK tide station (946-2620) served as control for the subordinate station on this project. Datum determinations were made for the primary subordinate station: Village Cove (946-4212). The NTDE 1960-78 was utilized.						
Location and Time Meridian	Name:	Lat (NAD 83)	Long (NAD 83)	Time Meridian:		
	Village Cove	57° 07' 31"	170° 17' 07"	0° (UTC)		
Time Period and Datum Reference	Name:	Established:	Removed:	MLLW	MHW	units
	Village Cove	4/12/2002	6/20/2002	0.000	0.904	meters
Tide observer	LCMF Incorporated 139 E. 51st Ave. Anchorage, Alaska 99503 (under subcontract to Thales GeoSolutions, Anchorage, AK)					
Gauges	Design Analysis H350/355 bubbler systems.					
Installation	Each gauge was secured inside a waterproof case, and fastened vertically inside of the tool shed on the St. Paul City fuel dock. Refer to the tide station package for additional site specific details of installation.					
Tide staff	None. Water level measurements were made using a fiberglass survey tape. The tape end was weighted, lowered to the water till the weight was submerged and the tape was read at a chiseled 'X' on the edge of the dock ladder.					
Benchmarks	The following benchmarks were installed at this site: Village Cove: 4212 N 2002, 4212 P 2002 The following benchmarks were recovered at this site: Village Cove: BM "3" 1946, BM "4" 1946, 4212 L 1976, USACE SP-3 2001, USACE RBD - 1 1994					
Levels	Benchmarks were leveled at the installation and removal of the tidal station. The benchmarks and station datums were connected through frequent measurements to the water. The level runs closed within NOS tolerance. Benchmark USACE RBD - 1 1994 was not stable. Only the closeout levels from 6/19/02 were used in determining the MLLW elevation of BM USACE RBD-1 1994.					
Final Tidal Zoning	One zone for the entire project. Used Village Cove data directly.					
Reduction of LIDAR data	Thales GeoSolutions (the prime contractor) was provided with preliminary datums developed by LCMF during May 2002 based upon an 11 day simultaneous comparison between Unalaska and Village Cove. Six minute tide data reduced to MLLW and smoothed with a 5th order 5 hour polynomial curve fit was provided to Thales throughout the field season. In June 2002, LCMF finalized datums and forwarded all data necessary to reduce lidar soundings to the prime contractor. Final MLLW datums were based on a one month, May 2002, monthly mean computation from Unalaska.					

Appendix E – Shoreline Verification Results and Detached Positions

Shoreline in general compared well with the chart, where it was detected by the system. The shoreline is only depicted on the smooth sheet where the hydrographer believes the system was able to detect the shoreline with better than 20m horizontal accuracy.[24] For more information, see the data quality and chart comparison sections of this report.

Detached positions were not required under this contract.

Appendix F – Grab Sample Results

No grab samples were required for this survey.[25]

Revisions complied during office processing and certification

[1] Concur with clarification; SHOALS 400 LIDAR data acquired in this survey area does not meet NOAA HSSDM requirements (equivalent to IHO Order 1) for object detection. The capability of LIDAR to meet NOAA object detection requirements is still unproven and questionable. In addition, survey specifications of 200% were not met. As a result, 100% bottom coverage was not achieved. The evaluator recommends retaining charted shoal soundings and charted features. These data do meet NOAA HSSDM requirements for depth and position accuracy.
[2] Filed with the hydrographic records
[3] See figure 1a, attached to this repor for actual survey limits.
[4] Filed with the hydrographic records
[5] Concur
[6] Concur
[7] Concur
[8] Concur
[9] Retain all kelp areas as charted.
[10] Concur
[11] Retain charted shoreline
[12] Concur
[13] Filed with the hydrographic records
[14] See endnote 1
[15] See endnote 11
[16] Concur
[17] Concur
[18] Filed with the hydrographic records
[19] Concur
[20] These data should be used to chart soundings and depth curves representing general bathymetric trends, and new shoals and features not depicted on the current edition of NOAA chart 16382. Data meet NOAA HSSDM requirements for depth and position accuracy.
These data should not be used to supersede charted shoals, wrecks, rocks, obstructions, or foul areas. Data do not meet NOAA HSSDM requirements for bottom search and object detection.
The charted shoreline should be retained as charted.
Bottom samples were not acquired and should be retained as charted.
Aids to navigation were not investigated and should be retained as charted.
[21] See endnotes 1 and 20
[22] Concur
[23] Concur
[24] See endnote 11
[25] Retain all bottom characteristics as charted.

APPROVAL SHEET
H11092

Initial Approvals:

The survey and associated records have been inspected with regard to survey coverage, delineation of the depth curves, development of critical depths, cartographic symbolization, and verification or disproval of charted data. The survey records and digital data comply with NOS requirements except where noted in the Descriptive Report and are adequate to supersede prior surveys and nautical charts in the common area.

Gary C. Nelson Date: 13 June 2005

Gary Nelson
Chief Cartographic Team
Pacific Hydrographic Branch

I have reviewed the smooth sheet, accompanying data, and reports. This survey and accompanying digital data meet or exceed NOS requirements and standards for products in support of nautical charting except where noted in the Descriptive Report.

CDR/NOAA Date: 21 JUNE 2005

Donald W. Haines
CDR, NOAA
Chief, Pacific Hydrographic Branch

Jennifer Sherry

Digitally signed by Jennifer Sherry
DN: CN = Jennifer Sherry, C = US, O = HSD, OU = Operations Branch
Reason: AWOIS/SURF check
Location: Operations Branch, HSD
Date: 2005.06.23 13:51:51 -04'00'

NOAA FORM 75-96
(10-83)

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

MARINE CHART BRANCH

RECORD OF APPLICATION TO CHARTS

FILE WITH DESCRIPTIVE REPORT OF SURVEY NO. H11092

INSTRUCTIONS

A basic hydrographic or topographic survey supersedes all information of like nature on the uncorrected chart.

1. Letter all information.
2. In "Remarks" column cross out words that do not apply.
3. Give reasons for deviations, if any, from recommendations made under "Comparison with Charts" in the Review.

CHART	DATE	CARTOGRAPHER	REMARKS
16382	6/6/05	Russ Davies	~~Full~~ Part ~~Before~~ After Marine Center Approval Signed Via PARTIAL application
			Drawing No. of soundings and curves from the smooth
			sheet.
			Full Part Before After Marine Center Approval Signed Via
			Drawing No.
			Full Part Before After Marine Center Approval Signed Via
			Drawing No.
			Full Part Before After Marine Center Approval Signed Via
			Drawing No.
			Full Part Before After Marine Center Approval Signed Via
			Drawing No.
			Full Part Before After Marine Center Approval Signed Via
			Drawing No.
			Full Part Before After Marine Center Approval Signed Via
			Drawing No.
			Full Part Before After Marine Center Approval Signed Via
			Drawing No.
			Full Part Before After Marine Center Approval Signed Via
			Drawing No.
			Full Part Before After Marine Center Approval Signed Via
			Drawing No.