H-11164

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. OPR-0327-KR

Registry No. H-11164

LOCALITY

State ALASKA

General Locality NORTHERN CLARENCE STRAIT

Sublocality LINCOLN ROCK TO DOUBLE ISLAND

2002

CHIEF OF PARTY
DEAN MOYLES

LIBRARY & ARCHIVES

DATE

NOAA FORM 77-28
(11-72)

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

REGISTER NO.

HYDROGRAPHIC TITLE SHEET

H-11164

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 **Northern Clarence Strait**

Sublocality **Lincoln Rock to Double Island**

Scale **1:20,000** Date of Survey **7/17/02-9/06/02**

Instructions Dated **6/24/2002** Project No. **OPR-O327-KR-02**

Vessel **RV Davidson, RV Quicksilver, RV Minotaur, and skiff**

Chief of Party **Dean Moyles**

Surveyed by **Moyles, Arumugam, Reynolds, Orthman, Sipos, Greene**
Harrison, Nadeau, et al

Soundings taken by echo sounder, hand lead, pole **Reson 8101, Reson 8111 and leadline**

Graphic record scaled by **Thales Geosolutions Personnel**

Graphic record checked by **Thales Geosolutions Personnel**

Evaluation by **B Taylor** Automated plot by **HP Design Jet 500**

Verification by **G Nelson**

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

REMARKS: **Times in UTC.**

Revisions and annotations appearing as endnotes were generated during office processing. All separates are filed with the project data. As a result, page numbering- may be interrupted or non-sequential.

Thales Geosolutions	**LCMF**	**Terra Surveys**
3738 Ruffin Road	**139 E. 51st Ave**	**1930 Whiting Circle**
San Diego, CA 92123	**Anchorage, AK 99503**	**Palmer, AK 99645**

A - Area Surveyed

H11164 (Sheet D), is bounded by the coordinate listing below, and encompasses Lincoln Rock to Double Island.[1]

Hydrographic data collection began on July 17, 2002 and ended on September 17, 2002.[2]

Table 1 H11164 Survey Limits

Survey Limits[3] Task Order # 10 H11164 Sheet D Scale 1:20,000		
Point #	Positions on NAD83	
	Degrees Latitude (N)	Degrees Longitude (W)
1	56º04’27.304” N	132º50’47.083” W
2	56º04’27.304” N	132º27’14.180” W
3	55º56’15.194” N	132º27’14.180” W
4	55º56’15.194” N	132º50’47.083” W

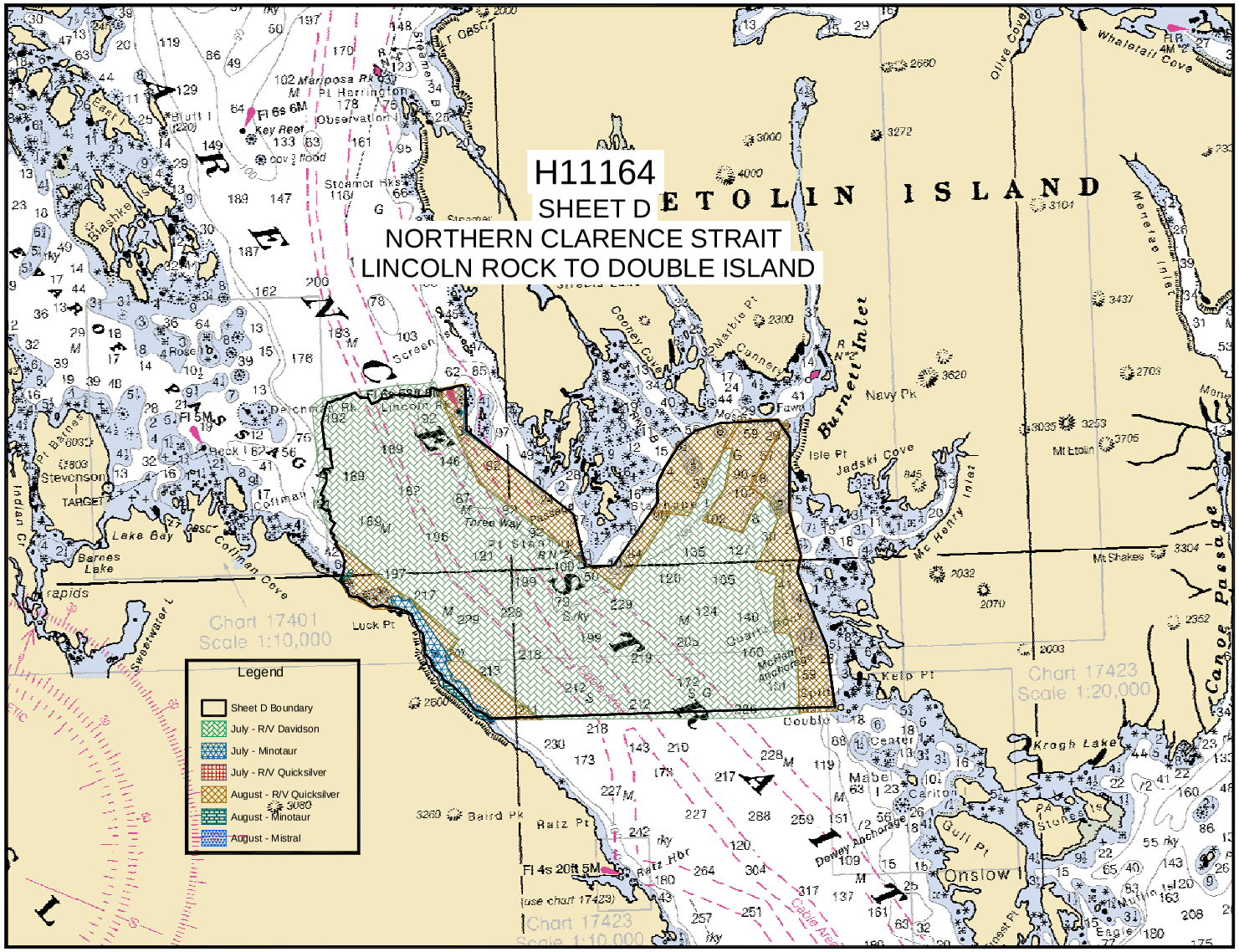


Figure 1 H11164 Survey Limits

B – Data Acquisition & Processing

Refer to the OPR-O327-KR 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

The R/V's Davidson, Quicksilver and Minotaur acquired all sounding data for H11164. The R/V Davidson is 153-foot survey vessel, with a draft of 17.75 feet, equipped with a hull mounted Reson SeaBat 8111 with option 033 (pseudo SideScan) for deep multibeam data acquisition. The Davidson was also equipped with two AML sound velocity and pressure sensors for sound velocity profiles. Vessel attitude was measured using a TSS Heading and Dynamic Motion Sensor (POS/MV) and XTF files logged in ISIS V 5.84.

The Quicksilver, which is 32 feet in length with a draft of 3 feet, was equipped with a Reson 8101 with option 033 (pseudo SideScan) for medium multibeam data acquisition. The vessel was also equipped with two AML sound velocity and pressure sensors for sound velocity profiles. Vessel attitude was measured using a TSS Heading and Dynamic Motion Sensor (HDMS) and XTF files logged in ISIS V 5.84.

The Minotaur was utilized for near shore multibeam data acquisition. The vessel is 29 feet in length, with a draft of 2 feet. The Minotaur was also equipped with a Reason[5] 8101 with option 033 (pseudo SideScan) and two AML sound velocity and pressure sensors for sound velocity profiles. Vessel attitude was measured using a TSS Heading and Dynamic Motion Sensor (POS/MV) and XTF files logged in ISIS V 5.84.

WinFrog v3.2.7 was configured to output a Pseudorange Console (PR-Console) position to ISIS v5.84 for all vessels. The PR-Console position was generated by WinFrog v3.2.7 as the weighted arithmetic average of the pseudo-range positions calculated from the RTCM sources.

Refer to OPR-O327-KR Data Acquisition & Processing Report[6] for a complete listing of equipment and vessel descriptions.

Quality Control

Crosslines

Sheet D was divided into 4 areas for survey operations. Quality control tielines were planned to measure 5 percent of the main scheme line length. Total crossline length surveyed was 51.03 km (27.55 nautical miles) or 6.3 percent of the total main scheme miles. A total of 53 tie line crossings were examined using the CARIS HIPS Q/C report.

The majority of QC Reports fell well within the required accuracy specifications. Reports that had beams below the 95 percent confidence level are associated with the following areas and conditions:

- The majority of beams that fell outside of the 95 percent confidence level were located in areas having extreme steep slopes and/or rocks. The figures below show a few examples of this.

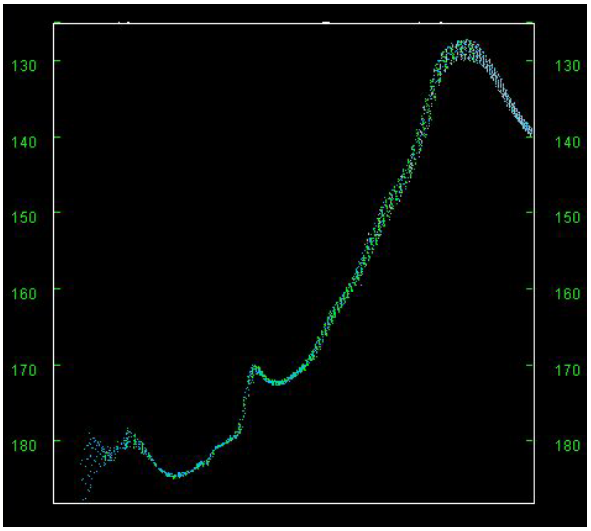


Figure 2: Profile of D01-QC008

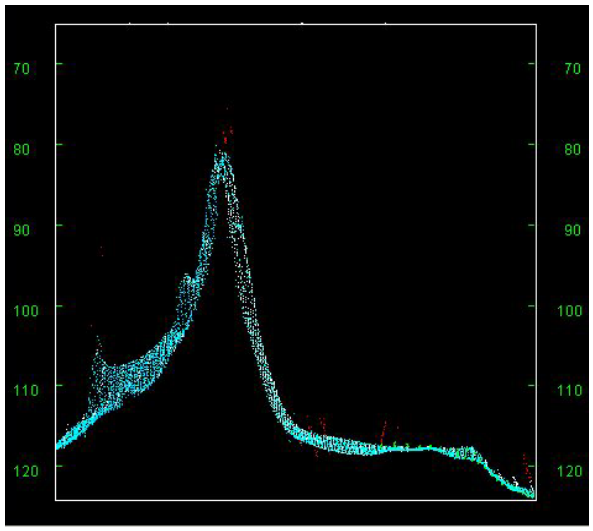


Figure 3: Profile of D01-QC038

- The accuracy of a typical DGPS unit is between 1 to 3 m, and with the constant coming and going of satellites in these areas; it was not uncommon to get a 1 to 3m-navigation jump. Although this is well within the NOS specifications, Figure 1 shows graphically how navigation error versus vertical error can rapidly affect the specified accuracy. For example, with a 1.5m navigation error at a water depth of 25m, if the slope of the bottom is greater then 20º then the beams are outside of the 95 percent confidence level.
- Although the extreme steep slopes and/or rocks caused the majority of failed beams, another concern was SVP refraction. Due to the fast currents associate[7] with the extreme tides in the area, it was virtually impossible to model the water column. To account for this, more sound velocity casts were conducted and survey line spacing decreased. The problem in most cases was not the survey lines but the tielines. The tielines may have used an SVP cast that was one or two kilometers away, causing cupping in the outer beams and thus not achieving the 95 percent confidence level.[8]

Note: The QC reports were generated based on the given accuracy specification of:

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

where, a = 0.5, b = 0.013 and d = depth.

However, since a variance of a difference, rather than a variance from a mean is being used, the a and b values defined in the makehist.cla file within CARIS will use:

$$a = 0.5*\sqrt{2} = 0.707$$
$$b = 0.013*\sqrt{2} = 0.018$$

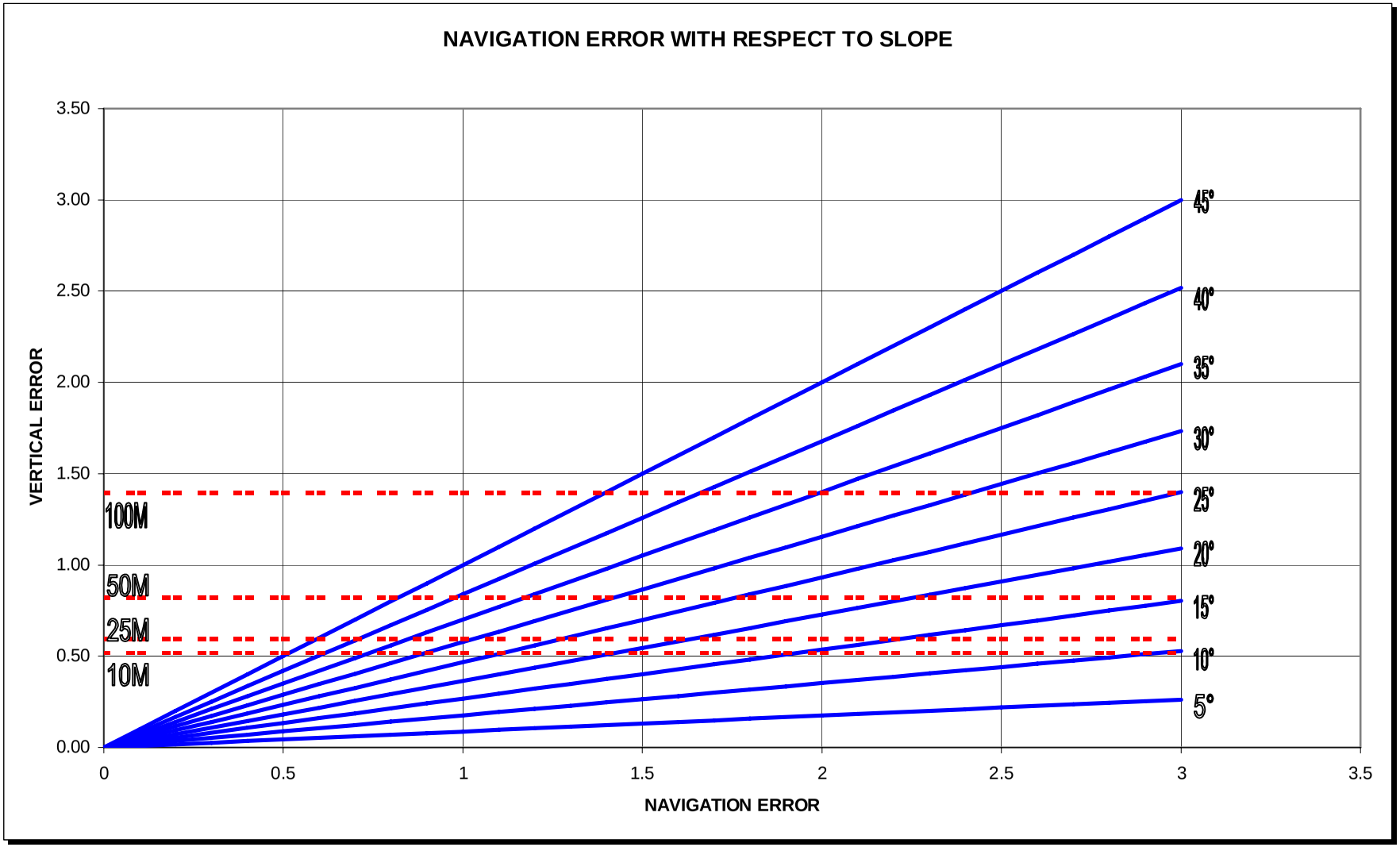


Figure 4: Navigation Error With Respect to Slope

Data Quality

In general the multibeam data quality for H11164 was excellent.[9] A few problems to note are as follows:

- The RTCM devices were configured incorrectly in WinFrog 3.2.7 (Quicksilver-J.D.198-201), and erroneous positioning values were written to the XTF files in ISIS 5.84. These devices were re-configured and the area was re-surveyed.

WinFrog v3.2.7 was configured to output the Pseudorange Console (PR-Console) position to ISIS v5.84 for the bathymetry data in the XTF files. The PR-Console position was generated by WinFrog v3.2.7 as the weighted arithmetic average of the pseudo-range positions calculated from the RTCM sources. Extensive testing revealed that the time between the calculation and the actual output of the PR-Console position was not constant, and since the computer clock in the Triton ISIS computer is set with the time in the PR-Console string from WinFrog v3.2.7, the time stamps in the XTF files were incorrect.

In most cases the latency varied between 0 and 1 sec, but in some instances (less than 5%) the navigation latency could have been up to 2 seconds. On average the survey speeds ranged from 3 to 5 knots, which would result in a horizontal positioning errors of 1.5 – 2.5 meters.

To rectify the variable latency, the navigation data (time and position) from the WinFrog RAW files were extracted and inserted into the XTF files. Since the time logged in the raw files was the GPS time of the position at the time of the calculation, any navigation time latencies (constant or variable) were removed. The XTF files were then re-converted to a new CARIS project. Then the newly generated navigation files were moved into the existing project to overwrite old navigation data. The navigation was then re-examined and the lines remerged in HDCS.[10]

Refer to the Non-Conformance Reports[11] numbered 2002-001 and 2002-002 in Appendix F[12] for a complete description of the problem and resolution.

Survey Junctions

The northeast side of H11164 (Sheet D) junctions with:

Registry #	Scale	Date	Junction Side
H11165	1:10,000	2002	Southwest

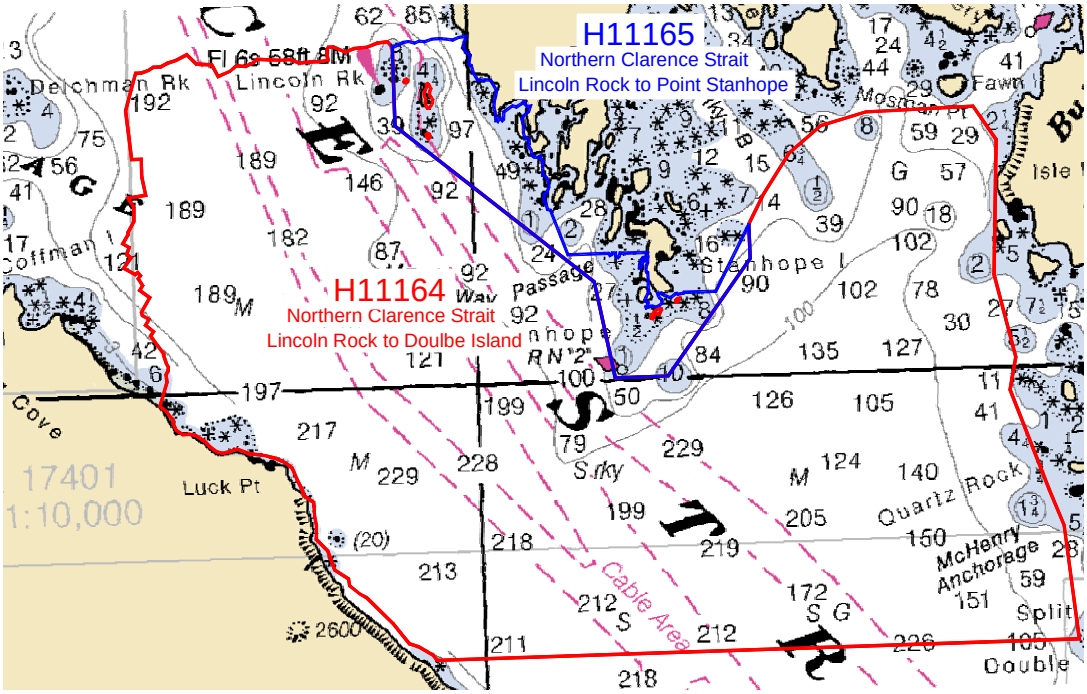


Figure 5: Survey Junction

The surveys are in agreement along their common borders. The agreement was noted in the field using the DTM's created for coverage verification. The conformity is also apparent in their preliminary smooth sheets.[13]

Smooth Sheet Histograms

Figure 6 Histogram is for the Reson 8111 data collected from July 17, 2002 to July 20, 2002 on the Davidson. This histogram shows a number of distinct features, one being the valley around the nadir beams; this is more noticeable on the port side. This is a result of nadir penetration, which is a common feature with Reson 8111 data. As the lines were run, port beams overlapped with port beams and starboard beams overlapped with starboard beams from the adjacent lines. This makes it possible to have higher density data per square meter on the outer edges, leading to a higher chance of sounding selection on the smooth sheet. Also apparent, is the transition from phase to amplitude detection of the sonar (around beams 36 and 71) and any errors due to sound velocity.

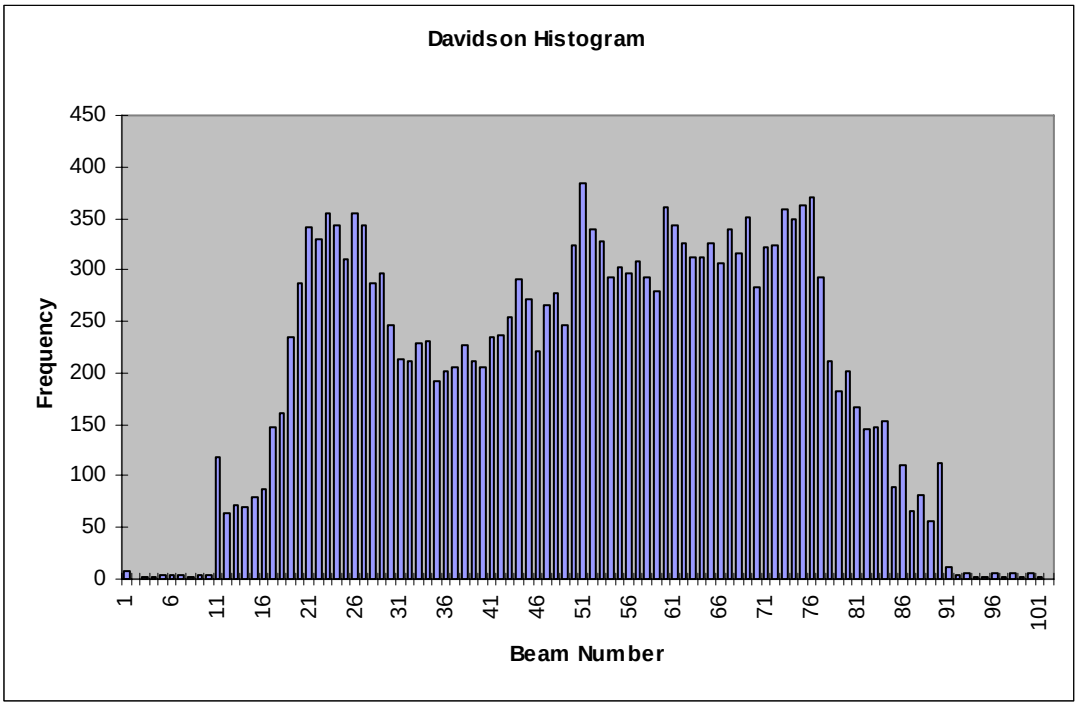


Figure 6 Histogram for 8111 (Davidson)

Figure 7 Histogram is for the Reson 8101 data collected from July 17, 2002 to August 11, 2002 on the Quicksilver. The histogram shows an increase on selected soundings from the outer beams. This is the result of surveying near the shoreline and the simple fact that the outer beams are the shallowest. Also the majority of lines were run,[14] port beams overlapped with port beams and starboard beams overlapped with starboard beams from the adjacent lines. This makes it possible to have higher density data per square meter on the outer edges, leading to a higher chance of sounding selection on the smooth sheet.

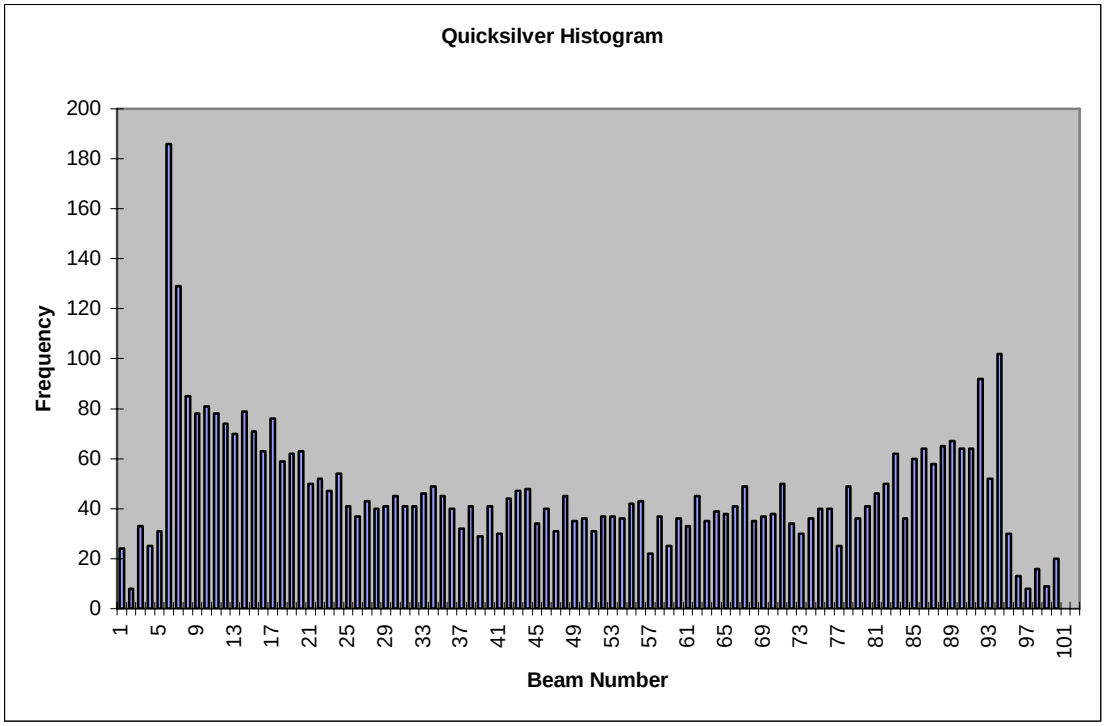


Figure 7 Histogram for 8101 (QuickSilver)

Figure 8 Histogram is for the Reson 8101 data collected from July 17, 2002 to September 17, 2002 on the Minotaur. The histogram shows an increase on selected soundings from the outer beams. This is the result of surveying near the shoreline and the simple fact that the outer beams are the shallowest. Also the majority of lines were run,[15] port beams overlapped with port beams and starboard beams overlapped with starboard beams from the adjacent lines. This makes it possible to have higher density data per square meter on the outer edges, leading to a higher chance of sounding selection on the smooth sheet.

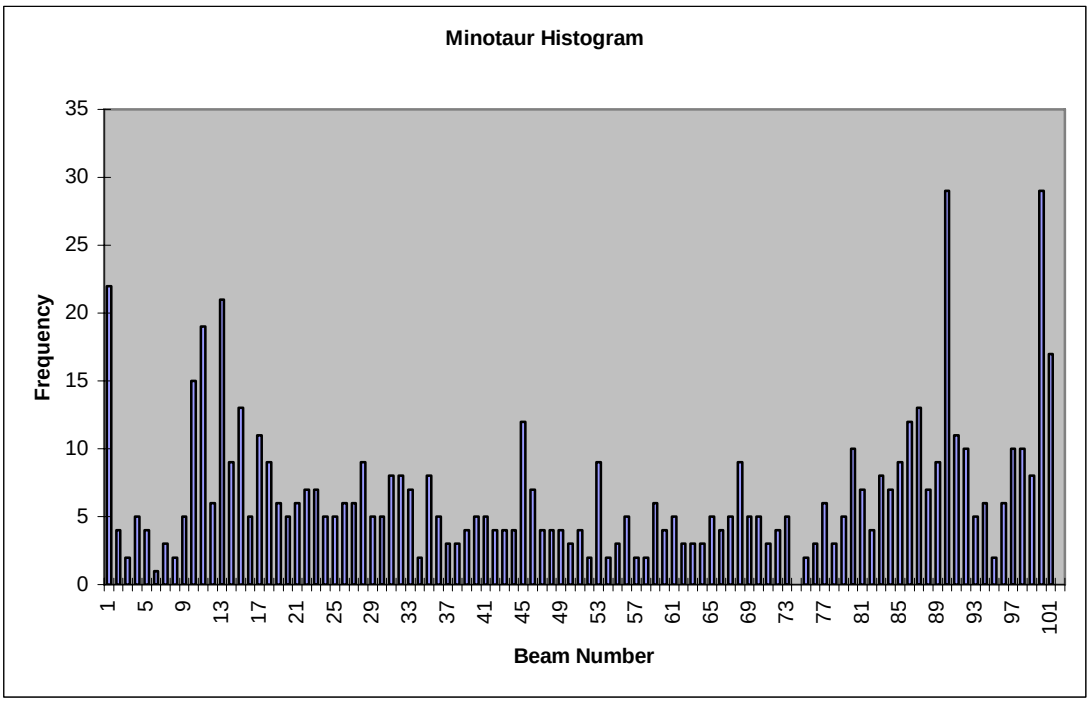


Figure 8 Histogram for 8101 (Minotaur)

Quality Control Checks

During the hydrographic survey OPR-O327-KR the R/V's Davidson, Quicksilver, Minotaur and Mistral conducted a number of confidence checks. This usually consisted of the vessels running two lines in the opposite direction[16] over a reference surface (usually the patch test site). The Reson 8101 systems that were installed on the Quicksilver, Minotaur and Mistral and the Reson 8111 on the Davidson usually compared to within 5 to 10 centimeters. This was also apparent from the results of the confidence checks that were preformed during OPR-O309-KR (Approaches to Icy Bay).

The patch tests that were conducted during OPR-O309-KR (Approaches to Icy Bay) to derive: timing, pitch, heading, roll errors, was[17] also used for OPR-O327-KR (Clarence Strait). It should be noted that due to the navigation latency and the re-processing of the XTF files for the patch test lines, new values were derived for timing, pitch, heading and roll.

These values were then enter[18] into the vessel configuration files for each vessel and utilized in the routine processing for OPR-O327-KR (Clarence Strait).

Positioning system confidence checks where[19] conducted on a daily basis. WinFrog has built in QC windows, where the positioning data was displayed and monitored. The graphics window was configured to show the navigation information in plan view. This includes vessel position, survey lines, and background plots and charts. The Vehicle window can be configured to show any tabular navigation information required. Typically, this window displays position, time, line name, heading, HDOP, speed over ground, distance to start of line, distance to end of line, and distance off line. The Calculation window is used to look at specific data items in tabular or graph format. Operators look here to view GPS satellite constellations and position solutions.

Corrections to Echo Soundings

Refer to the OPR-O327-KR Data Acquisition and Processing Report[20] for a detailed description of all corrections to echo soundings. No deviations from the report occurred.

C – Horizontal & Vertical Control

Refer to the OPR-O327-KR Horizontal and Vertical Control Report[21] for a detailed description of the horizontal and vertical control used on this Survey. A summary of the projects[22] horizontal and vertical control follows. No deviations from the report occurred.

Horizontal Control

The 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. Projection of smooth sheet is in NAD83, UTM (Central Meridian 135º00’00”).

Two MBX-3 differential receivers that used the U.S. Coast Guard (USCG) network of differential beacons were the main source of RTCM. Biorka Island, Level Island and Annette Island were the USCG stations utilized during the OPR-O327-KR survey.

Vertical Control

All sounding data were reduced to MLLW initially using unverified tidal data from one tide station located on Beck Island. A sub-contractor, LCMF, operated the gauges and the data was emailed to the Coffman Cove office at the end of every Julian day.

Table 2 Tide Gauges

Gauge	Model	Gauge Type	Location	Latitude	Longitude[23]	Operational
9450906	H350/355	Digital Bubbler	Beck Island	56º02'47"N	132º51'45" W	07/15/02–09/18/02
9450973	H350/355	Digital Bubbler	Blashke Is.	56º07'38"N	158º06'47"W	08/25/02–09/17/02

On September 24, 2002, LCMF issued verified tidal data and final zoning for OPR-O327-KR and all sounding data was re-merged. For the Preliminary Smooth Sheet verified tidal data were used. Refer to the Vertical and Horizontal Control Report[24] for additional tidal information and station descriptions.[25]

D – Results and Recommendations

Chart Comparison

H11164 survey was compared with charts:

- 17360, 32nd Edition (September 22, 2001, 1:217,828)
- 17382, 14th Edition (September, 2002, 1:80,000)
- 17420, 26th Edition (September 22, 2001, 1:229,376)
- 17423, 13th Edition (February 14, 1998, 1:20,000)

Comparison of Soundings

The soundings in general compare well with the existing charts.[26] Areas of differences to note are[27]:

- Hydrographic survey H11164 revealed a depth of 13.7 fathoms in the vicinity of a 8 fathom sounding on chart 17382 located at 56º03'38.705" N, 132º41'55.310" W (643287.506 E, 6215228.951 N). A 5.3 fathom sounding developed from H11164 is located 155 meters to the south of the 8 fathom charted sounding. This area was surveyed with 100% multibeam coverage.
- Hydrographic survey H11164 revealed a depth of 194 fathoms in the vicinity of a 189 fathom sounding on charts 17382 and 17360 located at 56º02'37.115" N, 132º46'01.911" W (639115.670 E, 6212231.347 N). This area was surveyed with 100% multibeam coverage.[28]
- Hydrographic survey H11164 revealed a depth of 194 fathoms in the vicinity of a 191 fathom sounding on chart 17382 located at 56º02'37.088" N, 132º45'33.586" W

(639574.868E, 6213200.339N). This area was surveyed with 100% multibeam coverage.

- Hydrographic survey H11164 revealed a depth of 48 fathoms in the vicinity of a 64 fathom sounding on chart 17382 located at 56º02’41.897” N, 132º41’17.237” W (644004.666 E, 6213495.183 N). This area was surveyed with 100% multibeam coverage.
- Hydrographic survey H11164 revealed a depth of 84 fathoms in the vicinity of a 92 fathom sounding on charts 17382 and 17420 located at 56º02’13.203” N, 132º40’36.896” W (644732.357 E, 6212631.802 N). This area was surveyed with 100% multibeam coverage.
- Hydrographic survey H11164 revealed a depth of 8.6 fathoms in the vicinity of a 24 fathom sounding on chart 17382 located at 56º02’22.485” N, 132º32’34.744” W (653064.435 E, 6213207.454 N). This area was surveyed with 100% multibeam coverage. Note: A shoaler sounding in the area was issued as a Danger to Navigation.
- Hydrographic survey H11164 revealed a depth of 20 fathoms in the vicinity of a 39 fathom sounding on charts 17382, 17360 and 17420 located at 56º01’39.201” N, 132º32’34.582” W (653114.844 E, 6211869.833 N). This area was surveyed with 100% multibeam coverage.
- Hydrographic survey H11164 revealed a depth of 187 fathoms in the vicinity of a 182 fathom sounding on charts 17382, 17360 and 17420 located at 56º01’42.199” N, 132º43’54.785” W (641339.829 E, 6211559.703 N). This area was surveyed with 100% multibeam coverage.
- Hydrographic survey H11164 revealed a depth of 190 fathoms in the vicinity of a 186 fathom sounding on chart 17382 located at 56º01’31.855” N, 132º44’39.446” W (640577.346 E, 6211214.687 N). This area was surveyed with 100% multibeam coverage.
- Hydrographic survey H11164 revealed a depth of 193 fathoms in the vicinity of a 189 fathom sounding on chart 17382 located at 56º01’04.530” N, 132º45’22.774” W (639854.874 E, 6210345.721 N). This area was surveyed with 100% multibeam coverage.
- Hydrographic survey H11164 revealed a depth of 88 fathoms in the vicinity of a 10 fathom sounding on charts 17382 and 17360 located at 56º00’04.188” N, 132º35’59.611” W (649668.608 E, 6208808.582 N). This area was surveyed with 100% multibeam coverage. This is AWOIS item 52537.[29]
- Hydrographic survey H11164 revealed a depth of 105 fathoms in the vicinity of a 135 fathom sounding on chart 17382 located at 56º00’25.909” N, 132º32’45.444” W (653007.364 E, 6209598.032 N). This area was surveyed with 100% multibeam coverage.
- Hydrographic survey H11164 revealed a depth of 105 fathoms in the vicinity of a 127 fathom sounding on chart 17382 located at 56º00’18.810” N, 132º30’52.340” W (654973.662 E, 6209448.669 N). This area was surveyed with 100% multibeam coverage.
- Hydrographic survey H11164 revealed a depth of 105 fathoms in the vicinity of a 124 fathom sounding on chart 17382 located at 55º59’07.451” N, 132º32’12.471” W

(653664.769 E, 6207193.602 N). This area was surveyed with 100% multibeam coverage.

- Hydrographic survey H11164 revealed a depth of 135 fathoms in the vicinity of a 169 fathom sounding on chart 17382 located at 55º59'01.284" N, 132º33'42.881" W (652105.138 E, 6206947.433 N). This area was surveyed with 100% multibeam coverage.
- Hydrographic survey H11164 revealed a depth of 160 fathoms in the vicinity of a 127 fathom sounding on chart 17382 located at 55º59'28.814" N, 132º34'46.094" W (650980.110 E, 6207759.742 N). This area was surveyed with 100% multibeam coverage.
- Hydrographic survey H11164 revealed a depth of 40 fathoms in the vicinity of a 77 fathom sounding on chart 17382 located at 55º59'33.460" N, 132º37'21.809" W (648277.771 E, 6207809.681 N). This area was surveyed with 100% multibeam coverage.
- Hydrographic survey H11164 revealed a depth of 222 fathoms in the vicinity of a 217 fathom sounding on chart 17382 located at 55º59'31.644" N, 132º43'28.298" W (641931.176 E, 6207539.753 N). This area was surveyed with 100% multibeam coverage.
- Hydrographic survey H11164 revealed a depth of 224 fathoms in the vicinity of a 218 fathom sounding on chart 17382 located at 55º58'07.122" N, 132º39'10.752" W (646481.292 E, 6205076.776 N). This area was surveyed with 100% multibeam coverage.
- Hydrographic survey H11164 revealed a depth of 214 fathoms in the vicinity of a 199 fathom sounding on chart 17382 located at 55º58'30.234" N, 132º37'4.564" W (648643.867 E, 6205865.914 N). This area was surveyed with 100% multibeam coverage.
- Hydrographic survey H11164 revealed a depth of 208 fathoms in the vicinity of a 219 fathom sounding on chart 17382 located at 55º58'08.569" N, 132º34'51.488" W (650973.510 E, 6205276.460 N). This area was surveyed with 100% multibeam coverage.
- Hydrographic survey H11164 revealed a depth of 160 fathoms in the vicinity of a 205 fathom sounding on chart 17382 located at 55º58'27.668" N, 132º33'11.333" W (652688.525 E, 6205927.857 N). This area was surveyed with 100% multibeam coverage.
- Hydrographic survey H11164 revealed a depth of 135 fathoms in the vicinity of a 152 fathom sounding on chart 17382 located at 55º58'42.554" N, 132º32'03.075" W (653855.004 E, 6206429.973 N). This area was surveyed with 100% multibeam coverage.[30]
- Hydrographic survey H11164 revealed a depth of 128 fathoms in the vicinity of a 140 fathom sounding on chart 17382 located at 55º58'48.898" N, 132º30'41.711" W (655257.817 E, 6206676.584 N). This area was surveyed with 100% multibeam coverage.
- Hydrographic survey H11164 revealed a depth of 182 fathoms in the vicinity of a 189 fathom sounding on chart 17360 located at 56º02'39.508" N, 132º44'31.971" W (640638.355 E, 6213309.866 N). This area was surveyed with 100% multibeam coverage.[31]

- Hydrographic survey H11164 revealed a depth of 16 fathoms in the vicinity of a 0.5 fathom sounding on chart 17360 located at 56º02’06.974” N, 132º32’58.097” W (652677.424 E, 6212713.704 N). It should be notes[32] that a 0.5 fathom sounding is located 350 m to the east . This area was surveyed with 100% multibeam coverage.
- Hydrographic survey H11164 revealed a depth of 207 fathoms in the vicinity of a 196 fathom sounding on chart 17420 located at 56º00’40.570” N, 132º42’45.602” W (642600.245 E, 6209694.442 N). This area was surveyed with 100% multibeam coverage.

Since the current charts have very little detail pertaining to the contours the hydrographer was only able to make a general comment.[33] From the figure below you can see that the east side of H11164 in Burnett Inlet has change substantially, new shoal areas are present and some random[34] deepening has occurred.

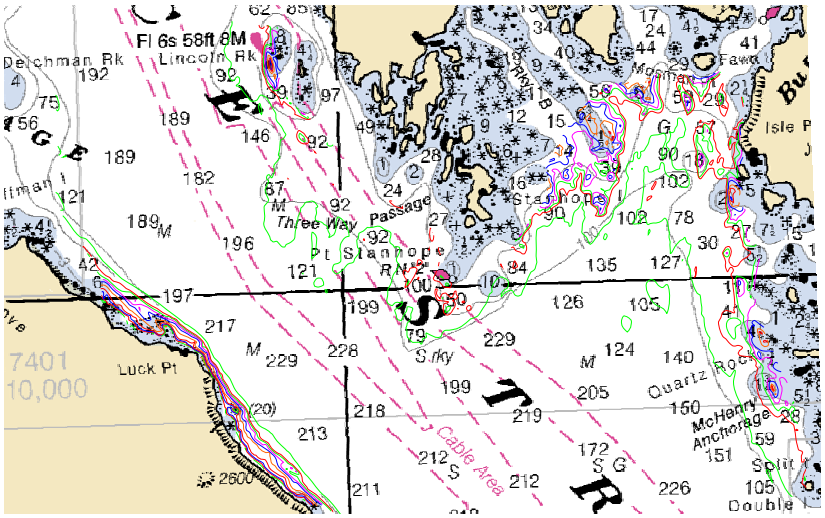


Figure 9 Comparisons of Contours

The MHW line shown on Chart 17360 is approximately 200 m further seaward than corresponding T-sheet MHW line. The MHW line shown on Chart 17382 generally agrees well with the MHW line on corresponding T-sheets, however it is approximately 50 m further seaward in several places. The T-sheet MHW was verified to be in the correct general location by means of limited shoreline verification and was digitized and incorporated into the smooth sheet. The hydrographer recommends that the MHW within the survey area be charted as shown on the smooth sheet.[35]

All charted rocks within the survey limits were identified to correspond with a smooth sheet rock, or cluster of smooth sheet rocks.[36] It should be noted that charted rock symbols are often centered at positions up to 200m away from their corresponding smooth sheet rocks. Charted rock symbols were often disproved with multibeam coverage at their centered

position, and/or, by DPs taken on actual highpoints observed in the area during shoreline verification.[37]

Soundings that differ from hydrographic survey H11164 are highlighted in red on the chart comparison sheet included in Separate 6.[38] Other soundings that differed resulted in a Danger to Navigation and are listed in Appendix A Danger to Navigations.[39]

Automated Wreck and Observation Information System

There were three AWOIS items assigned to OPR-O327-KR, but none were within the limits of H11164.[40]

Charted Features

There were no charted features labeled PA, ED, PD, or Rep within the limits of H11164.[41]

Dangers to Navigation

Nine dangers to navigation were located during the hydrographic survey of H11164 and were submitted on October 16, 2002 and December 5, 2002 respectively. Refer to Appendix A for Submitted Report [42]

Additional Results

Shoreline Verification[43]

Limited shoreline verification was conducted in accordance with SOW 3.4.2 for remote sensing features inshore of the 4-meter curve, including the MHW line. Traditional shoreline verification was conducted in accordance with SOW 3.4.3 for remote sensing features seaward of the 4-meter curve.[44] The 4-meter curve was determined from H11164 multibeam data, where present, and at the hydrographer's discretion in areas where no multibeam data was available.

A 19ft skiff, referred to as the DP Skiff, was used to perform shoreline verification. The skiff was owned and piloted by Mr. Clayton Smalley, a local resident of Coffman Cove, AK, who has over 35 years of extensive local knowledge of the survey area. The DP skiff could generally safely navigate in any area where it could maintain 0.5 meters of under-keel clearance, except in locations of heavy swells near shore. The DP skiff was outfitted with a Garmin GPSMAP 176C differential GPS receiver and a WINFROG data acquisition system. NOAA supplied Thales with photogrammetric shoreline data in raster format for TP-00582, TP-00583, TP-0583, TP-00584, T-12404, T-12373, T-12364, and T-13096 for use as source shoreline. The T-sheet raster images were registered and digitized in AutoCAD by Thales personnel and the resultant vector data were used in WINFROG for field verification. In

addition, the multibeam 4-meter curve and Chart 17382 and Chart 17360 were displayed as layers in WINFROG for reference. The DP skiff was not outfitted with an echosounder, however a leadline was used to take soundings on submerged features.

Traditional verification of remote sensing offshore features was generally performed within a few hours of predicted low water. Traditional verification of remote sensing offshore features was performed by running along the 4-meter curve and taking Detached Positions (DPs) on any feature observed near, on or off-shore of the 4-meter curve. Although the SOW only required that new features observed were to be noted and recommended for additional investigation, all new features actually observed near, on or off-shore of the 4-meter curve were immediately investigated with a DP. Observed features included exposed rocks, reefs, ledges, islets as well as submerged features indicated by visual sightings in clear water, kelp patches, surface action and the pilot's local knowledge. DPs and their corresponding hydrographer's remarks were digitally recorded in WINFROG. Digital photographs were taken for features when feasible. However, photographs were not taken on features that were submerged beneath the water's surface at the time of the DP. Digital photographs were favored over sketches in order to increase efficiency during the limited low tide windows. However, some hand-drawn sketches were also taken and are included in the Hydrographer's Field Notes.[45] A DP form for each DP was digitally produced from the WINFROG file. The DP form also includes the digital photograph, if taken and shows the DP overlaid onto the largest scale chart, the vector shoreline data and associated multibeam coverage. The DP forms and raw field notes can be found on the Project CD under the Reports Directory.

It should be noted that large rocks, generally greater than 20m in size, often received at least two DPs, with a DP taken at each physical extent. The physical extents of DP'd rocks were also often outlined as corresponding gaps in associated multibeam coverage. In such instances, the corresponding smooth sheet rock symbol was placed in the center of the extents as defined by DPs and/or the gap in multibeam coverage.[46]

Limited verification of the MHW line (remote sensing shoreline) was generally performed during periods of mid to high tide. However, limited verification of the MHW line was also performed concurrently with low tide investigation of offshore features in select areas at the hydrographer's discretion. The general location of the MHW line was determined by running as close to the shoreline as possible, generally 2-20 meters offshore and periodically recording an EVENT in WINFROG approximately every 10-45 seconds. Taking an EVENT digitally recorded the vessel's time and position and the hydrographer's remarks. Typical hydrographer's remarks were "GL HWL OK" for sections where the General Location of the MHW Line appeared to match the photogrammetric shoreline data to within 20 meters. In areas where there appeared to be a potential discrepancy, remarks typically described the location of the apparent MHW line in reference to the skiff at the time of the EVENT. For example, "HWL 5m to E" meant that the apparent MHW line was 5m to the east of the skiff at the time of the EVENT. EVENTS were plotted during office review and overlaid onto H11164 multibeam coverage plots, T-sheets, and affected charts for final MHW verification. DP Forms were not produced for EVENTS and EVENTS are not depicted on the DP plot, however, EVENTS are provided in a supplemental AutoCAD file.[47]

Limited verification of remote sensing features inshore of the 4-meter curve was performed concurrently with both limited verification of the MHW line (performed at mid-high tide) and traditional verification of offshore features (performed at low tide). EVENTS were taken to record hydrographer's remarks for most inshore features. Typical remarks included "DM rk ok" and "DM rk not seen". It should be noted that in such instances, the skiff's location, and therefore the EVENT position, was often at a significant distance (> 20 meters) away from the actual location of the inshore feature. The EVENTS for features inshore of the 4-meter curve were plotted during office review and compared to the multibeam coverage, T-sheets, and the chart. If a feature inshore of the 4-meter curve appeared to be inadequately located on the remote sensing source, it is listed as a recommendation for additional item investigation. Although it was not required by the SOW, some select inshore features were investigated by traditional verification (i.e. coming alongside the feature and recording a DP and photograph) when it was determined by the hydrographer that doing so had minimal operational impact on collecting required DPs.[48]

Source Shoreline – Verified features

T-sheet rocks and features that were located by traditional verification (DP or multibeam) and determined to be within 20 meters of their source position are shown on the smooth sheet in black at their surveyed positions with associated surveyed depth/height values.[49] This includes new rocks that were found to be high points of verified T-sheet ledges and reefs. They are not itemized in this report.

T-sheet rocks and features that fell in areas that received only limited verification (any feature inshore of the 4-meter curve that was not DP'd) were retained and are shown on the smooth sheet in black at their T-sheet positions with their T-sheet heights/depths.[50] Exceptions are itemized in the "Shoreline – Changes" section. Near shore features that are being recommended for additional item investigation are itemized in the "Recommendations for Additional Item Investigation" section.

All sections of T-sheet MHW line that were within the survey area were determined to be in the correct general location (within 20 meters) by means of limited shoreline verification and are shown on the smooth sheet in black.[51]

Source Shoreline – Changes[52]

The following are T-sheet rocks that were located by DP or multibeam to be > 20m from there[53] source position. They are shown on the smooth sheet in black at their surveyed position with surveyed heights/depths unless noted.[54] They are considered as new rocks with their corresponding T-sheet rocks disproved.

1. T-sheet rock (0 ft height MLLW), at 55 59 55.23 N, 132 46 36.43 W (X = 638648.69 Y = 6208162.45) was positioned by DP# JD228_03 as a rock (cov 2 ft at MLLW) at 55 59 54.34 N, 1232[55] 46 33.90 W (X = 638680.52 Y = 6208149.78).[56]

2. T-sheet rock (2 ft height MLLW), at 55 59 51.14 N, 132 46 27.62 W (X = 638805.32 Y = 6208041.14) was positioned by DP# JD228_04 as a rock (3 ft height at MLLW) at 55 59 50.27 N, 132 46 26.31 W (X = 638828.8640 Y = 6208015.8612)[57]
3. T-sheet rock (1 ft height MLLW), at 55 59 41.45 N, 132 46 9.30 W (X = 639132.37 Y = 6207751.88) was positioned by DP# JD228_13 as a rock (1 ft height MLLW) at 55 59 40.49 N, 132 46 08.67 W (X=639144.24 Y=6207722.48).[58]
4. T-sheet rock (2 ft height MLLW), at 55 59 25.20 N, 132 45 19.27 W (X = 640015.31 Y = 6207277.61) was positioned by DP# JD228_16 as a rock (2 ft height MLLW) at 55 59 24.73 N, 132 45 17.16 W (X = 640052.30 Y = 6207264.52).[59]
5. T-sheet rock (no height label) at 55 59 10.62 N, 132 44 21.82 W (X = 641025.32 Y = 6206859.64), was positioned by DP# JD229_05 as a rock (7 ft height MLLW) at 55 59 11.63 N, 132 44 21.92 W, (X=641022.57 Y=6206890.62).[60]
6. T-sheet rock (no height label) at 55 59 2.66 N, 132 44 0.54 W (X = 641402.03 Y = 6206625.49) was described by DP# JD229_07 to be the high point (15 ft height MLLW) of a charted/DM ledge and is shown on the smooth sheet in red at its T-sheet position but with its height changed according to this survey.[61]
7. T-sheet islet (5 ft height MHW) centered at 55 58 13.04 N, 132 43 6.73 W (X = 642384.98 Y = 6205122.80) was described by DP# JD229_15 through JD229_19 to be an islet with a height (10 ft height MHW) and is shown on the smooth sheet in black at its T-sheet position but with its height changed and a surrounding ledge added according to this survey. CH 17382 shows an islet (20 ft height MHW). The hydrographer recommends that the charted islet height be revised according to this survey.[62]
8. T-sheet rock (no height label) at 55 58 0.17 N, 132 43 15.70 W (X = 642242.73 Y = 6204719.82) was positioned by DP# JD231_07 as a rock (4 ft height MLLW) at 55 58 02.59 N, 132 43 10.95 W (X = 642322.53 Y = 6204797.36).[63]
9. T-sheet rock (no height label) at 55 57 59.12 N, 132 43 14.63 W (X = 642262.22 Y = 6204688.04) was positioned by DP# JD231_08 as a rock (3 ft height MLLW) at 55 58 01.37 N, 132 43 10.22 W (X = 642336.46 Y = 6204759.95).[64]
10. T-sheet rock (no height label) at 55 57 52.69 N, 132 43 15.19 W (X = 642259.07 Y = 6204488.77) was described by DP# JD232_01 to be the high point (13 ft height MLLW) of a new ledge that extends westward from shore to 55 57 52.15 N, 132 43 10.90 W (X = 642334.00 Y= 6204474.72). T-sheet rock is retained on smooth sheet in red and shown with height from this survey. New ledge is shown on the smooth sheet in black.[65]
11. T-sheet rock (no height label) at 55 56 50.82 N, 132 41 36.75 W (X = 644029.43 Y = 6202633.27) was positioned by DP# JD232_19 as a rock (12 ft height MLLW) at 55 56 51.16 N, 132 41 35.62 W (X = 644048.61 Y = 6202644.56).[66]
12. T-sheet rock (no height label) at 55 56 37.41 N, 132 41 5.30 W (X = 644588.64 Y = 6202237.09) was positioned by DP# JD231_11 as a rock (10 ft height MLLW) at 55 56 38.61 N, 132 41 07.13 W (X = 644555.76 Y = 6202273.15).[67]

Source Shoreline – Disprovals

1. T- sheet rock (cov 0 ft at MLLW) at 55 59 51.40 N, 132 46 25.54 W (X = 638841.09 Y = 6208050.32) was disproved by 100% multibeam coverage. The multibeam data indicated a shoal rising to a depth of 1.799 meters MLLW. However, this sounding was not shown on the smooth sheet as a selected sounding due to shoaler nearby soundings.[68]

Recommendations for Additional Item Investigations

1. T-sheet rock (cov 2 ft at MLLW) at 55 59 27.15 N, 132 45 38.40 W (X = 639682.00 Y = 6207327.06) was not seen during a visual search, DP# JD228_14. The hydrographer considers the visual search to be inconclusive, due to the fact that the search was for a submerged rock in a localized region of limited water clarity. Complete multibeam coverage was obtained at its corresponding charted position, which was offshore of the 4-meter curve. However, only partial multibeam coverage was obtained at the T-sheet position, which is inshore of the 4-meter curve. No rock was found in the multibeam coverage. The hydrographer recommends 100% multibeam coverage to be performed at high tide at the T-sheet position, with a 50 m search radius. The T-sheet rock is retained on the smooth sheet in black.[69]

2. T-sheet rock (no height label) at 55 57 1.10 N, 132 41 53.50 W (X = 643728.35 Y = 6202941.50) was not seen during limited shoreline verification. The T-sheet rock is inshore of the 4-meter curve and did not receive traditional verification. There is no multibeam coverage at the T-sheet rock location. The hydrographer recommends that a traditional verification (a visual search with DP) be performed and/or 100% multibeam coverage be performed at high tide at the T-sheet rock position, with a 50m-search radius. The T-sheet rock is retained on the smooth sheet in black.[70]

3. T-sheet rock (no height label) at 55 56 57.37 N, 132 41 48.47 W (X = 643819.33 Y = 6202829.10) was not seen during limited shoreline verification. The T-sheet rock is inshore of the 4-meter curve and did not receive traditional verification. There is no multibeam coverage at the T-sheet rock location. The hydrographer recommends that a traditional verification (a visual search with DP) be performed and/or 100% multibeam coverage be performed at high tide at the T-sheet rock position, with a 50m-search radius. The T-sheet rock is retained on the smooth sheet in black.[71]

4. T-sheet rock (no height label) at 55 56 33.04 N, 132 40 59.53 W (X = 644693.26 Y = 6202105.52) is outside the required survey limits and was not addressed by either traditional or limited shoreline verification. However, multibeam data was collected outside the required survey limits offshore of the T-sheet rock location and is represented on the smooth sheet with selected soundings. Consequently, the T-sheet rock is retained on the smooth sheet and shown in black for clarity. The hydrographer recommends that traditional shoreline verification be performed at the location of the T-sheet rock.[72]

5. A multibeam gap inshore of the 4 –meter curve indicates a likely shoal. The shallowest multibeam sounding found in the data was a 1.937 m MLLW (Line 2DFILL-005, profile 2766, beam 101) at 55-59-34.71N, 132-45-52.50W and[73] is represented on the smooth sheet as a 1 fathom sounding. However, the actual least depth was likely not obtained due to only partial multibeam coverage over the feature. The multibeam gap was investigated by DP# JD 254_02. No exposed feature was seen. The DP skiff conducted a 10-minute leadline search, however limited water clarity prevented the DP Skiff from finding the shoal. The hydrographer recommends that the shoal be investigated with 100% multibeam during a period of extreme high tide.[74]

Tidal Range

LCMF established the tidal range for OPR-O327-KR Clarence Strait to be 4.632 meters (15.19feet or 2.53 fathoms). This value was used in determining height above MHL.[75]

Shoreline Correlator Sheet

ArcMap 8.2 with the Shoreline Correlator add-on, written by the Thales GeoSolutions (Pacific) Inc. GIS department, aided in the processing of the Shoreline Verification results. The correlator utilized the Winfrog Log files to create an individual DP form for all acquired DP's. The correlator was mapped to the Log, Tide, Photos, NOAA Chart (largest scale available), T-Sheet, Smooth Sheet Soundings and Multibeam Coverage files to calculate and display the desired information for each DP. Figure 1 shows an example of a DP form produced from the Correlator. The DP forms and raw field notes can be found on the Project CD under the Reports Directory.[76]

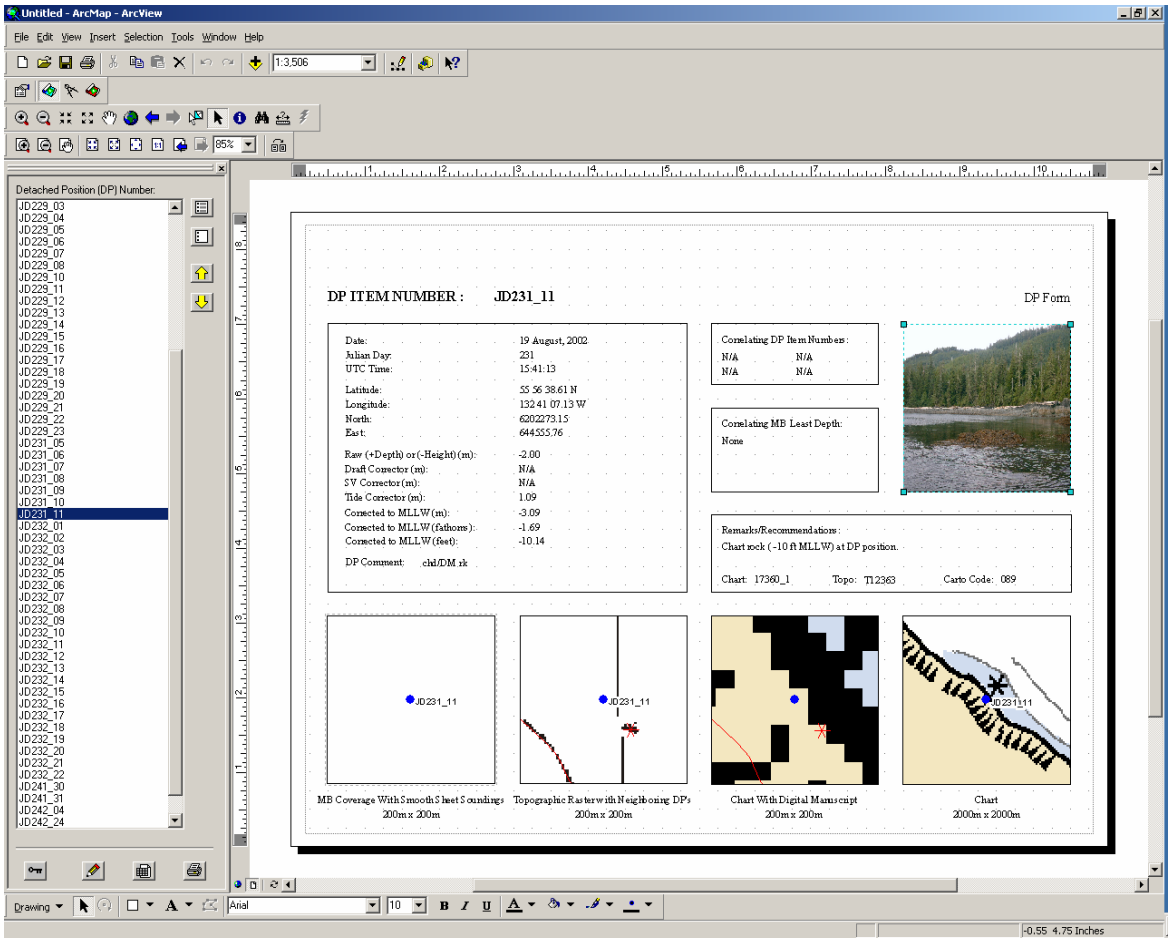


Figure 10 DP Correlator Sheet

Bottom Samples

Bottom Samples were not required under this contract.[77]

Aids to Navigation

Lincoln Rock West Light (Fl W 6 s), Light List No. 22470, was investigated by DP# JD241_30 and DP #JD41_31 in accordance with Section 7.2 of NOS Specifications and Deliverables. The characteristics described in the Light List are correct. Lincoln Rock West Light adequately serves the intended purpose for which it was established. The Light is fixed with a concrete foundation on Lincoln Rock.

Table 3 Position of Aid to Navigation

Name	Type	Surveyed Position	Charted Position (17401)	Listed Position	Position Difference (m) Survey-Charted	Position Difference (m) Charted-Listed
FI 6s 58ft 8M	Fixed Aid	56º03’23.68”N	56º03'25.34 N	56º03’24"N		
		132º41’51.20”W	132º41'50.87 W	132º41’48"W	51.62	64.71

The light list position was disproved by multibeam coverage. The CH17382 position was disproved by DP# JD242_24, which located a new rock. The T-sheet position was verified by DP# JD241_30 and DP# JD241_31, which positioned the Northern and Southern extents of the rock on which the light stands. The T-sheet position also corresponds well to a correlating gap in multibeam coverage. Lincoln Rock West Light is shown on the smooth sheet at its T-sheet position.

The hydrographer recommends that the chart be revised to show Lincoln Rock West Light at is T-sheet position. [78]

E – Approval Sheet

Approval Sheet

For

H11164

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

OPR-O327-KR statement of work and hydrographic manual;
Thales GeoSolutions (Pacific) Inc. Acquisition Procedures (AP-2438-01 & AP-ISIS-01);
Thales GeoSolutions (Pacific) Inc. Processing Procedures (PP-2438-01);
Technical Report for Tides, Clarence Strait.

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,

Dean Moyles, Thales GeoSolutions (Pacific) Inc.
Lead Hydrographer
TGP Survey Party

Appendix A - Danger to Navigation

Nine Dangers to Navigation were located in the survey.[79]

Hydrographic Survey Registry Number: **H11164**

Survey Title: State: ALASKA Locality: Northern Clarence Strait Sub-locality: Lincoln Rock to Double Island

Project Number: OPR-0327-KR-02

Survey Dates: August - September 2002

Depths are reduced to Mean Lower Low Water using predicted tides.

Positions are based on the NAD83 horizontal datum.

CHARTS AFFECTED:

Chart	Scale	Edition	Date
17360	1:217,828	32nd	09/22/01
17382	1:80,000	14th	04/26/97
17420	1:229,376	26th	09/22/01

DANGER:

Feature	Depth(ft or fms)	Latitude (N)	Longitude (W)
Sounding	7 1/2 fms	56/02/38.6	132/33/20.4
Sounding	4 1/2 fms	56/02/27.4	132/33/15.0
Sounding	4 1/2 fms	56/02/01.7	132/34/07.3
Sounding	7 fms	56/01/56.0	132/34/05.0
Sounding	7 1/2 fms	56/01/36.3	132/33/56.5
Sounding	4 1/2 fms	56/01/27.4	132/34/21.6
Sounding	8 1/2 fms	56/01/13.5	132/33/00.7
Sounding	2 3/4 fms	55/59/06.5	132/28/50.3

COMMENTS:

Questions concerning this report should be directed to the Chief, Pacific Hydrographic Branch (N/CS34),

at (206) 526-6836.

Hydrographic Survey Registry Number: **H11164**

Survey Title: State: ALASKA Locality: Northern Clarence Strait Sub-locality: Lincoln Rock to Double Island

Project Number: OPR-0327-KR-02

Survey Dates: August - September 2002

Depths are reduced to Mean Lower Low Water using predicted tides.

Positions are based on the NAD83 horizontal datum.

CHARTS AFFECTED:

Chart	Scale	Edition	Date
17360	1:217,828	32nd	09/22/01
17382	1:80,000	14th	04/26/97
17420	1:229,376	26th	09/22/01

DANGER:

Feature	Depth(ft or fms)	Latitude	Longitude
Sounding	3 1/4 fms	56/02/58.7N	132/31/34.4W

COMMENTS:

Questions concerning this report should be directed to the Chief, Pacific Hydrographic Branch (N/CS34),

at (206) 526-6836.

Appendix B - List of Geographic Names

No new geographic names in the survey were discovered.[80]

Appendix C – Progress Sheet

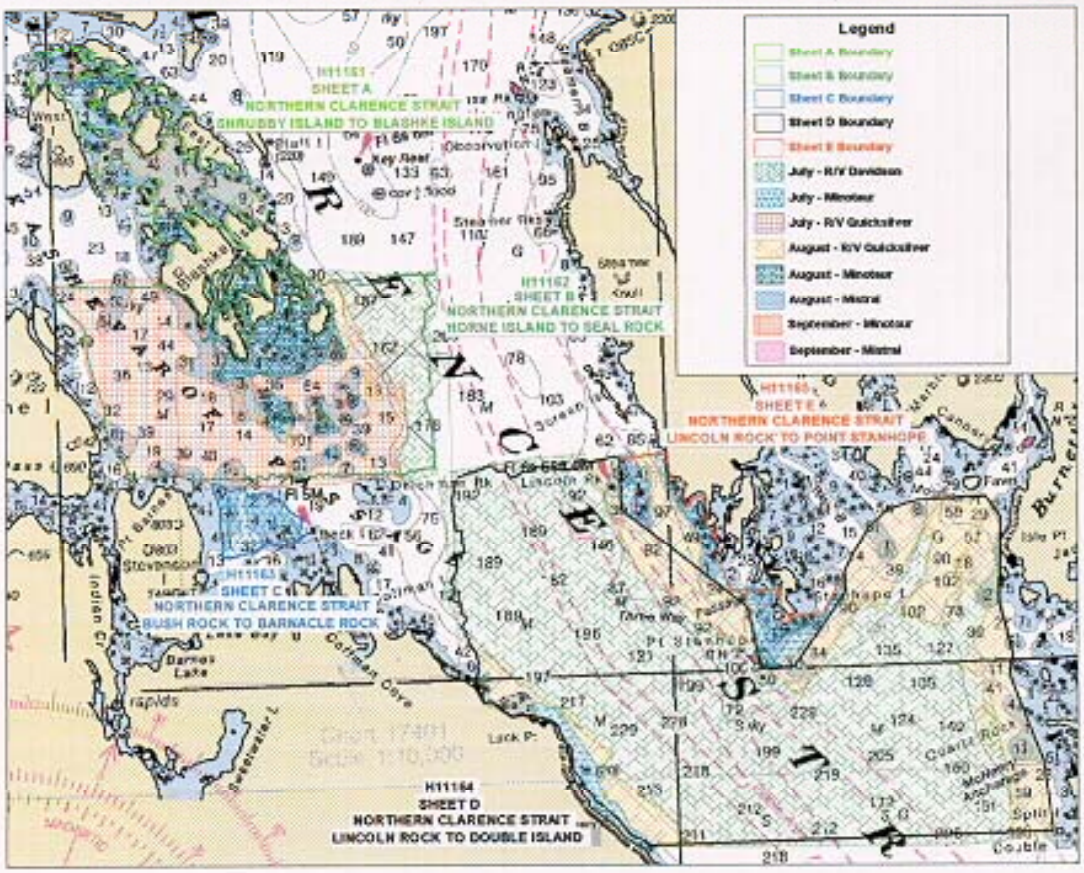
PROGRESS SKETCH

OPR-O327-KR-02
Northern Clarence Strait
Shrubby Island to Point Stanhope
Thales GeoSolutions (Pacific) Inc.

Dean Moyles, Lead Hydrographer
Chart 16360

Start Date: 7/17/02
End Date: 9/17/02
Submitted Date: N/A

Sheet	Month	DAS	LNM	SQNM	SVP Casts	Bottom Samples	AWOIS Completed	No. of Tide Gauges	Diff. Stations	Weather Downtime	Equipment Downtime
Sheet A	July	0	0	0	0	N/a	0	0	0	0	0
Sheet B	July	15	267.12	14.61	37	N/a	0	1	0	0	0
Sheet C	July	15	66.09	1.20	22	N/a	0	1	0	0	0
Sheet D	July	15	279.59	24.96	40	N/a	0	1	0	0	0
Sheet E	July	15	97.25	3.62	17	N/a	0	1	0	0.05	0.13
Sheet A	August	31	213.39	3.88	72	N/a	2	1	0	0	0
Sheet B	August	31	225.64	5.6	77	N/a	2	2	0	0	0
Sheet C	August	31	5.4	0.03	3	N/a	2	1	0	0	0
Sheet D	August	31	97.68	1.56	23	N/a	2	1	0	0	0
Sheet E	August	31	22.35	0.12	17	N/a	2	1	0	7.2	0.13
Sheet A	September	17	74.9	0.4	25	N/a	1	1	0	3.9	0.7
Sheet B	September	17	46.9	0.2	23	N/a	1	2	0	0	0
Sheet C	September	17	1	0	3	N/a	1	1	0	0	0
Sheet D	September	6	1	0	1	N/a	1	1	0	0	0
Sheet E	September	9	1	0	1	N/a	1	1	0	0	0



Appendix D - Tides and Water Levels

2002 FIELD and FINAL TIDE NOTE

Hydrographic Sheet: H11164

Sheet D
Lincoln Rock to Double Island
Northern Clarence Strait, Alaska

NOAA Project No:	OPR-O327-KR-2002 Clarence Strait, AK
NOAA Contract No:	50-DGNC-8-90028

The NOS Ketchikan, AK tide station (945-0460) served as control for the subordinate station on this project. Datum determinations were made for the tertiary subordinate station: Beck Island (945-0906). The NTDE 1960-78 was utilized.

Location and Time Meridian	Name:	Lat (NAD 83)	Long (NAD 83)	Time Meridian:		
	Beck Island	56° 02' 47"	132° 51' 45"	0° (UTC)		
Time Period and Datum Reference	Name:	Established:	Removed:	MLLW	MHW	units
	Beck Island	7/15/2002	9/18/2002	0.000	4.632	meters

Tide observer	LCMF, Inc. 139 E. 51st Avenue Anchorage, AK 99503 (907) 273-1825
Gauges	Three Design Analysis H350/355 bubbler systems.
Installation	Each gauge was secured inside a waterproof Pelican case, and fastened vertically inside of an Weatherport Tent. Refer to the tide station package for additional site specific details of installation.
Tide staff	No tide staff was installed. Leveling was performed from a tidal benchmark to the water surface. The water height was read using a metric rod with a stilling well attached to remove interference from waves.
Benchmarks	The following benchmarks were installed at this site: Beck Island: none The following NOS benchmarks were recovered at this site: Beck Island: 0906 A 1978, 0906 B 1978, 0906 C 1978, 0906 D 1978, 0906 E 1978
Levels	Benchmarks were leveled at the installation, reinstallation 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 and the benchmarks were stable.
Final Tidal Zoning	Tide zones SA129, SA130 and SA133 were used to apply tide data from Beck Island to reduce hydrographic soundings to MLLW.
Reduction of Hydrographic data	Thales Geosolutions, Pacific (the prime contractor) was provided with preliminary datums developed by LCMF during July 2002 based upon a short series simultaneous comparison between Ketchikan and the subordinate station. 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 October 2002, LCMF finalized datums and forwarded all data necessary to reduce hydrographic soundings to the prime contractor.

Appendix E - AWOIS

RECRD	52537	VESSLTERMS	SOUNDING	CHART	17382	AREA	O
		CARTOCODE	0067	SNDINGCODE	130	DEPTH	

NATIVLAT		NATIVLON		Convert		NATIVDATUM	31
LAT83	56 00 03.7	LONG83	132 36 00.7	Update GP		GPQUALITY	Med
	56 0 3.7		132 36 0.7			GPSOURCE	Scaled
LATDEC	56.001027777778	LONDEC	132.60019444444				

PROJECT	OPR-O327-KR	ITEMSTATUS	Assigned	SEARCHTYPE	Full
RADIUS	300	INIT	MCR	ASSIGNED	2/14/2000
TECNIQ	MB,ES				

Techniqnote

History

HISTORY
SOURCE UNKNOWN-- ISOLATED 10 FM SOUNDING APPEARS ON 6TH ED OF CHART 17382 IN 1963 AS A RESULT OF (RE) APPLYING SURVEYS TO EXTEND THE CHART SOUTHWARD. CHARTED IN POS.56-00-03.7 N 132-36-00.7 W NAD 83. ENTERED 2/00 MCR

Fieldnote

INVESTIGATION

DATE(S): 07/31/02 (DN: 212)

HYDROGRAPHIC SURVEY NUMBER:H11164

VN:Qiucksilver TIME: 00:42:55

INVESTIGATION METHODS USED: (IE DI, 200% SIDE SCAN SONAR, ECHO SOUNDER) 200% Multibeam abd Backscatter coverage

SURVEYED POSITION: LAT. 56 00 03.7 N LON. 132 36 00.7 W, searched 300m radius circle.

POSITION DETERMINED BY: DIFFERENTIAL GPS

INVESTIGATION SUMMARY: . The multibeam and backscatter data was reviewed in Delphmap and no shoal soundings were found in the area.

CHARTING RECOMMENDATION (HYDROGRAPHER): It is recommended that this sounding be removed from the affected charts.

EVALUATOR COMMENTS: Remove sounding from Charts 17382, 17360 and 17420 and chart with current survey data.

Proprietary

YEARSUNK		NIMANUM		SYSTEMNUM	11700	Print Record

Appendix F - Non-Conformance Reports[81]

NON-CONFORMANCE REPORT

Project Number:	P2544	Date: 11/5/2002
Project:	Hydrographic Survey, Alaska 2002	
Client:	NOAA (OPR-O327-KR-02)	
Vessel:	R/V Davidson, F/V Quicksilver, M/V Minotaur, F/V Mistral	
Reported:	D. Arumugam, D. Moyles	
Compiled:	D. Arumugam	

Description of Non-Conformance:

Positioning errors in some bottom features were noted during processing. The Navigation latency in the Patch tests were not consistent. Variable navigation latency in the navigation software (WinFrog) has been identified as the source of the positioning errors.

Discussion:

In most cases the Navigation latency was between 0 and 1 sec, causing a maximum horizontal positional error of 4m (maximum speed of survey was 8knots). On average the survey speeds were in the range of 3 to 5 knots, which result in horizontal position errors of 1.5 – 2.5 meters. There are also some instances (less than 5%) that the Navigation latency could be up to 2 seconds. Since the area of survey in Clarence strait had features of steep slopes any little error in horizontal position created a vertical error that failed IHO specifications.

The computer clock in the ISIS (acquisition software) computer is set with the time in the NMEA Position string, which comes from WinFrog v3.2.16 (navigation software) computer. The time between the calculation and the output of the NMEA Position string is not constant, hence the variable Navigation time latency. In addition to the above WinFrog outputs the same time and position if no new calculation was complete in time for the output cycle. Since ISIS uses this time to set its clock, the time in ISIS gets set back by a second. If two calculations occur before an output, you would see the time go ahead by one second. This causes some of the time stamps in the XTF files to be incorrect. The XTF file stores 5 different time stamps for each ping, which are listed below:

1. PING TIME (hh:mm:ss.00) The Bathy time.

2. FIX TIME (hh:mm:ss.00) The most recent navigation update time.

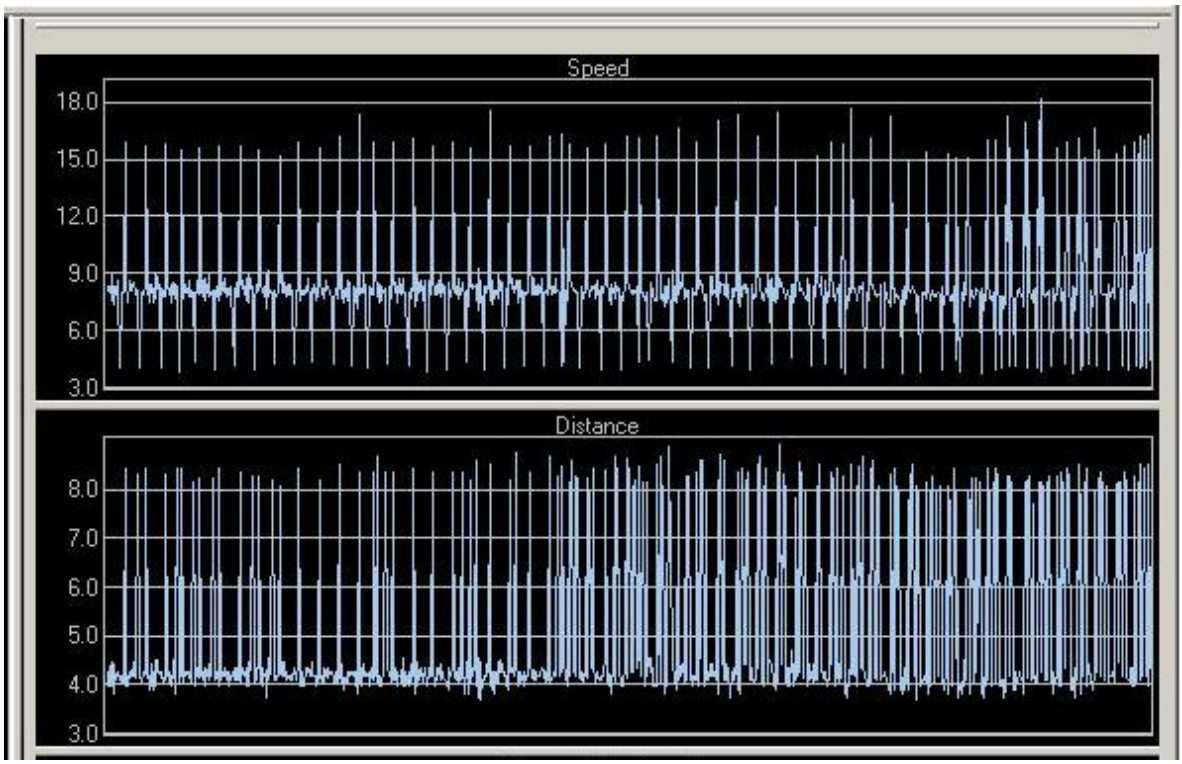
3. ATTITUDE TIME (milliseconds) The time used to coordinate Bathy data with Attitude data. The time the Bathy ping was received.

4. NAV FIX TIME (milliseconds) The time when navigation received.

5. BYTE COMPUTER CLOCK TIME (hh:mm:ss.00) The ISIS computer clock time when ping was received.

Of the five clocks only the three hh:mm:ss.00 clocks gets reset by ISIS. The 2 millisecond clocks (timers) continues to increment.

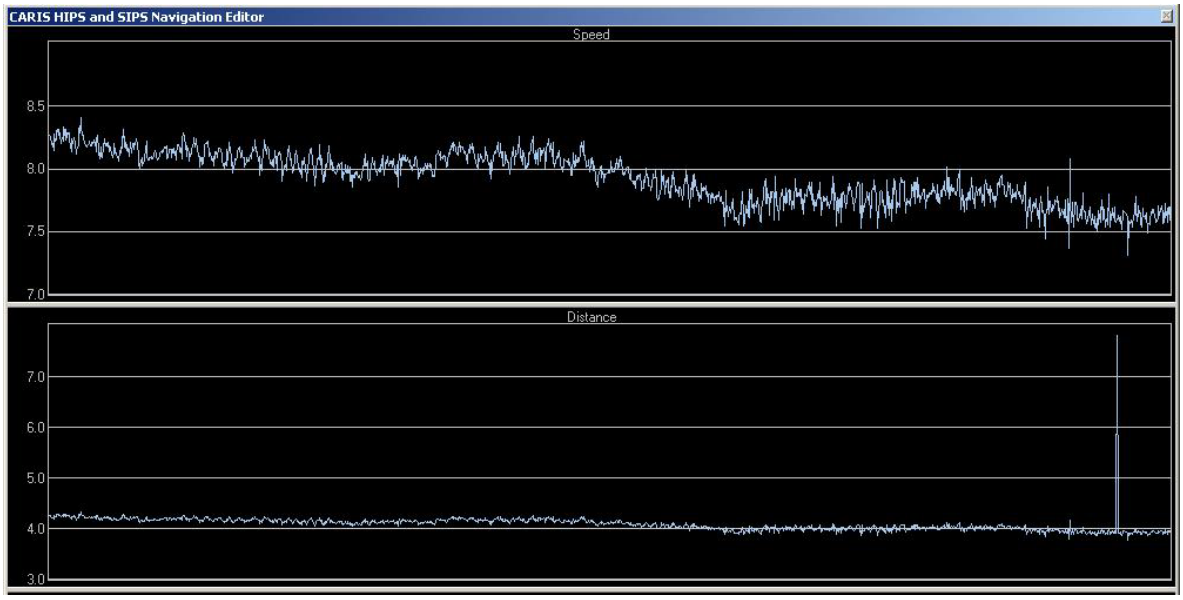
When converted to Caris the millisecond times are used to generate all the times in Caris. Since the millisecond timers have no reference the first ping used to set the reference time (Attitude time = Ping time). As a result if the first ping time is off by a second the whole line will have that error. Once converted to Caris the Navigation editor shows the following:



Since Caris users the millisecond clocks to generate its clocks we see speed jumps in the Navigation data.

Resolution

The XTF files were fixed (detailed below) then reconverted to a new Caris project. Then the newly generated Navigation files moved into the existing project to overwrite old Navigation data. This Navigation was then examined the data remerged in Caris.



In fixing the XTF files the problem was broken into 2 parts.

1. Fix the variable latency.
2. Calculate the time error in the first ping.

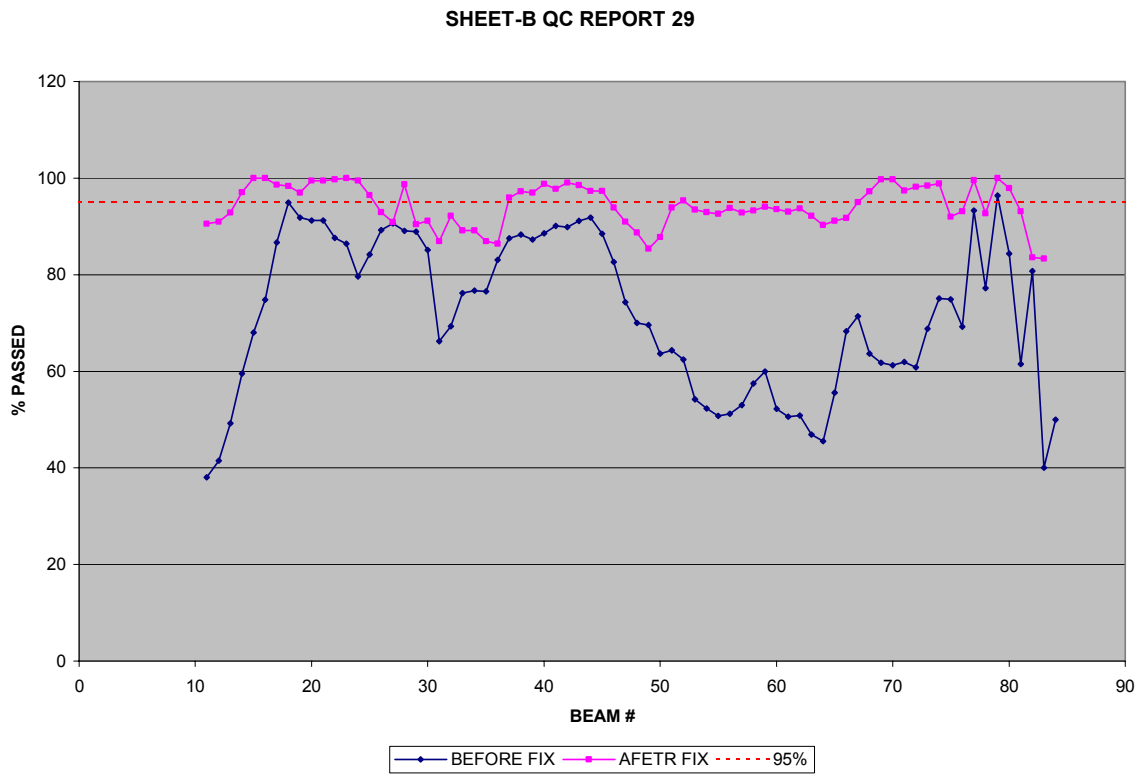
To fix the variable latency the Navigation data (time and position) from the WinFrog RAW files were extracted and inserted into the XTF files. Since the time logged in the raw files was the GPS time of the position at the time of the calculation, any Navigation time latencies (constant or variable) were removed.

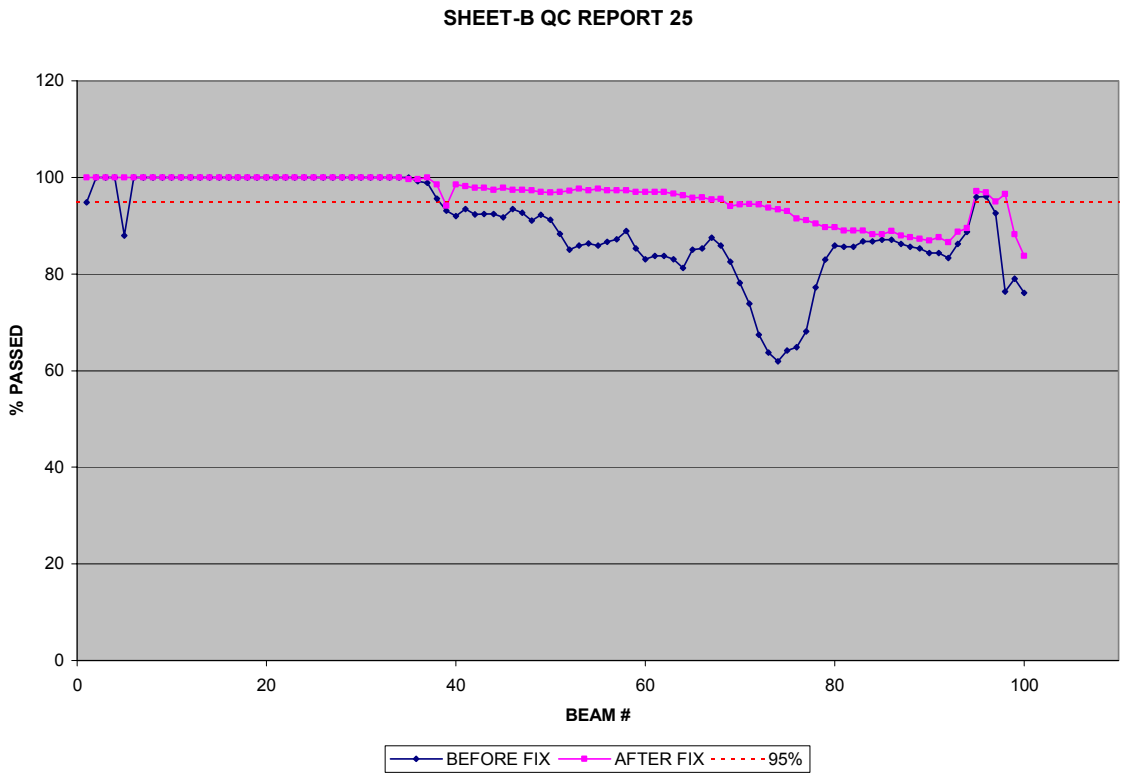
To calculate the time error in the first ping, the time differences between each Attitude time and Ping time were calculated. The minimum from this data was the time error in the first ping. The ping time as logged in the XTF file (comes from the NMEA string) can never go ahead in time, since that was true it was possible to use this formula. This difference was then applied to the first ping time.

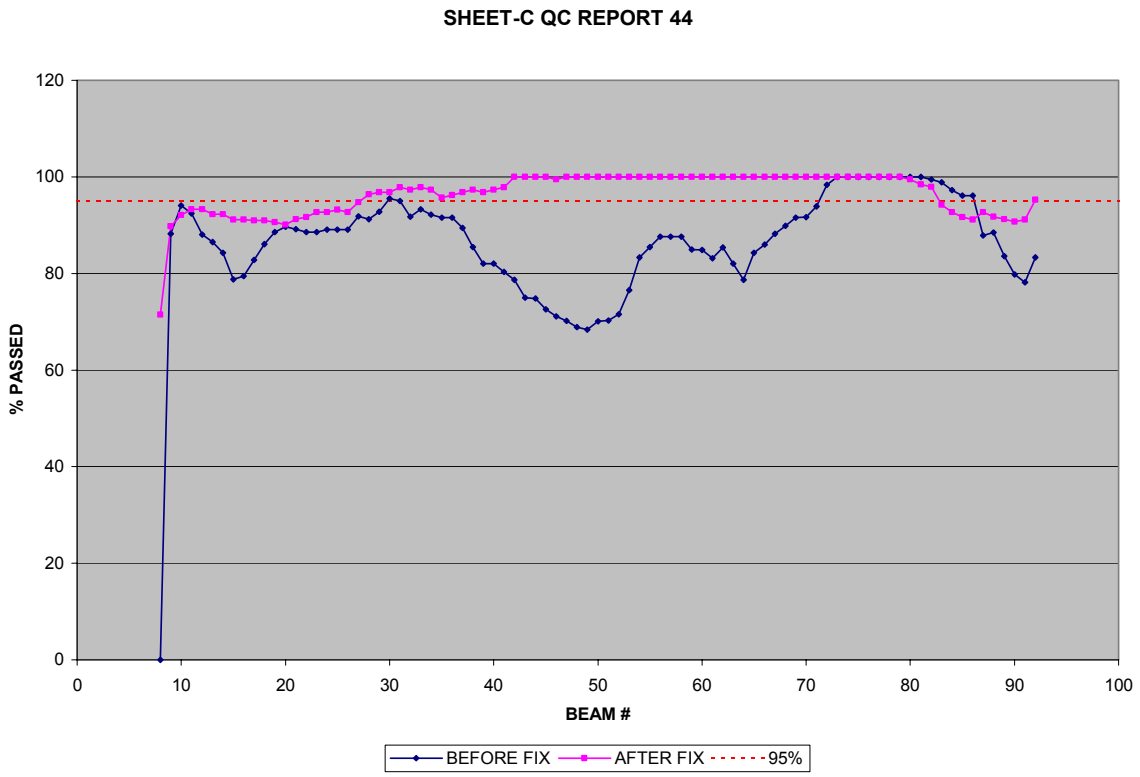
To keep things consistent all ping times were also corrected using the first ping time and the attitude time. The corrected XTF files are named with a *_C* at the end of the original filename.

Results

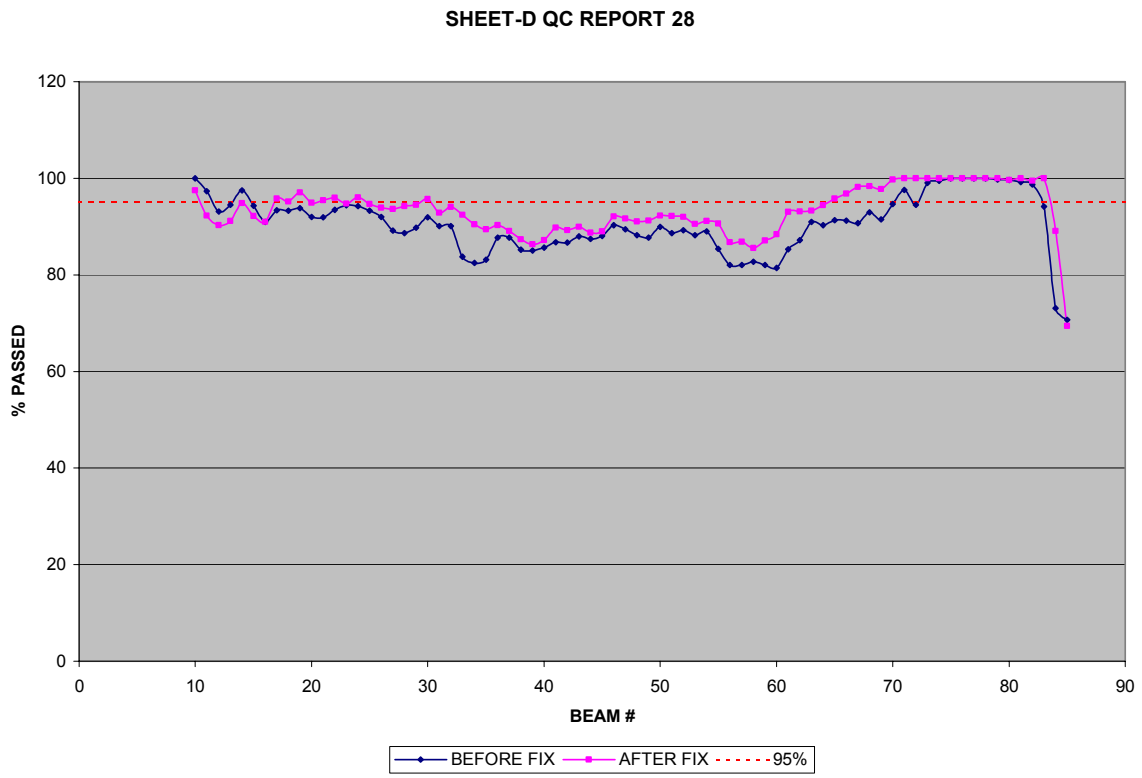
Below are some examples of QC Reports before and after the fix.




SHEET-B QC REPORT 25
% PASSED
BEAM #
BEFORE FIX
AFTER FIX
95%


SHEET-C QC REPORT 44
% PASSED
BEAM #
BEFORE FIX
AFTER FIX
95%

As per the graph it is clear that the QC results improved greatly for the above QC reports. This was true for about 80 – 90% of the QC reports. There were a few instances in which the results after the fix did not improve by much. The following is an example.



Around 40 QC results were compared by graphing the before and after. In no instances was it visible that this resolution degraded the QC results.

Revisions Compiled During Office Processing and Certification

[1] Concur with clarification. The coordinates define the sheet limits. Refer to Surdex for the limits of the survey area. Lincoln Rock is east of the western survey limit and Double Island is outside the southeastern survey limit.

Note that the project number was mistakenly listed on the smooth sheet title block and supplementary plots (filed with the project reports) as OPR-0309-KR. It has been corrected at Pacific Hydrographic Branch on the smooth sheet to OPR-0327-KR.

[2] Data collection ended on September 6, 2002.

[3] Concur with clarification. The positions given define the sheet limits. Survey limits are roughly defined by:

Lat 56/04/15, Lon 132/48/00
Lat 56/04/15, Lon 132/27/14
Lat 55/56/15, Lon 132/27/14
Lat 55/56/15, Lon 132/48/00

[4] Filed with the project reports.

[5] Strikethrough ~~Reason~~, replace with "Reson".

[6] Filed with the project reports.

[7] Strikethrough ~~associate~~, replace with "associated".

[8] Crossline data met or exceeded requirements for quality control.

[9] Concur. The data is adequate to supersede all prior surveys and charted miscellaneous source data except as specifically discussed in this report.

[10] PHB review of the data after reprocessing indicated that the latency issue was satisfactorily resolved and the data is within IHO standards.

[11] The title Non-Conformance Reports is in error. The problem described was satisfactorily resolved and the data is in conformance with IHO standards.

[12] Attached to this report.

[13] Concur. H11164 also junctions with H10959 and H11058. Examination of the junction areas during PHB processing showed very good correlation, generally within 0-2 fathoms. Charted depth curves within the common areas have been drawn with consideration for all data sets within the common areas. Supersede depths from H10959 in the common areas except as specifically noted in this report and the Hdrawing.

[14] Strikethrough ~~the majority of lines were run~~, replace with "in the majority of lines run".

[15] Strikethrough ~~the majority of lines were run~~, replace with "in the majority of lines run".

[16] Strikethrough ~~the opposite direction~~, replace with "in opposite directions".

[17] Strikethrough ~~was~~, replace with "were".

[18] Strikethrough ~~enter~~, replace with "entered".

[19] Strikethrough ~~where~~, replace with "were".

[20] Filed with the project reports.

[21] Filed with the project reports.

[22] Strikethrough ~~projects~~, replace with "project's".

[23] Longitude for Blashke Island gauge 9450973 is in error. Strikethrough ~~158º06'47"W~~ and replace with "132°53'39"W".

[24] Filed with the project reports.
[25] Also see Final Tide Note, attached to this report.
[26] Do not concur. While there was consistency with the charts in some areas, the survey also found considerable deviation from charted contours and soundings in many areas, including a number of uncharted shoals.

Note that errors occurred in the depiction of contours on the smooth sheet. Contour errors have been corrected on the Hdrawings.

Chart areas discussed below based on current survey information.

[27] Concur with hydrographer's findings except as noted. Chart areas discussed below based on current survey information.
[28] Concur, with exception. The latitude given is incorrect. The easting is correct and the correct latitude is 56/02/6.25N.
[29] Concur with clarification. The area was surveyed with 200% multibeam coverage for the AWOIS investigation. See the AWOIS form attached to this report for further information.
[30] Concur, with exception. The shoalest sounding falling on the charted sounding is 136 fathoms.
[31] Do not concur. No sounding is charted at this position on 17360.
[32] Strikethrough ~~notes~~, replace with "noted".
[33] Note that errors occurred in the depiction of contours on the smooth sheet. Contour errors have been corrected on the Hdrawing.
[34] Strikethrough ~~random~~.
[35] Concur.
[36] Concur, with exception. Three charted rocks did not correspond to rocks shown on the smooth sheet and are not specifically addressed in the Descriptive Report. See endnote 52 for further information.
[37] Chart features according to the smooth sheet except as noted in this report and the Hdrawings.
[38] Filed with the project reports.
[39] Strikethrough ~~Danger to Navigations~~, replace with "Dangers to Navigation". Attached to this report.
[40] Do not concur. AWOIS item 52537 is within the limits of H11164 and is discussed under Chart Comparison, page 14 of this report, and endnote 29. See AWOIS form attached to this report for charting recommendation.
[41] Concur.
[42] Attached to this report. Differences between reported DtoNs and the final smooth sheet are discussed below.

- DtoN Sounding 7½ fms, Lat 56/02/38.6N, Lon 132/33/20.4W, is shown on the smooth sheet as 7.6 fms and on Chart 17382 as 7 fm 3 ft. Chart according to the smooth sheet.
- DtoN Sounding 4½ fms, Lat 56/02/27.4N, Lon 132/33/15.0W appears on the smooth sheet as 4.9 fms and on Chart 17382 as 4 fms 3 ft. Chart according to the smooth sheet.
- DtoN Sounding 4½ fms, Lat 56/2/1.7N, Lon 132/34/7.3W appears on the smooth sheet as 4.8 fms and on Chart 17382 as 4 fms 3 ft. Chart according to the smooth sheet.
- DtoN Sounding 7½ fms, Lat 56/1/36.3N, Lon 132/33/56.5W appears on the smooth sheet as 7.7 fms and on Chart 17382 as 7 fms 3 ft. Chart according to the smooth sheet.

- DtoN Sounding 4½ fms, Lat 56/01/27.4N and Lon 132/34/21.6W is shown on the smooth sheet as 4.7 fathoms and on Chart 17382 as 4 fms 3 feet. Chart according to the smooth sheet.
- DtoN Sounding 8½ fms, Lat 56/01/13/5N, Lon 132/33/0.7W appears on the smooth sheet as 8.7 fms and on Chart 17382 as 8 fms 3 feet. Chart according to the smooth sheet.
- DtoN Sounding 2¾ fms, Lat 55/59/6.5N, Lon 132/28/50.3W appears on the smooth sheet as 3 fms and on Chart 17382 as 2 fms 5 feet. Chart according to the smooth sheet.
- DtoN Sounding 3¼ fms, Lat 56/02/58.7, Lon 132/31/34.4W appears on the smooth sheet as 3.3 fms and on Chart 17382 as 3 fms 1 foot. Chart according to the smooth sheet.

[43] Shoreline verification was analyzed during office processing and compiled to the Hdrawings 17382h11.164, 17423ins.164 and 17360h11.164 as warranted.
[44] Concur.
[45] Filed with the project reports.
[46] Chart according to the smooth sheet except as specifically noted in this report and the Hdrawings.
[47] Filed with the project reports.
[48] Features have been compiled on the Hdrawings as depicted on the smooth sheet, except as specifically noted in this report.
[49] Verified features with Detached Positions are shown on the Hdrawings in red.
[50] Unverified features from remote source data are shown on the Hdrawings in blue on level 5.
[51] RSD shoreline is shown on the Hdrawings in blue on level 5.
[52] Because the scope of the survey did not include complete shoreline verification, charted ledges in some areas are not considered disproved. Due to scale considerations, rocks with detached positions have been incorporated into the ledge line where warranted. The evaluator recommends retaining the ledges as depicted in the Hdrawings, with revisions based on the current survey.

Three charted rocks that were not addressed in the Descriptive Report or the multibeam data have been retained in green on the Hdrawing. The rocks fall within the smooth sheet designated foul area, but seaward of the ledge line supported by the data. Their locations are:

- Lat 55/59/39.3N, Lon 132/46/17.22W
- Lat 55/59/37.19N, Lon 132/46/14.13W
- Lat 55/59/24.19N, Lon 132/45/36.22W

Retain rocks as charted.
[53] Strikethrough ~~there~~, replace with “their”.
[54] Verified features with Detached Positions are shown on the Hdrawing in red. Chart features at smooth sheet positions except as noted.
[55] Strikethrough ~~1232~~, replace with “132”.
[56] Concur. Chart as shown on the smooth sheet.
[57] Concur. Chart as shown on the smooth sheet.
[58] Concur. Chart as shown on the smooth sheet.
[59] Concur. Chart as shown on the smooth sheet.
[60] Concur. Chart as shown on the smooth sheet.

[61] Concur, with exception. The high point is not depicted on the smooth sheet. It has been incorporated into the ledge on the Hdrawing. Chart according to the Hdrawing.
[62] Concur. Due to scale, the verified rock at Lat 55 58 12.17N and Lon 132 43 5.04W has been incorporated into the ledge on the Hdrawing. Chart according to the Hdrawing. See DP Correlator Form JD229_20 (filed with the project reports) for further information.
[63] Concur. The rock has been incorporated into the ledge on the Hdrawing. Chart according to the Hdrawing.
[64] Concur. The rock has been incorporated into the ledge on the Hdrawing. Chart according to the Hdrawing.
[65] Concur, with exception and clarification. The high point of the ledge is not depicted on the smooth sheet. A rock at Lat 55/57/48.54N and Lon 132/43/9.64 is depicted on the smooth sheet with a height of 13 ft MLLW. The rock has been incorporated into the ledge on the Hdrawing. Chart according to the Hdrawing. See DP Correlator Form JD232_02 (filed with the project reports) for further explanation.
[66] Concur. The rock has been incorporated into the ledge on the Hdrawing. Chart according to the Hdrawing.
[67] Concur. The rock has been incorporated into the ledge on the Hdrawing. Chart according to the Hdrawing.
[68] Concur with clarification. There is no rock charted at this position. Chart area according to smooth sheet.
[69] Concur. The rock is shown in blue on Level 5 of the Hdrawing. Chart according to the smooth sheet.
[70] Concur with clarification. The rock has been incorporated into the ledge on the Hdrawing. Chart according to the Hdrawing.
[71] Concur with clarification. The rock has been incorporated into the ledge on the Hdrawing. Chart according to the Hdrawing.
[72] Concur with clarification. The rock has been incorporated into the ledge on the Hdrawing, shown in blue on Level 5. Resurvey as national survey priorities and budget allow.
[73] Strikethrough ~~The shallowest multibeam sounding found in the data was a 1.937 m MLLW (Line 2DFILL-005, profile 2766, beam 101) at 55-59-34.71N, 132-45-52.50W and~~, replace with "A multibeam sounding of 1.937m MLLW (Line 2DFILL-005, profile 2766, beam 101) at Lat 55-59-34.71N, Lon 132-45-52.50W was the shallowest found in the vicinity of a gap. It".
[74] Concur with clarification. The shoal is within a foul area on the smooth sheet. Chart according to the smooth sheet.
[75] Strikethrough ~~MHL~~, replace with MHW.
[76] Filed with the project reports.
[77] Concur. Bottom samples have been retained in green on the Hdrawings from Charts 17382 and 17360.
[78] Chart aid to navigation with the most recent information from USCG, District 17.
[79] See attached reports and endnote 63 for further information.
[80] Strikethrough ~~in the survey were discovered~~, replace with "were discovered in the survey area".
[81] The title Non-Conformance Reports is in error. The problem described was satisfactorily resolved and the data is in conformance with IHO standards.

APPROVAL SHEET
H11164

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.

Bruce A. Olmstead Date: 12/9/2005
Bruce A. Olmstead
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: 22 DEC 2005
Donald W. Haines
CDR, NOAA
Chief, Pacific Hydrographic Branch

Digitally signed by Jeremy McHugh
Reason: AWOIS / SURF check complete
Date: 2006.01.04 09:29:46 -05'00'

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. H 11164

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
17423	10/12/05	B. TAYLOR	Full Part ~~Before After Marine Center Approval Signed Via~~ APPLICATION
			~~Drawing No.~~ OF SOUNDINGS AND FEATURES
			FROM SMOOTH SHEET
17382	10/6/05	B. TAYLOR	Full Part ~~Before After Marine Center Approval Signed~~ Via APPLICATION
			~~Drawing No.~~ OF SOUNDINGS AND FEATURES
			FROM SMOOTH SHEET
17360	10/13/05	B. TAYLOR	Full Part ~~Before After Marine Center~~ Approval Signed Via APPLICATION
			~~Drawing No.~~ OF SOUNDINGS AND FEATURES
			FROM SMOOTH SHEET & CHARTS 17423 & 17382
			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.
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			Full Part Before After Marine Center Approval Signed Via
			Drawing No.
			Full Part Before After Marine Center Approval Signed Via
			Drawing No.

SUPERSEDES C&GS FORM 8352 WHICH MAY BE USED.