

F00682

NOAA Form 76-35A

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

DESCRIPTIVE REPORT

Type of Survey: Field Examination

Registry Number: F00682

LOCALITY

State: Washington

General Locality: Strait of Juan De Fuca

Sub-locality: Deception Pass

2016

CHIEF OF PARTY
CDR Mark Van Waes, NOAA

LIBRARY & ARCHIVES

Date:

HYDROGRAPHIC TITLE SHEET

F00682

INSTRUCTIONS: The Hydrographic Sheet should be accompanied by this form, filled in as completely as possible, when the sheet is forwarded to the Office.

State: **Washington**

General Locality: **Strait of Juan De Fuca**

Sub-Locality: **Deception Pass**

Scale: **1: 10,000**

Dates of Survey: **11/21/2016 to 11/21/2016**

Instructions Dated: **11/16/2016**

Project Number: **S-N912-FA-16**

Field Unit: **NOAA Ship *Fairweather***

Chief of Party: **CDR Mark Van Waes**

Soundings by: **Multibeam Echo Sounder**

Imagery by:

Verification by: **Pacific Hydrographic Branch**

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

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

Remarks:

The purpose of this survey is to provide contemporary surveys to update National Ocean Service (NOS) nautical charts. All separates are filed with the hydrographic data. Any revisions to the Descriptive Report (DR) generated during office processing are shown in bold red italic text. The processing branch maintains the DR as a field unit product, therefore, all information and recommendations within the body of the DR are considered preliminary unless otherwise noted. The final disposition of surveyed features is represented in the OCS nautical chart update products. All pertinent records for this survey, including the DR, are archived at the National Centers for Environmental Information (NCEI) and can be retrieved via <http://www.ncei.noaa.gov/>.

A. Area Surveyed

This hydrographic survey was acquired in accordance with the requirements defined in the 2016 NOS Hydrographic Survey Specifications and Deliverables Manual (HSSD) Section 5.2.2.3 Complete Coverage Multibeam survey. All requirements set forth in the NOAA Field Procedures Manual for Hydrographic Surveying (FPM) dated May 2014 and Hydrographic Survey Technical Directives (HTD) 2016-1 were met.

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
48° 24' 28.4" N 122° 38' 53.1" W	48° 24' 17.3" N 122° 38' 6.4" W

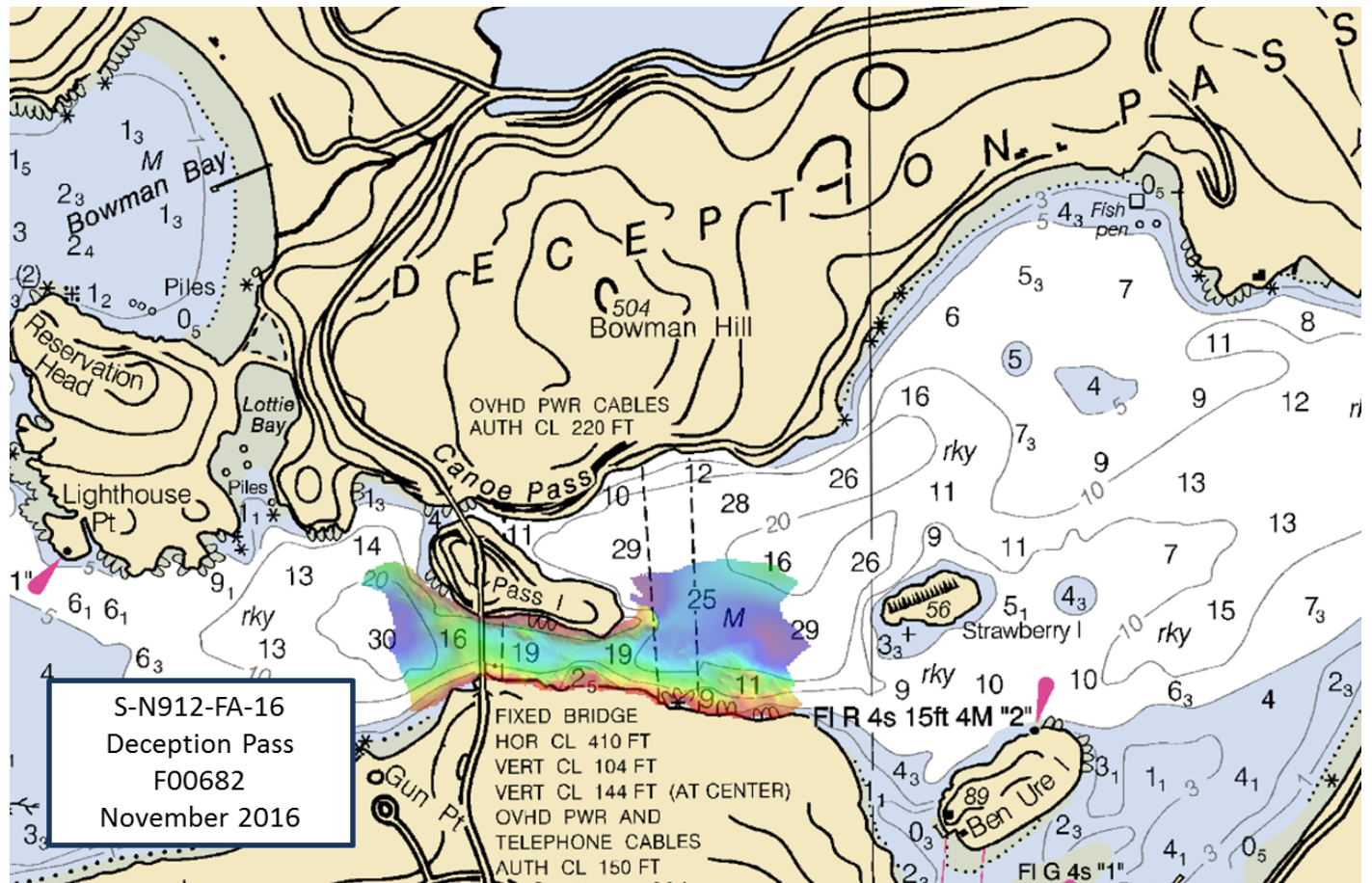


Figure 1: F00682 Survey overview

B. Survey Purpose

NOAA's Center for Operational Oceanographic Products and Services (CO-OPS) requested updated bathymetric survey data in Deception Pass, WA. The survey data will help define a site acceptable for the deployment of a bottom mounted current meter station. In addition to the CO-OPS request, there have been several other inquiries to update the nautical chart for recreational boaters. Survey data from this project is intended to supersede all prior survey data in the common area.

C. Intended Use of Survey

The entire survey is adequate to supersede previous data.

In order to support the NOS and CO-OPS missions, new current meter stations are regularly required. The best method for assembling the information needed to deploy these stations is survey. The primary objective of the survey is to provide information to determine the best location for current meter installation. It is necessary to obtain the longitude, latitude, bottom type, depth, salinity, and observe any coastal hazards/obstructions around the sites.

The NOAA CUBE parameters defined in the HSSD were used for the creation of all CUBE surfaces in Survey F00682. The surfaces have been reviewed where noisy data, or "fliers," are incorporated into the gridded solutions causing the surfaces to be shoaler or deeper than the true sea floor. Where these spurious soundings cause the gridded surface to be shoaler or deeper than the reliably measured seabed by greater than the maximum allowable Total Vertical Uncertainty at that depth, the noisy data have been rejected by the Hydrographer and the surface recomputed.

Flier Finder v3, part of the QC Tools package within Pydro, was used to assist the search for spurious soundings following the gross cleaning. Flier Finder was run multiple times for each surface, reducing the flier height value for each consecutive run. This allowed Flier Finder to accurately and quickly identify gross fliers, but as the flier height was reduced the effectiveness of the tool diminished. At this point, the hydrographer ceased using the tool and returned to manual cleaning.

D. Data Acquisition and Processing

Please reference Data Acquisition and Processing Report S-N912-FA-16_Deception_Pass_DAPR for a complete description of data acquisition and processing systems, survey vessels, quality control procedures and data processing methods.

E. Uncertainty

To verify that all data meet the accuracy specifications as stated in the HSSD, a child layer titled "NOAA_Allowable_1" was created for the 1 and 2 meter finalized surfaces using the equation stated in Section C.2.1 of the DAPR. These surfaces were then analyzed using the Pydro Finalized CSAR QA tool. Figure 2 shows an overview of the NOAA Allowable Uncertainty layers in each of the surfaces. Figure 3 shows the statistics for each of the individual surfaces. It was found that at least 99.67% of nodes in the 1 and 2 meter grids meet or exceed NOAA Allowable Uncertainty specifications for all depths of survey F00682. For individual graphs per surface of uncertainty and density requirements, see the Standards Compliance Review in Appendix II.

Finalized surfaces were analyzed using the Pydro QC Tools Grid QA feature and the results are shown below in Figure 4. Density requirements for F00682 were achieved with at least 97.99% of finalized surface nodes containing five or more soundings as required by HSSD Section 5.2.2.3. The few nodes that did not meet density requirements are due to sparse data in the outer beams, especially near steep slopes and rocky areas where acoustic shadowing occurred, and at the edges of the survey limits as shown in Figure 4. For individual graphs (per surface) of density requirements, see the Standards and Compliance Review located in Appendix II.

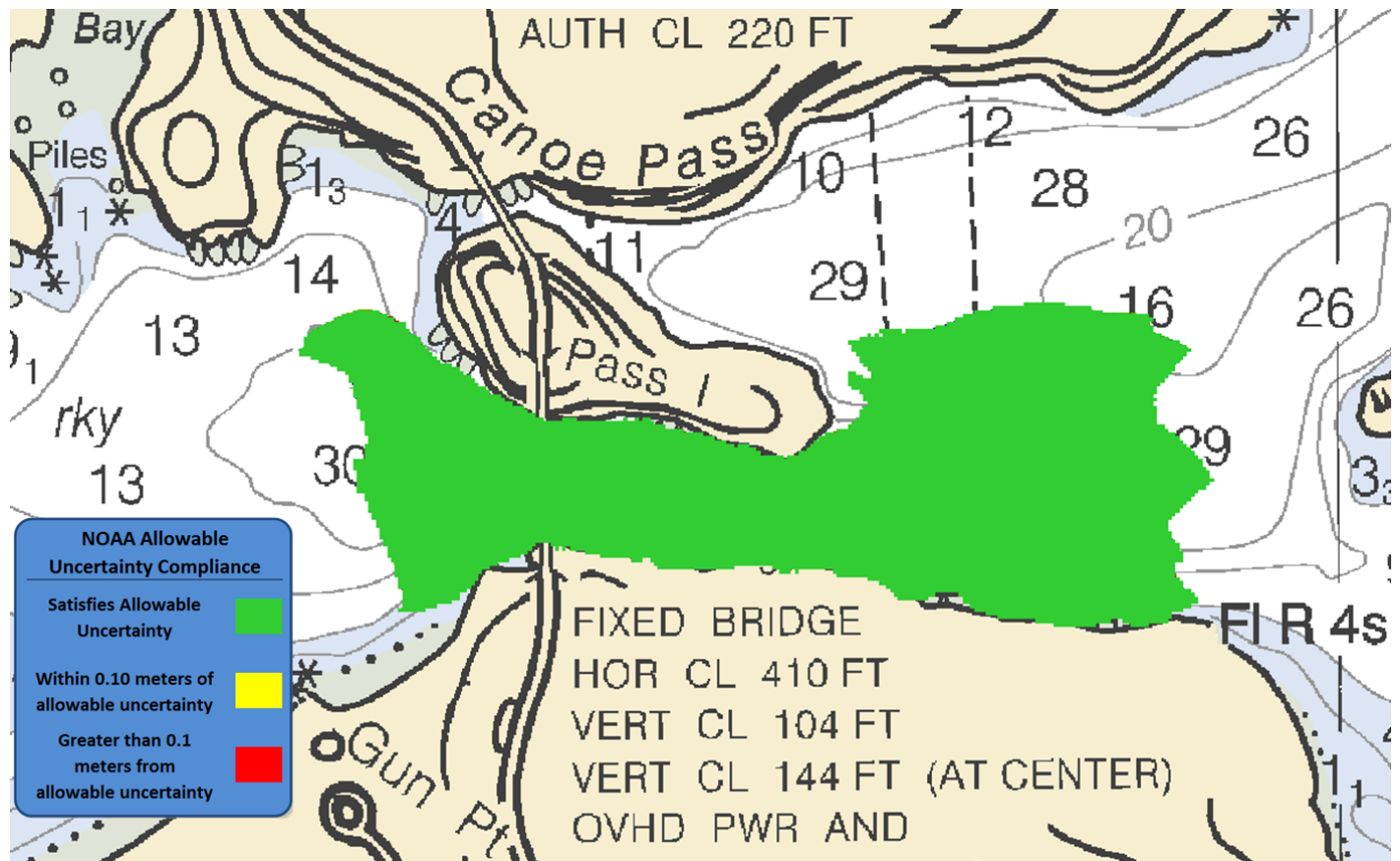


Figure 2: F00682 NOAA Allowable Uncertainty overview.

F00682 NOAA Allowable Uncertainty			
	Total Nodes	Passed Nodes	Percent Pass
1m	62,591	62,301	99.54%
2m	40,034	39,987	99.88%
Total Nodes		102,625	
Total Nodes Pass		102,288	
Total Percent Pass		99.67%	

Figure 3: F00682 NOAA Allowable Uncertainty statistics.

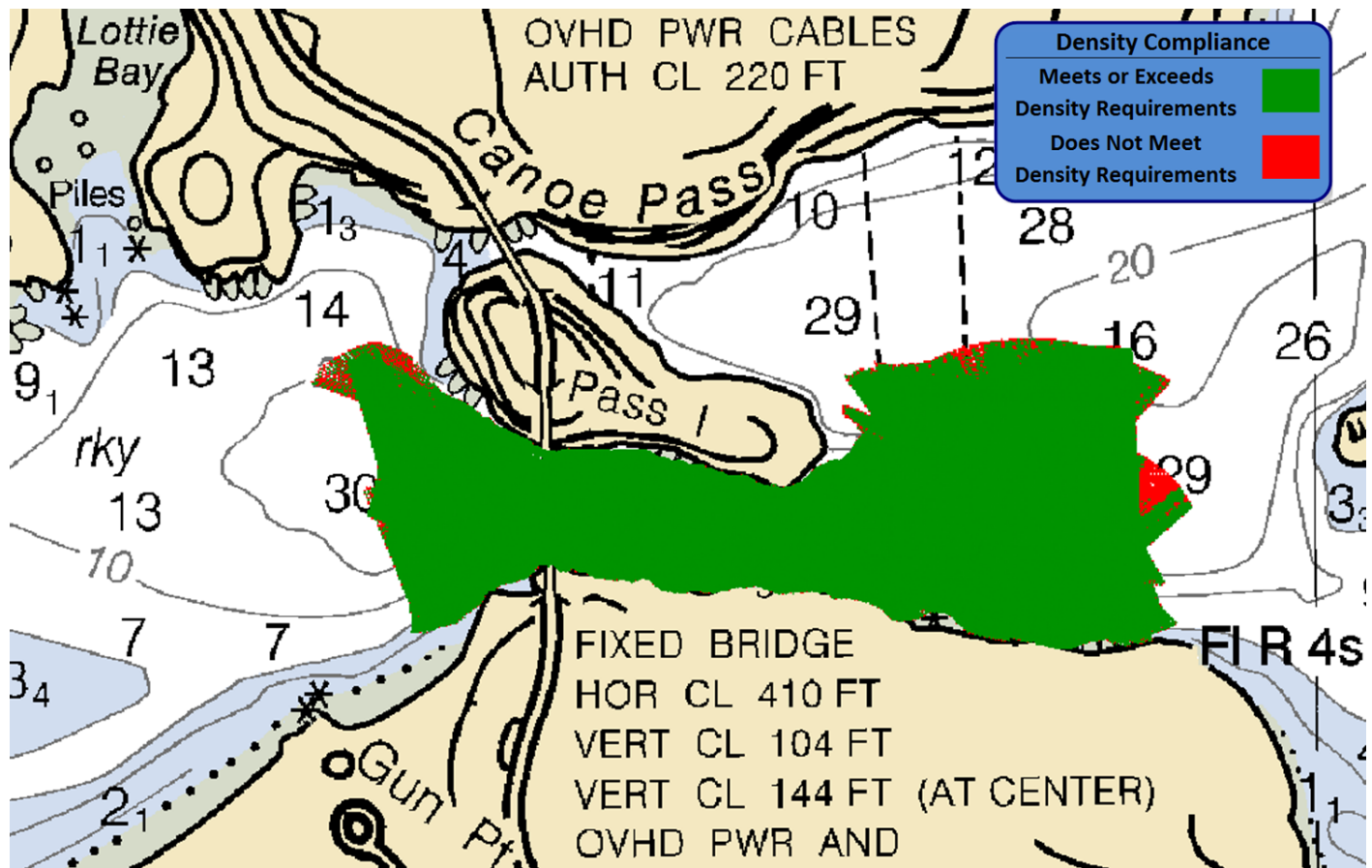


Figure 4: F00682 Density overview.

F00682 Density Statistics			
	Total Nodes	Passed Nodes	Percent Pass
1m	62,591	61,629	98.46%
2m	40,034	38,938	97.26%
Total Nodes			102,625
Total Nodes Pass			100,567
Total Percent Pass			97.99%

Figure 5: F00682 Density statistics.

The "NOAA_Allowable_1" layers were created using the equation stated in Section B.2.1.1 of the DAPR

F. Results and Recommendations

The following are the largest scale RNC and ENC, which cover the survey area:

Chart	Scale	Edition	Edition Date	LNM Date	NM Date
18427	1:25000	24	05/2013	06/28/2016	07/09/2016

ENC	Scale	Edition	Update Application Date	Issue Date	Preliminary?
US5WA31M	1:25000	23	06/15/2016	06/15/2016	NO

A comparison was performed between survey F00682 and Chart 18427 as well as ENC US5WA31M using CARIS HIPS and SIPS sounding layers derived from a 4 meter surface. The soundings were overlaid on the charts to assess differences between the surveyed soundings and the charted depths. All data from F00682 should supersede charted data. In general, surveyed soundings agree within 1 fathom of the majority of charted depths. A full discussion of the disagreements follows below.

The charted depths of Chart 18427 are identical to those found on ENC US5WA31M and are in general agreement with soundings from F00682, with most depths agreeing within 3 fathoms as shown in Figure 6. Contours from F00682 are in general agreement with charted contours, with the exception of the shoreline contours as shown in Figures 8 and 9. Additionally, charted shoreline to the north and south of Deception Pass is not in agreement with surveyed soundings, as shown in Figure 16. The overlap in these areas appears to be largely due to chart scale.

To more accurately visualize trends within these differences, a 4 meter TIN surface was interpolated from the ENC sounding layer. A corresponding 4 meter surface from F00682 was created and differenced from the 4 meter TIN surface. This difference surface showed the mean difference between surfaces to be 3.86 fathoms with 95% of nodes falling within 7.73 fathoms, as shown in Figure 10. Figure 9 shows this difference surface where red colors indicate F00682 was shoaler than the ENC US5WA31M, green colors indicate agreement, and blue colors indicate F00682 was deeper than ENC US5WA31M. The majority of F00682 is either in agreement with or is deeper than charted depths, with the exception of near shore areas where F00682 is shoaler.

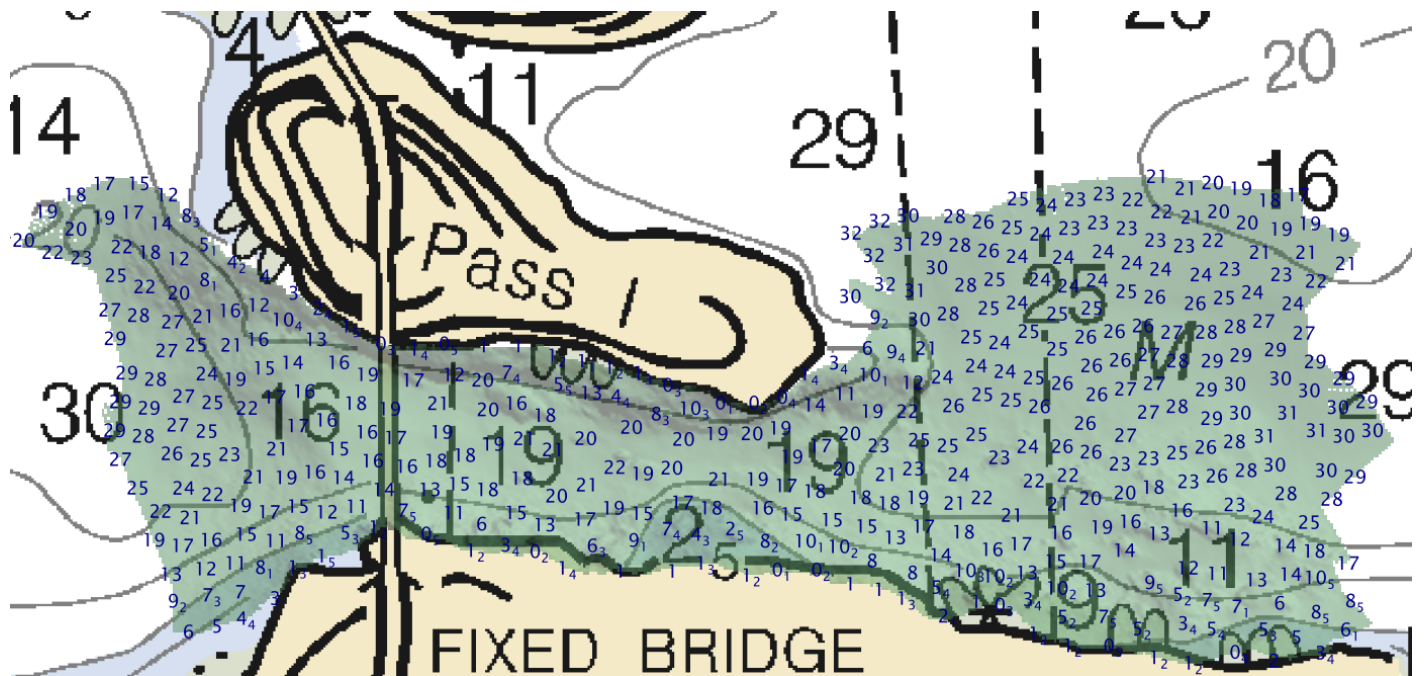


Figure 6: Comparison of F00682 soundings as compared to Chart 18427 depths

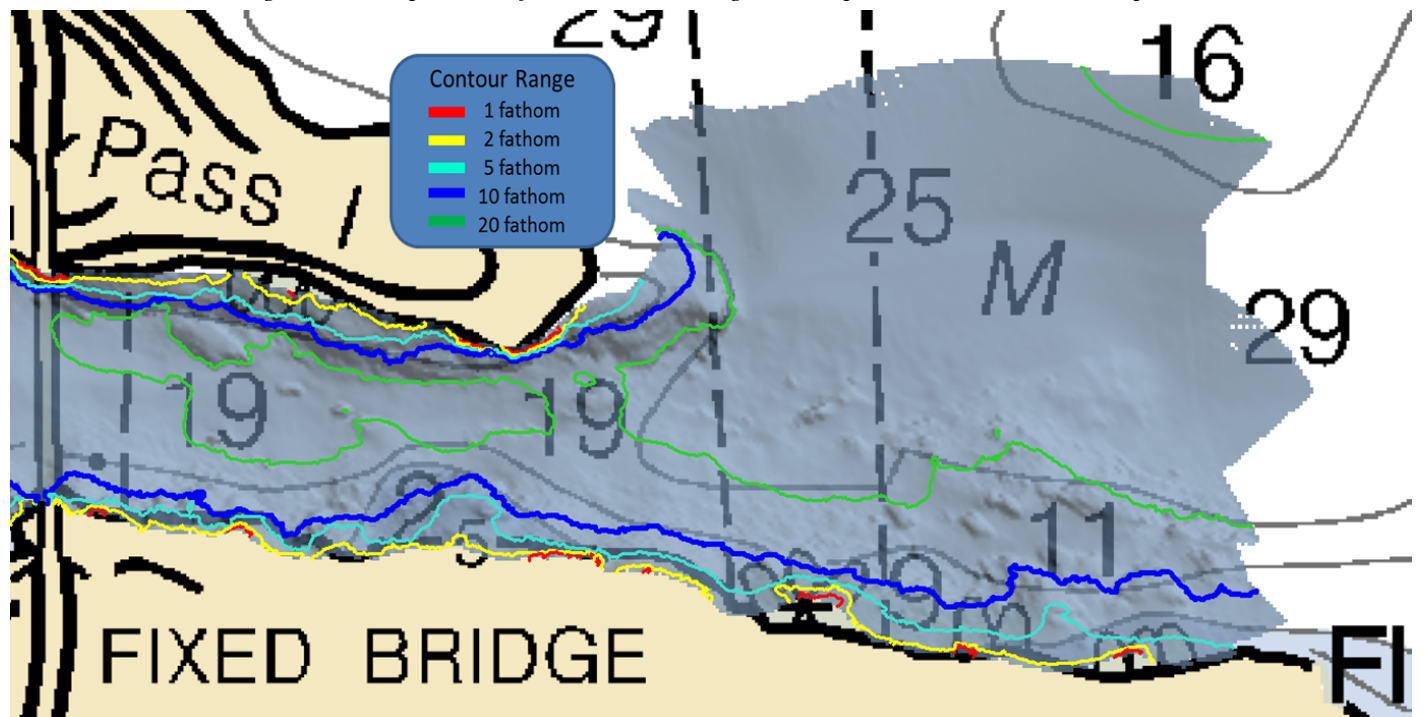


Figure 7: Comparison of F00682 contours as compared to Chart 18427 depths

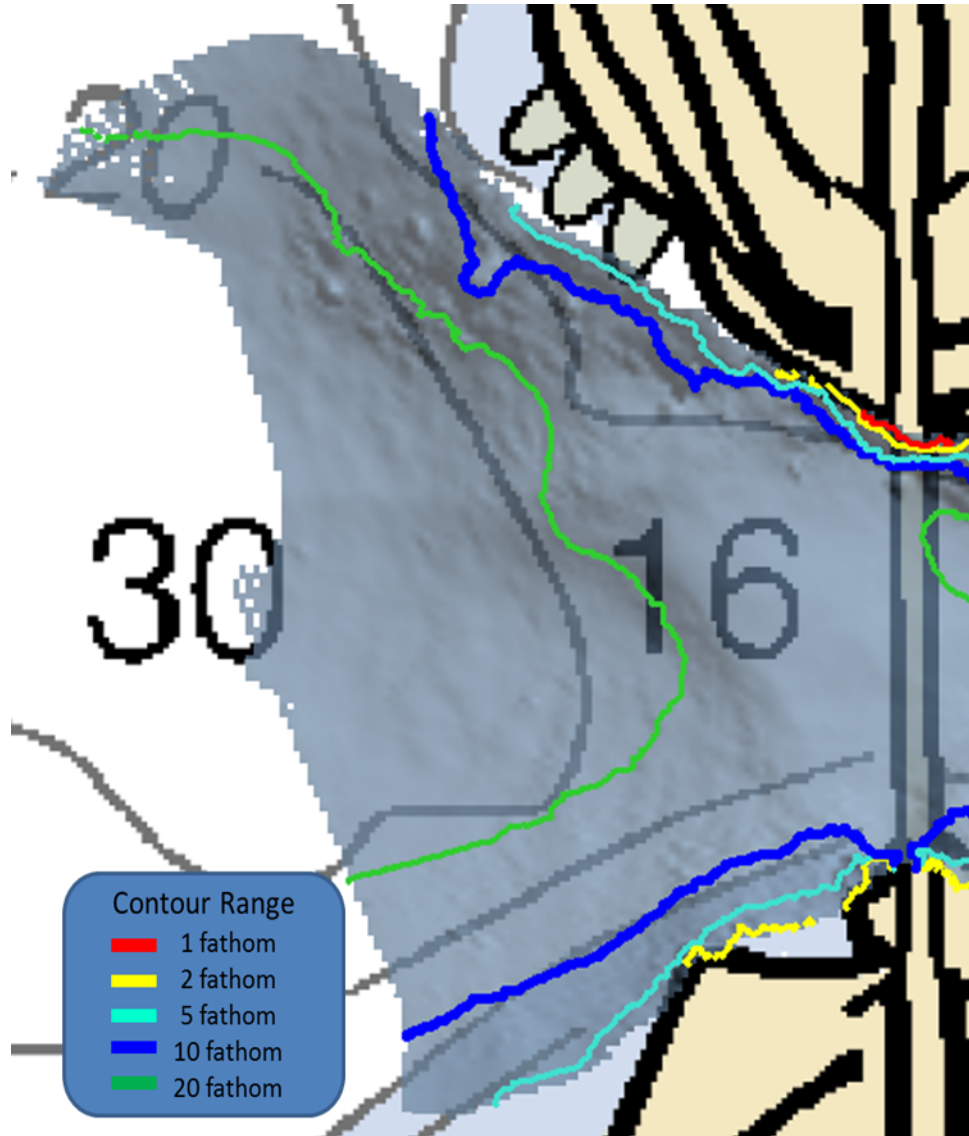


Figure 8: Comparison of F00682 contours as compared to Chart 18427 depths

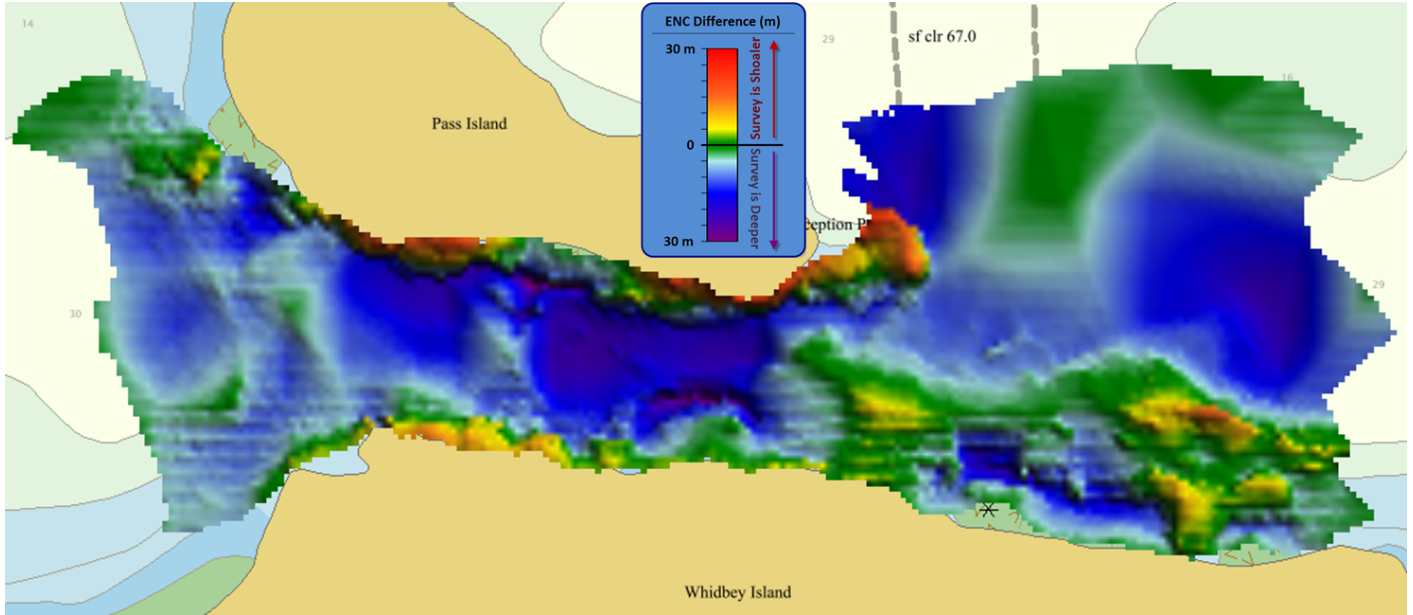


Figure 9: Comparison of F00682 soundings as compared to ENC US5WA31M depths

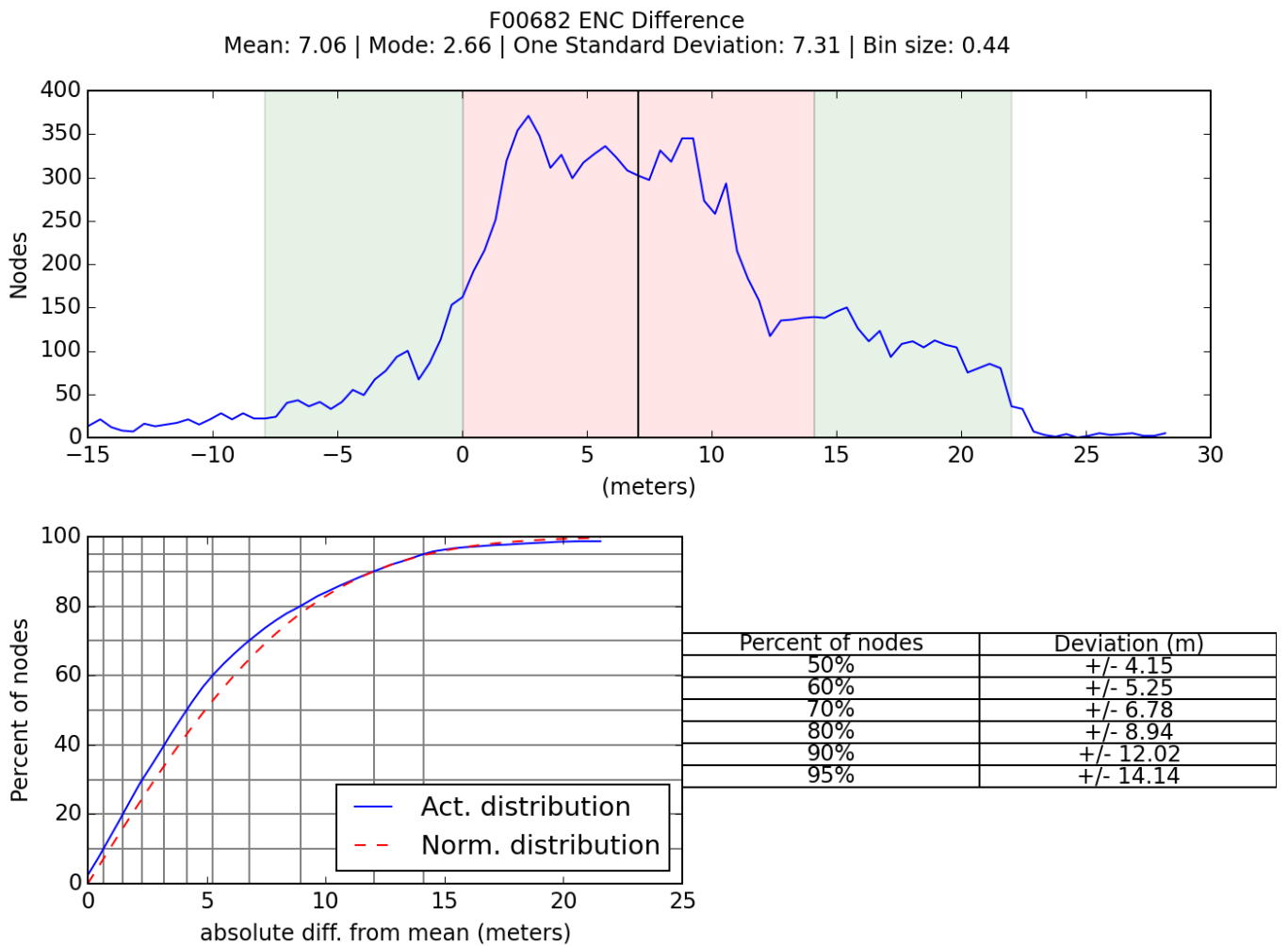


Figure 10: Statistical comparison of F00682 soundings as compared to ENC US5WA31M depths

The following surfaces and/or BAGs were submitted to the Processing Branch:

Surface Name	Surface Type	Resolution	Depth Range	Surface Parameter	Purpose
F00682_MB_1m_MLLW	CUBE	1 m	-	NOAA_1m	Complete MBES
F00682_MB_2m_MLLW	CUBE	2 m	-	NOAA_2m	Complete MBES
F00682_MB_1m_MLLW_Final	CUBE	1 m	0 m - 30 m	NOAA_1m	Complete MBES
F00682_MB_2m_MLLW_Final	CUBE	2 m	18 m - 60 m	NOAA_2m	Complete MBES

G. Vertical and Horizontal Control

The vertical datum for this project is Mean Lower Low Water.

The vertical control method used for this survey was VDatum.

The following National Water Level Observation Network (NWLON) stations served as datum control for this survey:

Station Name	Station ID
Port Townsend	9444900
Friday Harbor	9449880

The vertical datum for this project is Mean Lower Low Water. While a TCARI grid was used to initially reduce the soundings to MLLW, following successful processing of SBETS VDatum was used to reduce soundings to MLLW.

See attached Tide Note dated December 12, 2016

The horizontal datum for this project is North American Datum 1983. The projection used for this survey is UTM Zone 10N.

The following DGPS Stations were used for horizontal control:

DGPS Stations
Whidbey Island, WA - 302 kHz (100 BPS)

During real-time acquisition 2805 and 2806 received correctors from USCG DGPS for increased accuracies.

H. Additional Results

Due to the relatively small size of the survey crosslines were not acquired to satisfy quality control requirements in Section 5.2.4.3 of the HSSD. Instead, the two survey launches used different sonar frequencies (FA2805 used 200kHz and FA2806 used 400kHz) both acquiring MB data for the entire survey area, effectively satisfying HSSD quality control requirements. To evaluate coverage, a 1-meter CUBE surface was created using strictly lines collected by FA2805, and a 1-meter CUBE surface was created using strictly lines collected by FA2806. From these two surfaces, a difference surface (FA2805 mainscheme - FA2806 mainscheme = difference surface) was generated at a 1-meter resolution (Figure 11), and is submitted in the Separates II Digital Data folder. Statistics show the mean difference between the depths derived from FA2805 and FA2806 was -0.08 meters (with FA2805 being deeper) with 95% of nodes falling within +/- 0.52 meters (Figure 12). For the respective depths, the difference surface was compared to the allowable NOAA accuracy standards (Figure 13). In total, 96.86% of the depth differences between FA2805 and FA2806 data were within allowable NOAA uncertainties (Figure 14).

Although depth differences between the surfaces created from FA2805 and FA2806 exist (Figure 11), the individual soundings from FA2805 and FA2806 are in agreement as shown in Figure 15. The observed differences are largely caused by the gridding algorithm's representation of the two separate data sets. This is especially apparent along steep slopes, where small changes in density and position resulted in significant changes in the resulting launch-specific grid.

An original final feature file was not provided for this survey, and no features were assigned. An incorrectly charted islet was disproved during acquisition, a final feature file was created and included with the data submission, as seen in Figure 17.

In order to prevent visual data gaps between the finalized surfaces, a waiver was obtained to modify the finalized surface depth ranges. The 1 and 2 meter surface depths were extended by 10 times their respective resolution for greater overlap as shown in Section F of this report. As a result of modifying the depth ranges, the 2 meter finalized surface covered the extents of the 4 meter surface. As the 2 meter surface met all density and NOAA uncertainty requirements for the expanded range, the requirement to submit the 4 meter surface was waived.

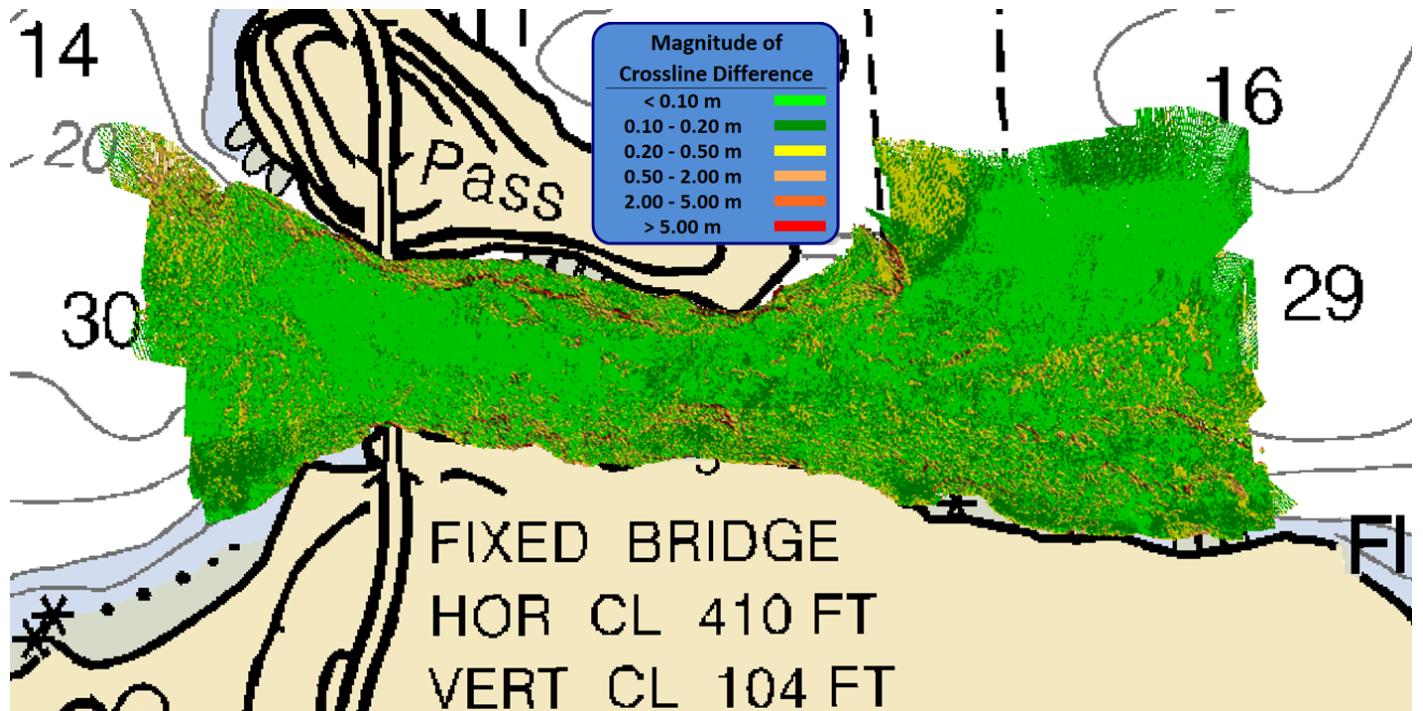


Figure 11: F00682 comparison between FA2806 and FA2805 coverage

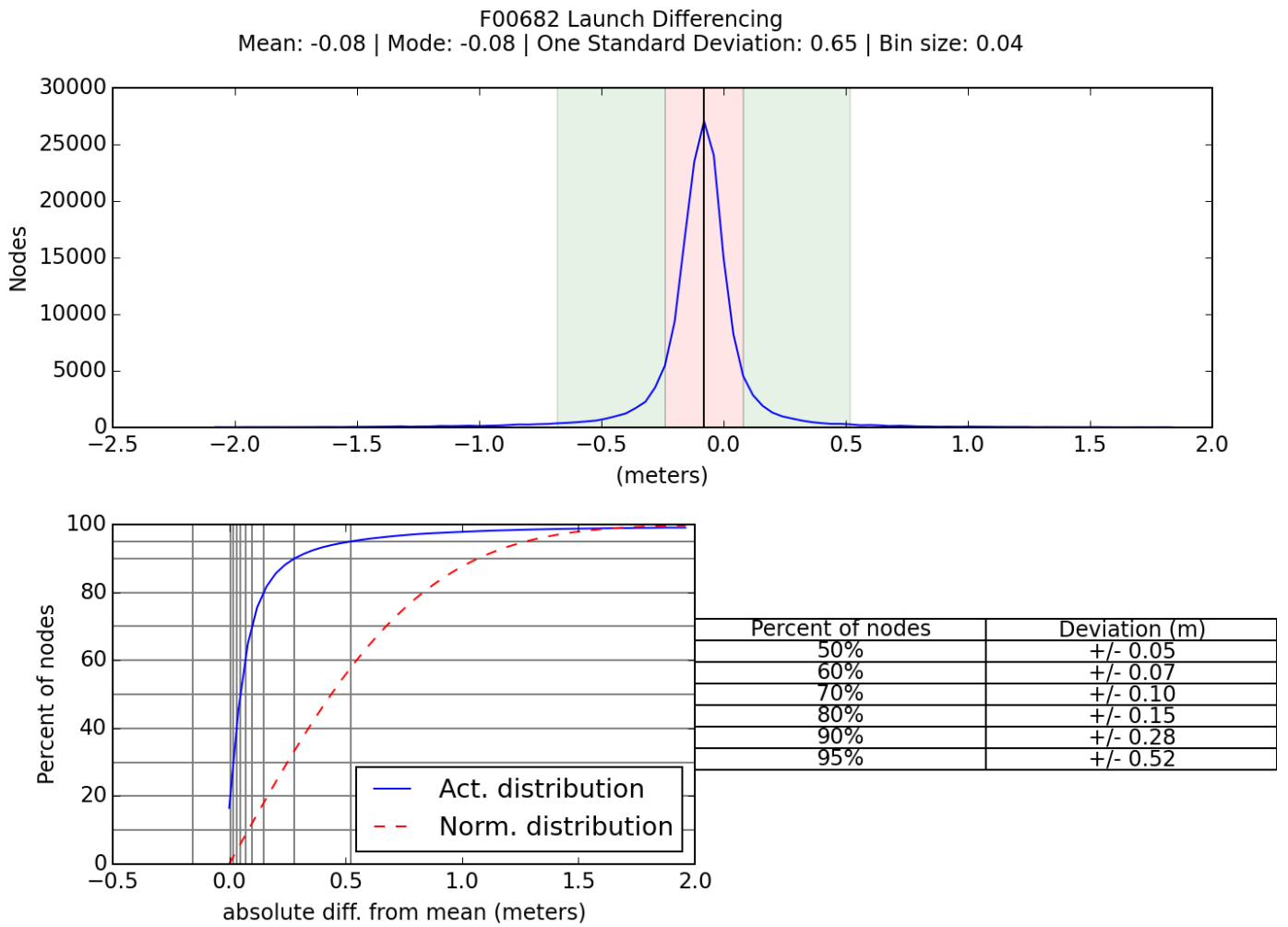


Figure 12: F00682 FA2806 and FA2805 comparison statistics

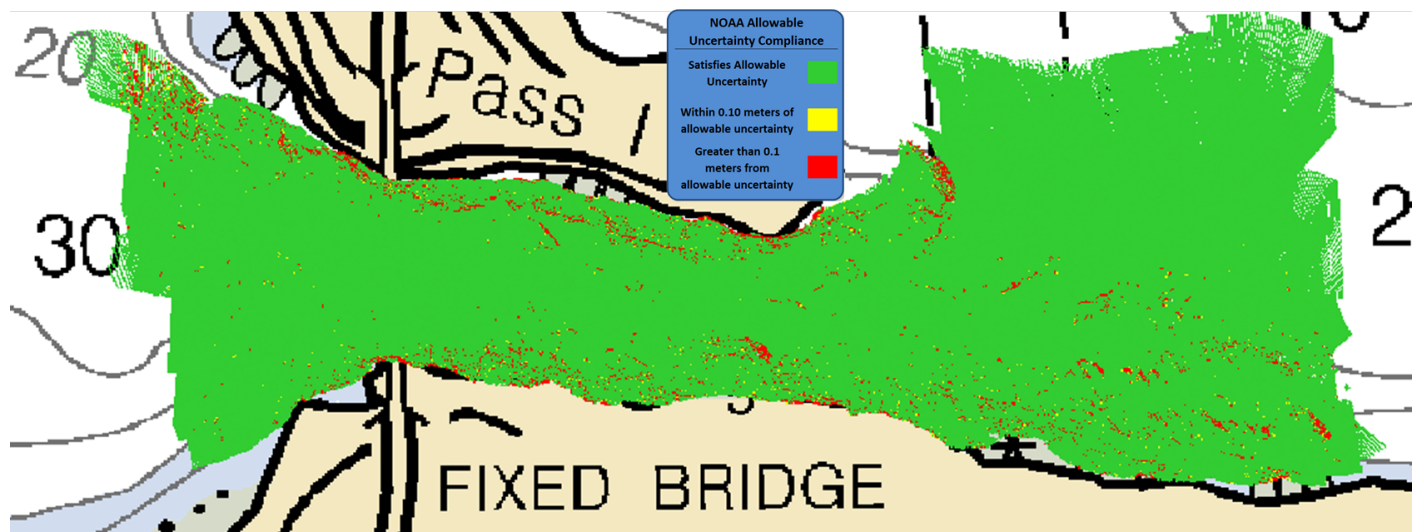


Figure 13: F00682 difference surface compared to NOAA accuracy standards

F00682 Launch Differencing NOAA Allowable Uncertainty		
Total Nodes	Passed Nodes	Failed Nodes
163,743	158,606	5,137
Percentage Nodes Passed		96.86%
Percentage Nodes Failed		3.14%

Figure 14: F00682 Magnitude of survey launch difference

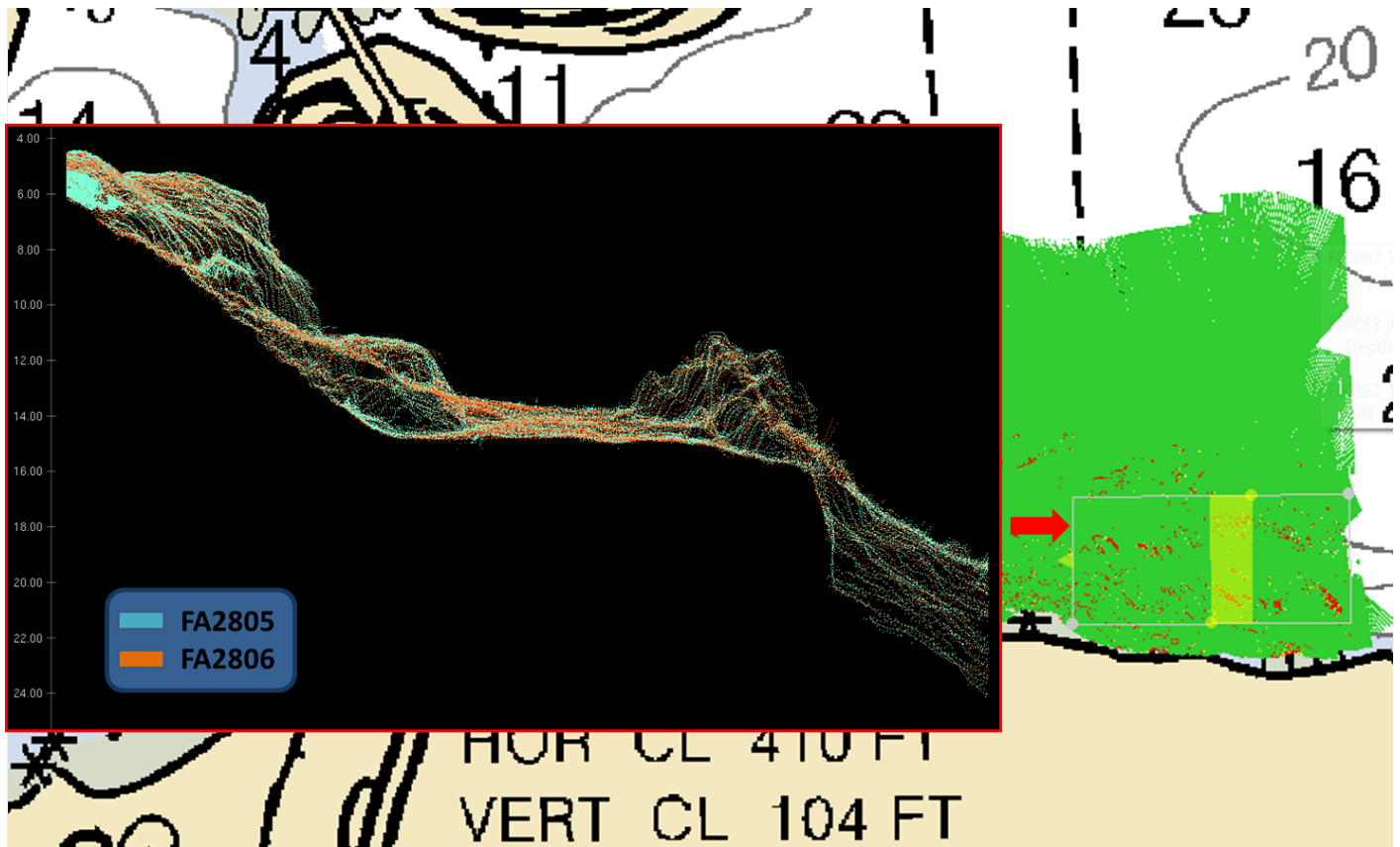


Figure 15: F00682 point cloud agreement between launches

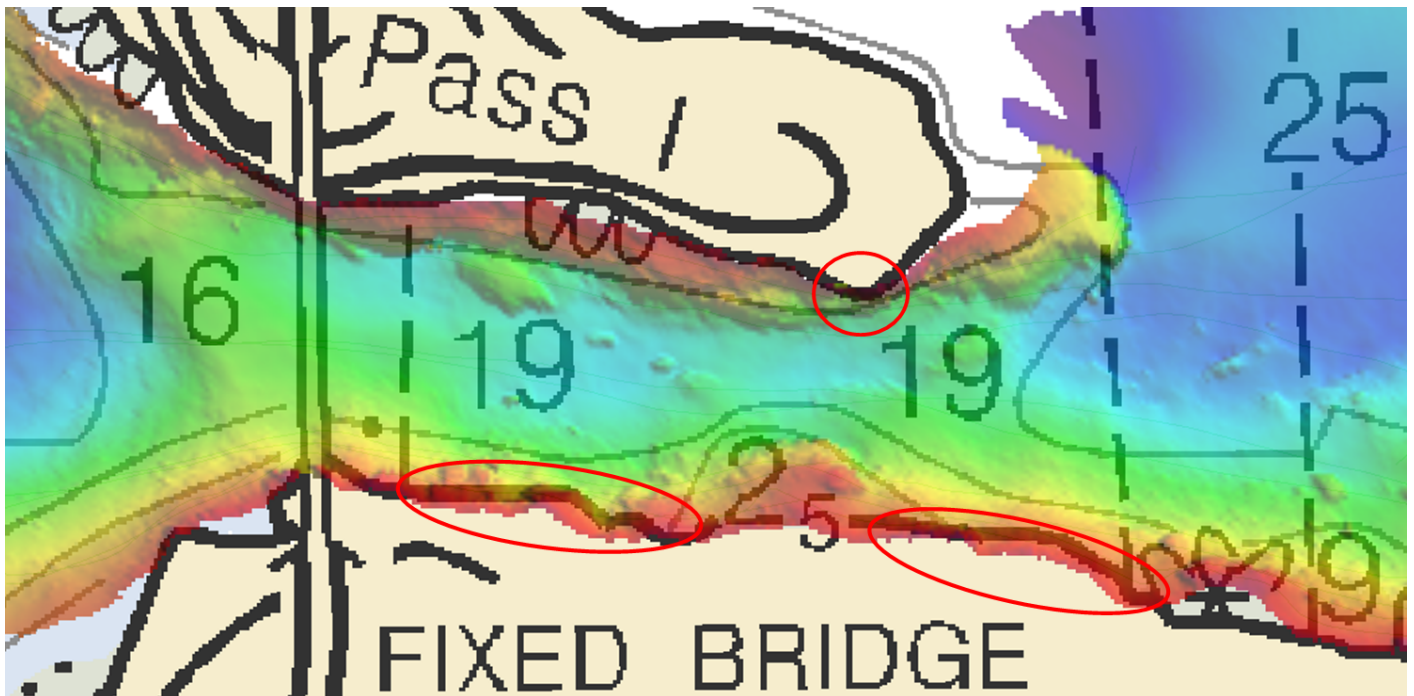


Figure 16: F00682 example of multibeam data overlapping charted shoreline

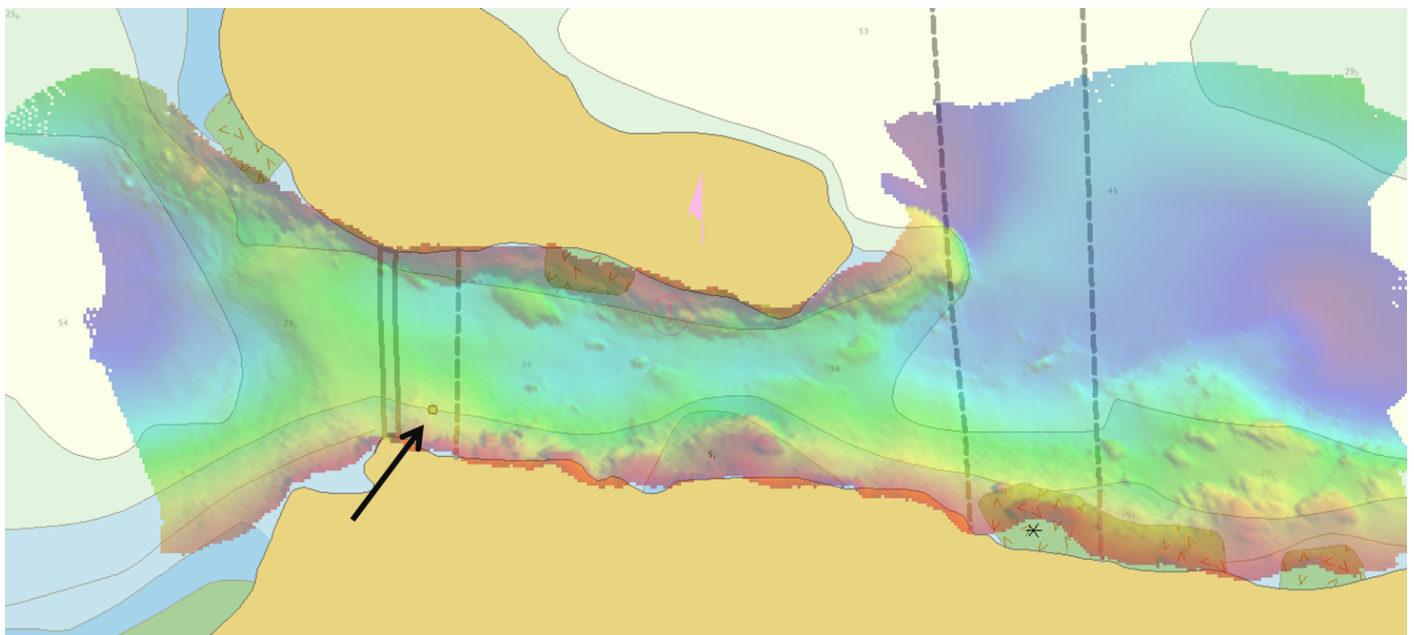


Figure 17: F00682 incorrectly charted islet in Deception Pass






See attached correspondence regarding depth ranges on submitted finalized surfaces.

I. Approval

As Chief of Party, field operations for this hydrographic survey were conducted under my direct supervision, with frequent personal checks of progress and adequacy. I have reviewed the attached survey data and reports.

All field sheets, this Descriptive Report Summary, and all accompanying records and data are approved. All records are forwarded for final review and processing to the Processing Branch.

The survey data meet or exceed requirements as set forth in the NOS Hydrographic Surveys Specifications and Deliverables, Field Procedures Manual, Letter Instructions, and all HSD Technical Directives, except as noted in this Descriptive Report Summary. These data are adequate to supersede charted data in their common areas. This survey is complete and no additional work is required unless otherwise noted herein.

Approver Name	Title	Date	Signature
CDR Mark Van Waes, NOAA	Chief of Party	02/28/2017	
LT Bart Buessler, NOAA	Field Operations Officer	02/28/2017	
LT Damian Manda, NOAA	Fourth Officer	02/28/2017	
HCST Douglas Bravo	Hydrographic Chief Survey Technician	02/28/2017	
ENS Matthew Sharr, NOAA	Sheet Manager	02/28/2017	

Subject: Re: Modified Finalized Depth Ranges for S-N912-FA-16

From: Corey Allen - NOAA Federal <corey.allen@noaa.gov>

Date: 2/16/2017 10:26 AM

To: OPS Fairweather <ops.fairweather@noaa.gov>

CC: Mark Van Waes <co.fairweather@noaa.gov>, Matthew Sharr <matthew.sharr@noaa.gov>

Gents,

Apologies for missing the first email, so thank you for the reminder. You are approved as proposed.

Corey

On Thu, Feb 16, 2017 at 12:04 PM OPS Fairweather <ops.fairweather@noaa.gov> wrote:

Good Morning Corey,

As I can't seem to track down a reply to this email I wanted to ping you and see if we were good to not submit the 4 meter surface and extend the 1 meter and 2 meter surfaces as described below? (All data still meets spec) Thanks!

Very Respectfully,

LT Bart Buesseler, NOAA

Operations Officer
NOAA Ship Fairweather
1010 Stedman Street
Ketchikan, Alaska 99901

Ship Cell: 907.254.2842
Iridium: 808.659.0054

OPS.Fairweather@noaa.gov

On 2/9/2017 12:12 PM, FA OPS wrote:

Corey,

Due to the steep nature of the terrain at Deception Pass, when using the finalization depth ranges specified in the HSSD, visual gaps appear between surfaces. To prevent this, we would like to request an adjustment to the finalized depth ranges. We propose extending the finer resolution surfaces deeper than the HSSD specification by 10 times the resolution of the surface. This results in the following depth ranges:

1m: 0-30m

2m: 18-60m

4m: 36-120m

As a result of extending the 2 m surface, it now covers the maximum depths of the survey, so we also request that the 4 m surface not be required in the submission of the survey. If further processing or density analysis indicates that a 4 m surface is appropriate, we will include one.

Please let me know if you have any questions.

Very Respectfully,

LT Damian Manda

Operations Officer in Training
NOAA Ship *Fairweather*
1010 Stedman Street
Ketchikan, Alaska 99901

Cell: 907.254.2842

Iridium: 808.659.0054

OPS.Fairweather@noaa.gov

--

J. Corey Allen

Team Lead, Operations Branch

Hydrographic Surveys Division

Office of Coast Survey, NOAA

Corey.Allen@noaa.gov

301.713.2777 x119 (Office)

301.717.7271 (Cell)



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Ocean Service
Silver Spring, Maryland 20910

TIDE NOTE FOR HYDROGRAPHIC SURVEY

DATE : December 12, 2016

HYDROGRAPHIC BRANCH: Pacific
HYDROGRAPHIC PROJECT: S-N912-FA-16
HYDROGRAPHIC SHEET: F00682

LOCALITY: Deception Pass, WA
TIME PERIOD: November 21, 2016

TIDE STATION USED: 944-4900 Port Townsend, WA
Lat. 48° 6.8' N Long. 122° 45.6' W
PLANE OF REFERENCE (MEAN LOWER LOW WATER): 0.000 meters
HEIGHT OF HIGH WATER ABOVE PLANE OF REFERENCE: 2.389 meters

TIDE STATION USED: 944-9880 Friday Harbor, WA
Lat. 48° 32.7' N Long. 123° 0.8' W
PLANE OF REFERENCE (MEAN LOWER LOW WATER): 0.000 meters
HEIGHT OF HIGH WATER ABOVE PLANE OF REFERENCE: 2.167 meters

REMARKS: RECOMMENDED GRID

Please use the TCARI grid "F00682.tc" as the final grid for project S-N912-FA-16, Registry No. F00682, on November 21, 2016.

Refer to attachments for grid information.

Note 1: Provided time series data are tabulated in metric units (meters), relative to MLLW and on Greenwich Mean Time on the 1983-2001 National Tidal Datum Epoch (NTDE).

Note 2: Due to inaccurate shoreline around S-N912-FA-16, survey tracklines fall outside of the TCARI grid boundaries in some areas. TCARI will extrapolate the tide corrector to cover these soundings.

HOVIS.GERALD.THOMAS.JR.1365860250

Digitally signed by
HOVIS.GERALD.THOMAS.JR.1365860250
DN: c=US, o=U.S. Government, ou=DoD, ou=PKI,
ou=OTHER,
cn=HOVIS.GERALD.THOMAS.JR.1365860250
Date: 2016.12.14 12:06:52 -05'00'

CHIEF, PRODUCTS AND SERVICES BRANCH



Final TCARI Grid for S-N912-FA-16 F00682

Deception Pass, WA

9449880 FRIDAY HARBOR

9444900 PORT TOWNSEND

APPROVAL PAGE

F00682

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

The following products will be sent to NCEI for archive

- F00682_DR.pdf
- Collection of depth varied resolution BAGS
- Processed survey data and records
- F00682_GeoImage.pdf

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

Approved: _____

Katie Reser

Physical Scientist, Pacific Hydrographic Branch

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

Approved: _____

Peter Holmberg

Cartographic Team Lead, Pacific Hydrographic Branch