H12700

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

DESCRIPTIVE REPORT

Type of Survey:	Navigable Area
Registry Number:	H12700

LOCALITY

State(s):	Rhode Island
General Locality:	Rhode Island Sound and Approaches
Sub-locality:	5NM South of Block Island

2014

CHIEF OF PARTY
LCDR Marc S. Moser, NOAA

LIBRARY & ARCHIVES

Date:

U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION	REGISTRY NUMBER:
HYDROGRAPHIC TITLE SHEET	**H12700**

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(s):	**Rhode Island**
General Locality:	**Rhode Island Sound and Approaches**
Sub-Locality:	**5NM South of Block Island**
Scale:	**40000**
Dates of Survey:	**06/05/2014 to 06/23/2014**
Instructions Dated:	**06/04/2014**
Project Number:	**OPR-B307-FH-14**
Field Unit:	**NOAA Ship *Ferdinand R. Hassler***
Chief of Party:	**LCDR Marc S. Moser, NOAA**
Soundings by:	**Multibeam Echo Sounder**
Imagery by:	**Multibeam Echo Sounder Backscatter**
Verification by:	**Atlantic Hydrographic Branch**
Soundings Acquired in:	**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 Geophysical Data Center (NGDC) and can be retrieved via http://www.ngdc.noaa.gov/.

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Descriptive Report to Accompany Survey H12700

Project: OPR-B307-FH-14

Locality: Rhode Island Sound and Approaches

Sublocality: 5NM South of Block Island

Scale: 1:40000

June 2014 - June 2014

NOAA Ship *Ferdinand R. Hassler*

Chief of Party: LCDR Marc S. Moser, NOAA

A. Area Surveyed

The survey area is located in Rhode Island Sound, within the sub-locality 5NM south of Block Island as shown in Figure 1.

A.1 Survey Limits

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
41° 12' 24.5" N 71° 31' 26.2" W	40° 59' 11.3" N 71° 23' 43.5" W

Table 1: Survey Limits

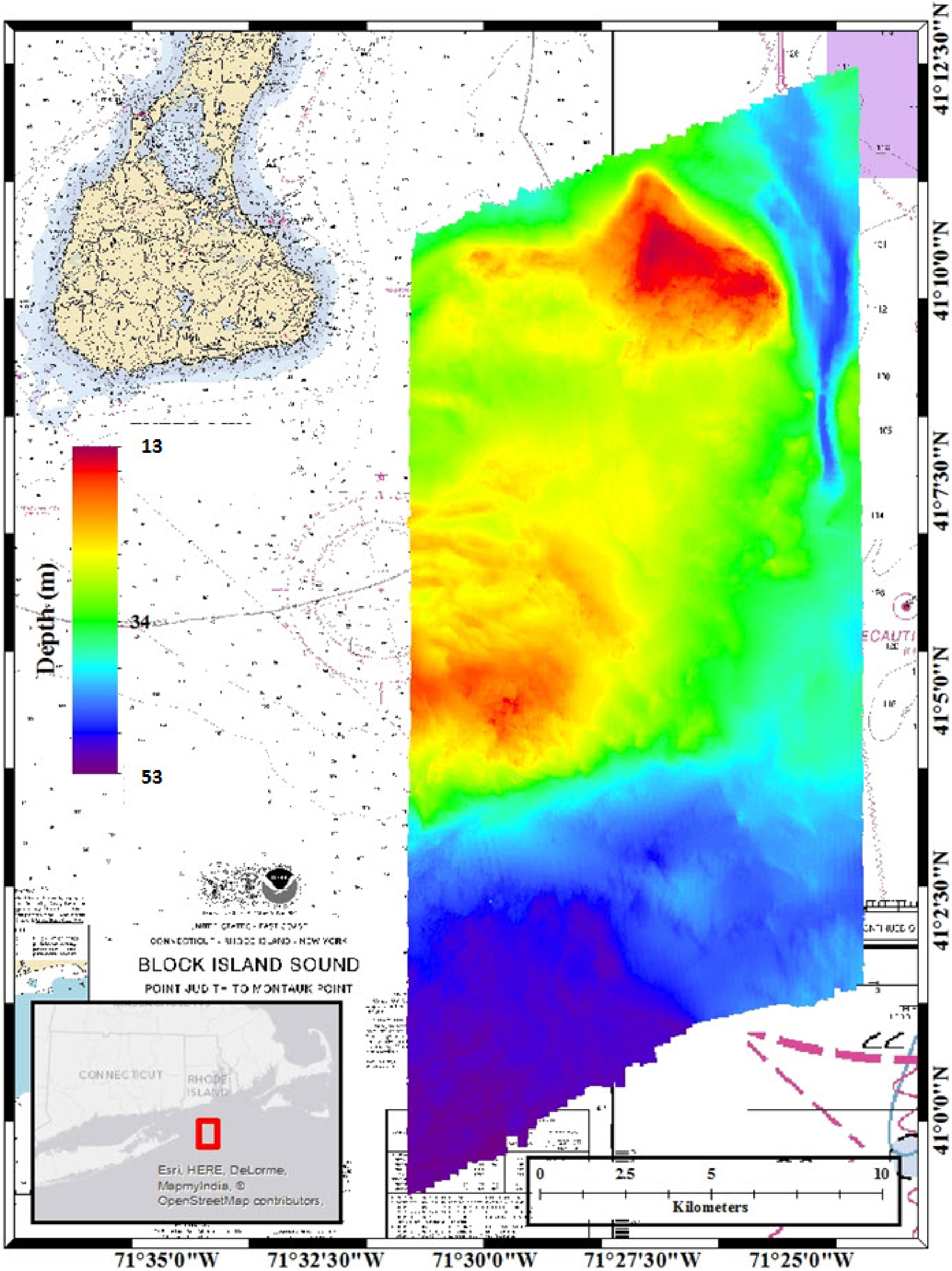


Figure 1: General locality of survey H12700

Survey Limits were acquired in accordance with the requirements in the Project Instructions and the HSSD.

A.2 Survey Purpose

The purpose of this project is to provide contemporary surveys to update National Ocean Service (NOS) nautical charting products. Additionally, this survey area addresses a portion of an outstanding request to survey routes used by deep draft vessels carrying oil east of Block Island.

A.3 Survey Quality

The entire survey is adequate to supersede previous data.

A.4 Survey Coverage

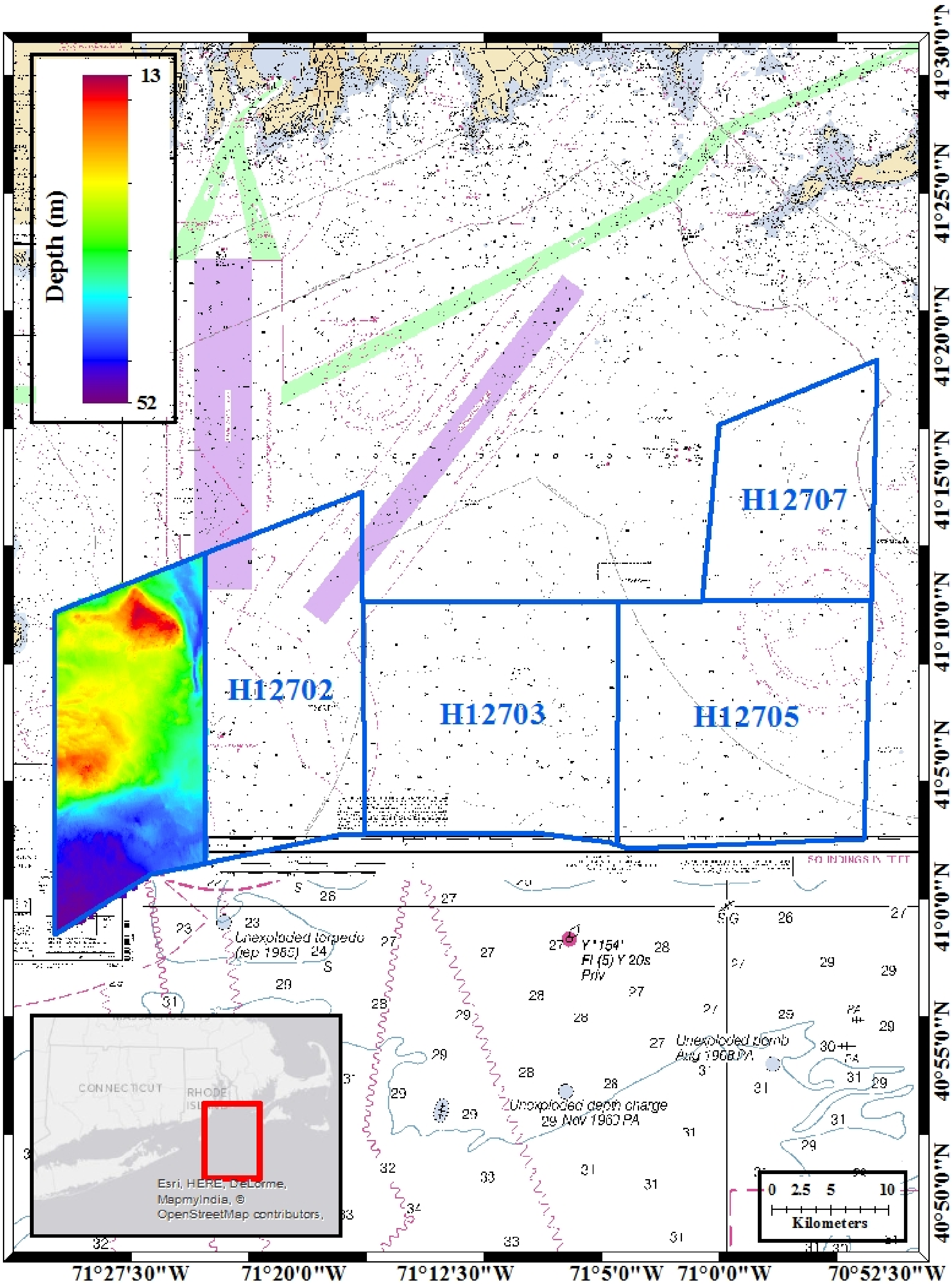


Figure 2: Survey layout for OPR-B307-FH-14 plotted over charts 13215, 13218 and 12300.

Some holidays exist in the coverage for this survey, predominately in the 0.5-meter surface. Analyses of surrounding data show that the least depths over features have been achieved and holidays do not compromise data integrity. Additional discussion can be found in section B.2.9.

A.5 Survey Statistics

The following table lists the mainscheme and crossline acquisition mileage for this survey:

	HULL ID	*S250*	*Total*
LNM	SBES Mainscheme	0	0
	MBES Mainscheme	929.25	929.25
	Lidar Mainscheme	0	0
	SSS Mainscheme	0	0
	SBES/MBES Mainscheme	0	0
	SBES/SSS Mainscheme	0	0
	MBES/SSS Mainscheme	0	0
	SBES/MBES Crosslines	64.81	64.81
	Lidar Crosslines	0	0
Number of Bottom Samples			10
Number of AWOIS Items Investigated			8
Number Maritime Boundary Points Investigated			0
Number of DPs			0
Number of Items Investigated by Dive Ops			0
Total SNM			59.31

Table 2: Hydrographic Survey Statistics

The following table lists the specific dates of data acquisition for this survey:

Survey Dates	Day of the Year
06/05/2014	156
06/07/2014	158
06/08/2014	159
06/09/2014	160
06/10/2014	161
06/11/2014	162
06/12/2014	163
06/23/2014	174

Table 3: Dates of Hydrography

Mainscheme survey lines were run with a dual-head multibeam echosounder. Linear nautical miles for the dual-head system were calculated using statistics from the starboard head.

B. Data Acquisition and Processing

B.1 Equipment and Vessels

Refer to the Data Acquisition and Processing Report (DAPR) for a complete description of data acquisition and processing systems, survey vessels, quality control procedures, and data processing methods. Additional information to supplement sounding and survey data, and any deviations from the DAPR are discussed in the following sections.

B.1.1 Vessels

The following vessels were used for data acquisition during this survey:

Hull ID	***S250***
LOA	37.7 meters
Draft	3.77 meters

Table 4: Vessels Used

Figure 3: NOAA Ship FERDINAND R. HASSLER alongside pier at Marine Operations Center - Atlantic

NOAA Ship FERDINAND R. HASSLER (S250), shown in Figure 3, acquired all data within the limits of H12700.

B.1.2 Equipment

The following major systems were used for data acquisition during this survey:

Manufacturer	Model	Type
RESON	7125	MBES
Applanix	POS M/V 320 V5	Positioning and Attitude System
Hemisphere	MBX-4	Positioning System
AML	MicroCTD	Sound Speed System
Brooke Ocean	MVP-200	Sound Speed System
RESON	SVP-70	Sound Speed System
Sea Bird	SBE 19+	Conductivity, Temperature, and Depth Sensor

Table 5: Major Systems Used

B.2 Quality Control

B.2.1 Crosslines

Crosslines, acquired for this survey, totalled 6.9% of mainscheme acquisition.

Multibeam crosslines were acquired using the RESON 7125 on Dn162 and Dn163. Crosslines were filtered to remove soundings greater than 45 degrees from nadir. The crossline percentage satisfies requirements stated in Section 5.2.4.3 of the HSSD. A 4-meter CUBE surface was created using the mainscheme lines, while a second 4-meter CUBE surface was created using only crosslines. These two surfaces were differenced at a 4-meter resolution as shown in Figure 4. The average difference between the depths derived from the mainscheme and crosslines is -0.07 meters with a standard deviation of 0.11 meters; 95% of all differences are less than 0.19 meters from the mean, as shown in Figure 5.

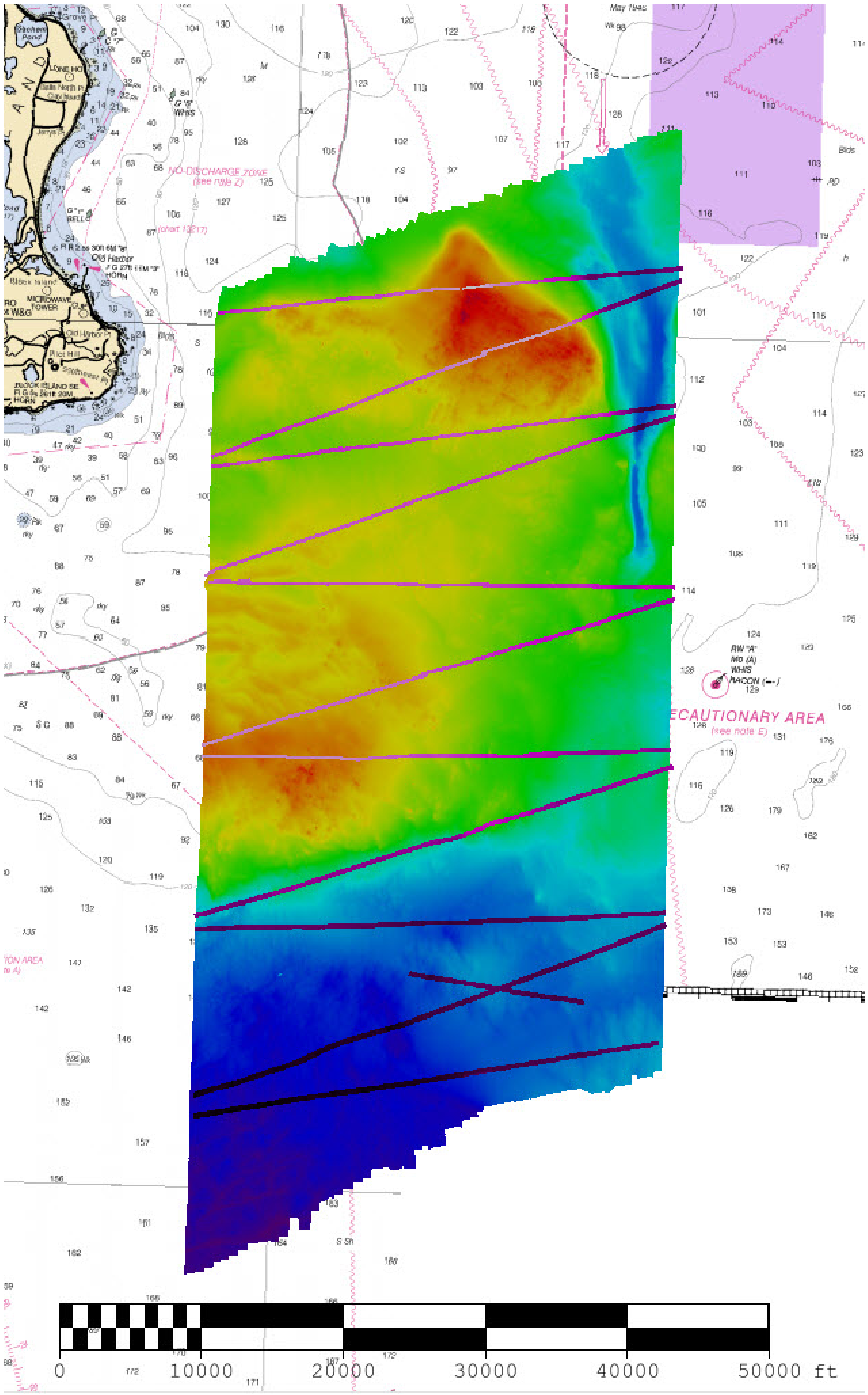


Figure 4: H12700 MBES crossline data, shown in purple, overlaid on mainscheme surface.

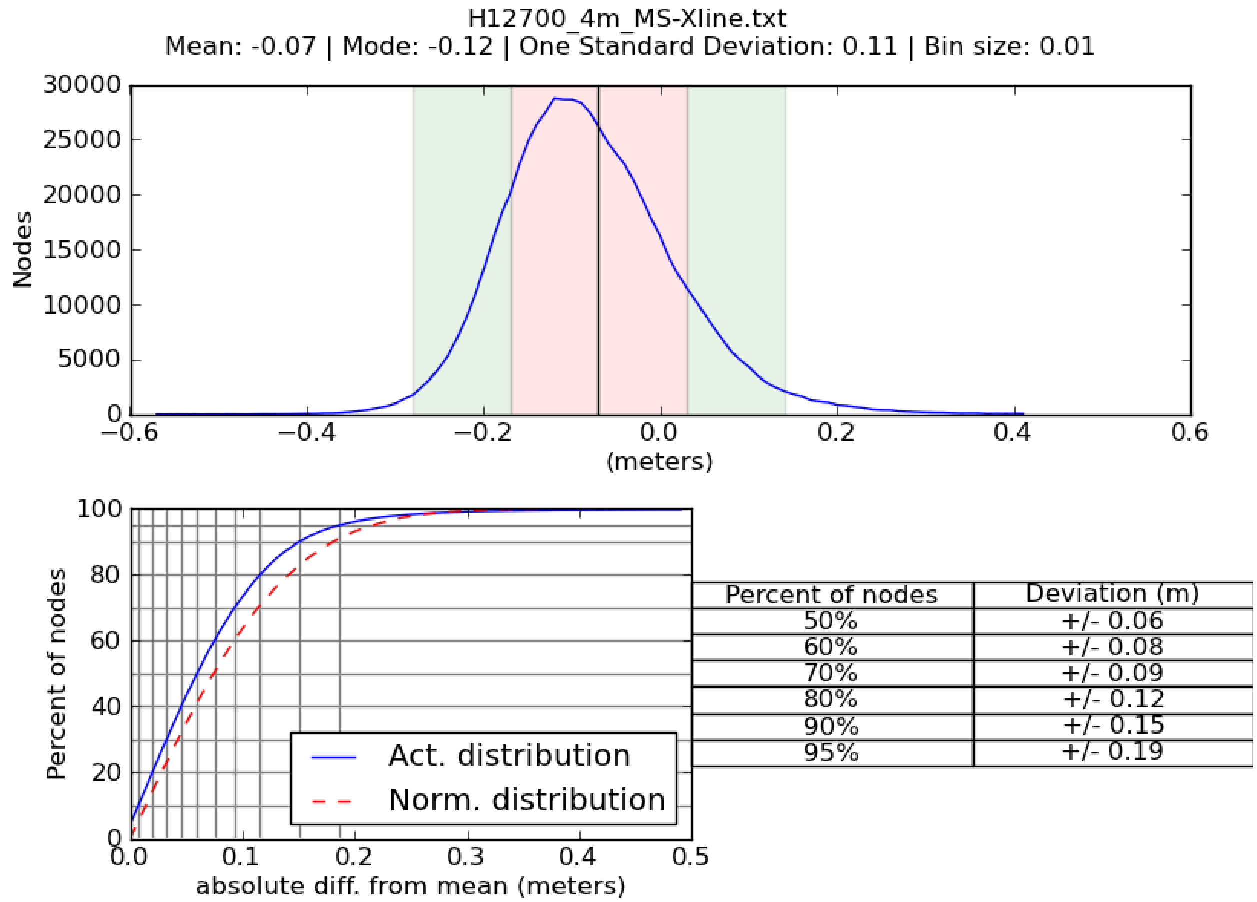


Figure 5: H12700 crossline difference statistics: mainscheme minus crosslines

B.2.2 Uncertainty

The following survey specific parameters were used for this survey:

Measured	Zoning
0.01 meters	0.14 meters

Table 6: Survey Specific Tide TPU Values

Hull ID	Measured - CTD	Measured - MVP	Surface
S250	1.0 m/s	1.0 m/s	0.5 m/s

Table 7: Survey Specific Sound Speed TPU Values

CO-OPS provided the tidal zoning uncertainty of 0.14 meters in the Project Instructions for project OPR-B307-FH-14. All data were corrected with zoned tides and received this uncertainty estimate.

SMRMSG files were loaded for all lines, except for the three lines mentioned in section C.2 of this report, for post-processed position and attitude RMS values. These were applied by selecting Realtime as the uncertainty source in the CARIS HIPS Compute TPU tool for the following; position, heading, pitch, and roll. For the three lines mentioned in section C.2, SMRMSG files failed to load and received TPU calculations from Vessel Settings. Vertical uncertainty was calculated using the Delayed Heave RMS file for all lines. Refer to Figure 6 for sources of error data chosen in CARIS for computing TPU.

	SOURCE	
Uncertainty	Majority of Lines	3 Lines in Section C.2
Position	Realtime	Vessel
Sonar	Vessel	Vessel
Heading	Realtime	Vessel
Pitch	Realtime	Vessel
Roll	Realtime	Vessel
Vertical	Delayed Heave	Delayed Heave
Tide	Static	Static

Figure 6: Sources of error data chosen in CARIS

B.2.3 Junctions

Five junction comparisons were completed for H12700 as shown in Figure 7. Four surveys were completed by NOAA Ship THOMAS JEFFERSON: H12009 and H12010 in 2009, and H12430 and H12431 in 2012. One survey was completed in 2014 by NOAA Ship FERDINAND R. HASSLER, H12702, which is within the same project as H12700. Additionally, NOAA Ship THOMAS JEFFERSON is conducting one survey, H12675, during the 2014 field season, which was not complete at the time of processing survey H12700.

All junction surfaces were subtracted from the surface of H12700 to assess sounding consistency.

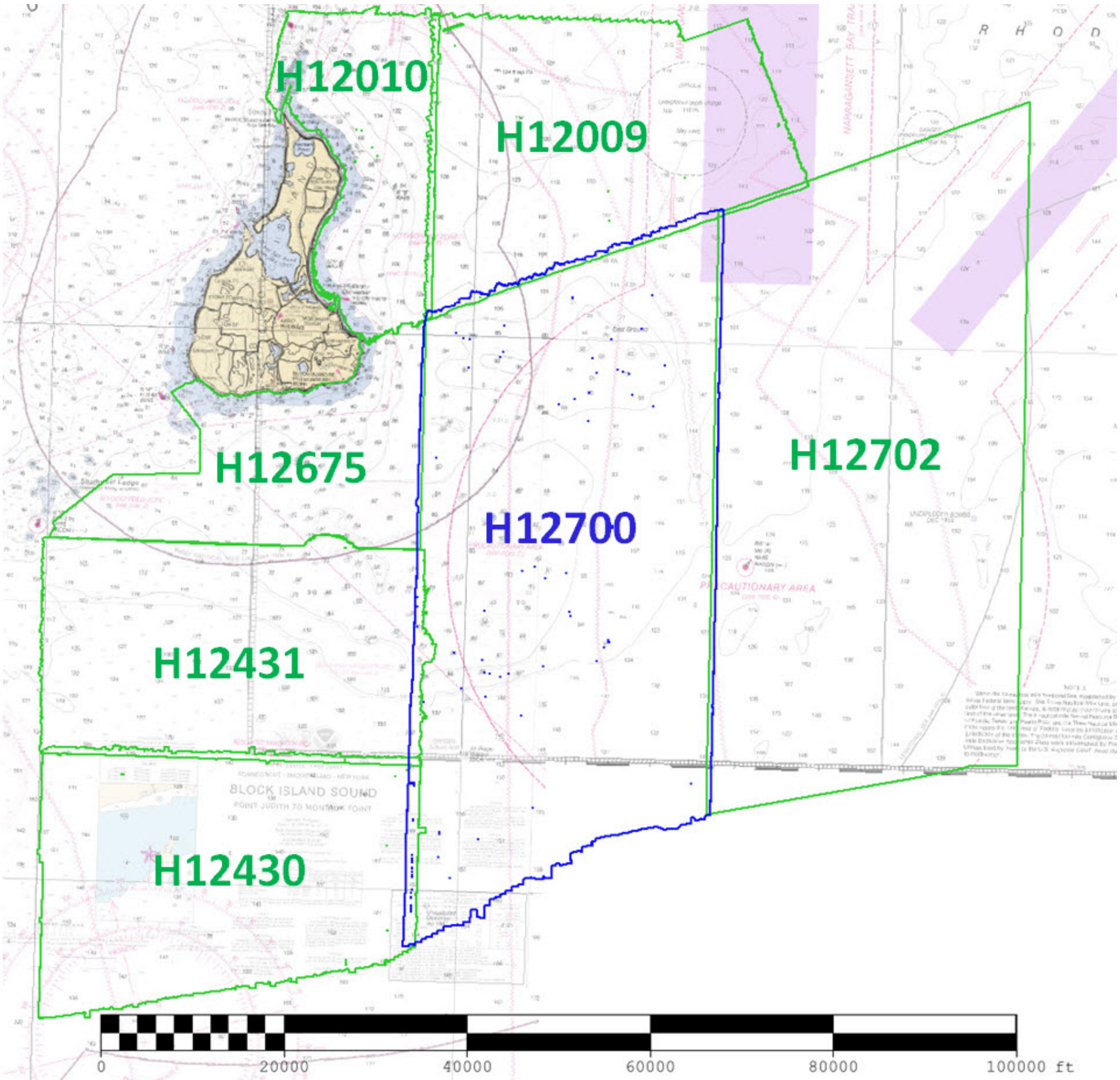


Figure 7: H12700 and junction surveys

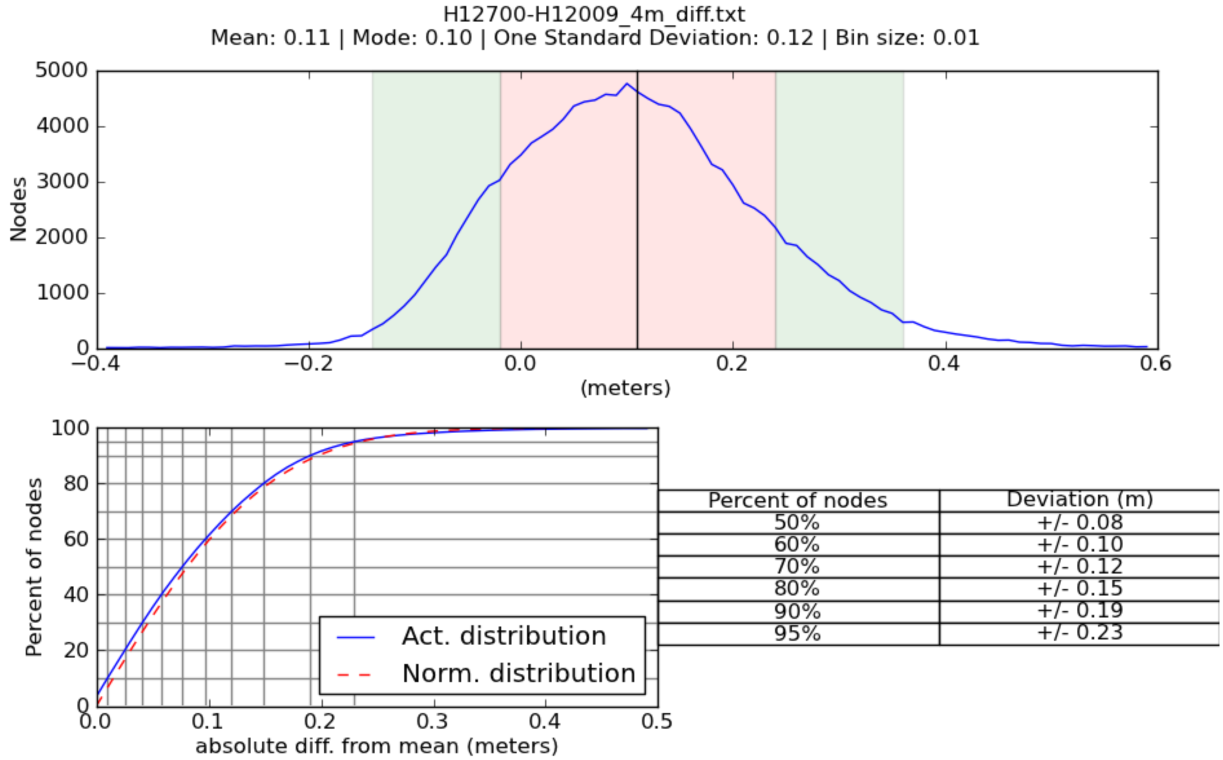
The following junctions were made with this survey:

Registry Number	Scale	Year	Field Unit	Relative Location
H12009	1:20000	2009	NOAA Ship THOMAS JEFFERSON	NW
H12010	1:7500	2009	NOAA Ship THOMAS JEFFERSON	NW
H12430	1:20000	2012	NOAA Ship THOMAS JEFFERSON	SW
H12431	1:20000	2012	NOAA Ship THOMAS JEFFERSON	W
H12702	1:40000	2014	NOAA Ship FERDINAND R. HASSLER	E

Table 8: Junctioning Surveys

H12009

Survey H12009 was assigned to the NOAA Ship THOMAS JEFFERSON as a part of project OPR-B363-TJ-09. The location is shown in Figure 7. A 4-meter resolution surface of H12009 was subtracted from a 4-meter resolution surface of H12700. Of the 138 thousand overlapping nodes, the average difference is 0.11 meters with a standard deviation of 0.12 meters. Ninety-five percent of all nodes are within 0.23 meters of the mean, as shown in Figure 8.



Percent of nodes	Deviation (m)
50%	+/- 0.08
60%	+/- 0.10
70%	+/- 0.12
80%	+/- 0.15
90%	+/- 0.19
95%	+/- 0.23

Figure 8: Differenced surface statistics: H12700 minus H12009

<u>H12010</u>

Survey H12010 was assigned to the NOAA Ship THOMAS JEFFERSON as a part of project OPR-B363-TJ-09. The location of H12010 is shown in Figure 7. A 4-meter resolution surface of H12010 was subtracted from a 4-meter resolution surface of H12700. Of the 2,700 overlapping nodes, the average difference is 0.09 meters with a standard deviation of 0.11 meters. Ninety-five percent of all nodes are within 0.24 meters of the mean, as shown in Figure 9.

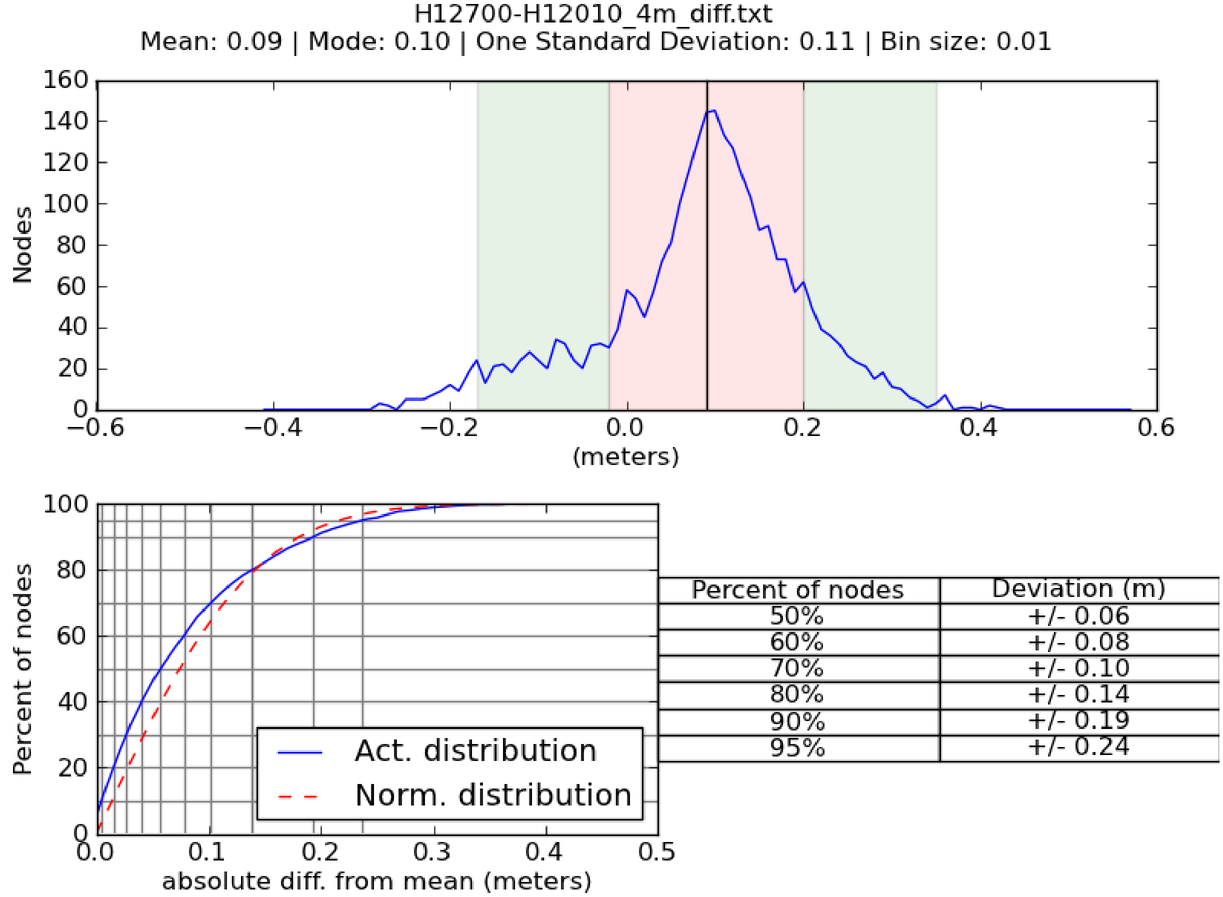
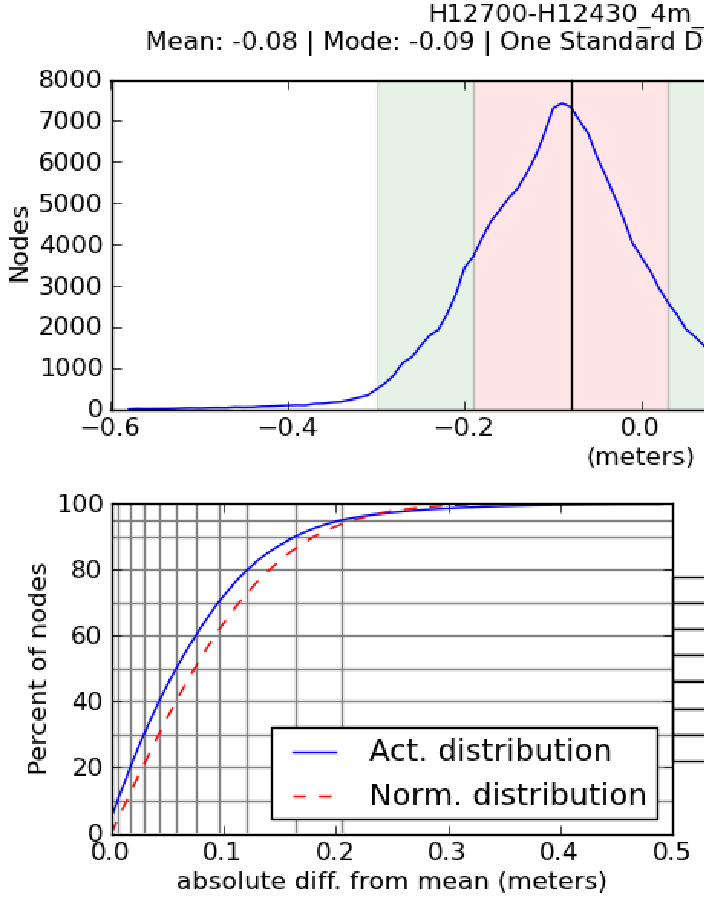


Figure 9: Differenced surface statistics: H12700 minus H12010

<u>H12430</u>

Survey H12430 was assigned to the NOAA Ship THOMAS JEFFERSON as a part of project OPR-B363-TJ-12. The location of H12430 is shown in Figure 7. A 4-meter resolution surface of H12430 was subtracted from a 4-meter resolution surface of H12700. Of the 158 thousand overlapping nodes, the average difference is -0.08 meters with a standard deviation of 0.11 meters. Ninety-five percent of all nodes are within 0.20 meters of the mean, as shown in Figure 10.

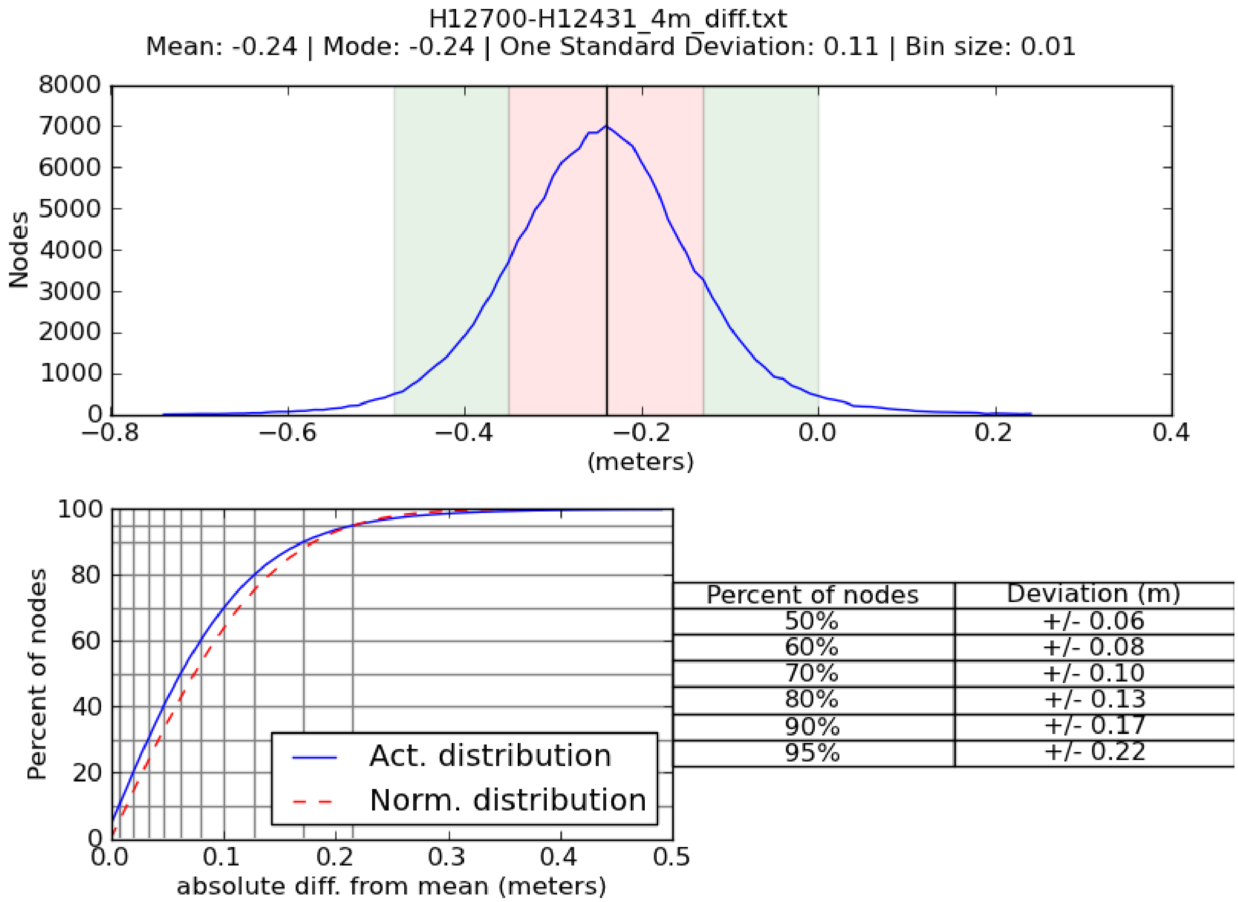


Percent of nodes	Deviation (m)
50%	+/- 0.06
60%	+/- 0.08
70%	+/- 0.10
80%	+/- 0.12
90%	+/- 0.16
95%	+/- 0.20

Figure 10: Differenced surface statistics: H12700 minus H12430

<u>H12431</u>

Survey H12431 was assigned to the NOAA Ship THOMAS JEFFERSON as a part of project OPR-B363-TJ-12. The location of H12431 is shown in Figure 7. A 4-meter resolution surface of H12431 was subtracted from a 4-meter resolution surface of H12700. Of the 169 thousand overlapping nodes, the average difference is -0.24 meters with a standard deviation of 0.11 meters. Ninety-five percent of all nodes are within 0.22 meters of the mean, as shown in Figure 11.



Percent of nodes	Deviation (m)
50%	+/- 0.06
60%	+/- 0.08
70%	+/- 0.10
80%	+/- 0.13
90%	+/- 0.17
95%	+/- 0.22

Figure 11: Differenced surface statistics: H12700 minus H12431

<u>H12702</u>

Survey H12702 was assigned to the NOAA Ship FERDINAND R. HASSLER as a part of project OPR-B307-FH-14. The location of H12702 is shown in Figure 7. A 4-meter resolution surface of H12702 was subtracted from a 4-meter resolution surface of H12700. Of the 277 thousand overlapping nodes, the average difference is 0.07 meters with a standard deviation of 0.14 meters. Ninety-five percent of all nodes are within 0.27 meters of the mean, as shown in Figure 12.

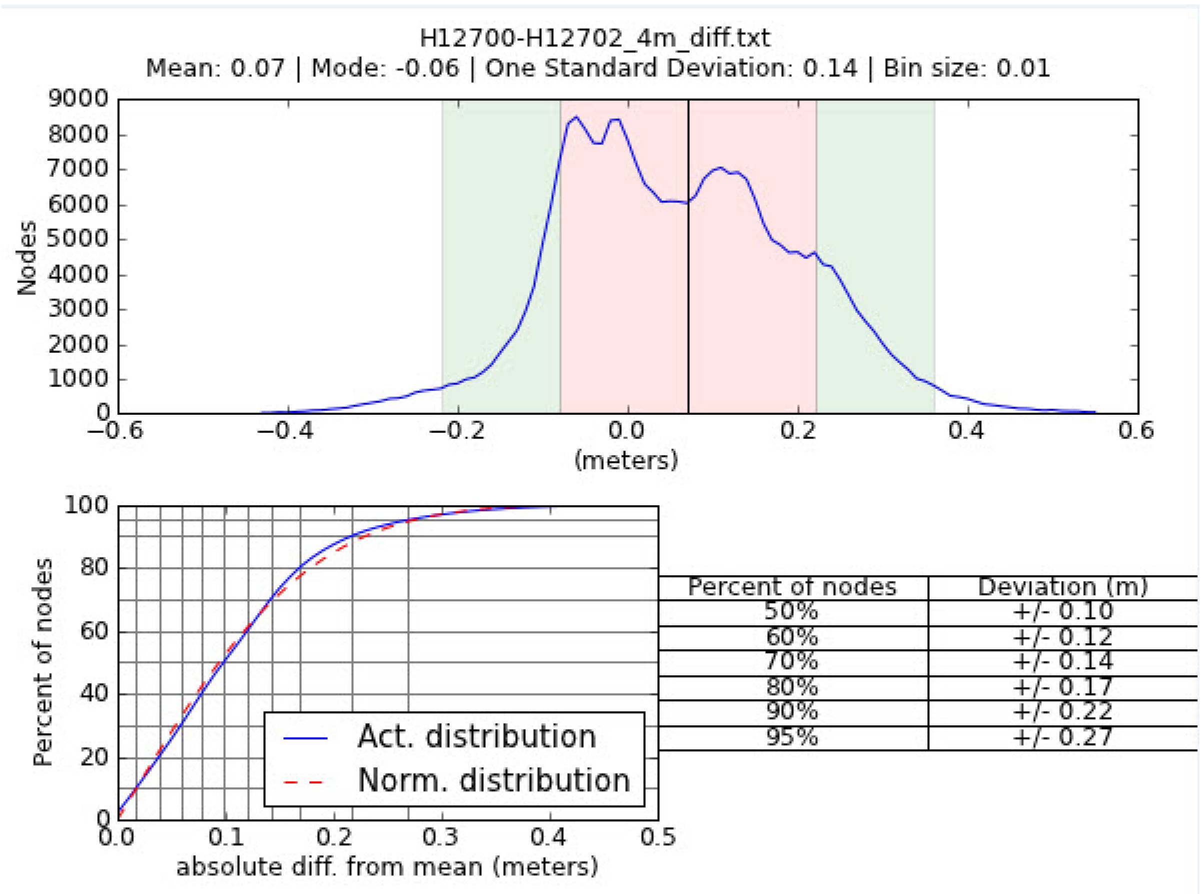


Figure 12: Differenced surface statistics: H12700 minus H12702

B.2.4 Sonar QC Checks

Sonar system quality control checks were conducted as detailed in the quality control section of the DAPR.

B.2.5 Equipment Effectiveness

<u>POS IMU Failure</u>

A port-side IMU failure on Dn156 during acquisition caused two port 7125 lines to contain navigation errors. These data were deleted and are not included as part of the data submitted as H12700. The corresponding starboard data, lines 20140605_094304 and 20140605_104519, were unaffected and were included in the project files for H12700.

B.2.6 Factors Affecting Soundings

There were no other factors that affected corrections to soundings.

B.2.7 Sound Speed Methods

Sound Speed Cast Frequency: CTD casts using the MVP-200 or SBE 19+ were taken approximately every hour.

Sound speed corrections were applied in CARIS using Nearest in Distance Within Time (NIDWT) of 4 hours for the entire survey (Figure 13). Comparisons were made by the survey watch to assess sound speed variation in the water column. The results of these comparisons showed that variations were mainly spatial and not a function of time. To try to accurately capture the spatial trend, the project area was divided into three sections. Data were still acquired with north/south ship tracklines but not for the entire length of the sheet. The number of turns resulting from this strategy increased the overall acquisition time but better allowed us to accurately sample smaller areas without conducting more casts.

Even with this strategy, the sampling frequency was not high enough to capture all of the temporal and spatial sound speed variations within the surveyed area. As shown in Figure 14, sound speed refraction errors are evident in the data. These data are cleaned thoroughly if outer beam errors exceeded allowable uncertainty values.

Sound speed casts were completed using the Sea Bird 19+ on Dn174 due to the loss of the MVP probe on Dn173. Figures 15 and 16 below show the position of the CTD casts taken and the lines in which the casts were applied.

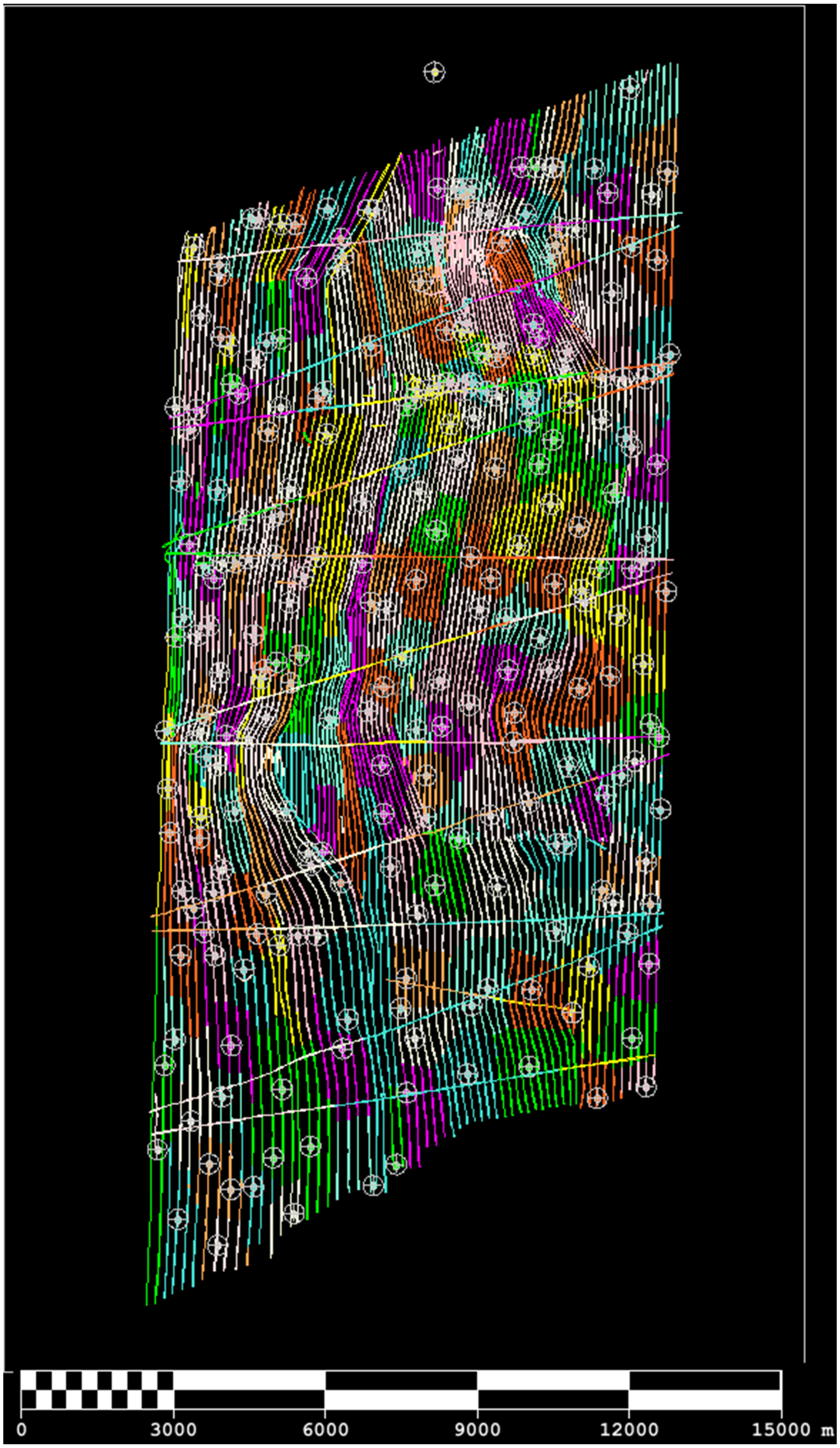


Figure 13: H12700 lines colored by applied sound velocity profile

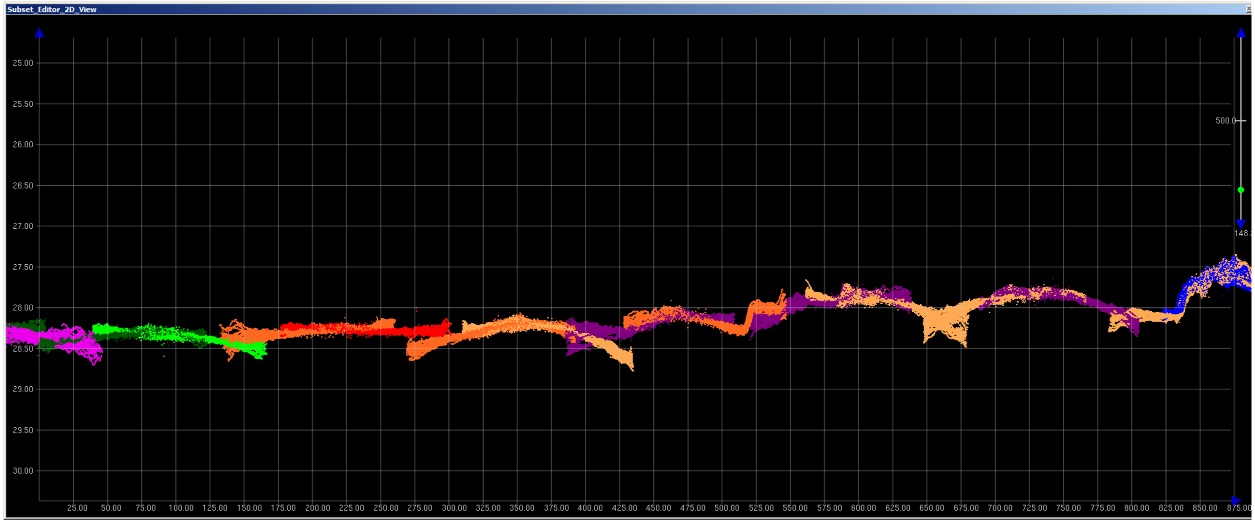


Figure 14: Outer beam refraction errors cause from changing sound velocity throughout the survey area. Data were cleaned thoroughly if outer beam errors exceeded allowable uncertainty values.

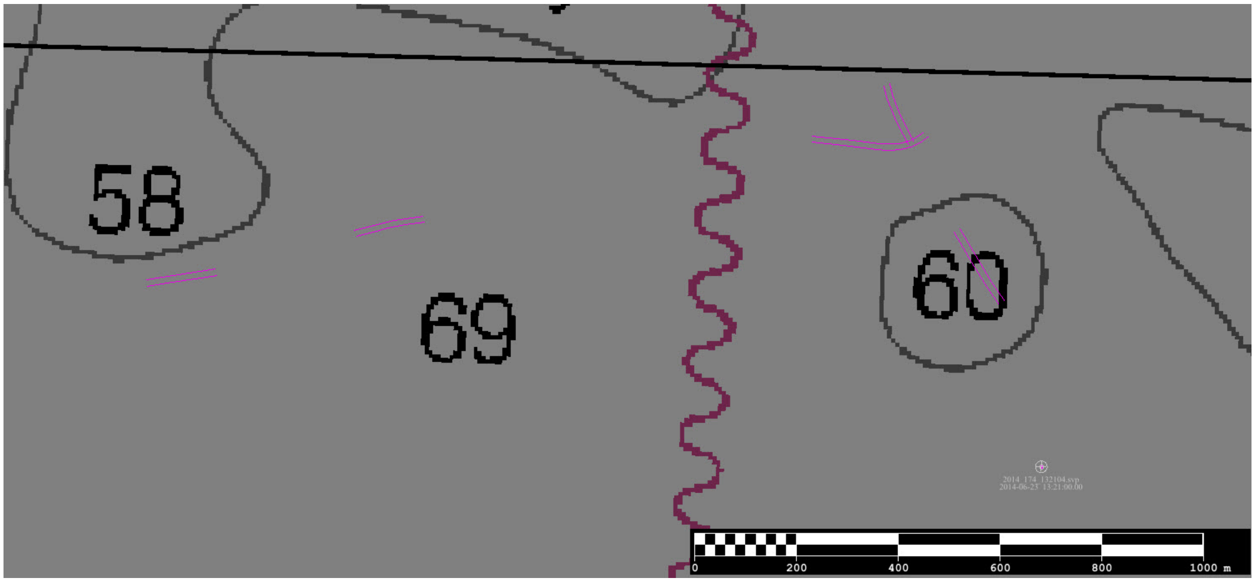


Figure 15: CTD cast in northern section of survey and applied lines

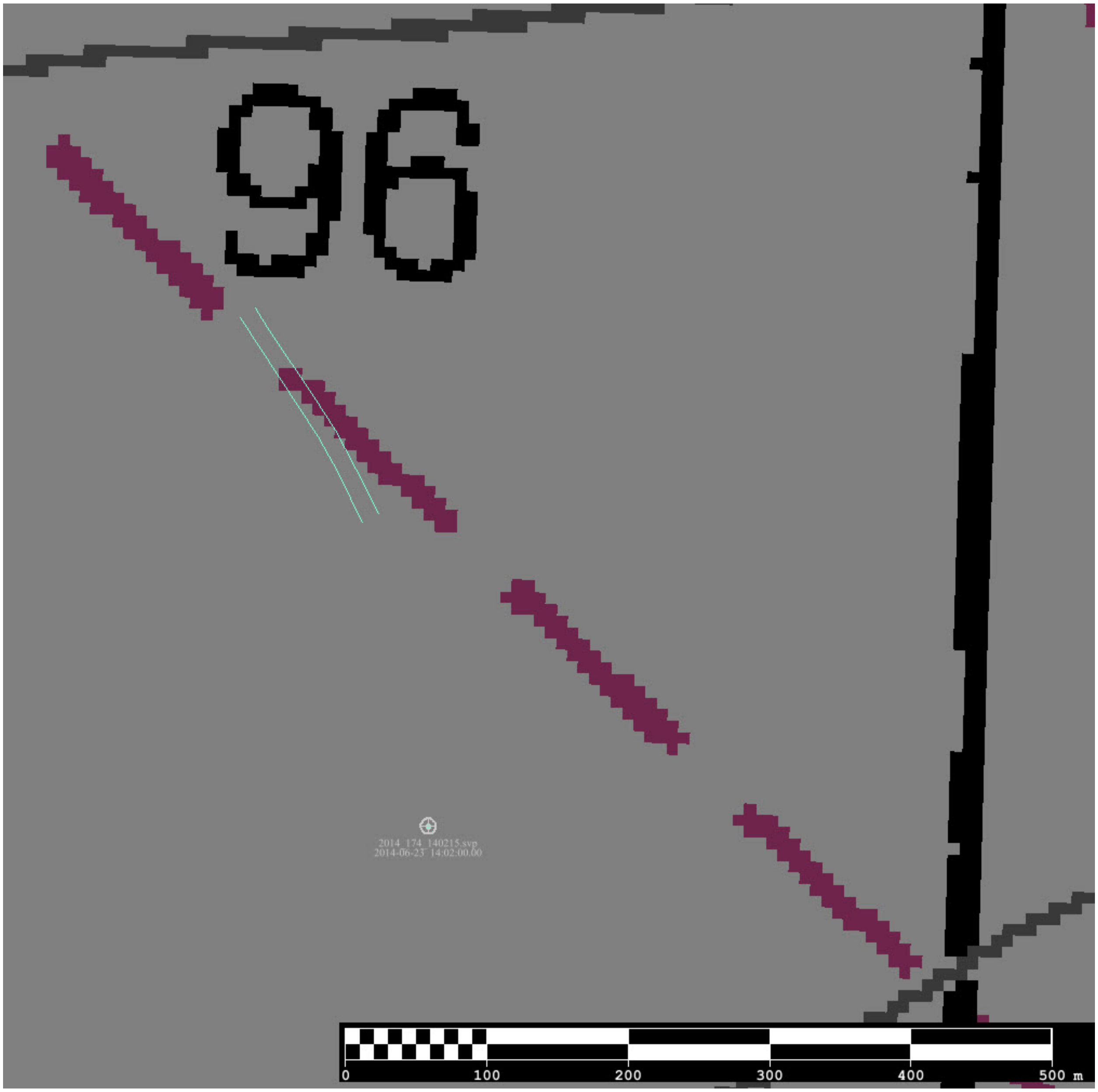


Figure 16: CTD cast in the southwestern section of survey and applied lines

B.2.8 Coverage Equipment and Methods

A density analysis was run to calculate the number of soundings per surface node for complete multibeam coverage and object detection surfaces. Five or more soundings per node are present in over 96.33% of the 0.5-meter surface, 99.99% of the 2-meter surface, and 99.98% of the 4-meter surface. For additional detail refer to H12700_Standards_Compliance report submitted in Appendix II of this report.

The density analysis only includes nodes which are populated by at least one sounding and does not account for holidays located within the surface, which will be discussed in the following section of this report.

B.2.9 Holidays

There are a number of holidays that exist as a result of acoustic shadowing at the base of rocks and other areas of high relief, predominately in the 0.5-meter surface. Examples of these holidays are shown below in Figures 17-19. These holidays have been examined by the hydrographer and are deemed insignificant as the least depths in these areas have been obtained.

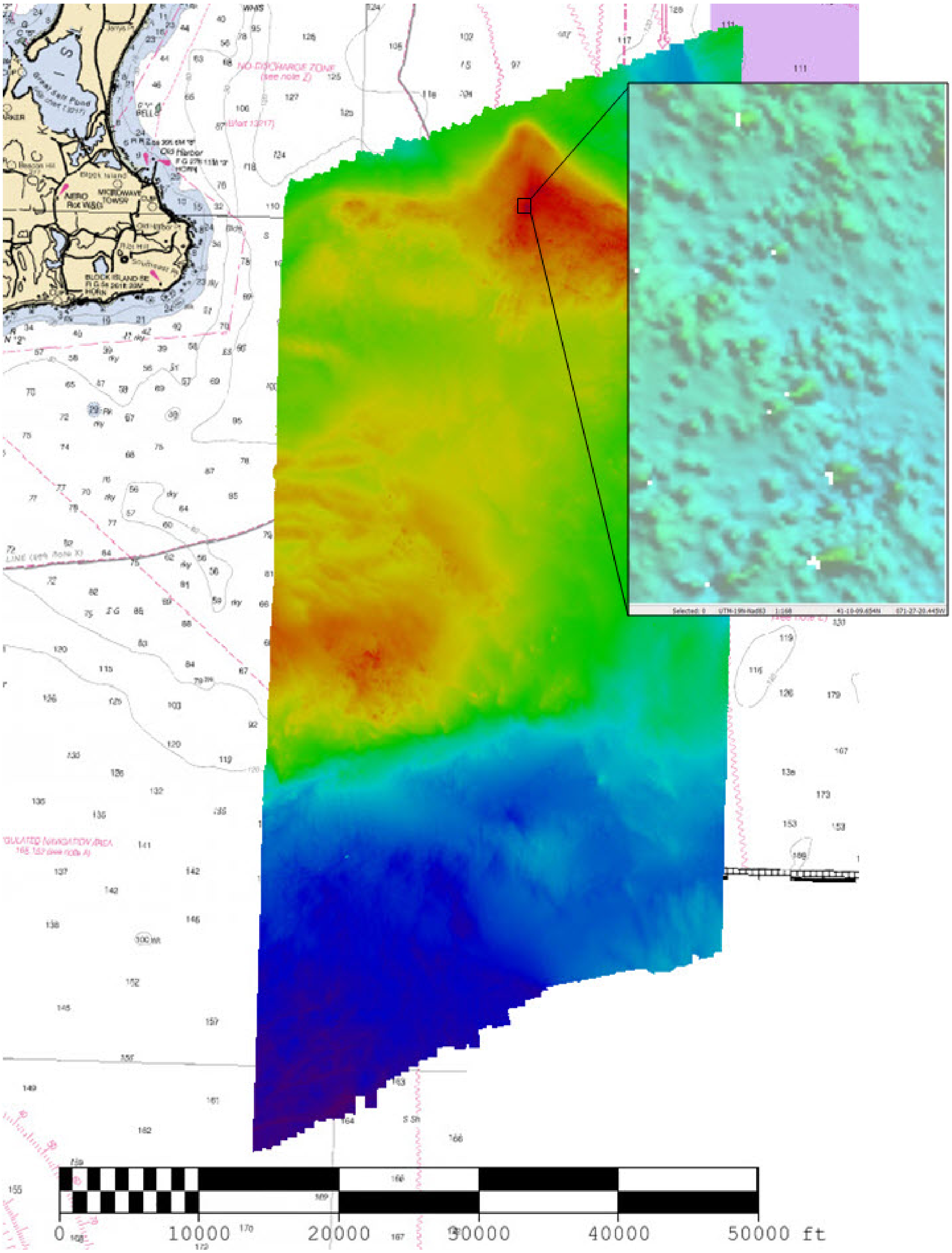


Figure 17: Example of holidays observed in rocky area due to acoustic shadowing.

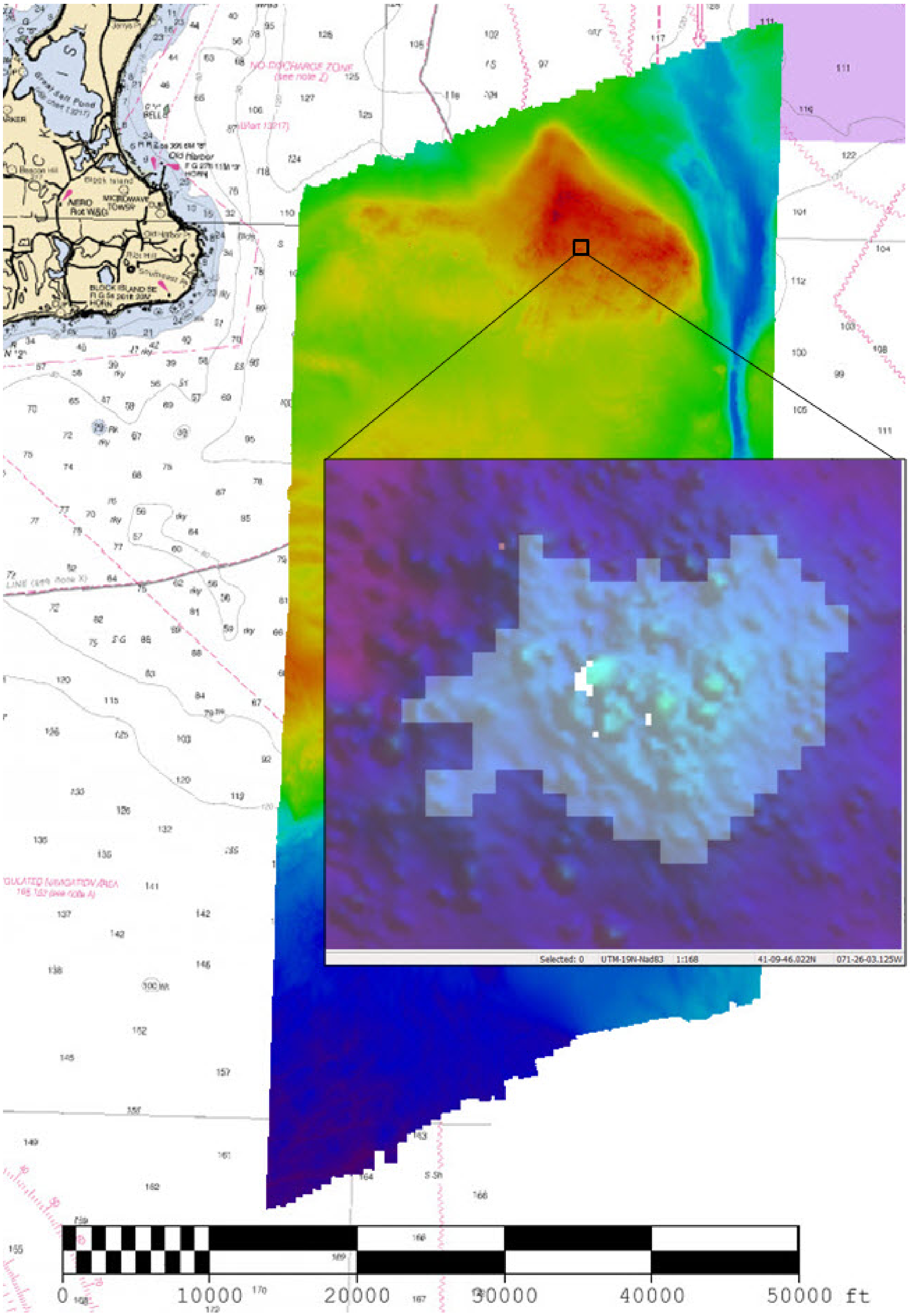


Figure 18: Example of holidays observed in rocky area due to acoustic shadowing.

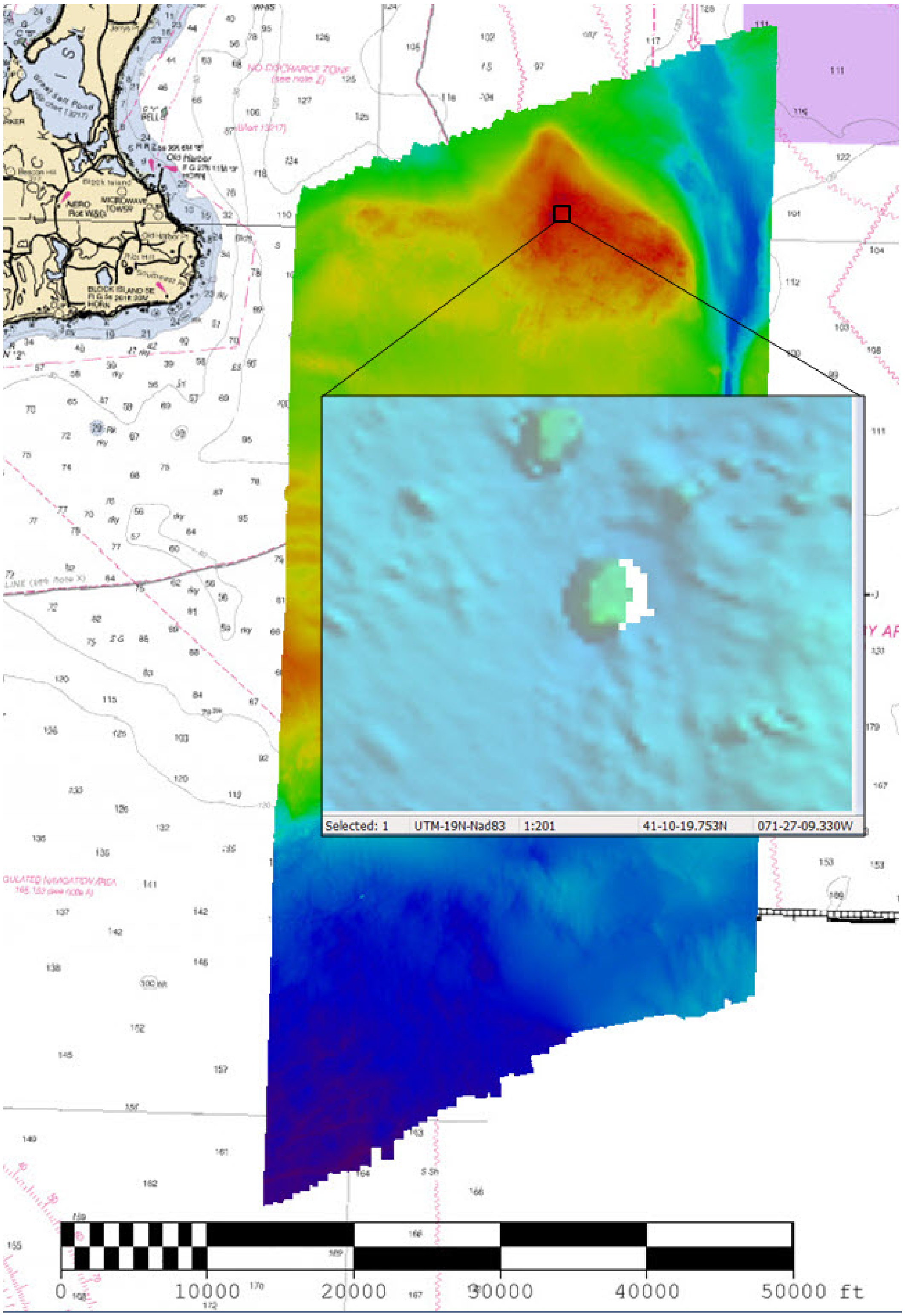


Figure 19: Example of holidays observed in rocky area due to acoustic shadowing.

B.3 Echo Sounding Corrections

B.3.1 Corrections to Echo Soundings

All data reduction procedures conform to those detailed in the DAPR.

B.3.2 Calibrations

All sounding systems were calibrated as detailed in the DAPR.

B.4 Backscatter

Backscatter was logged in RESON datagram 7008 snippets record in the raw .s7k files. The .s7k file also holds the navigation record and bottom detections for all lines of survey H12700. The files were paired with the CARIS HDCS data, imported, and processed using Fledermaus Geocoder Toolbox.

The GSF files containing the extracted backscatter are submitted with the data in this survey. The processed mosaic is saved as a Geo-Tiff and also submitted.

B.5 Data Processing

B.5.1 Software Updates

There were no software configuration changes after the DAPR was submitted.

The following Feature Object Catalog was used: NOAA Profile Version 5.3.2

B.5.2 Surfaces

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

Surface Name	Surface Type	Resolution	Depth Range	Surface Parameter	Purpose
H12700_MB_50cm_MLLW	CUBE	0.5 meters	13.06 meters - 60.77 meters	NOAA_0.5m	Object Detection
H12700_MB_1m_MLLW	CUBE	1 meters	13.14 meters - 54.45 meters	NOAA_1m	Object Detection

Surface Name	Surface Type	Resolution	Depth Range	Surface Parameter	Purpose
H12700_MB_2m_MLLW	CUBE	2 meters	13.61 meters - 52.08 meters	NOAA_2m	Complete MBES
H12700_MB_4m_MLLW	CUBE	4 meters	13.66 meters - 52.30 meters	NOAA_4m	Complete MBES
H12700_MB_50cm_MLLW_Final	CUBE	0.5 meters	13.06 meters - 22.00 meters	NOAA_0.5m	Object Detection
H12700_1m_MLLW_Final	CUBE	1 meters	18.00 meters - 40.00 meters	NOAA_1m	Object Detection
H12700_MB_2m_MLLW_Final	CUBE	2 meters	18.00 meters - 40.00 meters	NOAA_2m	Complete MBES
H12700_MB_4m_MLLW_Final	CUBE	4 meters	36.00 meters - 52.30 meters	NOAA_4m	Complete MBES

Table 9: Submitted Surfaces

Two surfaces are being submitted for each recommended depth range deeper than 20 meters. Refer to Section B.5.3 of this report for additional information for why two surfaces are being submitted as well as quality control practices that were taken on each.

B.5.3 Surface honoring least depths in rocky areas

During processing it was noticed that least depths on rocks and boulders were not being reflected in the recommended resolution surfaces. For example, a 2-meter rock was not being honored at a depth of 30 meters in the 2-meter surface. A subset of a single survey (approximately 2km x 4km with depths 30 to 35 meters) was analyzed and found to require approximately 60 designated soundings to honor the least depths of rocks and boulders. The decision was made to create higher resolution surfaces to eliminate the need to individually designate these rocks, e.g. a 1-meter resolution surface. After analysis of the 1-meter surface, 59 of the 60 soundings no longer required to be designated and were accepted per normal procedures by the hydrographer.

The 1-meter surface was created for least depth values only. It is the field unit’s intent that during the compilation at the hydrographic branch, the 1-meter depths will be chosen over subsequent 2 and 4-meter depths, if the z value is least. According to section 5.2.2.4 of the Hydrographic Survey Specifications and Deliverables (HSSD) it is not necessary that this higher grid resolution surface meet coverage requirements typical for that resolution surface, instead coverage will still be measured by the original resolution requirement. This includes holidays spanning more than three nodes and density standards compliance.

Two finalized surfaces are submitted for individual depth ranges for all surveys conducted during the course of OPR-B307-FH-14, one for least depths and the other for coverage. For example, H12700_MB_1m_MLLW_Final surface is for least depths while H12700_MB_2m_MLLW_Final surface, covering the same depth range as the 1-meter, is being submitted for coverage. This only applies to depths deeper than 20 meters. For depths shallower than 20 meters, object detection methods were assigned in the Project Instructions (PIs), therefore requiring the creation and submission of a 0.5-meter surface that meets or exceeds standards specified in the HSSD.

B.5.4 Designated Soundings

Within the limits of H12700, thirty-five soundings are submitted flagged as designated in CARIS HIPS and SIPS. Of these thirty-five soundings; five are designated for feature creation and thirty are to preserve the shoal depth in the finalized surfaces.

B.5.5 Total Vertical Uncertainty Analysis

A custom layer was created on finalized surfaces showing the uncertainty of individual nodes in relation to the allowable uncertainty for their depths. This layer was exported and run through a custom Python script resulting in statistical analysis. Over 99% of nodes with survey H12700 meet the vertical uncertainty standards of section 5.1.3 of the Hydrographic Surveys Specifications and Deliverables (2014). See H12700_Standards_Compliance report submitted in Appendix II of this report.

C. Vertical and Horizontal Control

All vertical and horizontal control activities conducted during the course of this survey are fully addressed in the following sections. Therefore, no separate HVCR is submitted.

C.1 Vertical Control

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

<u>Standard Vertical Control Methods Used:</u>

Discrete Zoning

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

Station Name	Station ID
Newport, RI	8452660

Table 10: NWLON Tide Stations

File Name	Status
8452660.tid	Verified Observed

Table 11: Water Level Files (.tid)

File Name	Status
B307FH2014_RevCORP.zdf	Final

Table 12: Tide Correctors (.zdf or .tc)

A request for final approved tides was sent to N/OPS1 on 06/24/2014. The final tide note was received on 07/02/2014.

Preliminary zoning is accepted as the final zoning for Project OPR-B307-FH-14, H12700, during the time period between June 5 - 24, 2014.

All soundings submitted are reduced to Mean Lower Low Water (MLLW) using verified discrete zoned tides. As required by the Project Instructions, a VDatum evaluation was conducted prior to survey submittal. From this analysis results it was discovered that due to the presence of poor vertical GPS solutions, considerable additional time and resources would have been required to complete and submit an acceptable finished product. The recommendation to use the discrete tidal zoning for vertical transformation was made from the analysis and is included in the evaluation report submitted. The Chief, Hydrographic Survey Division, acknowledged the delivery of the report and stated that no approval memo from HSD is required when proceeding with zoned tides. The VDatum evaluation report and correspondence are included in the Appendix II of this report.

C.2 Horizontal Control

The horizontal datum for this project is North American Datum of 1983 (NAD83).

The projection used for this project is UTM Zone 19N.

<u>The following PPK methods were used for horizontal control:</u>

Smart Base

All data submitted as H12700 have SBETs applied for post-processed horizontal position and attitude except for the following lines collected from the starboard head on Dn160; 20140609_102850, 20140609_105729, and 20140609_112441.

These lines did not have successful post-processed solutions to apply and are corrected with DGPS positioning and real-time attitude values.

The following CORS Stations were used for horizontal control:

HVCR Site ID	Base Station ID
ACUSHNET 5, Acushnet, MA	ACU5
ACUSHNET 5, Acushnet, MA	ACU6
CHESAPEAKE LIGHT, Chesapeake Light, VA	COVX
GROTON, Groton, CT	CTGR
MANSFIELD, Mansfield, CT	CTMA
PUTNAM, Putnam, CT	CTPU
MILLSBORO, Millsboro, DE	DEMI
HLFX CACS-GSD, Halifax, Nova Scotia, Canada	HLFX
LOYOLA 2 COOP, Chesapeake, VA	LOY2
LOYOLA LOYW, Exmore, VA	LOYW
LOYOLA LS03, Virginia Beach, VA	LS03
MORICHES 5, East Moriches, NY	MOR5
MORICHES 6, East Moriches, NY	MOR6
NEW BERN 6, New Bern, NC	NBR6
BODIE ISLAND, Bodie Island, NC	NCBI
BUXTON, Buxton, NC	NCBX
CEDAR ISLAND, Cedar Island, NC	NCCI
ELIZABETH CITY, Elizabeth City, NC	NCEL
GATESVILLE, Gatesville, NC	NCGA
KINSTON, Kinston, NC	NCKI
RIVERHEAD, Riverhead, NY	NYRH
U of RI COOP, Kingston, RI	URIL
MTS FOX COOP, Foxborough, MA	XMTS
NEW YORK WAAS 1, New York, NY	ZNY1

Table 13: CORS Base Stations

DGPS was used for real-time positioning during acquisition.

The following DGPS Stations were used for horizontal control:

DGPS Stations
Moriches, NY (293 kHz)

Table 14: USCG DGPS Stations

C.3 Additional Horizontal or Vertical Control Issues

3.3.1 Horizontal Offsets

Horizontal offset exist in the data where the post-processed solutions are not as precise as expected. As shown in Figure 20, one rock may appear as two rocks with about 2 meters of separation. This offset is still well within the allowable horizontal uncertainty for the depths of soundings and has been determined to have little effect to the quality of the final product.

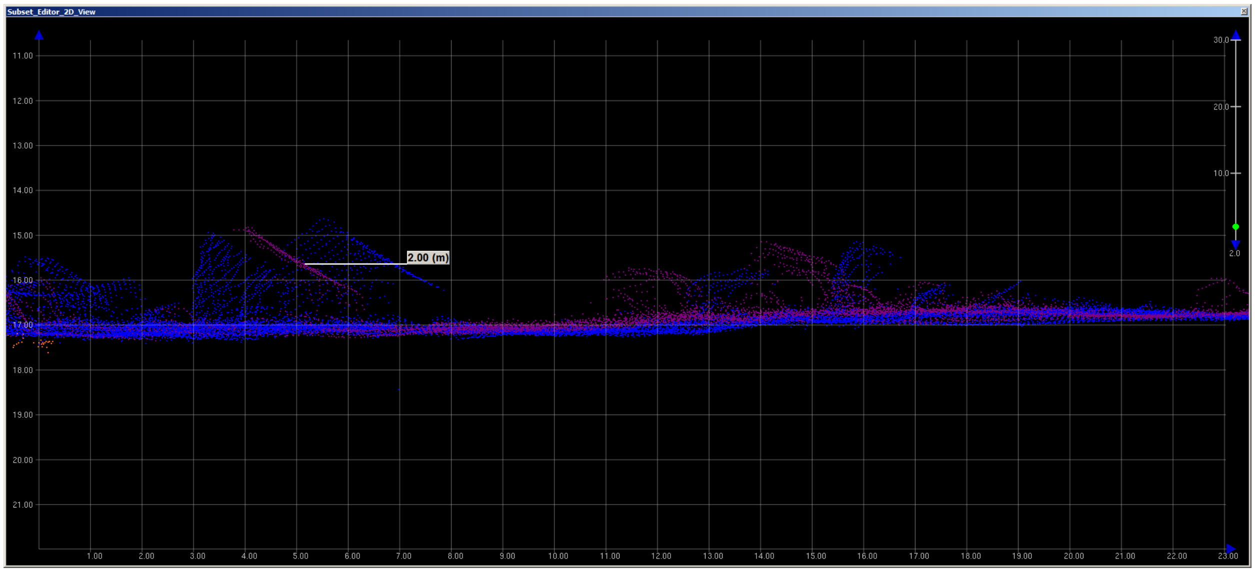


Figure 20: Horizontal offsets shown in 2D Subset Editor, soundings colored by line

D. Results and Recommendations

D.1 Chart Comparison

D.1.1 Raster Charts

The following are the largest scale raster charts, which cover the survey area:

Chart	Scale	Edition	Edition Date	LNM Date	NM Date
13215	1:40000	20	02/2011	04/22/2014	05/03/2014
13218	1:80000	42	07/2013	04/22/2014	05/03/2014
13205	1:80000	39	12/2010	04/22/2014	05/03/2014

Table 15: Largest Scale Raster Charts

13215

A comparison was performed with chart 13215 (1:40,000) using a CARIS sounding layer based on a 2-meter H12700 bathymetric surface and contour layer based on a 50-meter generalized surface from H12700. Most charted depths compare to within 4 feet of H12700 data.

Two surveyed soundings are about 10 feet shoaler than charted depths, as shown in Figure 21. Soundings acquired during H12700 in the areas of the two charted depths were shoaler by 4 - 13 feet. Additionally, a charted 57-foot wreck positioned at 41-06-45N, 071-29-24W was found to have a sounding depth of 69 feet.

The surveyed area outside of the charted 60-foot contour positioned at 41-04-51N, 071-29-38W is shoaler than 60 feet. The 60-foot contour at this location may need to be extended to encompass this shoaler region as shown in Figure 22.

It is recommended that H12700 data supersede all charted depths.

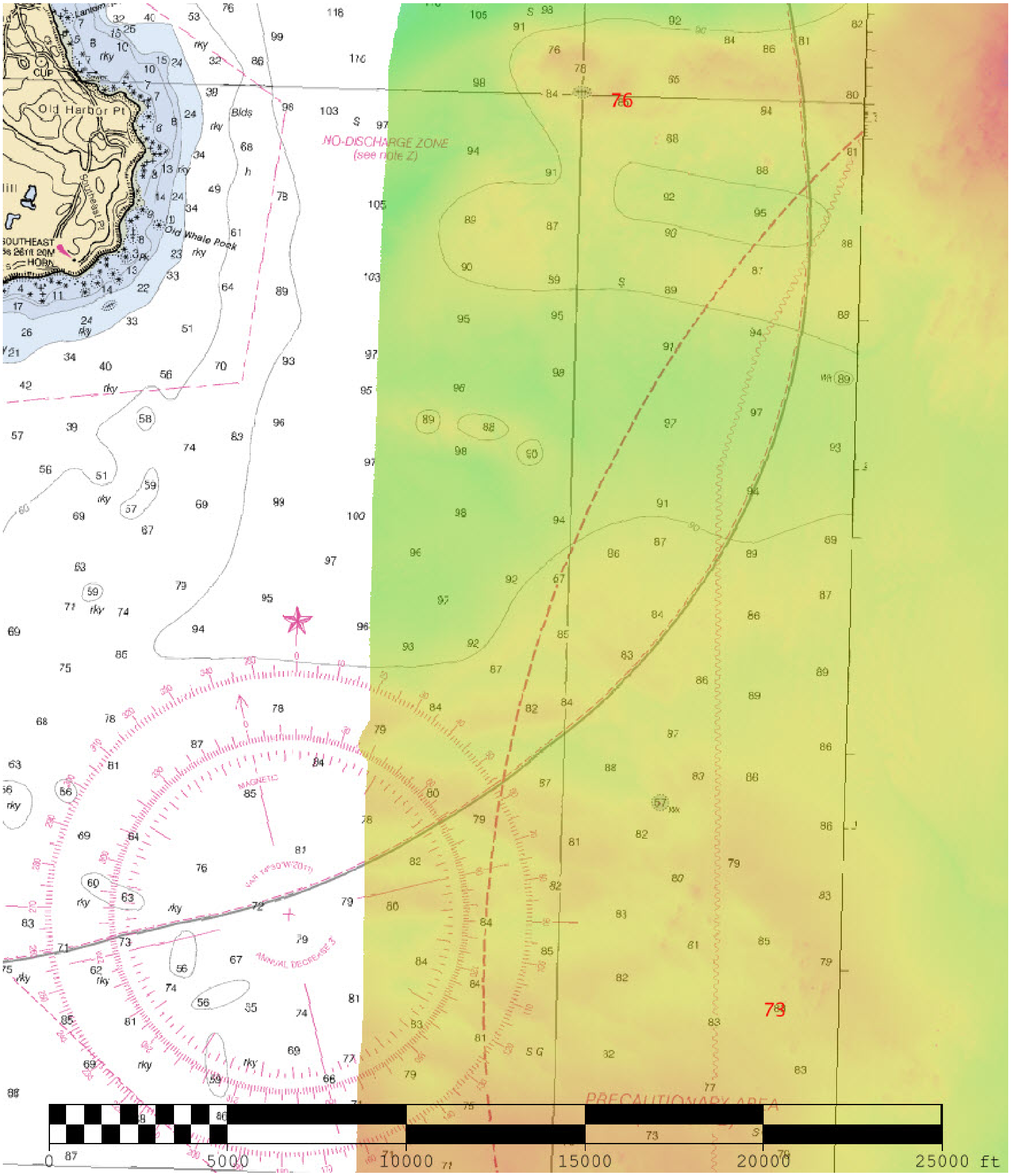


Figure 21: H12700 soundings, shown in red, highlight areas where surveyed depths are >10 feet shoaler than the corresponding charted depth.

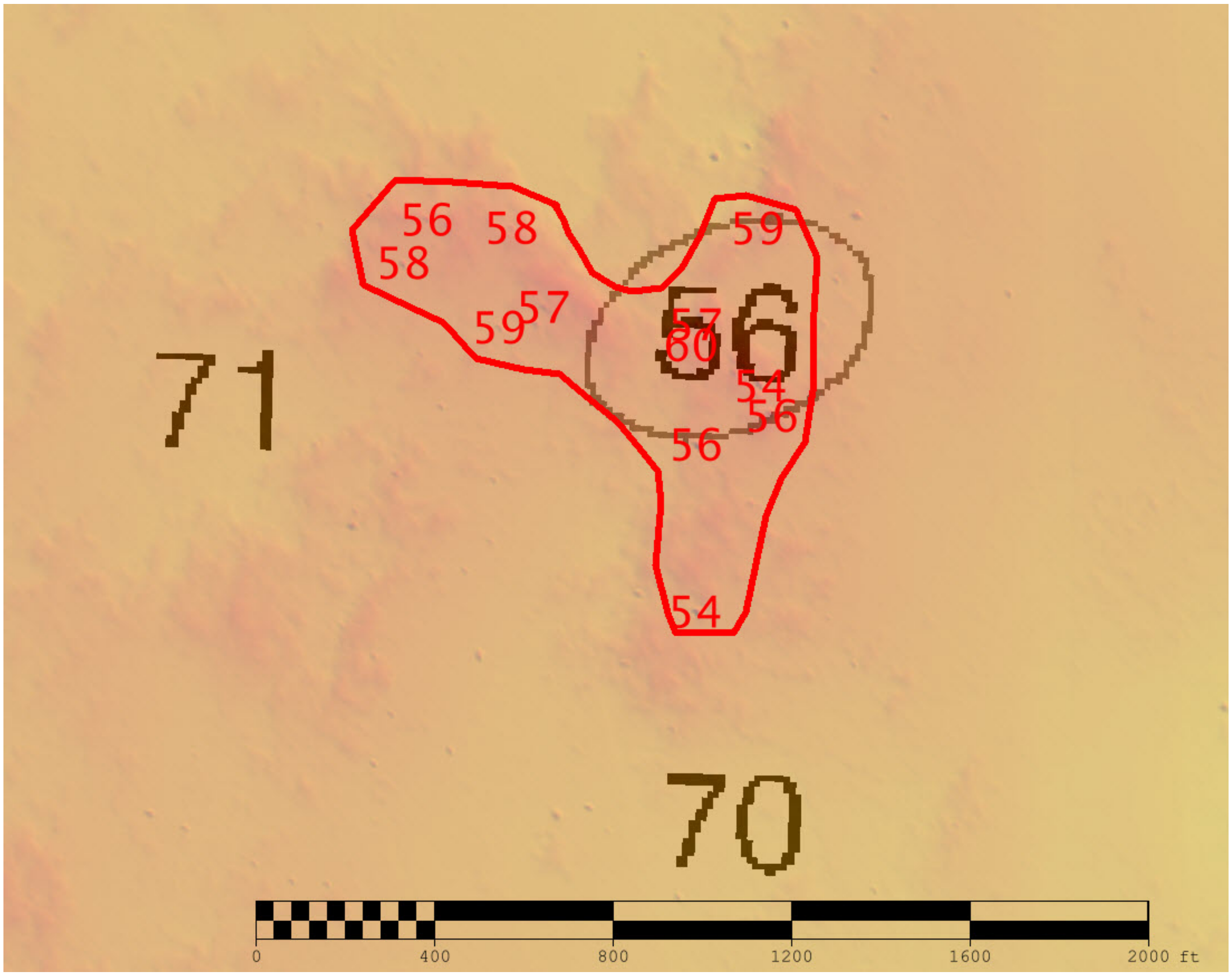


Figure 22: H12700 soundings, shown in red, overlaid on the 60-foot charted depth curve indicate surveyed soundings shoaler than 60 feet occur on the outside of the 60-foot depth curve.

<u>13218</u>

A comparison was performed with chart 13218 (1:80,000) using a CARIS sounding layer based on a 2-meter H12700 bathymetric surface and contour layer based on a 50-meter generalized surface from H12700. Most charted depths compare to within 3 feet of H12700 data.

Four charted depths are shoaler than surveyed, specifically along the northeastern edge of the surveyed area as shown in Figure 23. The depth differences between the chart and H12700 survey data in the area of these charted depths range from 7 to 12 feet. Additionally, the shoal located in the northeastern portion of the H12700 survey area is shoaler than is displayed on Chart 13218, see Figure 24.

It is recommended that H12700 data supersede all charted depths.

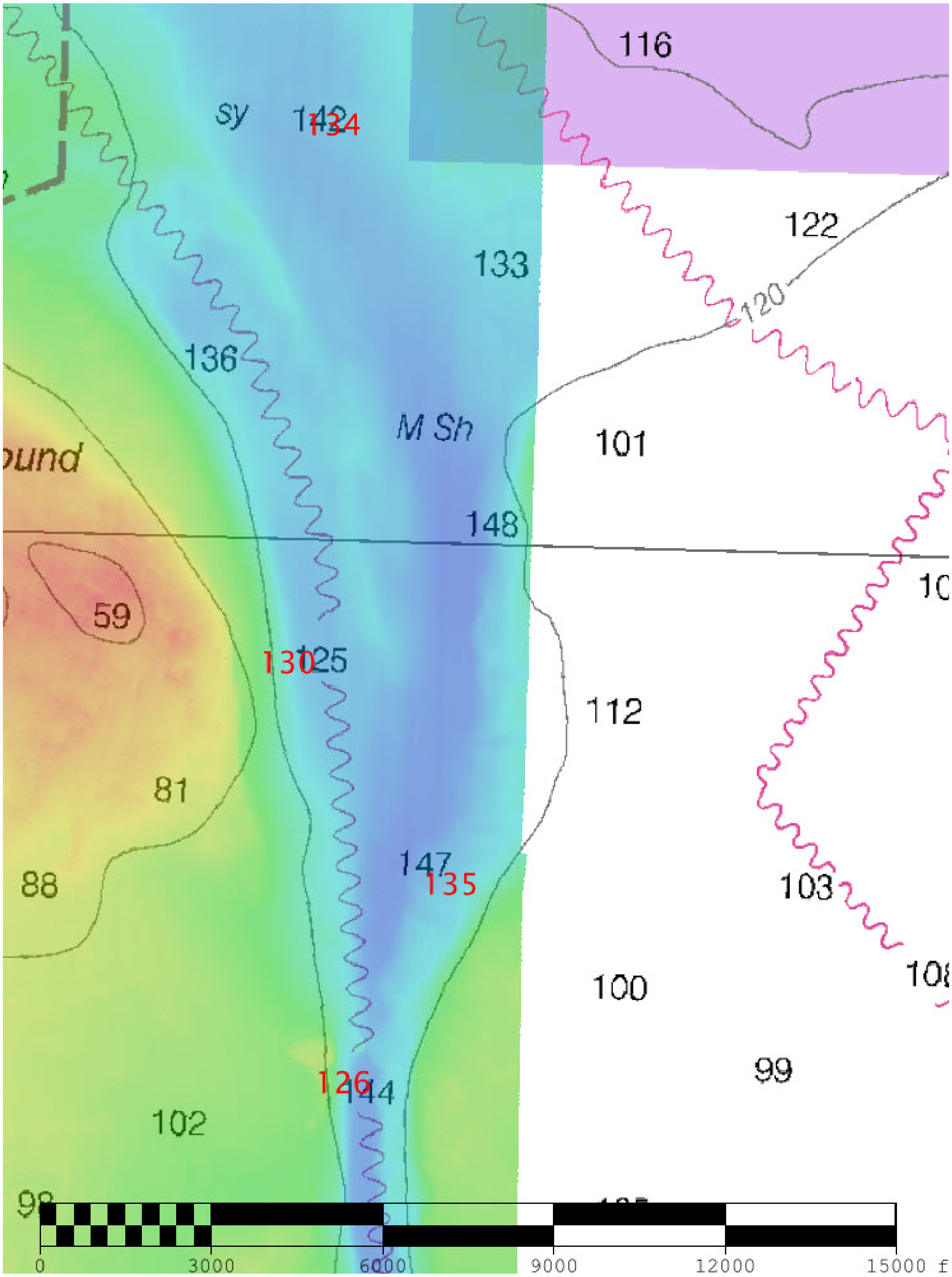


Figure 23: H12700 soundings, shown in red, highlight areas where surveyed soundings are between 7-12 feet shoaler than the charted depths.

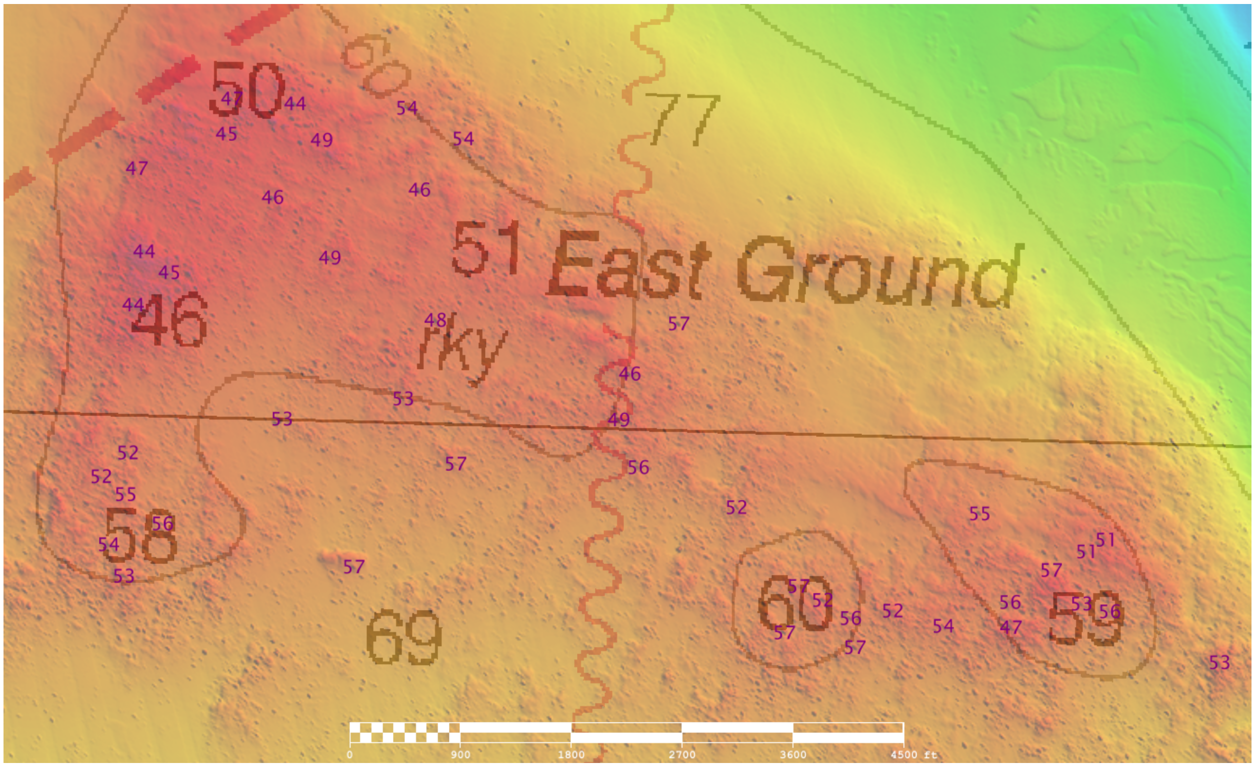


Figure 24: H12700 soundings, shown in purple, highlight areas where surveyed soundings are up to 10 feet shoaler than charted depths.

<u>13205</u>

A comparison was performed with chart 13205 (1:80,000) using a CARIS sounding layer based on a 2-meter H12700 bathymetric surface and contour layer based on a 50-meter generalized surface from H12700. Most charted depths compare to within 4 feet of H12700 data.

As stated in the discussion of chart 13215, the 57-foot wreck positioned at 41-04-51N, 071-29-38W is charted as much shoaler than the surveyed 69 feet. Additionally, the surveyed area outside of the charted 60-foot depth curve located at 41-06-45N, 071-29-24W is shoaler than 60 feet. The 60-foot depth curve at this location may need to be extended to encompass this shoaler region as shown in Figure 22.

It is recommended that H12700 data supersede all charted depths.

D.1.2 Electronic Navigational Charts

The following are the largest scale ENCs, which cover the survey area:

ENC	Scale	Edition	Update Application Date	Issue Date	Preliminary?
US4CN22M	1:80000	7	08/16/2012	06/10/2013	NO
US4MA23M	1:80000	27	11/07/2013	01/06/2013	NO
US5RI10M	1:40000	7	01/16/2013	08/09/2013	NO

Table 16: Largest Scale ENCs

<u>US4CN22M</u>

ENC US4CN22M contains no soundings different than RNC 13205. See previous discussion for comparison with RNC 13205.

<u>US4MA23M</u>

ENC US4MA23M contains no soundings different than RNC 13218. See previous discussion for comparison with RNC 13218.

<u>US5RI10M</u>

ENC US5RI10M contains no soundings different than RNC 13215. See previous discussion for comparison with RNC 13215.

D.1.3 AWOIS Items

While no assigned AWOIS items were included in the Project Instructions or the Project Reference File (PRF), there are eight AWOIS items that exist within the limits of H12700. Each item was fully investigated during the course of survey H12700. Positions of AWOIS items in H12700 survey coverage are shown in Figure 25.

AWOIS 6950 is the northernmost AWOIS item and is a submerged wreck, the MISS JENNIFER, with a charted depth of 93 feet. The AWOIS item was found 15 meters north of the charted wreck and is three feet shoaler than currently charted. Refer to the Final Feature File (FFF) for position, least depth, and further remarks.

AWOIS 7446 is in the northern portion of H12700. The submerged vessel is an unknown wooden barge at a charted depth of 89 feet. This AWOIS item was not found during acquisition of H12700. Refer to the FFF for further remarks.

AWOIS 8746, in the central portion of survey H12700, is a 120-foot long fishing trawler, the IDEANE. The IDEANE is charted at a depth of 55 feet. During acquisition of H12700, AWOIS 8746 was found 40 feet southwest of the charted position and at a depth of 69 feet, 12 feet deeper than currently charted. Refer to the FFF for position, least depth and further remarks.

AWOIS 6947 is a position approximate wreck that is located in the central portion of the survey. The item is an unknown fishing vessel that is in charted waters of 100 feet. This AWOIS item was not found during acquisition of H12700. Refer to the FFF for further remarks.

AWOIS 7666 is a wreck that is positioned along the central western bounds of H12700. This AWOIS item has been disproved in 1991 and removed from the chart. Data acquisition from H12700 shows no sign of wreck and the AWOIS item is disproved. Refer to the FFF for further remarks.

AWOIS 1768 is a wreck along the central western edge of survey H12700. The wreck is a 240-foot barge containing sulphuric acid charted in depths of 128 feet. Survey H12700 found the AWOIS item 65 feet southwest and at a depth of 130 feet, 2 feet deeper than currently charted. Refer to the FFF for position, least depth, and further remarks.

AWOIS items 7306 and 7543 are duplicate entries for unexploded ordnance positioned in the southwestern corner of the survey, near charted depths of 164 feet. Unexploded ordnance was not found within H12700. It is recommended to retain unexploded ordnance as charted.

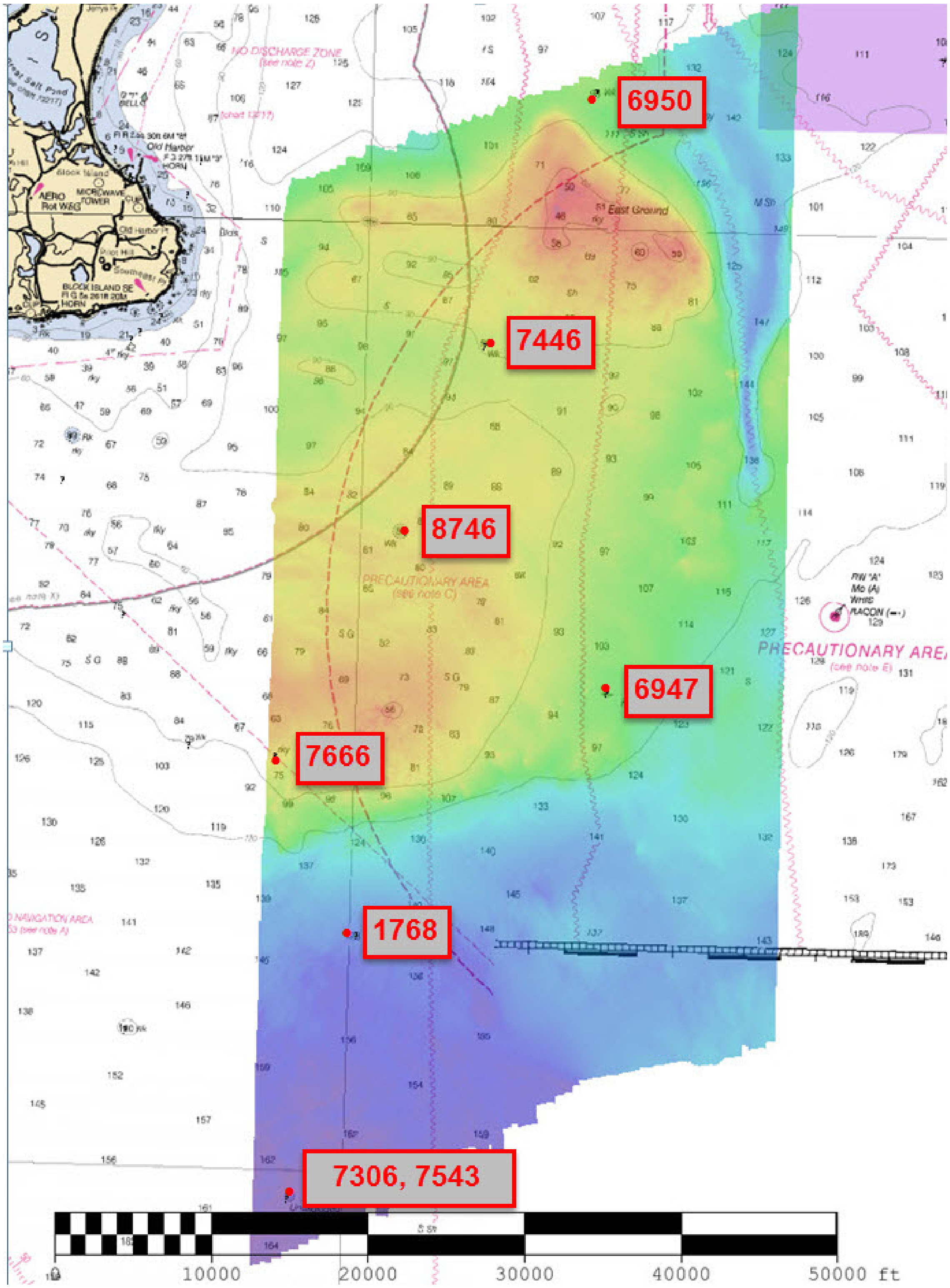


Figure 25: Eight AWOIS items positioned within the sheet extents of survey H12700.

D.1.4 Maritime Boundary Points

No Maritime Boundary Points were assigned for this survey.

D.1.5 Charted Features

Reported unexploded ordnance, duplicate AWOIS items 7306 and 7543, are discussed in Section D.1.3. Refer to the FFF for remarks and recommendations.

A position approximate wreck, AWOIS item 6947, is discussed in Section D.1.3. Refer to the FFF for remarks and recommendations.

D.1.6 Uncharted Features

Two new features were identified within the survey limits of H12700. These new features are non-dangerous and should be charted accordingly. See Figure 26 for an overview of the uncharted features.

A new obstruction was found positioned in the central portion of the survey. This obstruction appears 164 feet in length and its shoalest point is 77 feet.

A new wreck was found positioned in the northwestern corner of the survey. This wreck appears 20 feet in length and its shoalest point is 84 feet.

Refer to the FFF for remarks and recommendations.

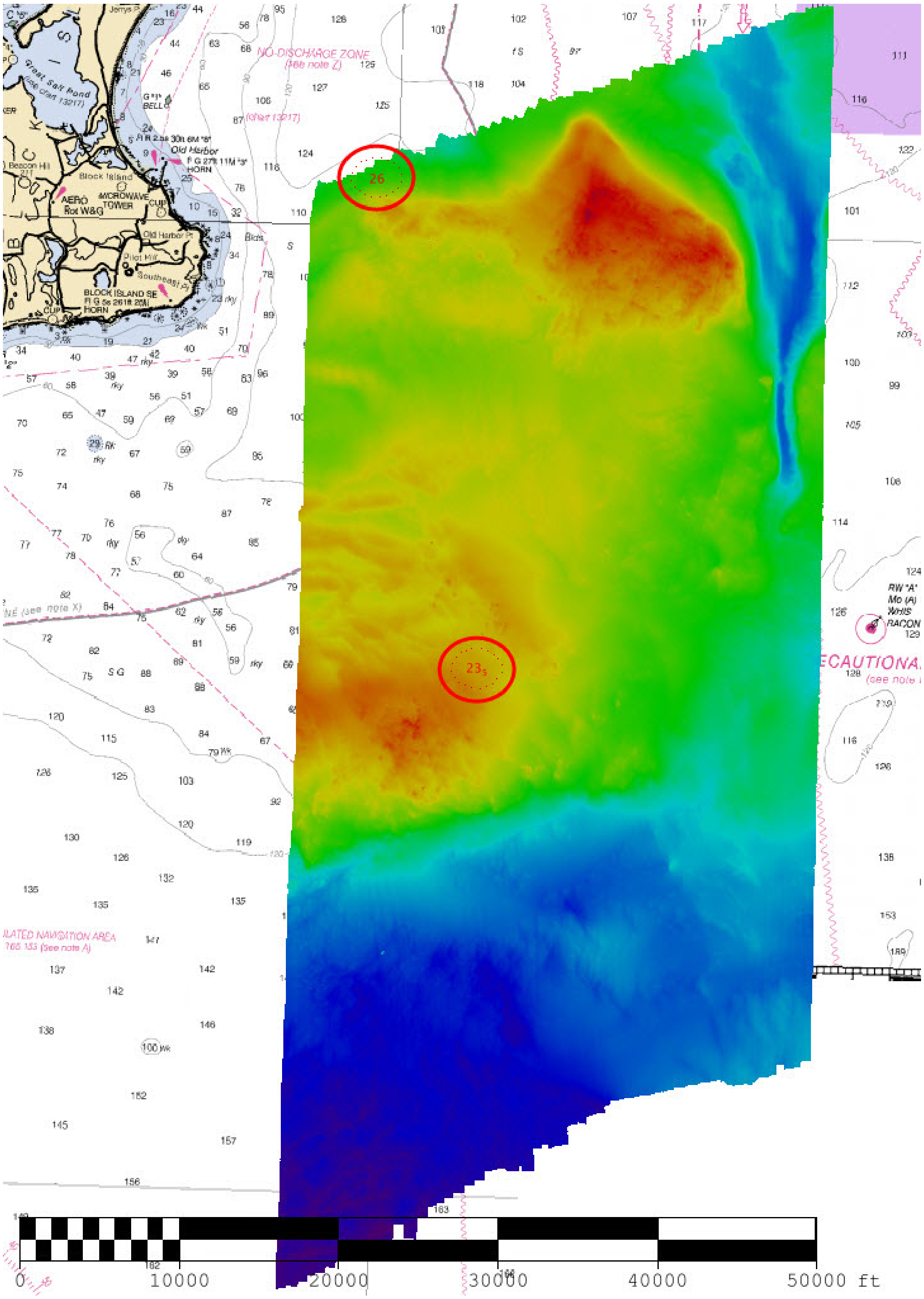


Figure 26: Two uncharted features identified in H12700.

D.1.7 Dangers to Navigation

No Danger to Navigation Reports were submitted for this survey.

D.1.8 Shoal and Hazardous Features

No shoals or potentially hazardous features exist for this survey.

D.1.9 Channels

The Narragansett Bay traffic lane, separations zones, and precautionary area have charted depths that need to be updated within the limits of H12700. See section D.1.1 regarding charts 13215 and 13218 for information.

D.1.10 Bottom Samples

Eleven bottom samples, chosen from HSD OPS suggestions and acquired backscatter, were taken within the limits of H12700 and are submitted with the FFF and shown below in Figure 27. Video coverage was obtained on most bottom samples acquired on Dn163 and is submitted with the survey. One bottom sample failed to yield a sample with the grab sampler, and was not included in the FFF. Bottom samples ranged from soft mud to cobbles.

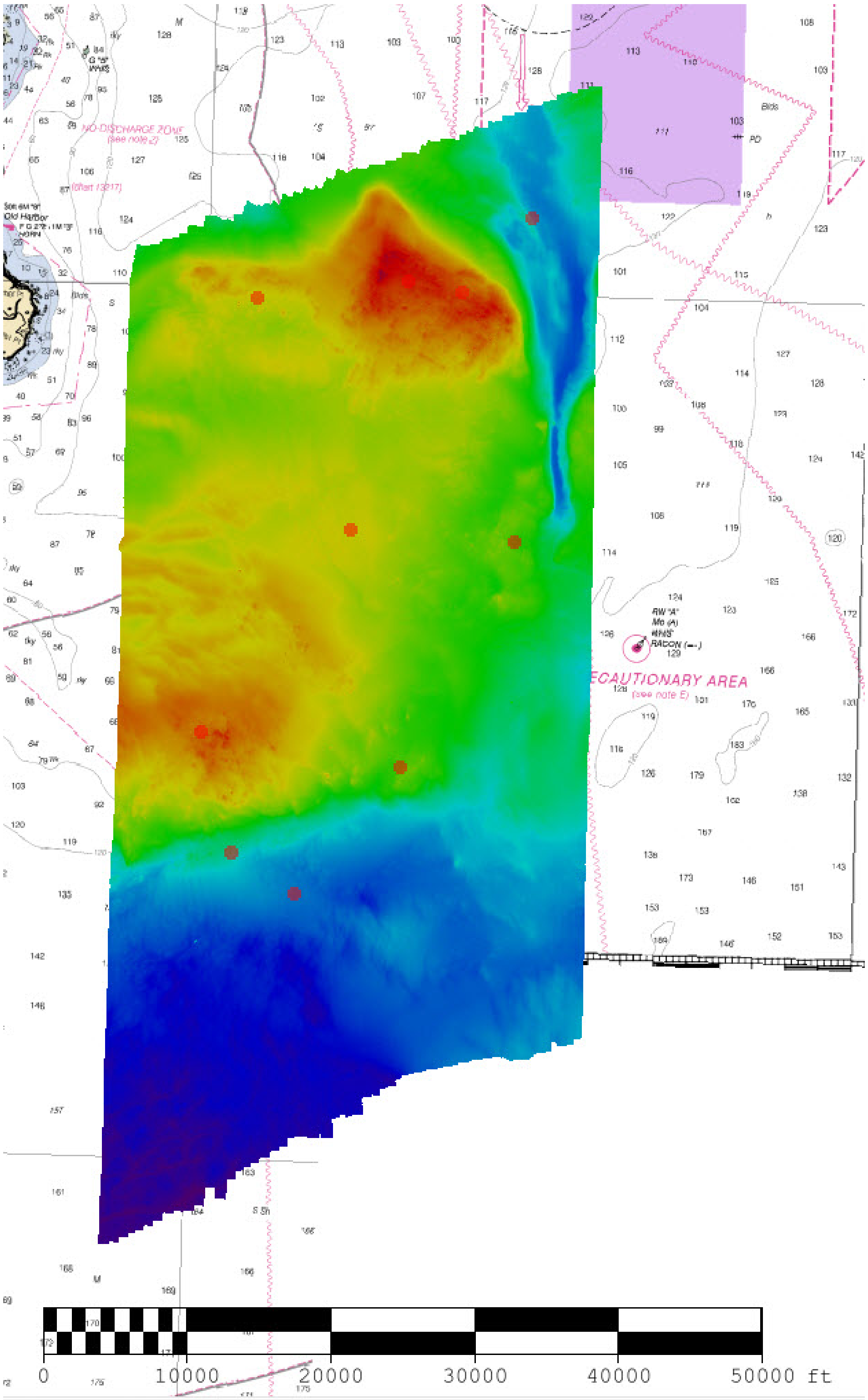


Figure 27: Ten bottom samples (shown in red) were acquired during H12700.

D.2 Additional Results

D.2.1 Shoreline

Shoreline was not assigned in the Hydrographic Survey Project Instructions or Statement of Work.

D.2.2 Prior Surveys

Prior survey comparisons exist for this survey, but were not investigated.

D.2.3 Aids to Navigation

No aids to navigation (ATONs) exist for this survey.

D.2.4 Overhead Features

No overhead features exist for this survey.

D.2.5 Submarine Features

Charted cables were fully investigated within the limits of H12700. While no evidence of cables were found in the multibeam data, it is recommended that these be retained as charted.

Unexploded ordnance was fully investigated within the limits of H12700. While no evidence of unexploded ordnance were found in the multibeam data, it is recommended that these be retained as charted. Refer to Section D.1.3.

D.2.6 Ferry Routes and Terminals

No ferry routes or terminals exist for this survey.

D.2.7 Platforms

No platforms exist for this survey.

D.2.8 Significant Features

No significant features exist for this survey.

D.2.9 Construction and Dredging

No present or planned construction or dredging exist within the survey limits.

D.2 New Survey Recommendation

No new surveys or further investigations are recommended for this area.

E. Approval Sheet

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, and all accompanying records and data are approved. All records are forwarded for final review and processing to the Processing Branch.

The survey data meets or exceeds requirements as set forth in the NOS Hydrographic Surveys and Specifications Deliverables Manual, Field Procedures Manual, Letter Instructions, and all HSD Technical Directives. These data are adequate to supersede charted data in their common areas. This survey is complete and no additional work is required with the exception of deficiencies noted in the Descriptive Report.

Report Name	Report Date Sent
OPR-B307-FH-14 Data Acquisition and Processing Report	2014-09-15
OPR-B307-FH-14 VDatum Validation Report	2014-08-01
2014 Hydrographic Systems Readiness Review Memo	2014-05-06

Approver Name	Approver Title	Approval Date	Signature
LCDR Marc S. Moser, NOAA	Chief of Party	09/12/2014	2014.09.13 11:24:11 -04'00'
LT Adam Reed, NOAA	Field Operations Officer	09/12/2014	
David T. Moehl	Senior Survey Technician	09/12/2014	

APPENDIX I

TIDES AND WATERLEVELS

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

TIDE NOTE FOR HYDROGRAPHIC SURVEY

DATE : June 25, 2014

HYDROGRAPHIC BRANCH: Atlantic
HYDROGRAPHIC PROJECT: OPR-B307-FH-2014
HYDROGRAPHIC SHEET: H12700

LOCALITY: 5NM South of Block Island,Rhode Island Sound and Approaches, RI
TIME PERIOD: June 5 - June 23, 2014

TIDE STATION USED: 845-2660 Newport, RI
Lat. 41° 30.3’N Long. 71° 19.6' W
PLANE OF REFERENCE (MEAN LOWER LOW WATER): 0.000 meters
HEIGHT OF HIGH WATER ABOVE PLANE OF REFERENCE: 1.099 meters

REMARKS: RECOMMENDED ZONING

Preliminary zoning is accepted as the final zoning for project OPR-B307-FH-2014, H12700, during the time period between June 5 - June 23, 2014.

Please use the zoning file B307FH2014CORP submitted with the project instructions for OPR-B307-FH-2014. Zones NA629, NA630, NA634, NA640, and NA644 are the applicable zones for H12700.

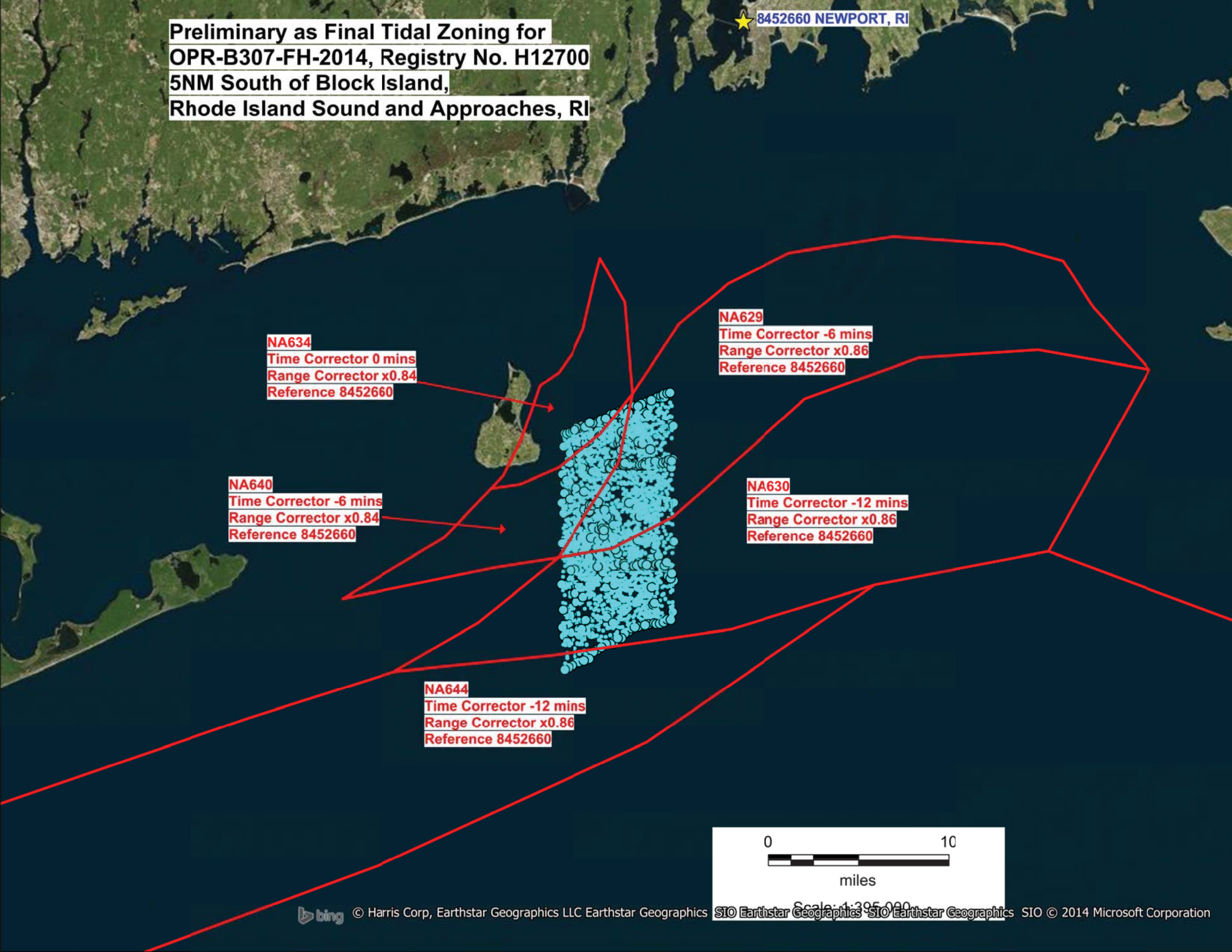
Refer to attachments for zoning information.

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).

HOVIS.GERALD.THOMAS.1365860250

Digitally signed by HOVIS.GERALD.THOMAS.1365860250
DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=OTHER, cn=HOVIS.GERALD.THOMAS.1365860250
Date: 2014.07.02 14:39:51 -04'00'

CHIEF, PRODUCTS AND SERVICES BRANCH


Preliminary as Final Tidal Zoning for
OPR-B307-FH-2014, Registry No. H12700
5NM South of Block Island,
Rhode Island Sound and Approaches, RI
8452660 NEWPORT, RI
NA634
Time Corrector 0 mins
Range Corrector x0.84
Reference 8452660
NA629
Time Corrector -6 mins
Range Corrector x0.86
Reference 8452660
NA640
Time Corrector -6 mins
Range Corrector x0.84
Reference 8452660
NA630
Time Corrector -12 mins
Range Corrector x0.86
Reference 8452660
NA644
Time Corrector -12 mins
Range Corrector x0.86
Reference 8452660
0
10
miles
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APPENDIX II

SUPPLEMENTAL SURVEY RECORDS AND COORESPONDENCE

Subject: Request for Final Tides, OPR-B307-FH-14; H12700
From: FOO <ops.ferdinand.hassler@noaa.gov>
Date: 6/24/2014 4:39 AM
To: Final Tides - NOAA Service Account <Final.Tides@noaa.gov>
CC: "CO.Ferdinand Hassler - NOAA Service Account" <CO.Ferdinand.Hassler@noaa.gov>, David Moehl - NOAA Federal <david.t.moehl@noaa.gov>

Good Morning,

Please find attached the final tide request for OPR-B307-FH-14, survey H12700.

Thank you,
Adam

--
Field Operations Officer, NOAA Ship Ferdinand R. Hassler
29 Wentworth Road
New Castle, NH, 03854

Attachments:

H12700_Request_for_Tides.pdf	27 bytes
H12700_Request_for_Tides.zip	27 bytes

Subject: Final Tide Note for OPR-B307-FH-2014, H12700
From: Hua Yang - NOAA Affiliate <hua.yang@noaa.gov>
Date: 7/2/2014 7:19 PM
To: CO.Ferdinand Hassler - NOAA Service Account <co.ferdinand.hassler@noaa.gov>, "OPS.Ferdinand Hassler - NOAA Service Account" <ops.ferdinand.hassler@noaa.gov>
CC: Michael Gonsalves - NOAA Federal <michael.gonsalves@noaa.gov>, Corey Allen - NOAA Federal <corey.allen@noaa.gov>, Castle Parker - NOAA Federal <Castle.E.Parker@noaa.gov>, Grant Froelich - NOAA Federal <Grant.Froelich@noaa.gov>, AHB Chief - NOAA Service Account <ahb.chief@noaa.gov>, HPT list <nos.coops.hpt@noaa.gov>

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

DATE: 0 7/ 02/2014

MEMORANDUM FOR: LCDR Marc Moser
Commanding Officer, NOAA Ship Ferdinand Hassler

FROM: Gerald Hovis
Chief, Products and Services Branch, N/OPS3

SUBJECT: Delivery of Tide Requirements for Hydrographic Surveys

This is notification that the preliminary zoning is accepted as the final zoning for survey project OPR-B3 07-FH-2014, Registry No. H12 700 during the time period between June 5 - June 23, 2014. The accepted reference station for Registry No. H12700 is Newport, RI (8 45-2660).

Included with this memo is the Tide Note in .PDF format, stating the preliminary zoning has been accepted as the final zoning.

--

Hua Yang

Hydrographic Planning Team
Oceanographic Division
NOAA/National Ocean Service
Center for Operational Oceanographic Products and Services
1305 East-West Highway
Silver Spring, MD 20910
Hua.Yang@noaa.gov
Phone (work): (301) 713-2890 x 210
http://tidesandcurrents.noaa.gov

Attachments:

H12700.pdf	27 bytes

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
Office of Marine and Aviation Operations
NOAA Ship *Ferdinand R. Hassler* (S-250)
Box 638, New Castle, NH 03854

August 1, 2014

MEMORANDUM FOR: Jeffrey Ferguson
Chief, Hydrographic Survey Branch

FROM: LCDR Marc S. Moser, NOAA
Commanding Officer

TITLE: OPR-B307-FH-14 VDatum Evaluation and Deliverable Recommendation

Ferdinand R. Hassler personnel conducted a comparison of VDatum based Ellipsoid Referenced Survey (ERS) versus discrete tidal zoning vertical transformation techniques using crossline data per the Hydrographic Survey Project Instructions (PI). In addition we conducted visual comparisons between surfaces referenced to MLLW using VDatum and discrete zoned tides. As this report will illustrate, due to the quality of the data it is impossible to either approve or disprove the VDatum separation model. Results and analysis of the comparison are in the attached report.

Ship personnel experienced problems in reliably processing the vessel trajectory relative to the ellipsoid. We recommend that all surveys for project OPR-B307-FH-14 be submitted using discrete zoned tides exclusively.

It is understood that upon review of this report, a determination will be made for the final vertical transformation technique to be used to create the final deliverables.

Attachment

Table of Contents

List of Figures

List of Tables

1.0 Introduction

This document is an interim report describing methods and results of the vertical datum analysis component of the vertical control requirements stated in Hydrographic Survey Project Instructions OPR-B307-FH-14 Rhode Island Sound and Approaches (June 4, 2014). The project is located in the vicinity of Rhode Island Sound and Approaches and includes hydrographic surveys H12700, H12702, and H12707. The Project Instructions require the field unit to recommend the final vertical transformation technique after analyzing crossline data. The recommendations and supporting data included in this report are intended for use by the Hydrographic Surveys Division (HSD) to support the final decision on the use of ellipsoidal-referenced survey (ERS) methods in lieu of traditional tides for final water level correctors for the OPR-B307-FH-14 project.

The basis of this analysis is a comparison of discrete tidal zoning and Vertical Datum Transformation (VDatum) as methods for vertical control. Because discrete tidal zoning is the conventional and accepted method, it is regarded as a baseline for this evaluation.

At the time of writing this report, survey H12702 was approximately 75% acquired, with the plan to finish acquisition upon our next working leg. Crossline mileage used for this analysis still equal greater than 4% of the mainscheme mileage and account geographically for all but the southern five kilometers of the assigned survey area. Methods and techniques used for previously acquired data will not change for the additional coverage. Similar results are thereby expected.

2.0 Procedure

The VDatum evaluation was conducted according to the instructions in Appendix 1 of the Project Instructions. Additional guidance, found in the Pydro distribution (Pydro\Lib\site-packages\HSTP\Pydro\PostAcqTools_CompareTSeries.docx), was followed for the direct comparison of data.

Project crossline data were reduced to Mean Lower Low Water (MLLW) via conventional discrete tidal zoning. A second set of crossline data were reduced using VDatum. Time series data for the nadir depth were extracted from both data sets and differenced using the Pydro Post Acquisition Tool.

In addition, CARIS surfaces were analyzed using both discrete zoning and VDatum methods. This analysis was used to evaluate the internal consistency of data and detect any spatial trends in the difference that may suggest inconsistencies in the VDatum model.

3.0 Results and Discussion

This report will attempt to answer three questions:

- Is the VDatum model correct in the geographic location of this project?
- Is the internal consistency of the data improved by ERS methods?
- What method of vertical control is appropriate for specific surveys?

3.1 VDatum Model Accuracies

To analyze the VDatum model, the separation model .csar file provided by HSD Operations was checked in CARIS Base Editor. An updated separation model was created during post-processing of data in July due to the original separation file obtained from OPS being clipped close to the sheet limits and not covering the acquired data extents. The updated model was examined to assess the overall slope of the model within the survey area and was also inspected for errors that could be the result of inconsistencies within the VDatum model. This surface is shown in Figure 1.

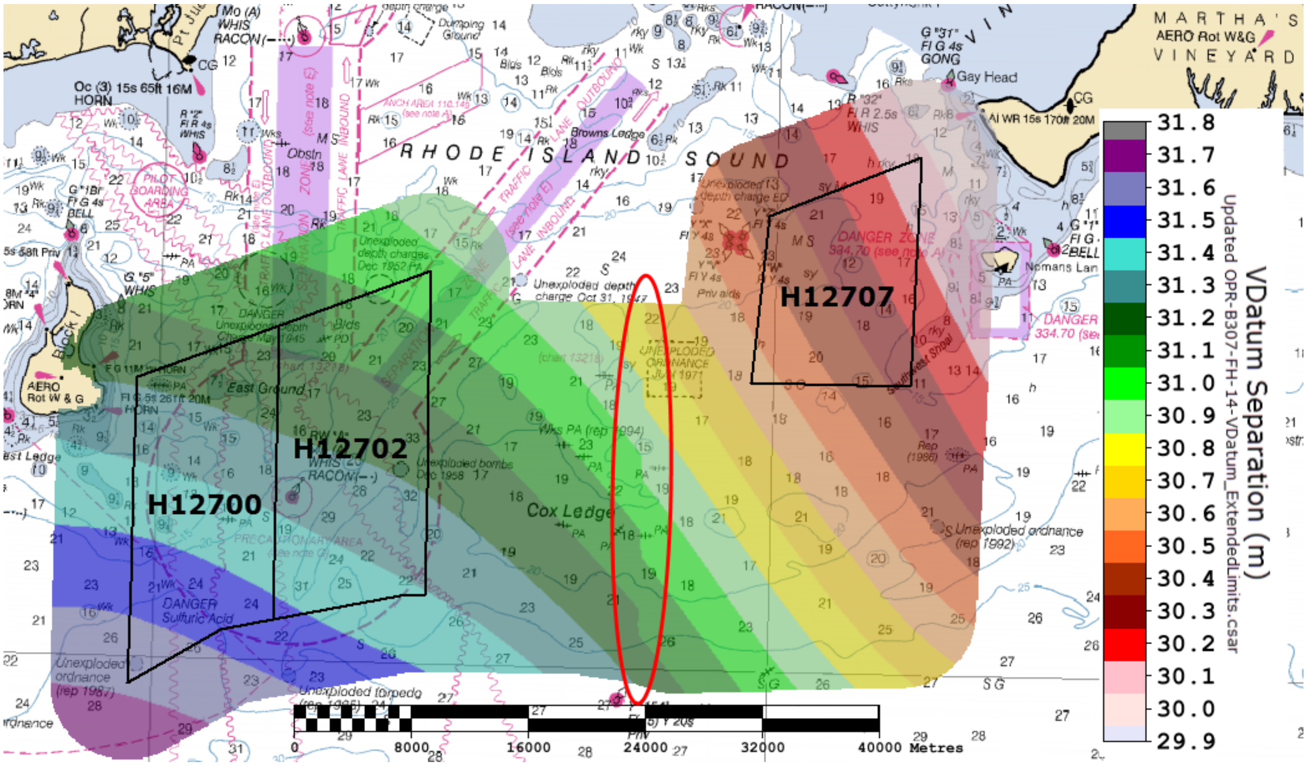


Figure 1: Updated OPR-B307-FH-14-VDatum_ExtendedLimits.csar separation model overlaid with H12700, H12702, and H12707 survey areas. Colored bands correspond to 10 cm intervals.

As illustrated in Figure 1, the separation model is free of gaps and anomalies within the survey limits acquired for OPR-B307-FH-14 (black outline). Overall, the updated model appears adequate for use within the limits of project OPR-B307-FH-14. One anomaly (red circle) exists outside of acquired limits which is likely a junction between two separate model areas.

In accordance with Appendix I of the Project Instructions, Pydro's Post Acquisition Tool utility was used to compare the nadir depths from data corrected with VDatum and discrete zoned tides. Shown in Table 1, the average difference ranges are larger than expected and suggest that issues exist. These differences may arise from many different sources including: poor vertical GPS solutions, poor zoning or separation models, errors in dynamic draft values, and loading errors. It is believed that the large mean difference and standard deviation values obtained during this project are mainly the result of poor vertical GPS solutions, discussed in further detail in the remainder of this report.

XL Discrete - VDatum (PostAcq Tools)		
H12700		
Sonar	**Mean (m)**	**St Dev (m)**
Port 7125	0.032	0.196
Starboard 7125	-0.123	1.744
H12702		
Port 7125	0.043	0.111
Starboard 7125	-0.017	0.153
H12707		
Port 7125	0.154	0.255
Starboard 7125	-0.095	0.249

Table 1: Results of Pydro Post Acquisition Tool script run on OPR-B307-FH-14.

While the VDatum model seems to be free of anomalies and other errors, the accuracy cannot be confidently determined from the results of the recommended test and evaluation.

3.2 Data Internal Consistency

To analyze the internal consistency of ERS methods, surfaces were created with all lines being reduced by the different methods. An example of this comparison is shown in Figure 2. A quick look at the surfaces shows that the VDatum surface contains many vertical anomalies, "ramping", that would be challenging to address. Ultimately, many lines would need to be reduced with discrete tides resulting in a complicated "hybrid" survey being submitted.

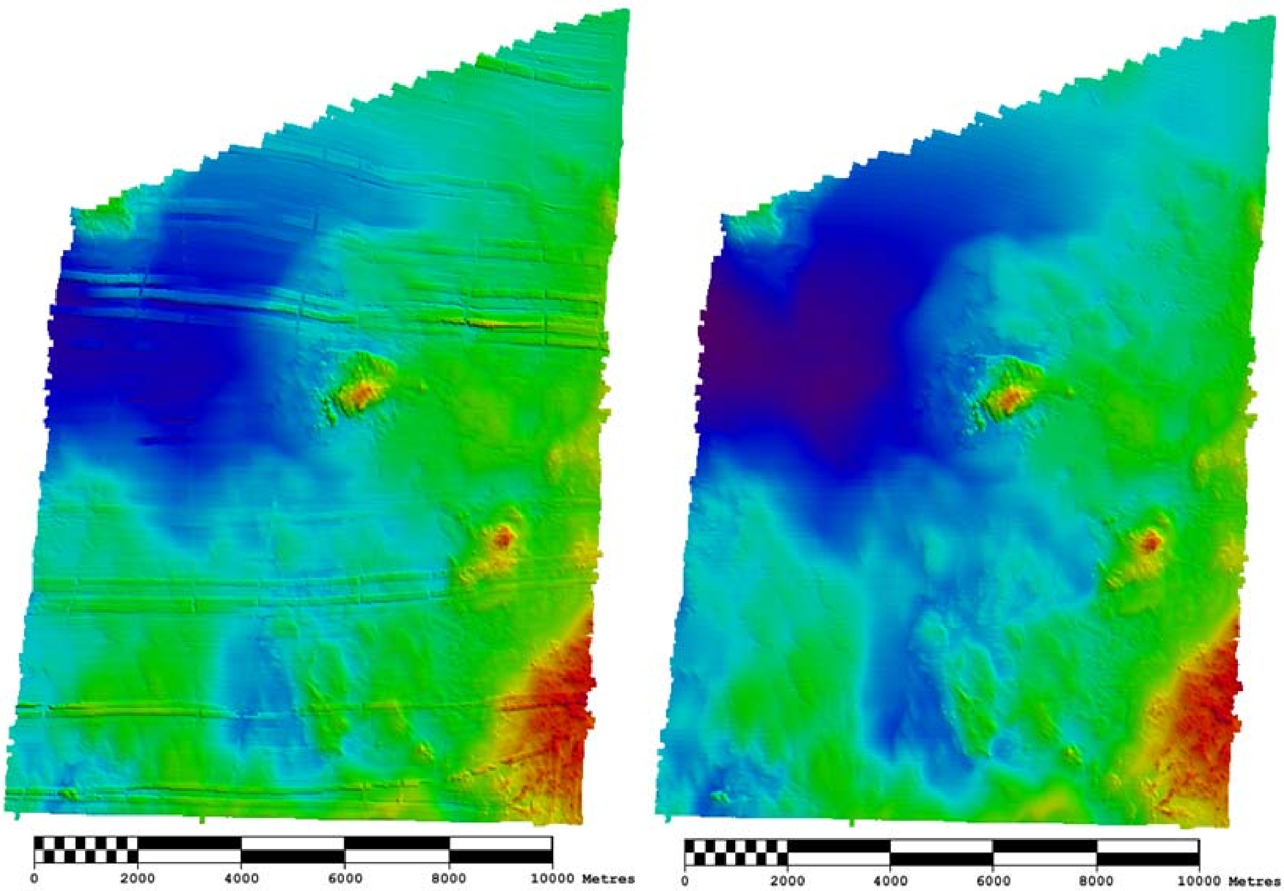


Figure 2: Survey H12707 CUBE surfaces; left surface is referenced to MLLW via VDatum and right is referenced to MLLW via discrete zoned tides. Numerous vertical anomalies, "ramping", are easily identified in the VDatum surface.

Visually it is easy to conclude that VDatum reduced CUBE surfaces do not contain better internal consistency then discrete zoning.

4.0 Discussion

ERS reduced by VDatum eliminates several sources of vertical errors that can be attributed to traditional tide models and ship water line estimators, such as dynamic draft. An ERS approach is therefore desired when possible. However, ERS and VDatum require good position solutions to be effective. The following are steps taken by the crew to try and track down what went wrong with our ERS vertical solutions during acquisition on OPR-B307-FH-14.

Soundings that are reduced via VDatum disagree with surrounding soundings by more than 4 meters in some areas. The following figures are soundings (colored by day) viewed in CARIS Subset Editor being reduced by discrete tides and VDatum, respectively.

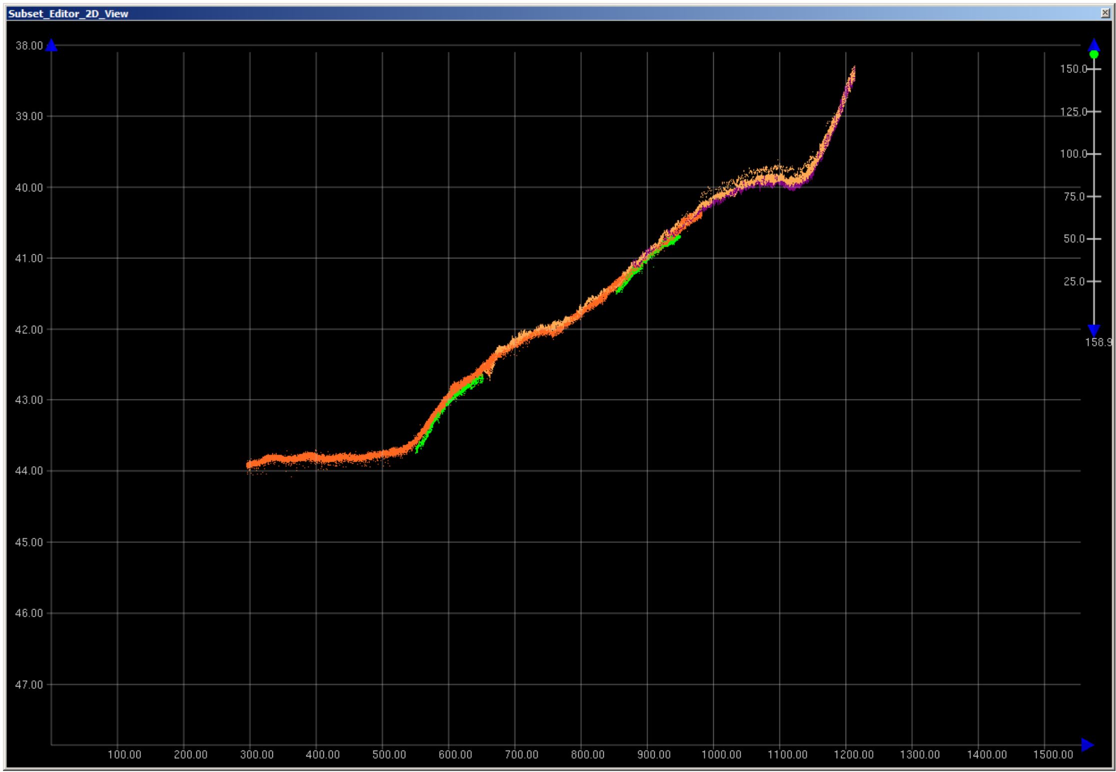


Figure 3: Soundings, colored by day, reduced by discrete zoned tides show general agreement.

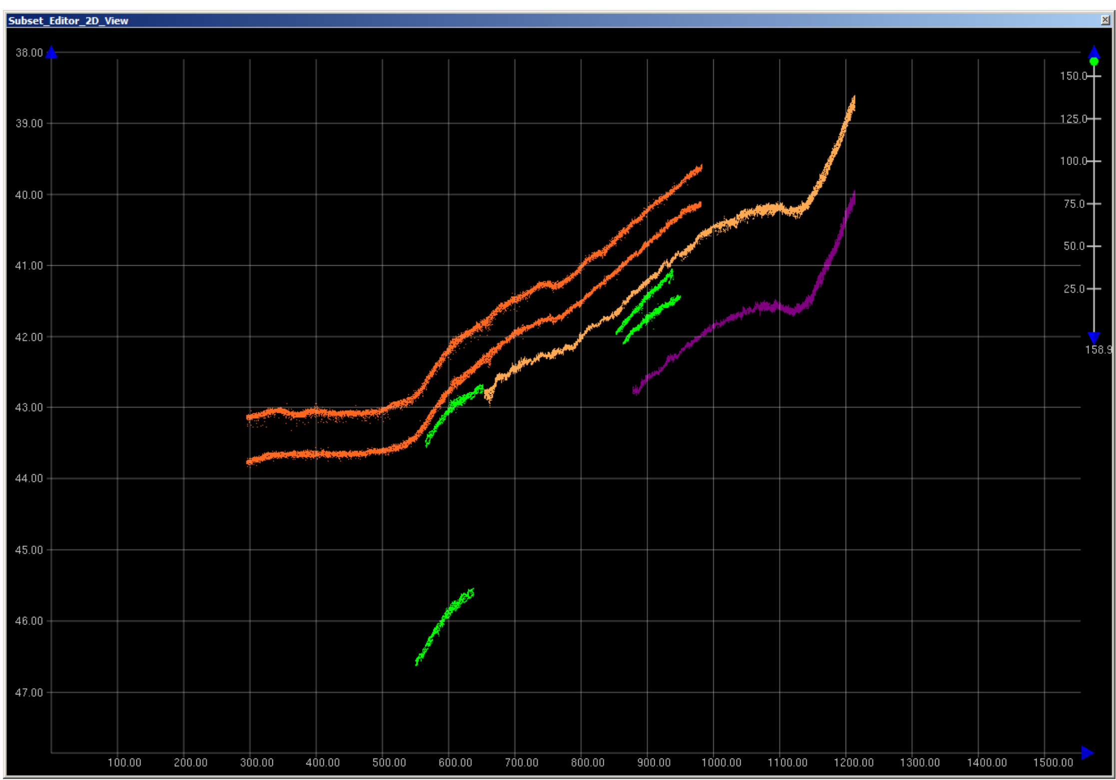


Figure 4: Soundings, colored by day, reduced by VDatum show strong disagreement.

The disagreement shown in the example above is widespread and of such a magnitude that it cannot be wholly contributed to the VDatum model. Much more likely is the application of a poor vertical GPS solution. An example of a vertical anomaly, viewed in CARIS Attitude Editor is shown in Figure 5. These vertical anomalies can also be seen in the GPS height values. GPS height values are the actual measurements made to the ellipsoid before the application of ellipsoid to MLLW models (VDatum). The GPS height values also contain the heave value making in-depth analysis difficult.

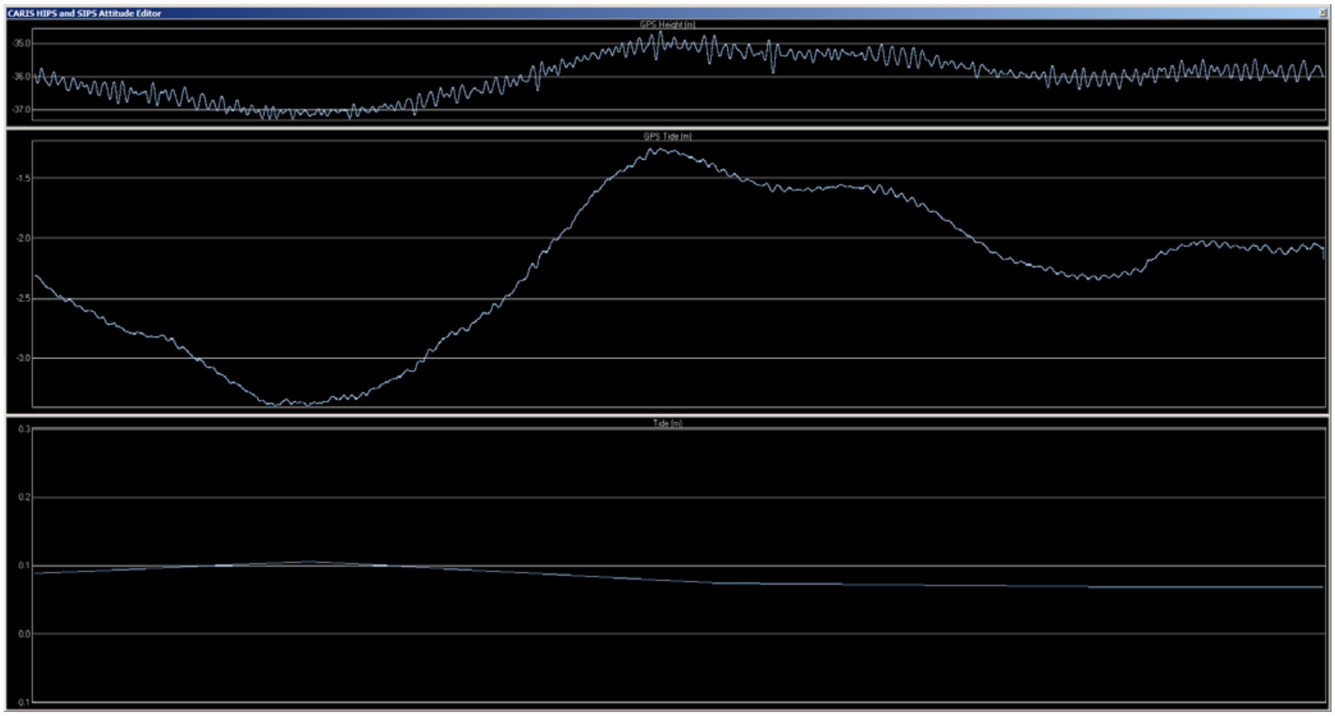


Figure 5: CARIS Attitude Editor showing an example of a ≈2 meter fluctuation in the GPS Tide value (middle). This fluctuation can also be visually interpolated from the GPS height values (top), demonstrating that it is evident before the application of the VDatum separation model.

Quality Control (QC) results of the post-processed solutions do warn the hydrographer that the solutions are less than the desired accuracies. The RMS and PDOP values routinely exceed the recommended values specified in the FPM. An investigation to explain the large values was conducted, from which it is theorized that the distance between SmartBase stations is the contributing factor. For the majority of post-processed solutions, 4-5 SmartBase stations were included that are close in distance and within the suggested range. However, POSPac software attempts to completely enclose the rover (ship) with a SmartBase network and, due to the vicinity offshore, pulled data from stations located in the Outer Banks, NC and Halifax, Nova Scotia (Figure 6).

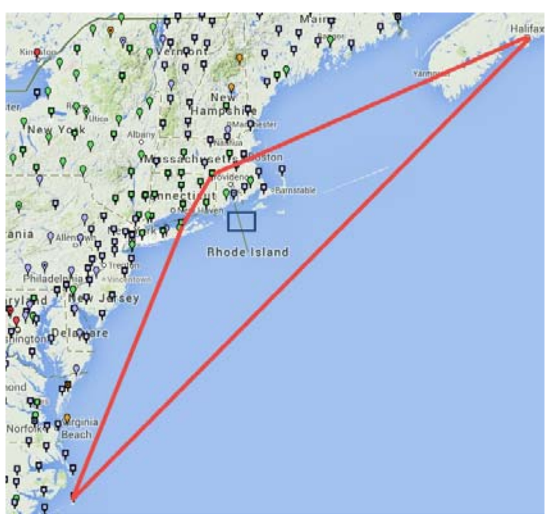


Figure 6: Typical SmartBase network configuration for OPR-B307-FH-14 outlined in red. Survey operations were conducted within the blue box.

From the results obtained during the course of this project, SmartBase processing should not be the recommended processing method. SingleBase stations requiring setups on Block Island and Nomans Land may have provided better solutions when within the 20km radius. H12700 and H12707 are almost wholly within the radii of stations setup on Block Island and Nomans Land, respectively. The majority of H12702 would fall outside of the 20km radius from Block Island.

It is also possible that conducting SmartBase techniques with the addition of these two manually setup stations would provide better results from the POSPac processing algorithm.

One day of crosslines for sheet H12700 was reduced to MLLW using VDatum Precise Point Positioning (PPP) results instead of SmartBase. While PPP is not recommended for vertical positioning, on initial analysis the differences did return a smaller standard deviation value. A smaller standard deviation value may suggest that the rapid vertical change anomalies were not present. The mean value difference for PPP was in the decimeter level, to be expected for a less accurate positioning method. Any suggestions made from the results of this small test should be verified by a larger and more robust test and is not included in the scope of this report.

For future surveys conducted in this area, different methods should be utilized. These may or may not include SingleBase processing techniques, ship or contractor installed long-term base stations, PPP processing techniques as well as over the air (either radio broadcast or satellite delivered) RTK correctors. This hydrographer is confident that if the same techniques are utilized in future years for this area it will yield the same, ineffective results.

5.0 Recommendation

For all surveys conducted during the course of OPR-B307-FH-14, VDatum derived vertical solutions are not reliable. As shown in this report this is likely the result of the abundance of poor vertical GPS solutions and not to be blamed on the VDatum model. However, without better results it is impossible to confidently validate the model in this geographic area.

It is the recommendation of the hydrographer that all surveys conducted for project OPR-B307-FH-14 be submitted with verified discrete zoned tides. If operations are conducted in this area at a future date, a new VDatum evaluation report should be performed at that time. To ensure that different results are obtained, alternate methods (some discussed in section 4.0) should be considered, utilized, and examined.

David Moehl - NOAA Federal <david.t.moehl@noaa.gov>

OPR-B307-FH-14 VDatum Evaluation

Jeffrey Ferguson - NOAA Federal <jeffrey.ferguson@noaa.gov> Thu, Aug 14, 2014 at 1:17 PM
To: FOO <ops.ferdinand.hassler@noaa.gov>
Cc: Michael Gonsalves - NOAA Federal <michael.gonsalves@noaa.gov>, Corey Allen - NOAA Federal <corey.allen@noaa.gov>, "CO.Ferdinand Hassler - NOAA Service Account" <CO.Ferdinand.Hassler@noaa.gov>, David Moehl - NOAA Federal <david.t.moehl@noaa.gov>, Mike Brown - NOAA Federal <mike.brown@noaa.gov>

Hassler,

Thank you for the detailed report. It has been sent to CSDL so they can be aware of the problems you encountered and we can improve the processes in the future.

Since you are choosing to use traditional zoned tides, no approval memo from HSD is required. The approval memo is only required when you choose to use ERS over traditional zoning.

So please proceed with processing using the zoned tides.

Let me know if you have any questions or concerns.

Thanks,

Jeff

****
Jeffrey Ferguson
NOAA, Office of Coast Survey
Chief, Hydrographic Surveys Division
office: 301-713-2700 x124
cell: 240-753-4729
[Quoted text hidden]

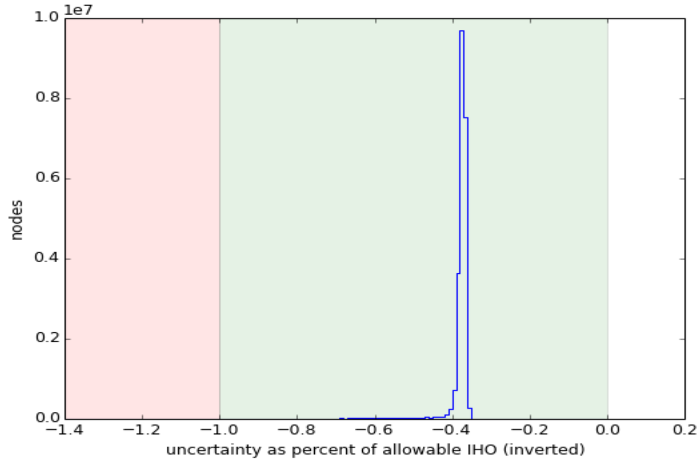
H12700_MB_50cm_MLLW_Final

The finalized surface has 23434055 nodes with 422378372 soundings.

Uncertainty Standards

99.22% | PASS

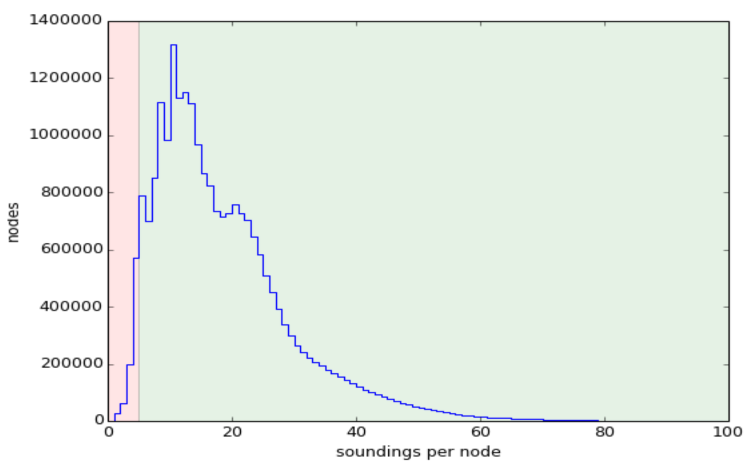
Nodes with Uncertainty less then or equal allowable IHO error **99.22%** (23251160/23434055).



Object Detection Coverage

96.33% | PASS

Nodes with 5 or more soundings **96.33%** (22574089/23434055).
Sounding count average is **18.02** soundings per node.
Sounding count mode is **11** soundings per node.



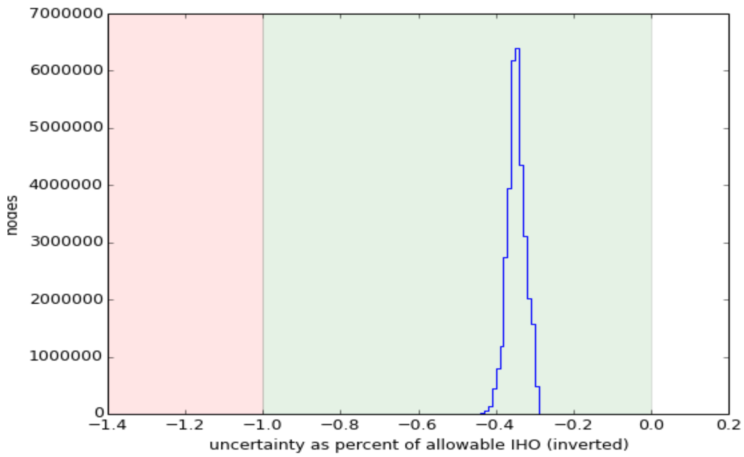
H12700_MB_2m_MLLW_Final

The finalized surface has 33447827 nodes with 2923144265 soundings.

Uncertainty Standards

100.00% | PASS

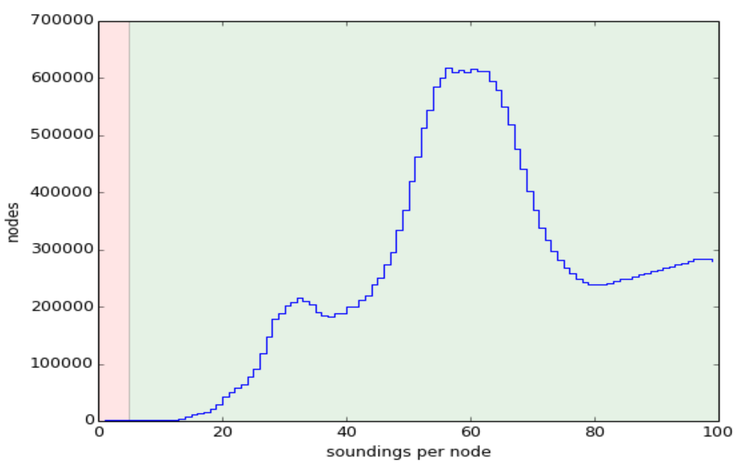
Nodes with Uncertainty less then or equal allowable IHO error **100.00%** (33447827/33447827).



Object Detection Coverage

99.99% | PASS

Nodes with 5 or more soundings **99.99%** (33442990/33447827).
Sounding count average is **87.39** soundings per node.
Sounding count mode is **57** soundings per node.



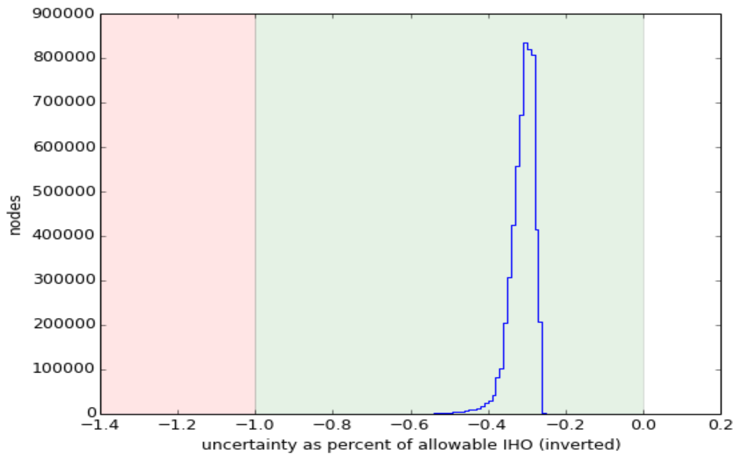
H12700_MB_4m_MLLW_Final

The finalized surface has 5621662 nodes with 928495510 soundings.

Uncertainty Standards

100.00% | PASS

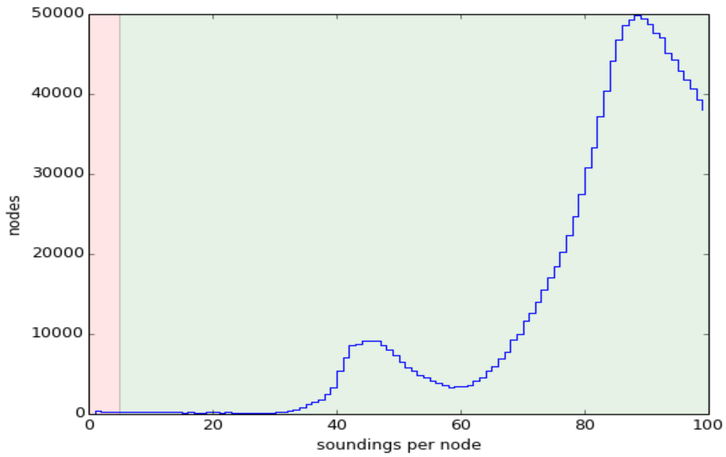
Nodes with Uncertainty less then or equal allowable IHO error **100.00%** (5621660/5621662).



Object Detection Coverage

99.98% | PASS

Nodes with 5 or more soundings **99.98%** (5620343/5621662).
Sounding count average is **165.16** soundings per node.
Sounding count mode is **89** soundings per node.



APPROVAL PAGE

H12700

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

The following products will be sent to NGDC for archive

- H12700_DR.pdf
- Collection of depth varied resolution BAGS
- Processed survey data and records
- H12700_GeoImage.pdf

The survey evaluation and verification has been conducted according to current OCS Specifications, and the survey has been approved for dissemination and usage of updating NOAA's suite of nautical charts.

Approved: ______________________________

Lieutenant Matthew Jaskoski, NOAA
Chief, Atlantic Hydrographic Branch