H12667

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

DESCRIPTIVE REPORT

Type of Survey:	Navigable Area
Registry Number:	H12667

LOCALITY

State(s):	Virginia
General Locality:	Approaches to Chesapeake Bay
Sub-locality:	Vicinity of Cape Charles

2014

CHIEF OF PARTY
CDR Marc S. Moser, NOAA

U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION	REGISTRY NUMBER:
HYDROGRAPHIC TITLE SHEET	**H12667**

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):	**Virginia**
General Locality:	**Approaches to Chesapeake Bay**
Sub-Locality:	**Vicinity of Cape Charles**
Scale:	**20000**
Dates of Survey:	**09/04/2014 to 11/04/2014**
Instructions Dated:	**03/03/2014**
Project Number:	**OPR-D304-FH-14**
Field Unit:	**NOAA Ship *Ferdinand R. Hassler***
Chief of Party:	**CDR 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:

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Descriptive Report to Accompany Survey H12667

Project: OPR-D304-FH-14

Locality: Approaches to Chesapeake Bay

Sublocality: Vicinity of Cape Charles

Scale: 1:20000

September 2014 - November 2014

NOAA Ship *Ferdinand R. Hassler*

Chief of Party: CDR Marc S. Moser, NOAA

A. Area Surveyed

Survey H12667 was conducted in the locality of Cape Charles near the approaches to Chesapeake Bay. Figures 1 and 2 show the general locality of the survey data submitted.

A.1 Survey Limits

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
37° 15' 8.29" N 75° 50' 1.96" W	37° 5' 4.41" N 75° 40' 57.6" W

Table 1: Survey Limits

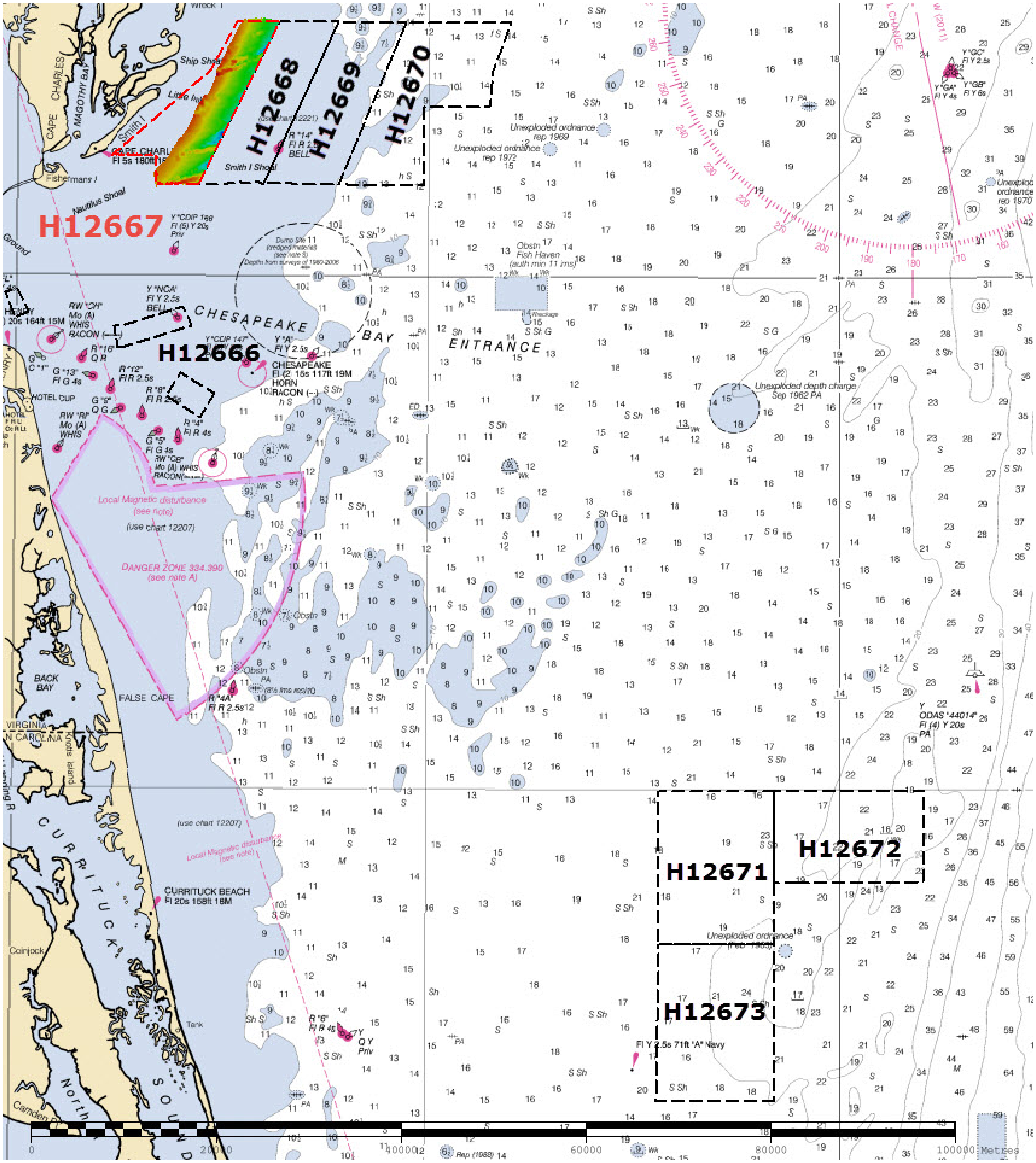


Figure 1: Survey layout for OPR-D034-FH-14, plotted over RNC 12200.

The survey does not reach the inshore limit on the western portion of the survey area. Due to safety and the draft of the ship, FERDINAND R. HASSLER personnel defined the inshore limit line just inshore of the 30 foot contour. As no survey launch was available at the time of the survey, this area went unaddressed.

A.2 Survey Purpose

The purpose of this project is to provide contemporary surveys to update National Ocean Service (NOS) nautical charting products. The survey area was declared a critical area as per the National Hydrographic Survey Priorities, ed. 2012.

A.3 Survey Quality

The entire survey is adequate to supersede previous data.

A.4 Survey Coverage

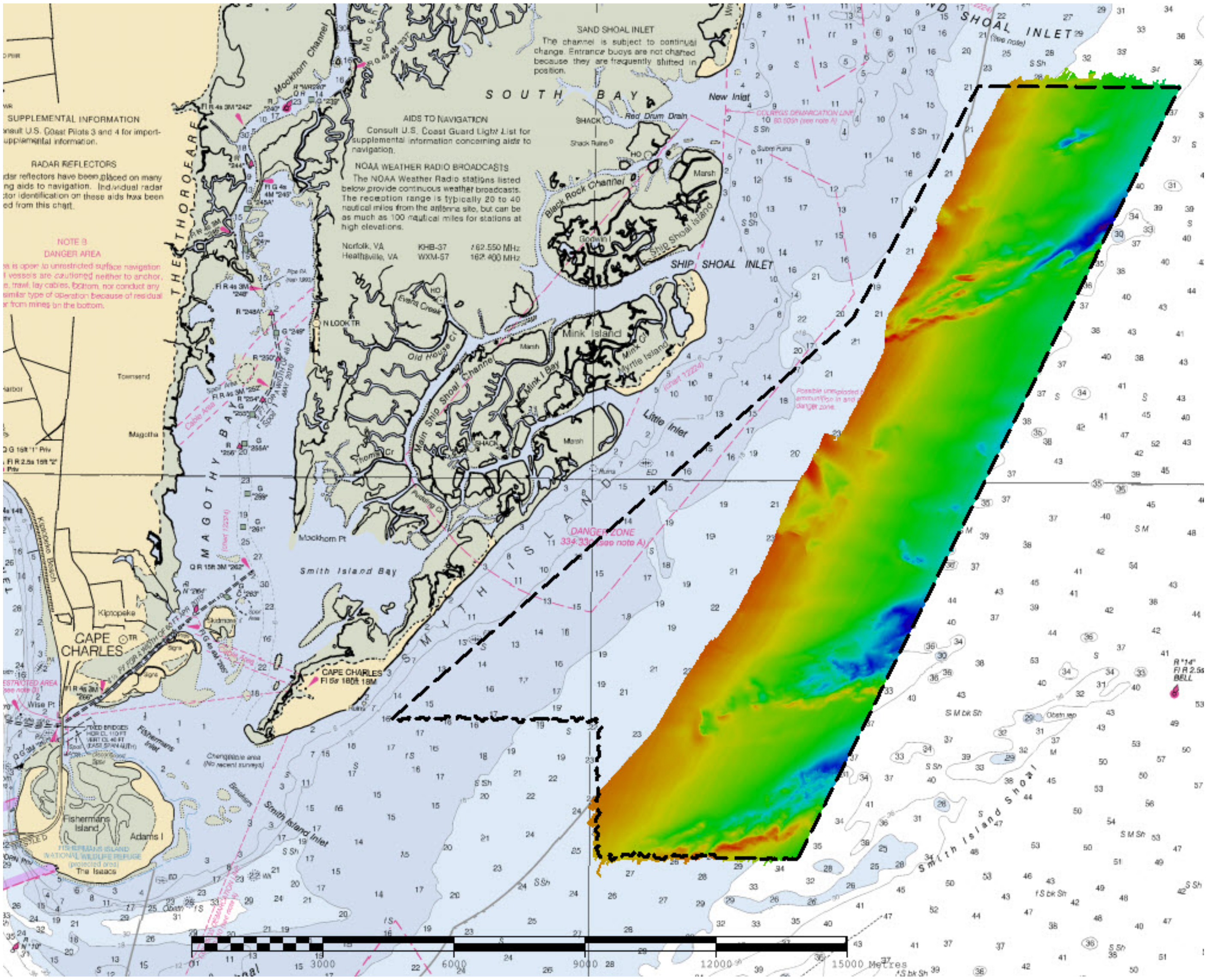


Figure 2: General locality of H12667.

Some holidays exist in the coverage of the submitted 0.5-meter surface. Analysis 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.2.10.

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	1456.3	1456.3
	Lidar Mainscheme	0	0
	SSS Mainscheme	0	0
	SBES/SSS Mainscheme	0	0
	MBES/SSS Mainscheme	0	0
	SBES/MBES Crosslines	67.6	67.6
	Lidar Crosslines	0	0
Number of Bottom Samples			6
Number of AWOIS Items Investigated			2
Number Maritime Boundary Points Investigated			0
Number of DPs			0
Number of Items Investigated by Dive Ops			0
Total SNM			22.6

Table 2: Hydrographic Survey Statistics

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

Survey Dates	Day of the Year
09/04/2014	247
09/05/2014	248
09/06/2014	249
09/07/2014	250
09/08/2014	251
09/10/2014	253
09/11/2014	254
09/12/2014	255
09/17/2014	260
09/18/2014	261
09/19/2014	262
09/20/2014	263
09/21/2014	264
10/05/2014	278
10/06/2014	279
10/08/2014	281
10/09/2014	282
11/04/2014	308

Table 3: Dates of Hydrography

Mainscheme survey lines were run with a dual-head multibeam echosounder for day of the year 247, 260, 261, 262, and 263. On all other days, only the port head was used. Linear nautical miles were calculated using statistics from the port 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 (250), shown in Figure 3, acquired all data within the limits of H12667.

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
Brooke Ocean	MVP-200	Sound Speed System
AML	Micro CTD	Conductivity, Temperature, and Depth Sensor
RESON	SVP-70	Sound Speed System

Table 5: Major Systems Used

B.2 Quality Control

B.2.1 Crosslines

Crosslines acquired for this survey totaled 5% of mainscheme acquisition.

A geographic plot of crosslines is shown in Figure 4. Crosslines were filtered to remove soundings greater than 45 degrees from nadir. To evaluate crossline agreement, two 2-meter surfaces were created: one from crossline soundings, the other from mainscheme soundings. These two surfaces were differenced using CARIS BASE Editor. More than 700,000 nodes have a difference value range of -6.41 meters and 0.50 meters. The statistical analysis of the differences between the mainscheme and crossline surfaces is shown in Figure 5. The average difference between the surfaces is 0.02 meters with a standard deviation of 0.08 meters; 95% of nodes agree within +/- 0.14 meters from the mean.

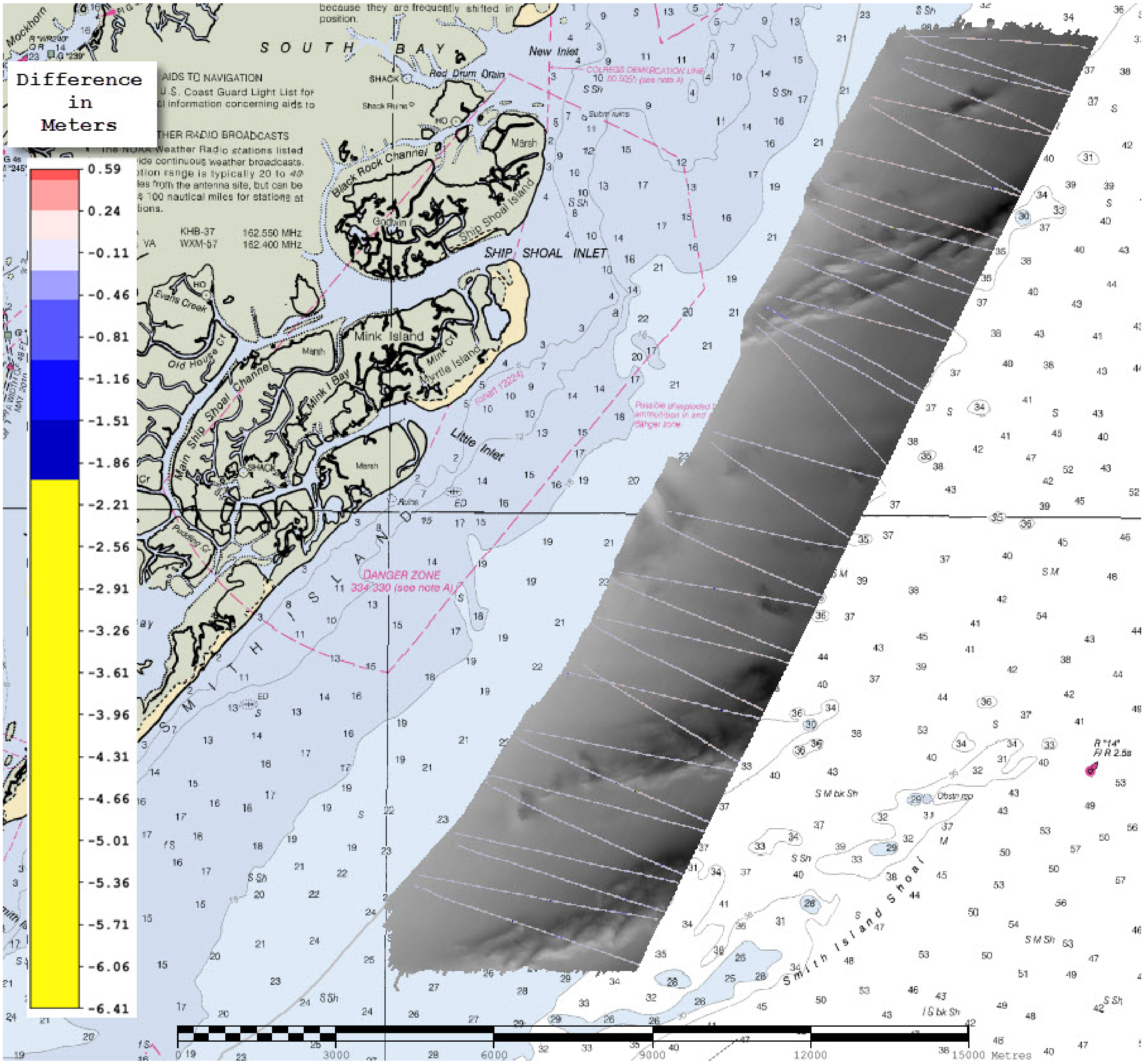


Figure 4: H12667 MBES crossline data overlaid on mainscheme data, shown in grey.

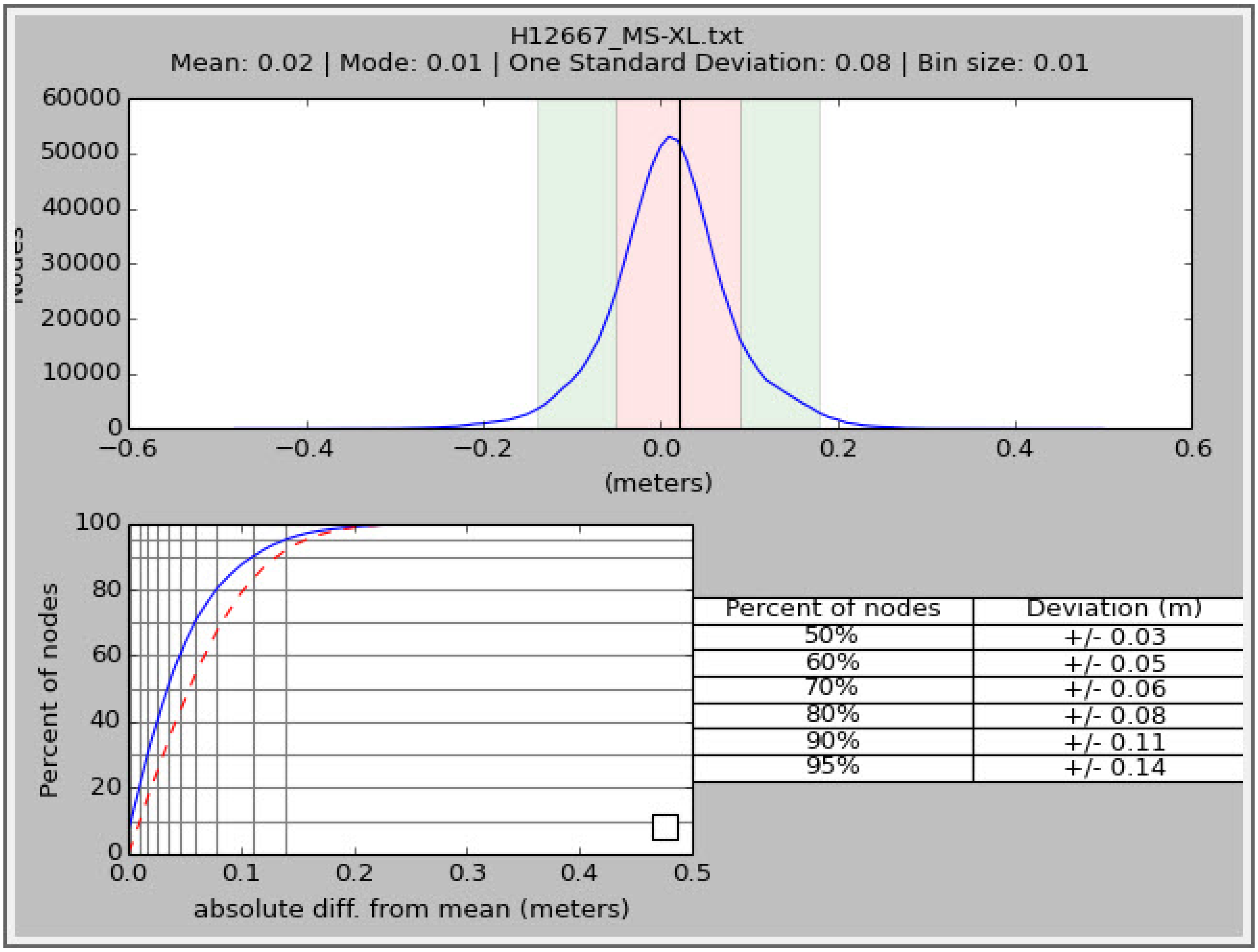


Figure 5: H12667 crossline difference statistics: mainscheme minus crossline.

B.2.2 Uncertainty

The following survey specific parameters were used for this survey:

Measured	Zoning
0.01 meters	0.102 meters
0.01 meters	0.21 meters

Table 6: Survey Specific Tide TPU Values

Hull ID	Measured - CTD	Measured - MVP	Surface
S250	1.0 meters/second	1.0 meters/second	0.5 meters/second

Table 7: Survey Specific Sound Speed TPU Values

CO-OPS provided the tidal zoning uncertainty of 0.21 meters in the Project Instructions for project OPR-D304-FH-14. Twenty-two lines, listed below, were corrected with zoned tides and received this uncertainty estimate. For these lines the TPU was calculated using "vessel settings" in CARIS.

The 0.102 meter uncertainty value was provided by HSD in the Project Instructions and is based on the VDatum uncertainty of the area. For lines except those noted below, TPU was calculated using the "realtime" selection in CARIS which uses uncertainty values from the SMRMSG files derived from SBETs. Error data sources applied through CARIS processing software are listed in Figure 6.

The twenty-two lines listed below exhibited unrealistic vertical offsets after Smooth Best Estimate of Trajectory (SBET) files were applied and GPS Tides computed. These lines have been reduced to chart datum using zoned water levels.

Port -
20140904_025457
20140904_032147
20140904_060559
20140904_070727
20140904_073125
20140904_083312
20140920_000839
20140920_064657
20141008_222719
20141104_125610

Starboard -
20140904_025424
20140904_050541
20140904_060517
20140904_070727
20140904_075659
20140904_085806
20140904_101151
20140904_205545
20140918_005847
20140919_235251
20140920_000839
20140920_064657

	SBET/SMRMSG applied but reduced via Discrete Zoning	SBET/SMRMSG applied but reduced via VDatum
Input		
Source	Selection	Selection
Tide		
Measured	0.01 (m)	0.01 (m)
Zoning	0.21 (m)	0.102 (m)
Sound Speed		
Measured	1.0 (m/s)	1.0 (m/s)
Surface	0.5 (m/s)	0.5 (m/s)
Uncertainty Source		
Source	Custom	Custom
Position	Realtime	Realtime
Sonar	Realtime	Realtime
Heading	Realtime	Realtime
Pitch	Realtime	Realtime
Roll	Realtime	Realtime
Vertical	Delayed Heave	Realtime Heave
Tide	Static	Static
Sweep parameters		
Peak to peak heave	0 (m)	0 (m)
Maximum Roll	0.0	0.0
Maximum Pitch	0.0	0.0

Figure 6: Sources of error data applied during CARIS processing.

B.2.3 Junctions

Four junctions comparisons were completed for H12667 (Figure 7). Two surveys were completed in 2009 by NOAA Ship THOMAS JEFFERSON (H12038 and H12100), one in 2013 by SAIC (H12559), and one contemporary 2014 survey by the NOAA Ship FERDINAND R. HASSLER (H12668). The areas of overlap between H12667 and its junction sheets were reviewed in CARIS BASE Editor. The junction surfaces were subtracted from the surface of H12667 to assess sounding consistency.

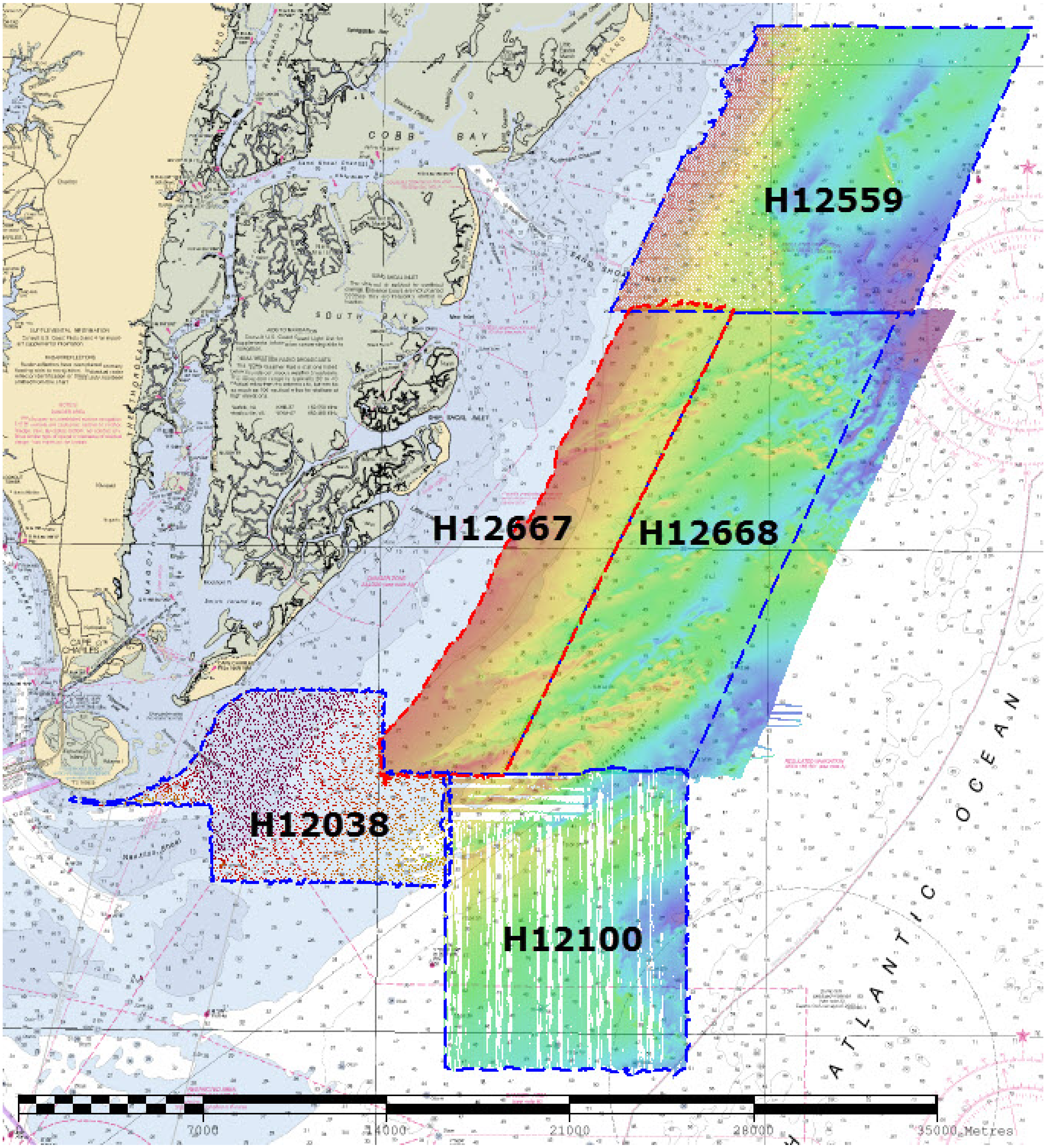


Figure 7: Overview of junctions with H12667.

The following junctions were made with this survey:

Registry Number	Scale	Year	Field Unit	Relative Location
H12038	1:20000	2009	NOAA Ship THOMAS JEFFERSON	SW
H12100	1:25000	2009	NOAA Ship THOMAS JEFFERSON	SE
H12559	1:20000	2013	SAIC	N
H12668	1:40000	2014	NOAA Ship FERDINAND R. HASSLER	E

Table 8: Junctioning Surveys

H12038

Overlap with survey H12038 was approximately 80 meters wide along the boundary of H12667. H12038 bathymetric depths were derived from single beam. A differenced surface between the 4-meter BAG surface and the 50-centimeter CUBE surface from H12667 showed that H12667 to be an average 0.11 meters deeper than H12038, with a standard deviation of 0.36 meters (Figure 8). 95% of all differences agree within 0.71 meters. The higher than usual standard deviation could be contributed to the differencing of high resolution multibeam against lower resolution single beam data. It is also possible that the shoals found between both surveys are migrating in a southwesterly direction. Evidence of this can be seen in both surveys, H12667 and H12668, as discussed in more detail in the chart comparison section of this report and the Descriptive Report accompanying Survey H12668.

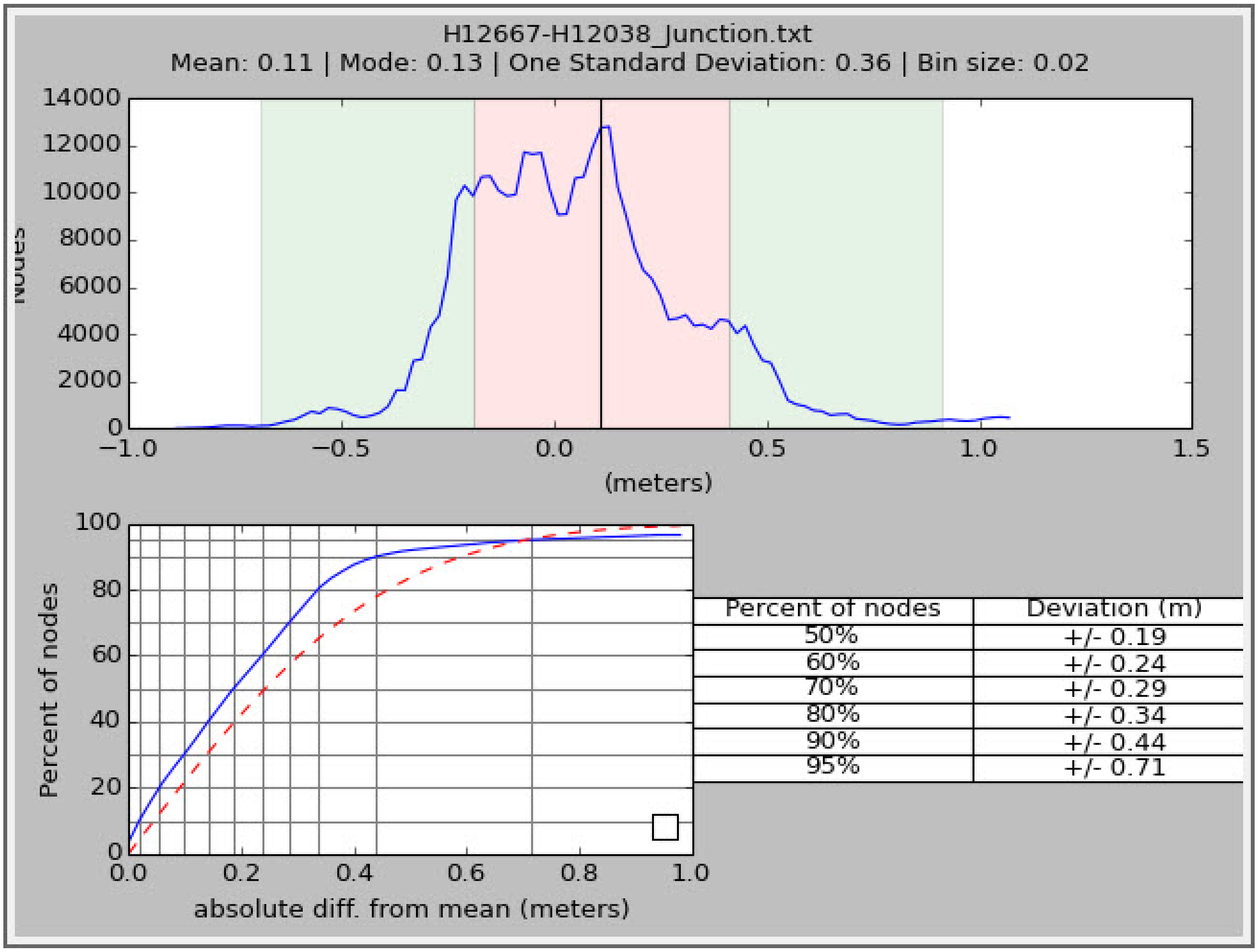


Figure 8: Differenced surface statistics, H12667 minus H12038.

<u>H12100</u>

Overlap with survey H12100 was approximately 14 meters wide along the boundary of H12667. H12100 bathymetric depths were derived from set distance multibeam. A differenced surface between the H12667 50-centimeter and H12100 2-meter resolution surfaces show very good parity with an exception around shoals, as shown in Figure 9. Shoals found during survey H12667 were not correlated with data from survey H12100, which leads the hydrographer to believe that these are shifting shoals in the area. A differenced surface analysis between the two surveys showed H12667 to be an average of 0.13 meters shallower than H12100, with a standard deviation of 0.12 meters (Figure 10). 95% of all differences agree within +/- 0.19 meters.

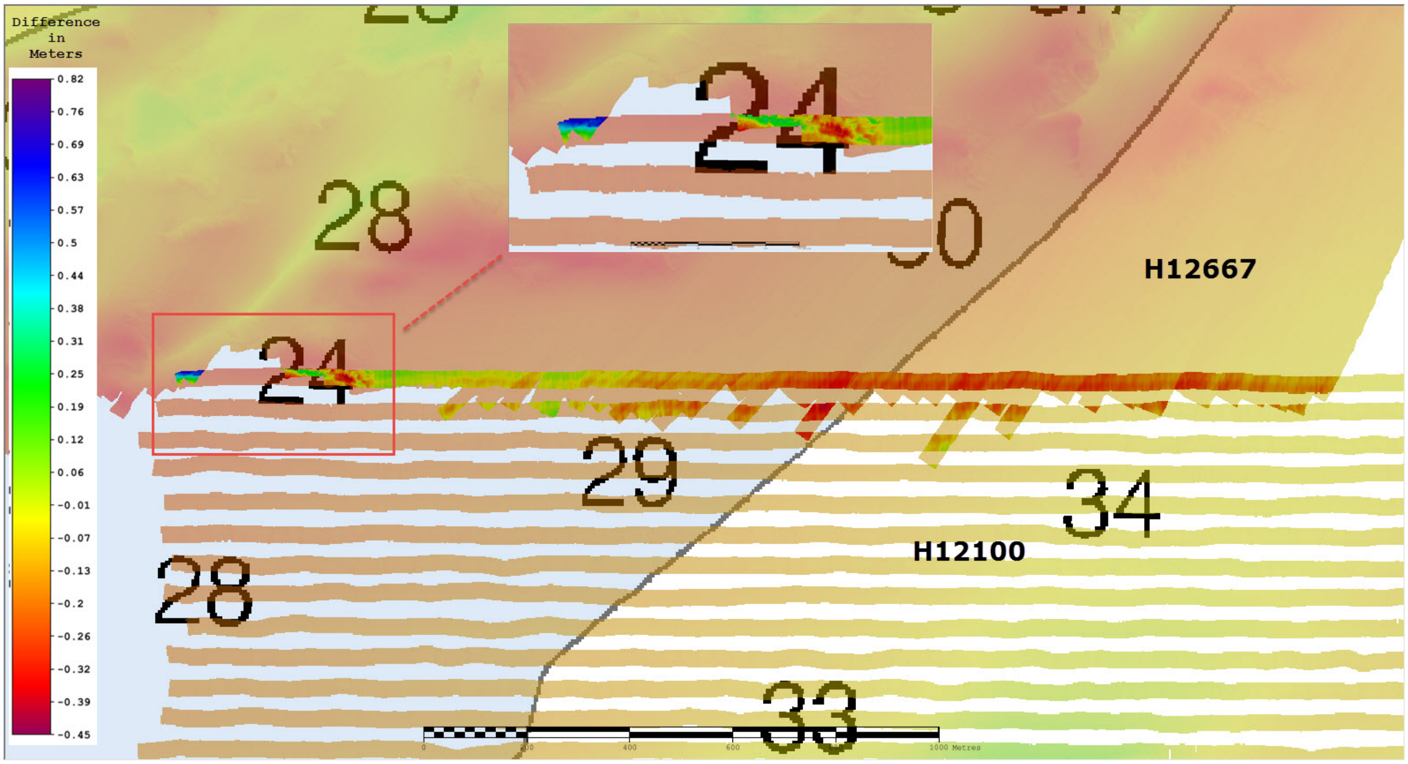


Figure 9: Junction between H12667 and H12100.

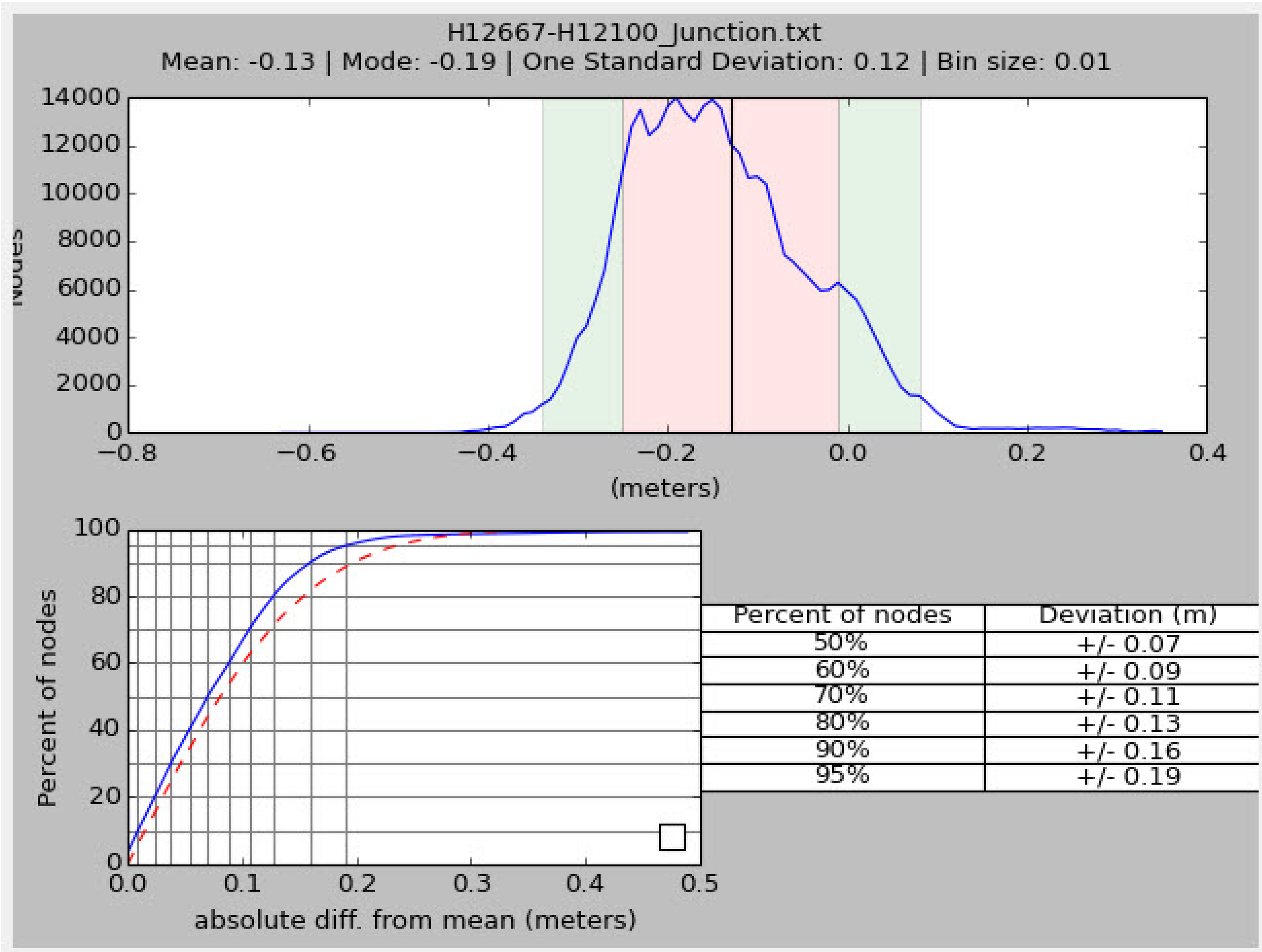


Figure 10: Differenced surface statistics, H12667 minus H12100.

<u>H12559</u>

Overlap with survey H12559 was approximately 115 meters wide along the boundary of H12667 (Figure 11). H12559 bathymetric depths were derived from set distance multibeam. A differenced surface analysis between the 2-meter BAG surface from H12559 and the 50-centimeter CUBE surface from H12667 showed H12667 to be an average 0.04 meters shallower than H12559, with a standard deviation of 0.11 meters (Figure 12). 95% of all differences agree within +/- 0.18m. One area (highlighted in Figure 12) showed differences up to 1.0 meter. It is unknown why the shoal's position has shifted 40 meters from the location of the 2013 survey but the hydrographer speculates it is due to currents and shifting shoals in the area.

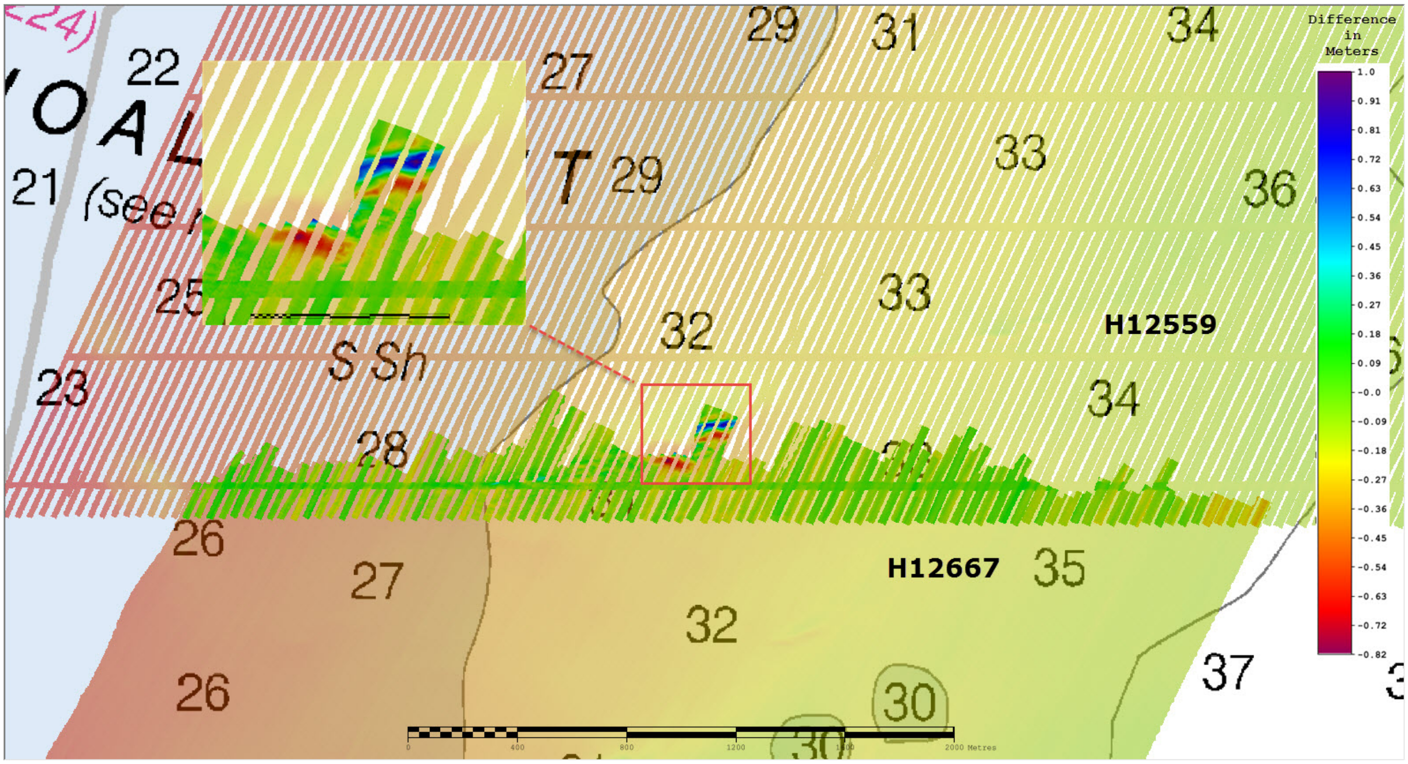


Figure 11: Junction between H12667 and H12559.

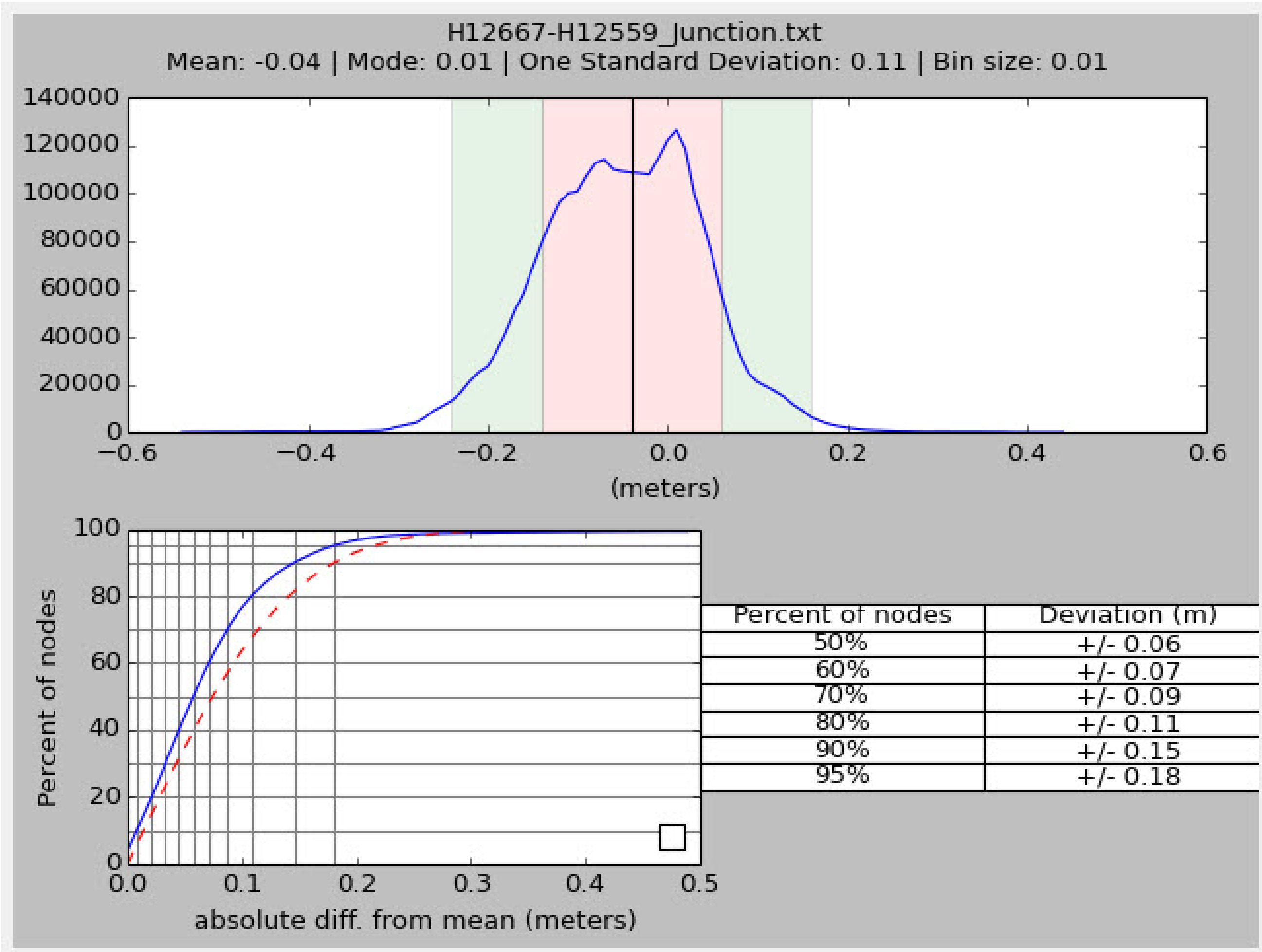
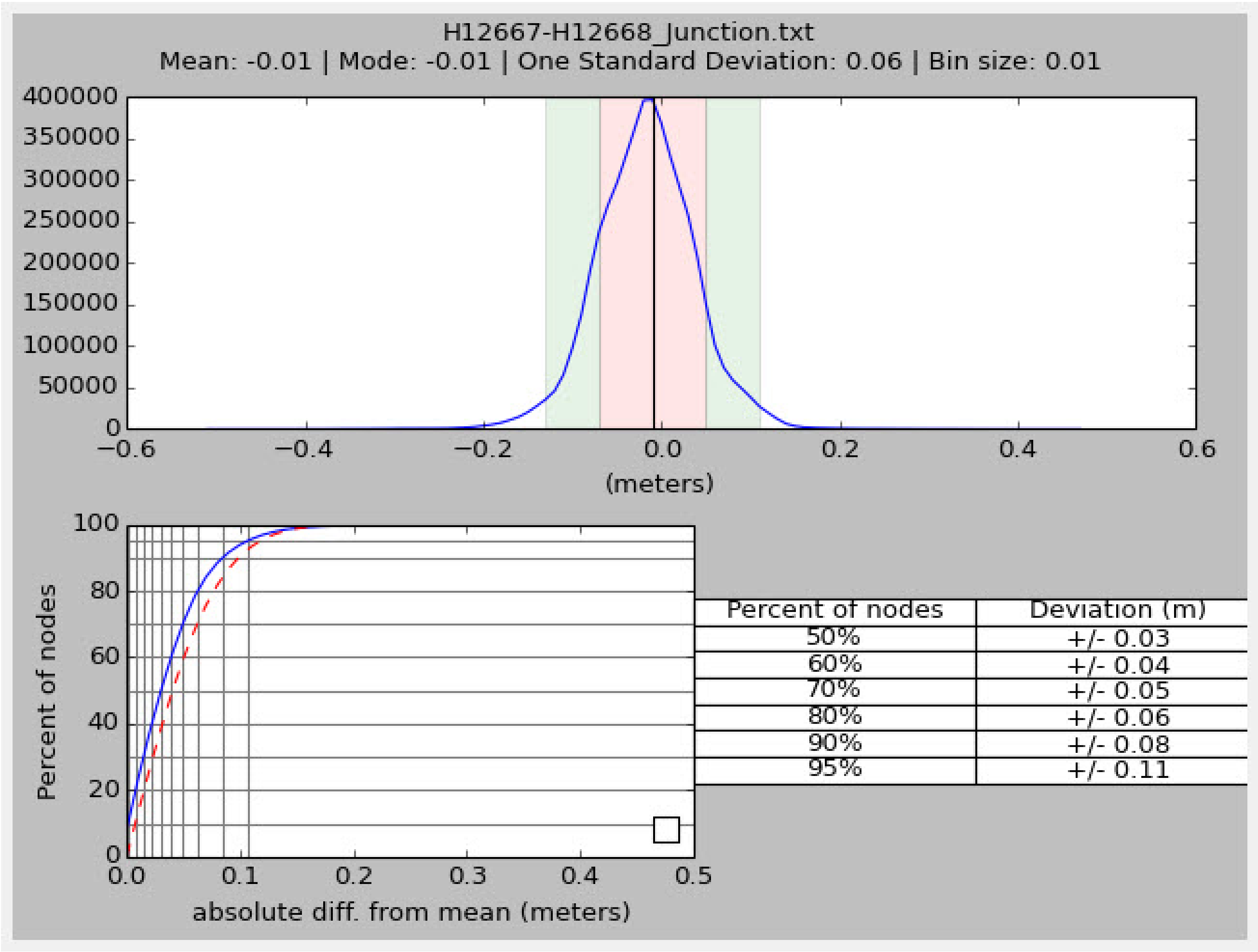


Figure 12: Differenced surface statistics, H12667 minus H12559.

<u>H12668</u>

Survey H12668 was conducted by NOAA Ship FERDINAND R. HASSLER in 2014 during the course of project OPR-D304-FH-14. A differenced surface analysis between H12667 and H12668 50-centimeter resolution surfaces showed that H12667 on average was 0.01 meters shallower than H12668, with a standard deviation of 0.06 meters (Figure 13). 95% of the nodes agree within +/- 0.11 meters.



Percent of nodes	Deviation (m)
50%	+/- 0.03
60%	+/- 0.04
70%	+/- 0.05
80%	+/- 0.06
90%	+/- 0.08
95%	+/- 0.11

Figure 13: Differenced surface statistics, H12667 minus H12668.

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

Starboard 7125 Errors

Prior to the beginning of acquisition of this survey, an artifact was noticed in data from the starboard 7125, shown in Figure 14. This artifact was determined to be the result of failed hardware components inside the RESON 7125 receiver array. This artifact is present in all data acquired by the starboard 7125, shown in Figure 15, despite attempts to minimize noise in the data with aggressive use of real-time gates. The resultant fliers were rejected in CARIS HIPS Subset Editor and using filters as described in Section B.5.3. See the Data Acquisition and Processing Report for project OPR-D304-FH-14 for further information regarding the history and correction of the starboard 7125 receiver array. Approximately 605 linear miles of starboard data is impacted by this malfunction.

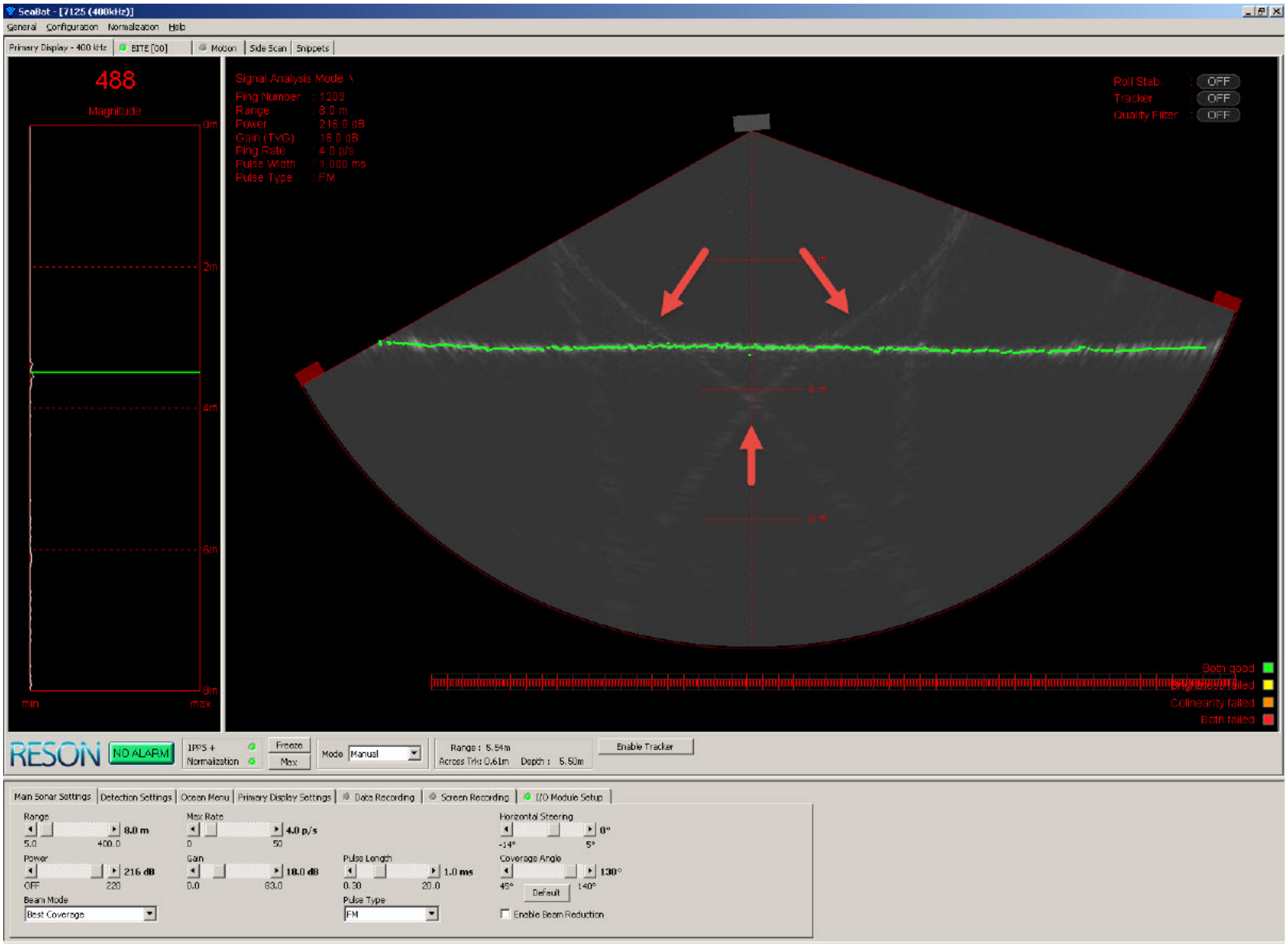


Figure 14: Artifact seen in the starboard RESON echosounder display

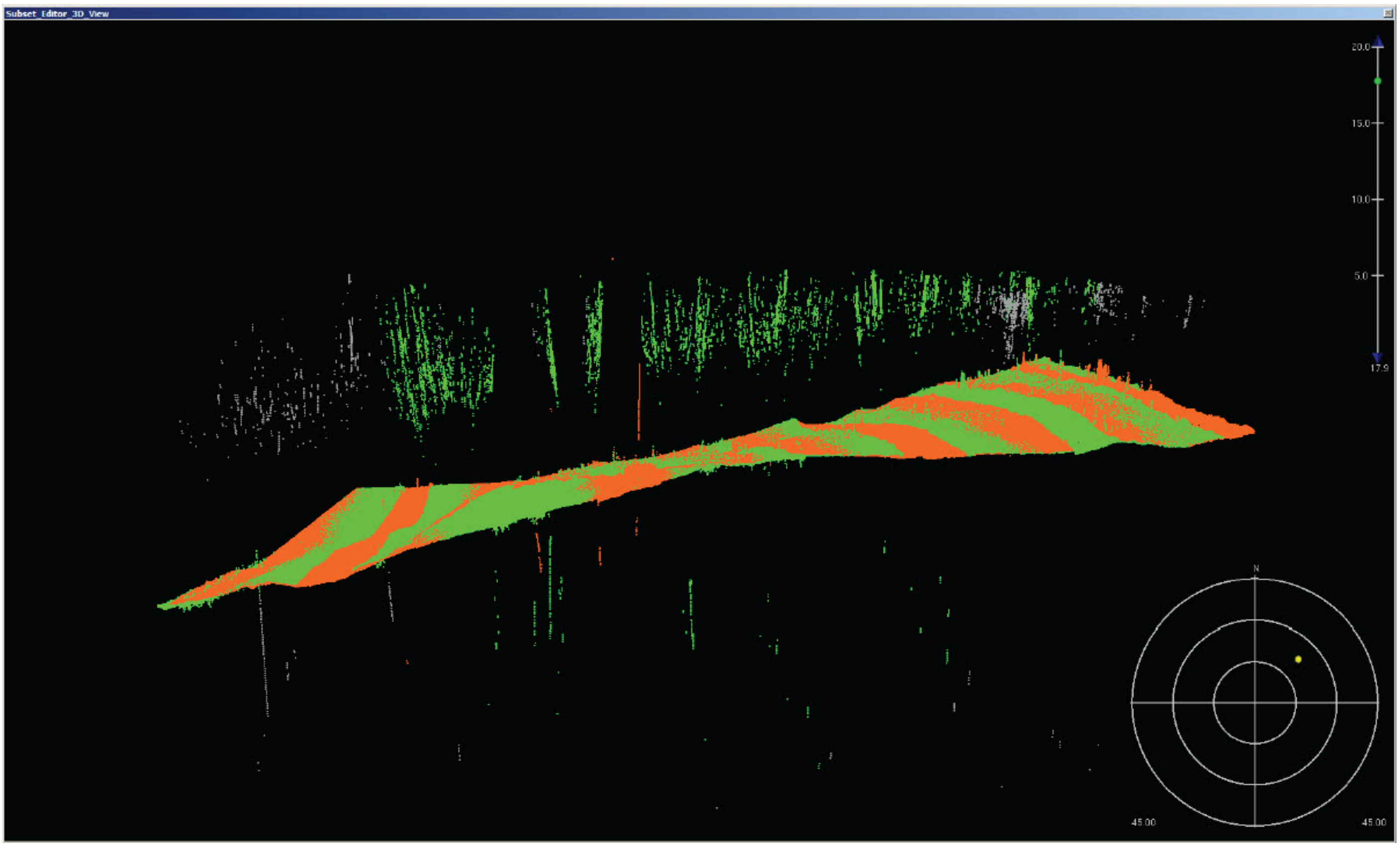


Figure 15: 3D subset of data collected colored by vessel, starboard (green) and port (orange). Data from the starboard head makes up the majority of noise displayed. Data were thoroughly cleaned to eliminate these erroneous soundings.

Surface Sound Speed Anomolies

On occasion, surface sound speed spikes occur on H12667. These spikes are brief but cause anomalous data to be collected (Figures 16 and 17). As a way to remedy the situation, the hydrographer tried to interpolate the surface sound speed in CARIS Attitude Editor but a bug in the software will not allow the data to be edited. It is believed that it is because the raw data were recorded in the *.s7k format. The hydrographer has cleaned these data so they no longer negatively impact the surface. The hydrographer does not believe that these anomalies have impacted the ability to detect objects on this survey.

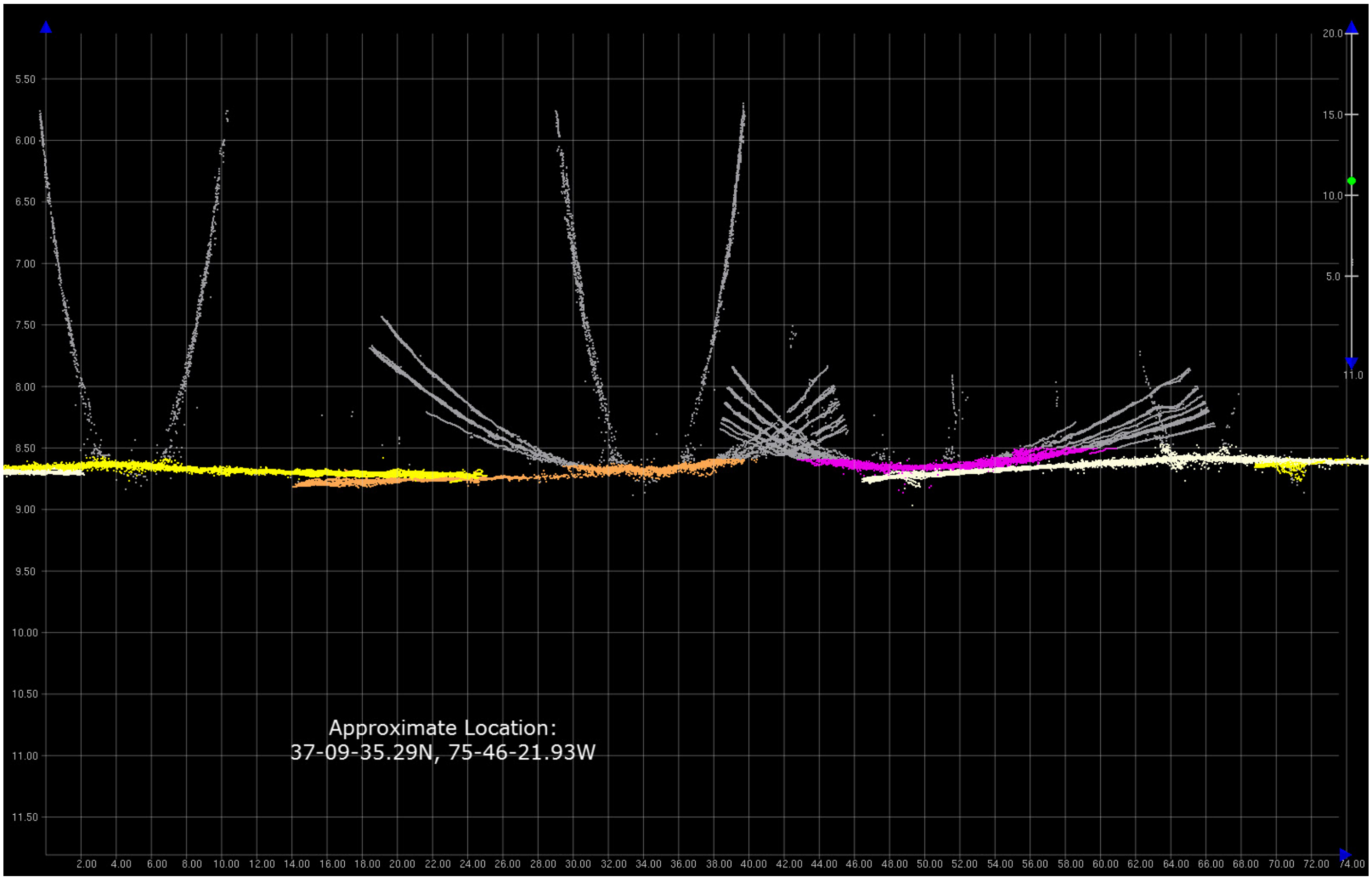


Figure 16: Example of an anomalies caused by a spikes in the surface sound speed.

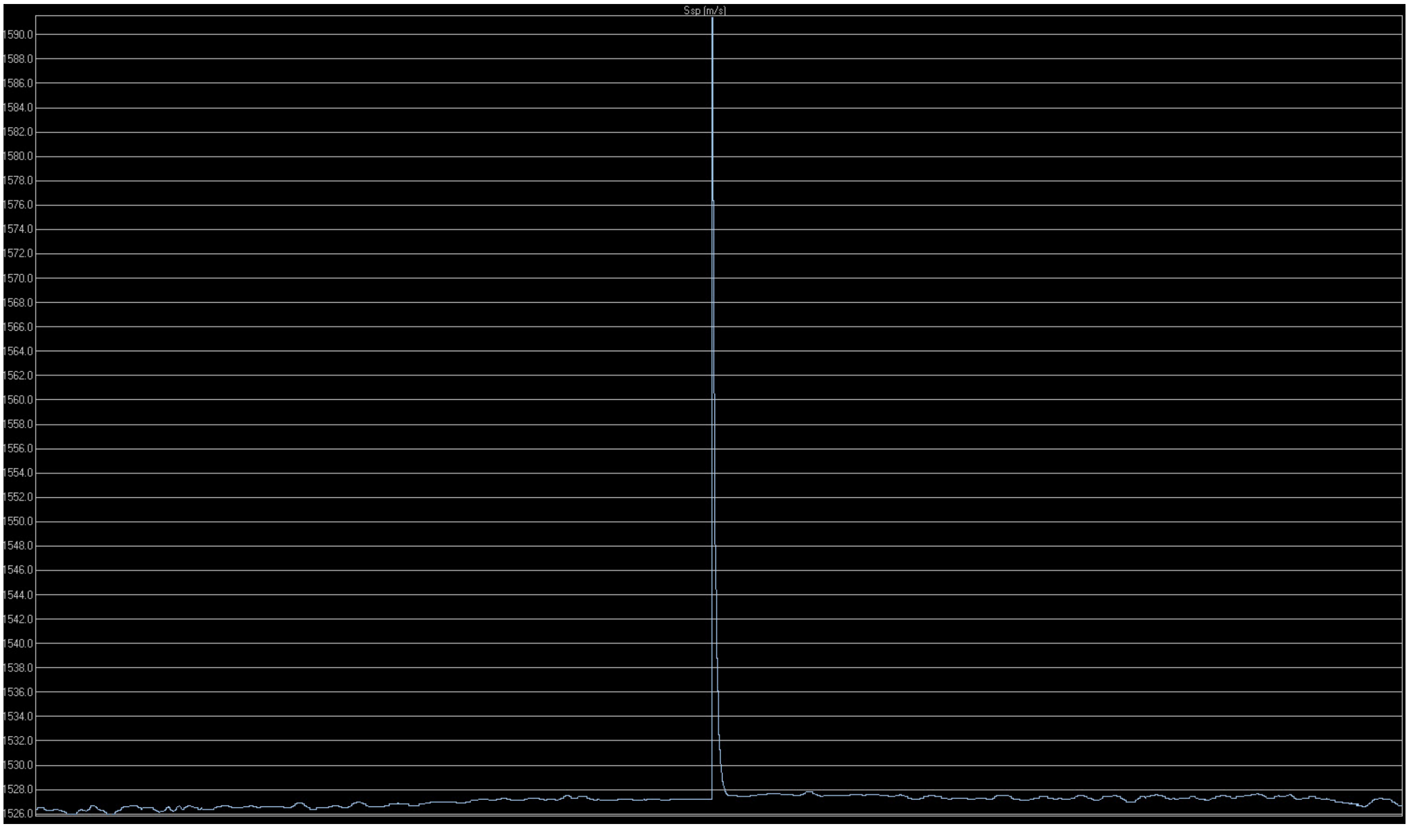


Figure 17: Surface sound speed spike.

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: A total of 233 sound speed measurements were taken within the boundaries of survey H12667. These sound speed measurements were collected using the MVP-200 approximately every hour. Comparisons were made by the survey watch to assess sound speed variation in the water column. The results of these comparisons showed the water column to be well mixed with minimal variance over space or time.

Sound speed corrections were applied in CARIS using Nearest in Distance Within Time (NIDWT) of 2 hours for the entire survey (Figure 18).

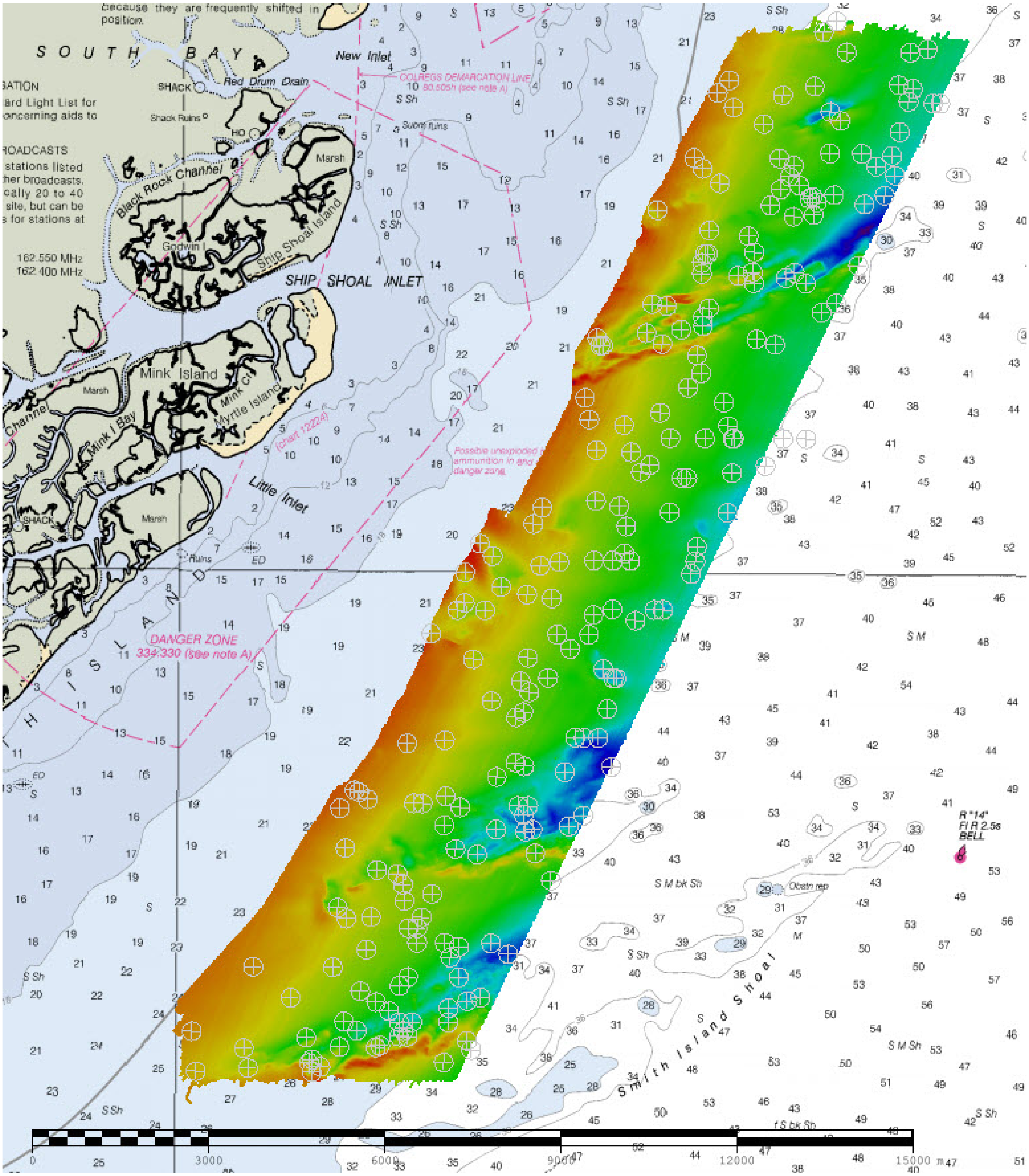


Figure 18: H12667 sound speed profile locations.

B.2.8 Coverage Equipment and Methods

All equipment and survey methods were used as detailed in the DAPR.

B.2.9 Data Density

A density analysis was run to calculate the number of soundings per surface node. The results determined that over 99% of all nodes contained five or more soundings. The density analysis was executed on nodes which are populated with at least one sounding and did not account for holidays located within the surface. For additional information see the H12667_Standards_Compliance report in Appendix II. Due to limitations of the Python script, the file to be read for the Standards Compliance report needed to be split into two parts.

B.2.10 Holidays

There are a high number of small coverage gaps that exist in this survey due to a number of factors including starboard 7125 errors (See Section B.2.5 of this report), surface sound speed anomalies (See Section B.2.6 of this report), and poor outerbeam overlap. Many holidays were also the result of the RESON MBES system automatically restarting logging once the raw .s7k file exceeds 1GB in size. Figure 19 shows examples of the holidays caused by automatic logging restarts. These holidays have been examined by the hydrographer and are deemed insignificant as they appear in flat featureless areas.

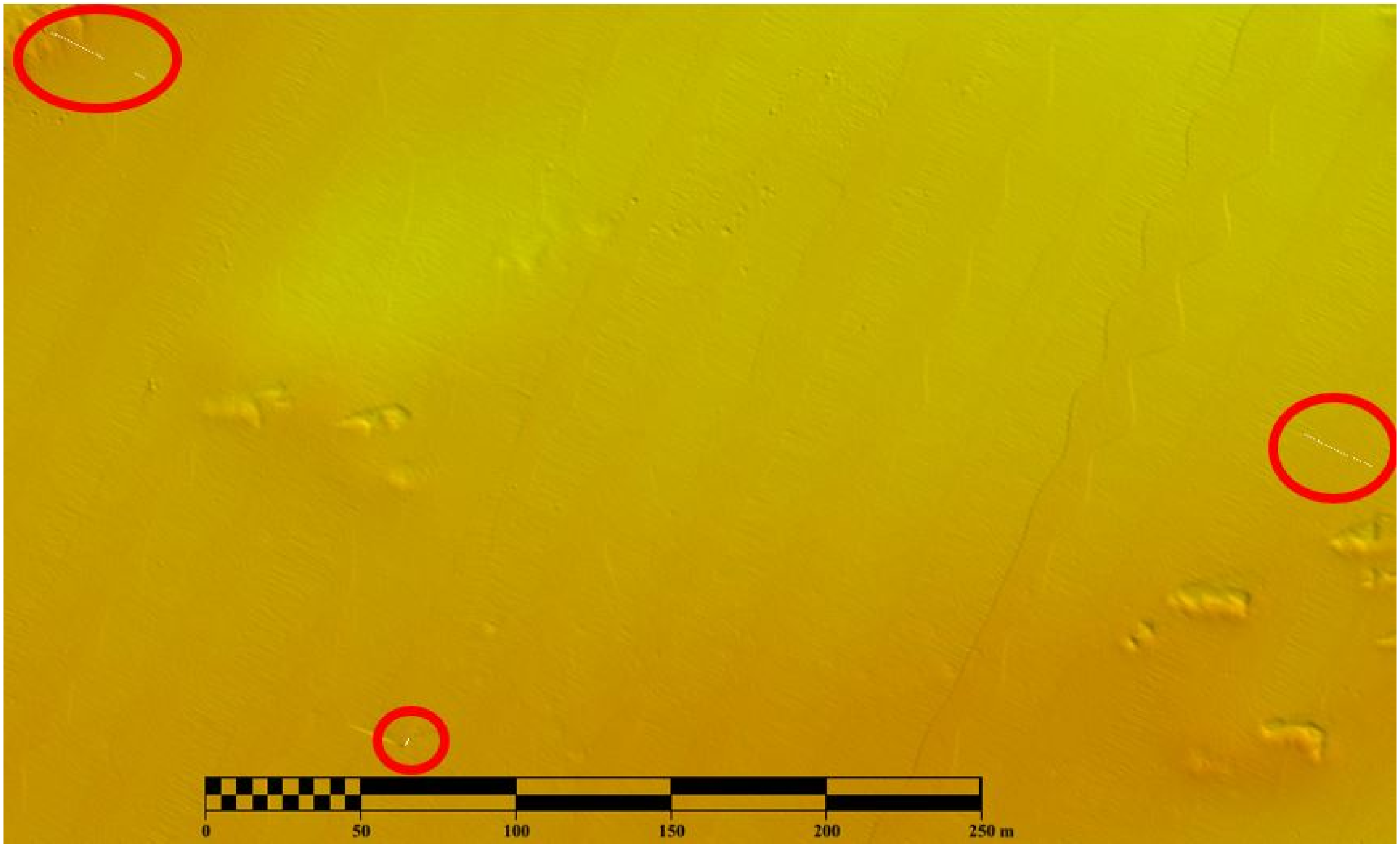


Figure 19: Example of holidays caused by automatic logging restart of RESON .s7k file.

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 H12667. The files were paired with the CARIS HDCS data, imported, and processed using Fledermaus Geocoder Toolbox (FMGT). The FMGT projects and backscatter mosaic imagery is included in the field submission. The processed mosaic is formated as a geo-rectified tiff image per specifications.

B.5 Data Processing

B.5.1 Software Updates

The following software updates occurred after the submission of the DAPR:

Manufacturer	Name	Version	Service Pack	Hotfix	Installation Date	Use
CARIS	HIPS/SIPS	8.1	10		12/22/2014	Processing

Table 9: Software Updates

The following Feature Object Catalog was used: NOAA Profile V_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**
H12667_MB_50cm_MLLW	CUBE	0.5 meters	6.40 meters - 14.58 meters	NOAA_0.5m	Object Detection
H12667_MB_50cm_MLLW_Final	CUBE	0.5 meters	6.40 meters - 14.58 meters	NOAA_0.5m	Object Detection

Table 10: Submitted Surfaces

B.5.3 Multibeam Data Filters

A swath filter was applied to the data to remove sonar side lobe anomalies which are explained in Section B.2.5. The filter used logic that rejected bathymetric data points with a RESON quality flag of 0, 1, or 2. The filter was only applied to lines with significant blowout as shown in Figures 15 and 16 which rejected most of the erroneous data. All other erroneous data was manually rejected by the hydrographer during normal data processing and editing.

B.5.4 Total Vertical Uncertainty Analysis

A custom layer was created for the finalized surface submitted with survey H12667. The layer was derived from the difference between the calculated uncertainties of individual nodes and the allowable uncertainty at the coupled node. This layer was examined using a custom Python script. The resulting statistical analysis identified over 99.9% of nodes within survey H12667 meet the vertical uncertainty standards of Section 5.1.3 of the 2014 Hydrographic Surveys Specifications and Deliverables. For additional information see the H12667_Standards_Compliance report in Appendix II. Due to limitations of the Python script, the file to be read for the Standards Compliance report needed to be split into two parts.

B.5.5 Designated Soundings

Within the limits of H12667, two soundings are submitted flagged as designated. These soundings are designated for feature creation.

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.

Standard Vertical Control Methods Used:

Discrete Zoning

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

Station Name	Station ID
Duck, NC	8651370

Table 11: NWLON Tide Stations

File Name	Status
8651370.tid	Verified Observed

Table 12: Water Level Files (.tid)

File Name	Status
D304FH2014CORP_Rev2.zdf	Final

Table 13: Tide Correctors (.zdf or .tc)

A request for final approved tides was sent to N/OPS1 on 11/21/2014. The final tide note was received on 11/25/2014.

An original request for final approved tides was requested on 10/15/2014 and received on 10/29/2014. Additional data were then collected on 11/4/2014 which made it necessary to re-submit a request for final approved tides. Information stated in the second request (received 11/25/2014) states the files that are submitted with the data.

Preliminary zoning is accepted as the final zoning for project OPR-D304-FH-2014, H12667, during the time period between September 3 - November 4, 2014.

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

VDatum

<u>Ellipsoid to Chart Datum Separation File:</u>

2014_D304_VDatum_NAD83_MLLW.csar

Soundings submitted as H12667 are referenced to MLLW reduced by ellipsoidal methods using the ellipsoid to chart datum separation file, with the exception of those lines discussed in section B.2.2 that were reduced to chart datum using zoned water levels.

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 18N.

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

Smart Base

All data submitted as H12667 has SBETs and SMRMSGs applied for post-processed position/attitude and TPU values, respectively.

The following CORS Stations were used for horizontal control:

HVCR Site ID	Base Station ID
BRODIE ISLAND, Brodie Island, NC	NCBI
LOYOLA 2 COOP, Chesapeake, VA	LOY2
WALLOPS ISLAND, Wallops Island, VA	VAWI
VA GLOUSCESTER PT, Gloucester Point, VA	VAGP
LOYOLA LS03, Virginia Beach, VA	LS03
LOYOLA LOYW, Exmore, VA	LOYW
DRIVER 6, Driver, VA	DRV6
MILLSBORO, Millsboro, DE	DEMI
CHESAPEAKE LIGHT, Chesapeake Light, VA	COVX

Table 14: CORS Base Stations

DGPS was used for real-time positioning during acquisition. All lines submitted are corrected using post-processed horizontal solutions.

The following DGPS Stations were used for horizontal control:

DGPS Stations
Driver, VA (289 kHz)

Table 15: USCG DGPS Stations

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
12224	1:40000	26	08/2014	03/03/2015	02/21/2015
12208	1:50000	16	07/2013	03/03/2015	02/28/2015
12221	1:80000	82	02/2014	03/03/2015	02/28/2015

Table 16: Largest Scale Raster Charts

<u>12224</u>

A comparison was performed with Chart 12224 (1:40,000) using soundings from a generalized 50-meter surface (Figure 19). Charted depths agree within 2-3 feet of H12667 soundings with occasional exceptions. Generally, surveyed soundings are deeper than charted depths. Surveyed contours are typically more westerly than charted depth curves. Two finger shoals (two southern subsets in Figure 20) are shoaler than charted and will effect the charted depth curves. The northern subset shown in Figure 20 may demonstrate the presence of migrating shoals in a general southwesterly direction (Figure 21). This is further discussed in the junction comparison section of this report and in survey H12668 Descriptive Report.

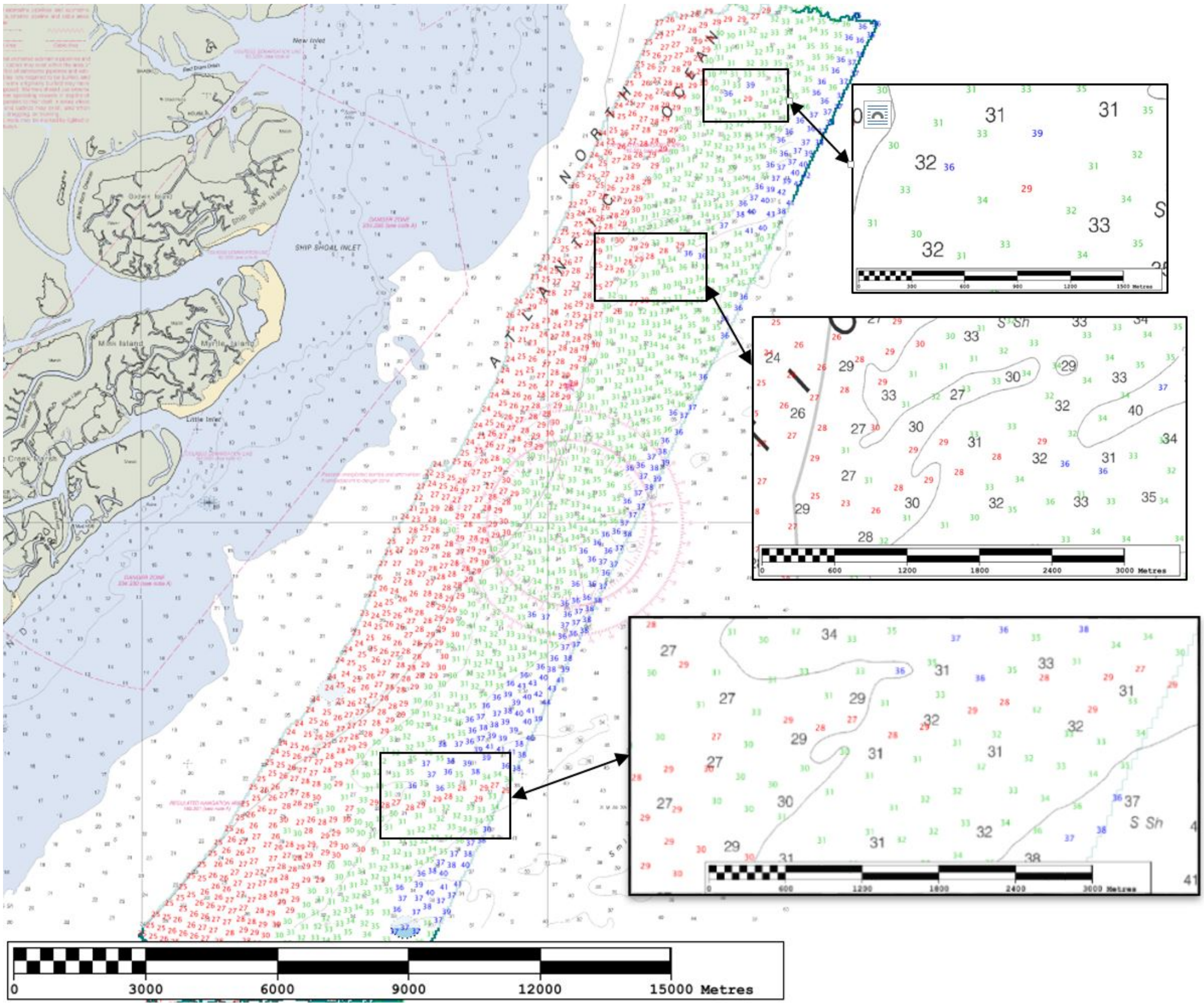


Figure 20: H12667 surveyed soundings in feet (red <30, green 30-36, blue >30) overlaid on RNC 12224. Areas with considerable variations are magnified in the subsets.

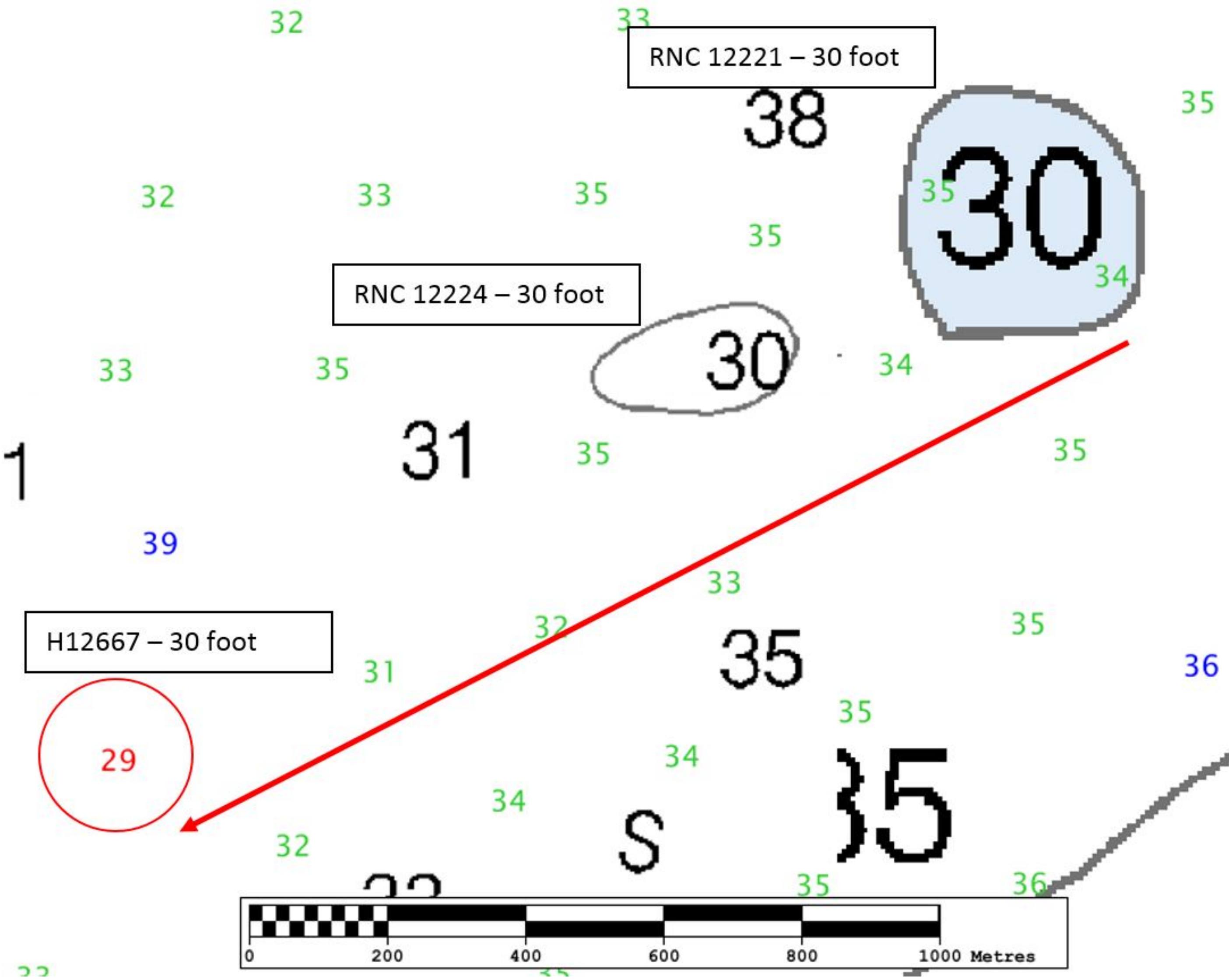


Figure 21: Possible migrating of shoals in a southwesterly direction.

<u>12208</u>

A comparison was performed with Chart 12208 (1:50,000) using soundings from a generalized 50-meter surface (Figure 22). The area of comparison was small, but in general, charted depths agree within 2-3 feet of H12667 surveyed soundings.

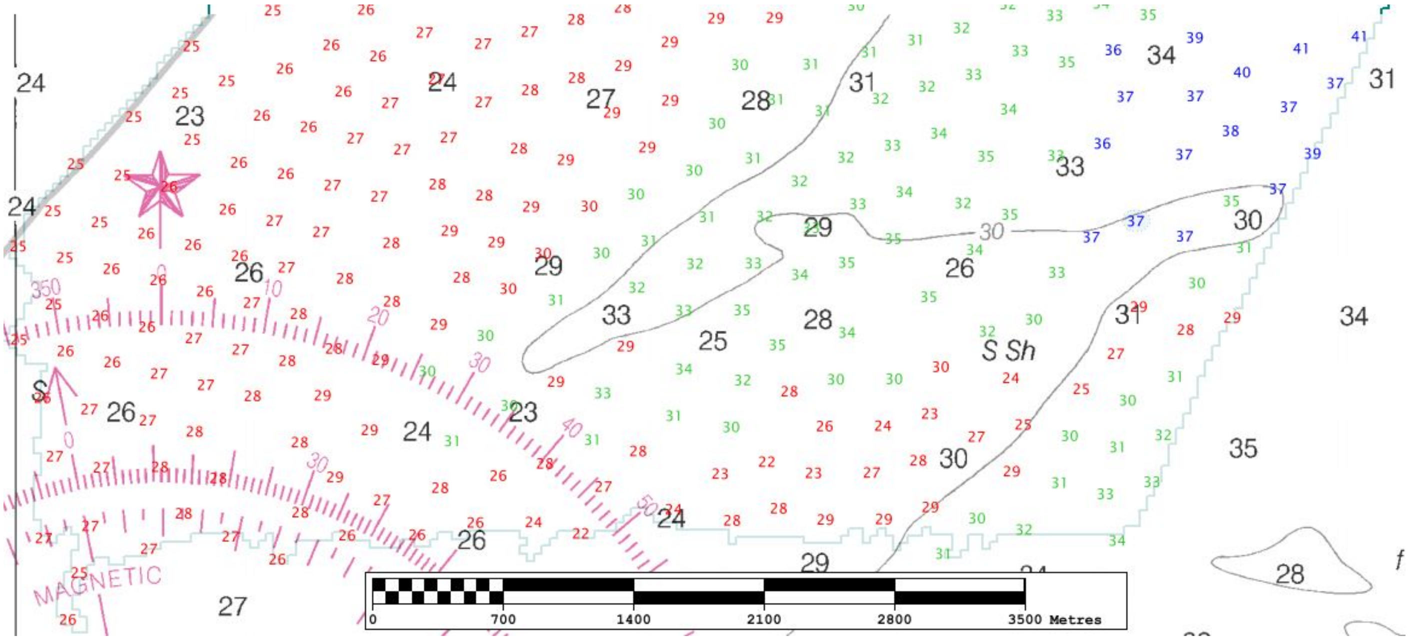


Figure 22: H12667 surveyed soundings in feet (red <30, green 30-36, blue >36) overlaid on RNC 12208.

<u>12221</u>

A comparison was performed with Chart 12221 (1:80,000) using soundings from a generalized 50-meter surface (Figure 23). The area of comparison was small, but with the exception of the charted blue tint, charted depths agreed within 1-2 feet of H12667 surveyed soundings. The blue tint is believed to have migrated southwesterly as discussed in the chart comparison with RNC 12224.

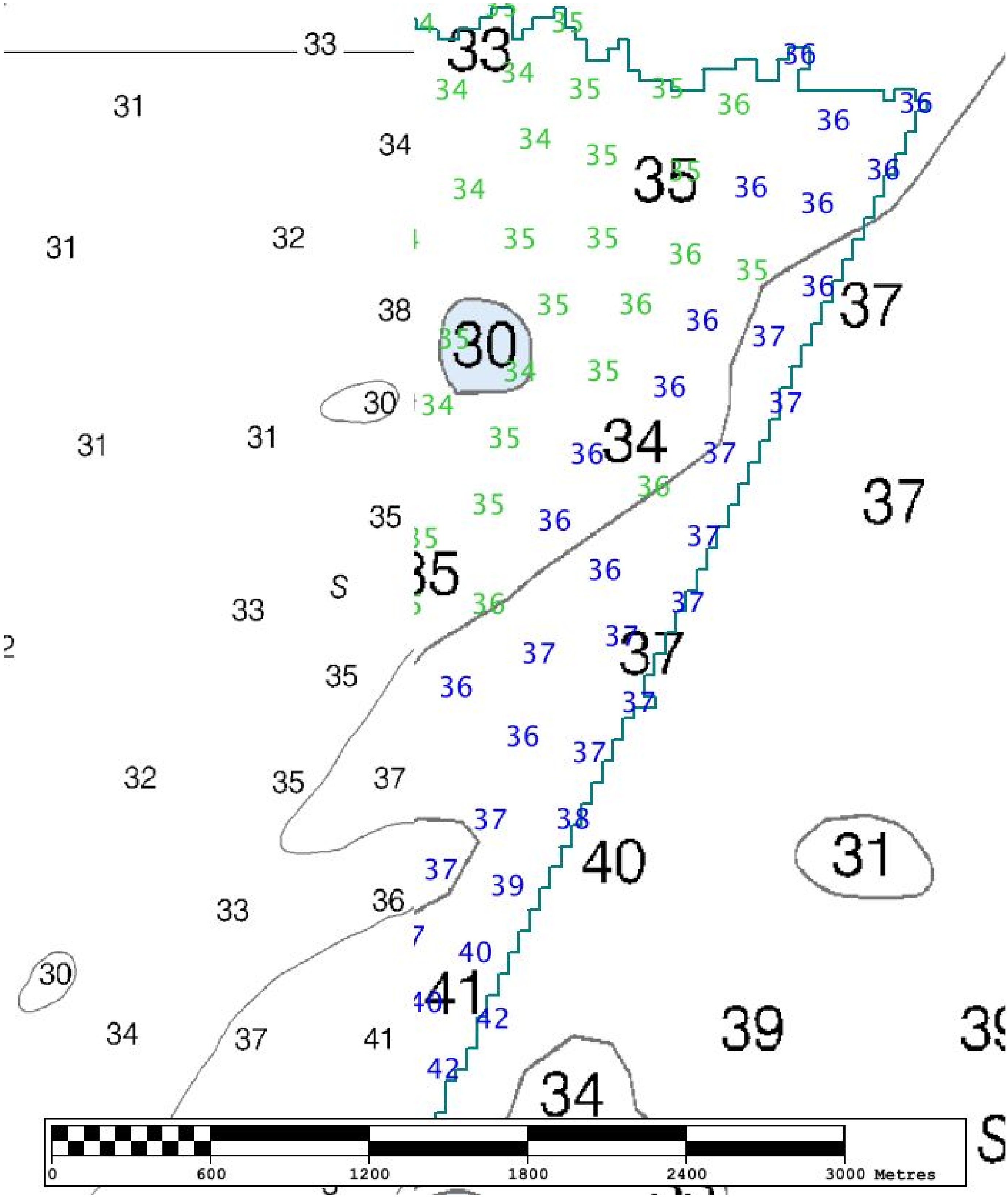


Figure 23: H12667 surveyed soundings in feet (red <30, green 30-36, blue >36) overlaid on RNC 12221. Surveyed soundings are only shown where previous chart comparison with RNC 12224 was not made previously.

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?
US5VA14M	1:40000	22	05/04/2012	02/18/2015	NO
US5VA11M	1:50000	18	10/18/2013	03/04/2015	NO
US5VA1AM	1:80000	1	10/30/2014	10/30/2014	NO

Table 17: Largest Scale ENCs

US5VA14M

No comparison was performed with ENC US5VA14M as it contains no soundings different than RNC 12224. See previous chart comparison with RNC 12224.

US5VA11M

No comparison was performed with ENC US5VA11M as it contains no soundings different than RNC 12208. See previous chart comparison with RNC 12208.

US5VA1AM

No comparison was performed with ENC US4VA1AM as it contained no soundings different than RNC 12221. See previous chart comparison with RNC 12221.

D.1.3 AWOIS Items

Two AWOIS items exist for this survey, but were not addressed. The AWOIS items are located in areas too shallow for the FERDINAND R. HASSLER to investigate as a survey launch does not exist (Figure 24).

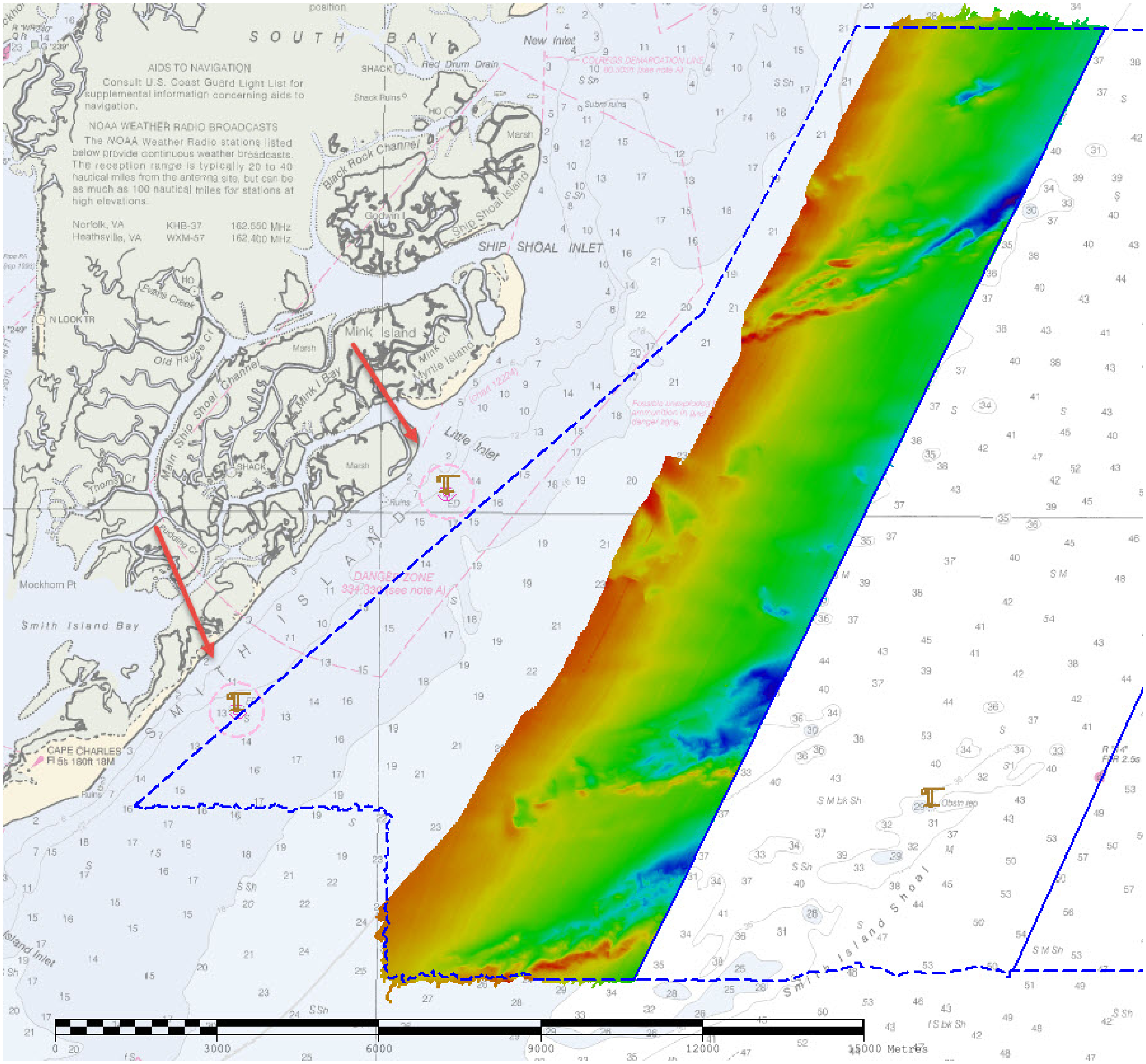


Figure 24: H12667 AWOIS Items.

D.1.4 Maritime Boundary Points

No Maritime Boundary Points were assigned for this survey.

D.1.5 Charted Features

No charted features exist for this survey.

D.1.6 Uncharted Features

Two new obstructions were identified for this survey. See the submitted Final Feature File for more information.

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

No channels exist for this survey. There are no designated anchorages, precautionary areas, safety fairways, traffic separation schemes, pilot boarding areas, or channel and range lines within the survey limits.

D.1.10 Bottom Samples

Six bottom samples were taken within the limits of H12667. These bottom samples are included in the Final Feature File submission. Photos obtained from video coverage are submitted in the Final Feature File for four of the six bottom samples.

D.2 Additional Results

D.2.1 Shoreline

A limited shoreline verification was assigned by the Project Instructions. All features within the area surveyed with the populated "Assigned" flag were addressed in the Final Feature File. Areas inshore of the area surveyed were too shallow for safe navigation of FERDINAND R. HASSLER, and were not investigated.

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

No submarine features exist for this survey.

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. Two insignificant features were identified by the hydrographer within H12667. Final disposition of these features shall be left to the branch to decide if they are to be charted. See the Final Feature File for more information.

Evidence of migrating shoals was also apparent in the survey data. More discussion of this can be found in the junction analysis and chart comparison sections of this report. Additional discussion can be found in the Descriptive Report accompanying survey H12668.

D.2.9 Construction and Dredging

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

D.2.10 New Survey Recommendation

The inshore area of H12667 was surveyed near the safe navigable limit achievable by FERDINAND R. HASSLER without the use of a survey launch. Work in shore of the western limit of H12667 will require a survey launch due to it proximity to hazards and shallow depths. The hydrographer recommends these areas be addressed in a later survey by a platform suited for nearshore work.

D.2.11 Inset Recommendation

No new insets are recommended for this area.

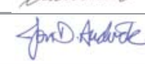
E. Approval Sheet

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-B304-FH-14 Data Acquisition and Processing Report	2015-01-20
2014 Hydrographic Systems Readiness Review Memo	2014-05-06

Approver Name	**Approver Title**	**Approval Date**	**Signature**
CDR Marc S. Moser, NOAA	Chief of Party	05/13/2015	MOSER.MARC.STANTON.1163193902 Digitally signed by MOSER.MARC.STANTON.1163193902 DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=NOAA, cn=MOSER.MARC.STANTON.1163193902 Date: 2015.05.14 06:36:15 -04'00'
LT Adam Reed, NOAA	Field Operations Officer	05/13/2015	
LT Jon D. Andvick, NOAA	Sheet Manager	05/13/2015	

F. Table of Acronyms

Acronym	Definition
AHB	Atlantic Hydrographic Branch
AST	Assistant Survey Technician
ATON	Aid to Navigation
AWOIS	Automated Wreck and Obstruction Information System
BAG	Bathymetric Attributed Grid
BASE	Bathymetry Associated with Statistical Error
CO	Commanding Officer
CO-OPS	Center for Operational Products and Services
CORS	Continually Operating Reference Staiton
CTD	Conductivity Temperature Depth
CEF	Chart Evaluation File
CSF	Composite Source File
CST	Chief Survey Technician
CUBE	Combined Uncertainty and Bathymetry Estimator
DAPR	Data Acquisition and Processing Report
DGPS	Differential Global Positioning System
DP	Detached Position
DR	Descriptive Report
DTON	Danger to Navigation
ENC	Electronic Navigational Chart
ERS	Ellipsoidal Referenced Survey
ERZT	Ellipsoidally Referenced Zoned Tides
FFF	Final Feature File
FOO	Field Operations Officer
FPM	Field Procedures Manual
GAMS	GPS Azimuth Measurement Subsystem
GC	Geographic Cell
GPS	Global Positioning System
HIPS	Hydrographic Information Processing System
HSD	Hydrographic Surveys Division
HSSD	Hydrographic Survey Specifications and Deliverables

Acronym	Definition
HSTP	Hydrographic Systems Technology Programs
HSX	Hypack Hysweep File Format
HTD	Hydrographic Surveys Technical Directive
HVCR	Horizontal and Vertical Control Report
HVF	HIPS Vessel File
IHO	International Hydrographic Organization
IMU	Inertial Motion Unit
ITRF	International Terrestrial Reference Frame
LNM	Local Notice to Mariners
LNM	Linear Nautical Miles
MCD	Marine Chart Division
MHW	Mean High Water
MLLW	Mean Lower Low Water
NAD 83	North American Datum of 1983
NAIP	National Agriculture and Imagery Program
NALL	Navigable Area Limit Line
NM	Notice to Mariners
NMEA	National Marine Electronics Association
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
NRT	Navigation Response Team
NSD	Navigation Services Division
OCS	Office of Coast Survey
OMAO	Office of Marine and Aviation Operations (NOAA)
OPS	Operations Branch
MBES	Multibeam Echosounder
NWLON	National Water Level Observation Network
PDBS	Phase Differencing Bathymetric Sonar
PHB	Pacific Hydrographic Branch
POS/MV	Position and Orientation System for Marine Vessels
PPK	Post Processed Kinematic
PPP	Precise Point Positioning
PPS	Pulse per second

Acronym	Definition
PRF	Project Reference File
PS	Physical Scientist
PST	Physical Science Technician
RNC	Raster Navigational Chart
RTK	Real Time Kinematic
SBES	Singlebeam Echosounder
SBET	Smooth Best Estimate and Trajectory
SNM	Square Nautical Miles
SSS	Side Scan Sonar
ST	Survey Technician
SVP	Sound Velocity Profiler
TCARI	Tidal Constituent And Residual Interpolation
TPE	Total Porpagated Error
TPU	Topside Processing Unit
USACE	United States Army Corps of Engineers
USCG	United Stated Coast Guard
UTM	Universal Transverse Mercator
XO	Executive Officer
ZDA	Global Positiong System timing message
ZDF	Zone Definition File