H12702

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

DESCRIPTIVE REPORT

Type of Survey:	Navigable Area
Registry Number:	H12702

LOCALITY

State(s):	Rhode Island
General Locality:	Rhode Island Sound and Approaches
Sub-locality:	10NM SE of Block Island

2014

CHIEF OF PARTY
LCDR Marc S. Moser, NOAA

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Date:

U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION	REGISTRY NUMBER:
HYDROGRAPHIC TITLE SHEET	**H12702**

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:	**10NM SE of Block Island**
Scale:	**40000**
Dates of Survey:	**06/22/2014 to 08/20/2014**
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, Side Scan Sonar**
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 H12702

Project: OPR-B307-FH-14

Locality: Rhode Island Sound and Approaches

Sublocality: 10NM SE of Block Island

Scale: 1:40000

June 2014 - August 2014

NOAA Ship *Ferdinand R. Hassler*

Chief of Party: LCDR Marc S. Moser, NOAA

A. Area Surveyed

The survey is located in Rhode Island Sound, within the sub-locality 10NM SE 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° 14' 35.1" N 71° 24' 16.89" W	41° 1' 28.28" N 71° 16' 49.18" W

Table 1: Survey Limits

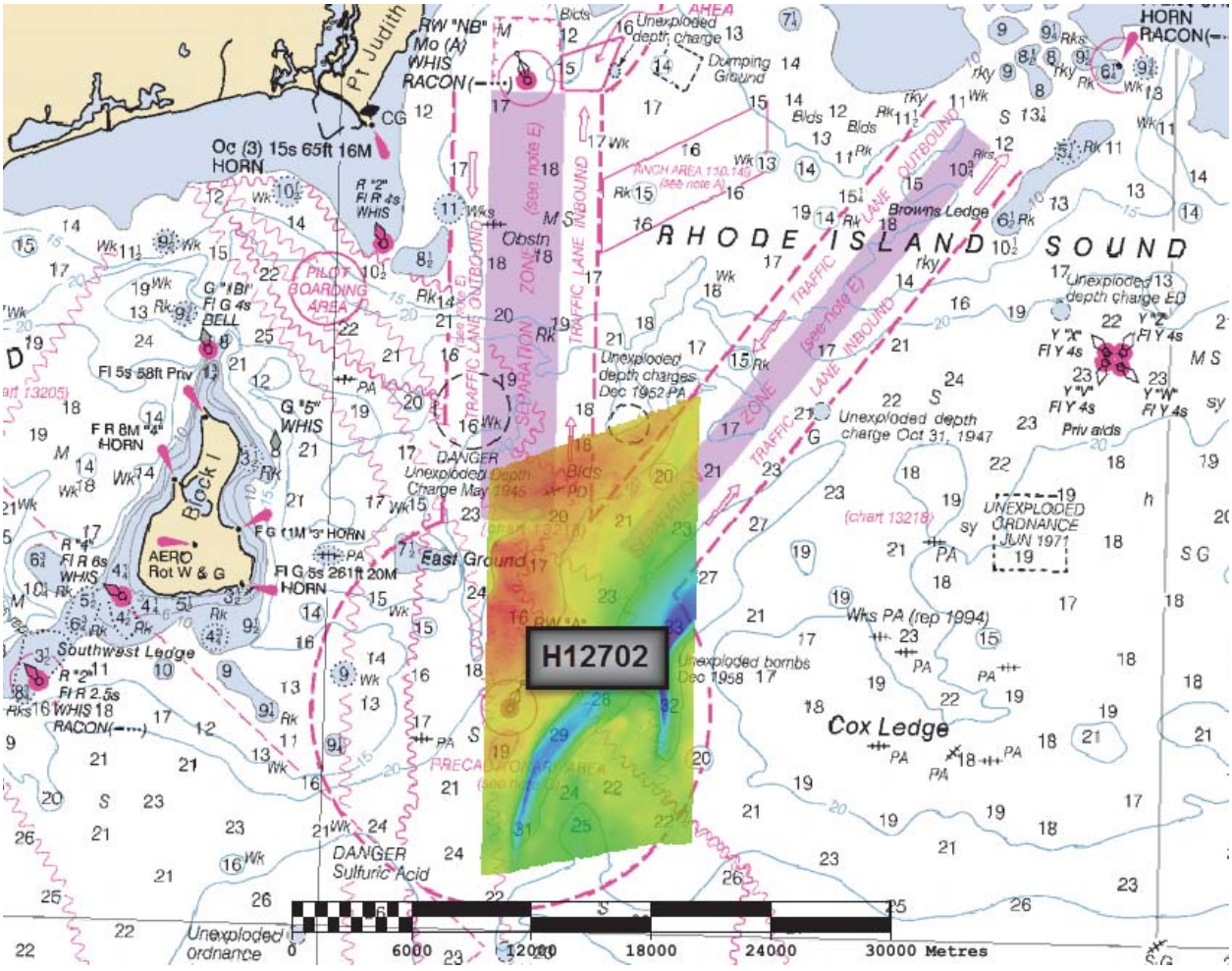


Figure 1: General locality of survey H12702

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.

A.3 Survey Quality

The entire survey is adequate to supersede previous data.

A.4 Survey Coverage

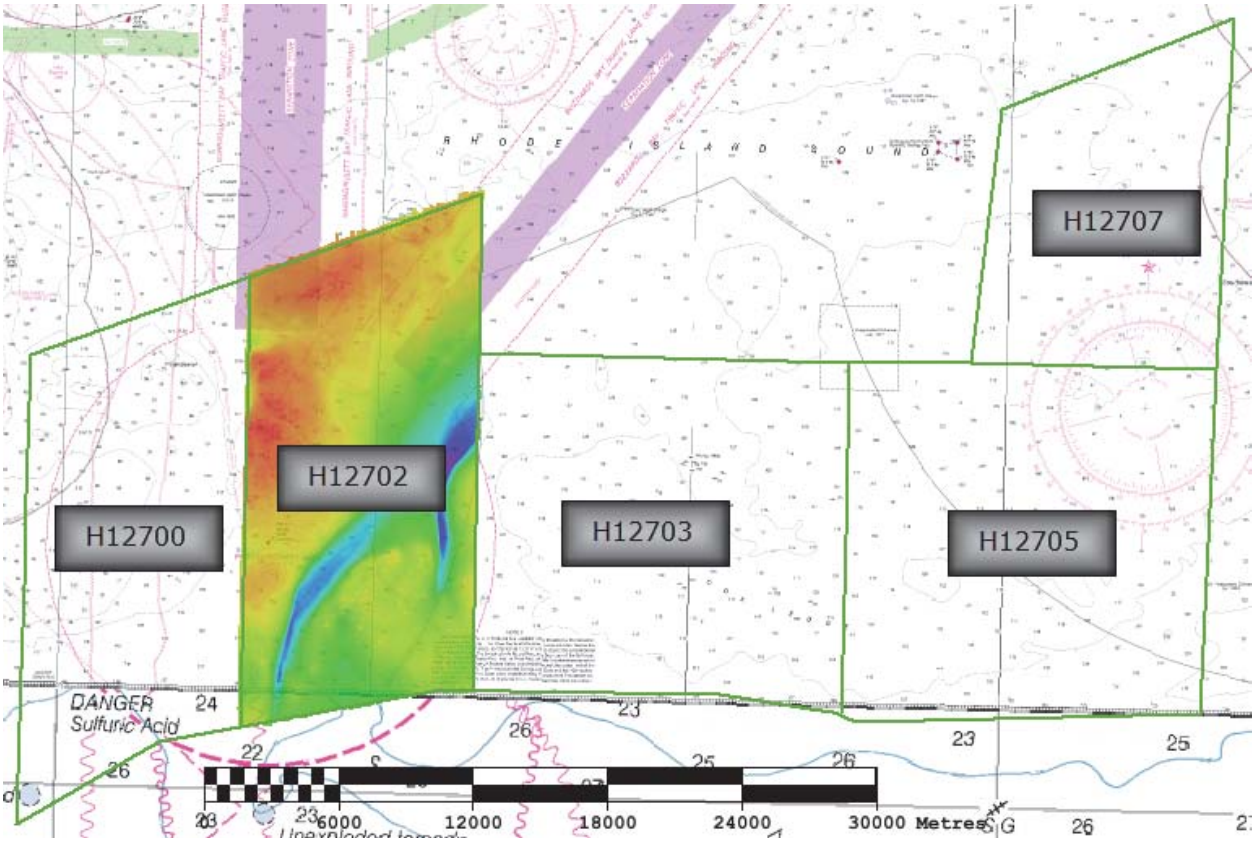


Figure 2: Survey layout for OPR-B307-FH-14 plotted over RNCs 13218 and 12300

Survey Coverage was in accordance with the requirements in the Project Instructions and the HSSD.

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	878.94	878.94
	Lidar Mainscheme	0	0
	SSS Mainscheme	0.63	0.63
	SBES/MBES Mainscheme	0	0
	SBES/SSS Mainscheme	0	0
	MBES/SSS Mainscheme	0	0
	SBES/MBES Crosslines	45.32	45.32
	Lidar Crosslines	0	0
Number of Bottom Samples			10
Number of AWOIS Items Investigated			0
Number Maritime Boundary Points Investigated			0
Number of DPs			0
Number of Items Investigated by Dive Ops			0
Total SNM			64.88

Table 2: Hydrographic Survey Statistics

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

Survey Dates	Day of the Year
06/22/2014	173
06/23/2014	174
06/24/2014	175
06/25/2014	176
06/26/2014	177
08/19/2014	231
08/20/2014	232

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 H12702.

B.1.2 Equipment

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

Manufacturer	Model	Type
RESON	7125	MBES
Klein	5000 V2	SSS
Applanix	POS M/V 320 V5	Positioning and Attitude System
Hemisphere	MBX-4	Positioning System
SeaBird	SBE19+	Conductivity, Temperature, and Depth Sensor
Brooke Ocean	MVP-200	Sound Speed System
AML	MicroCTD	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, totalled 5.15% of mainscheme acquisition.

Multibeam crosslines were acquired using the RESON 7125 on Dn176 and Dn232. 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 HIPS and SIPS. The statistical analysis of the differences between the mainscheme and crossline surfaces is shown in Figure 5. The average difference between the surfaces is 0.04 meters with a standard deviation of 0.11 meters; 95% of all differences were less than 0.22 meters from the mean.

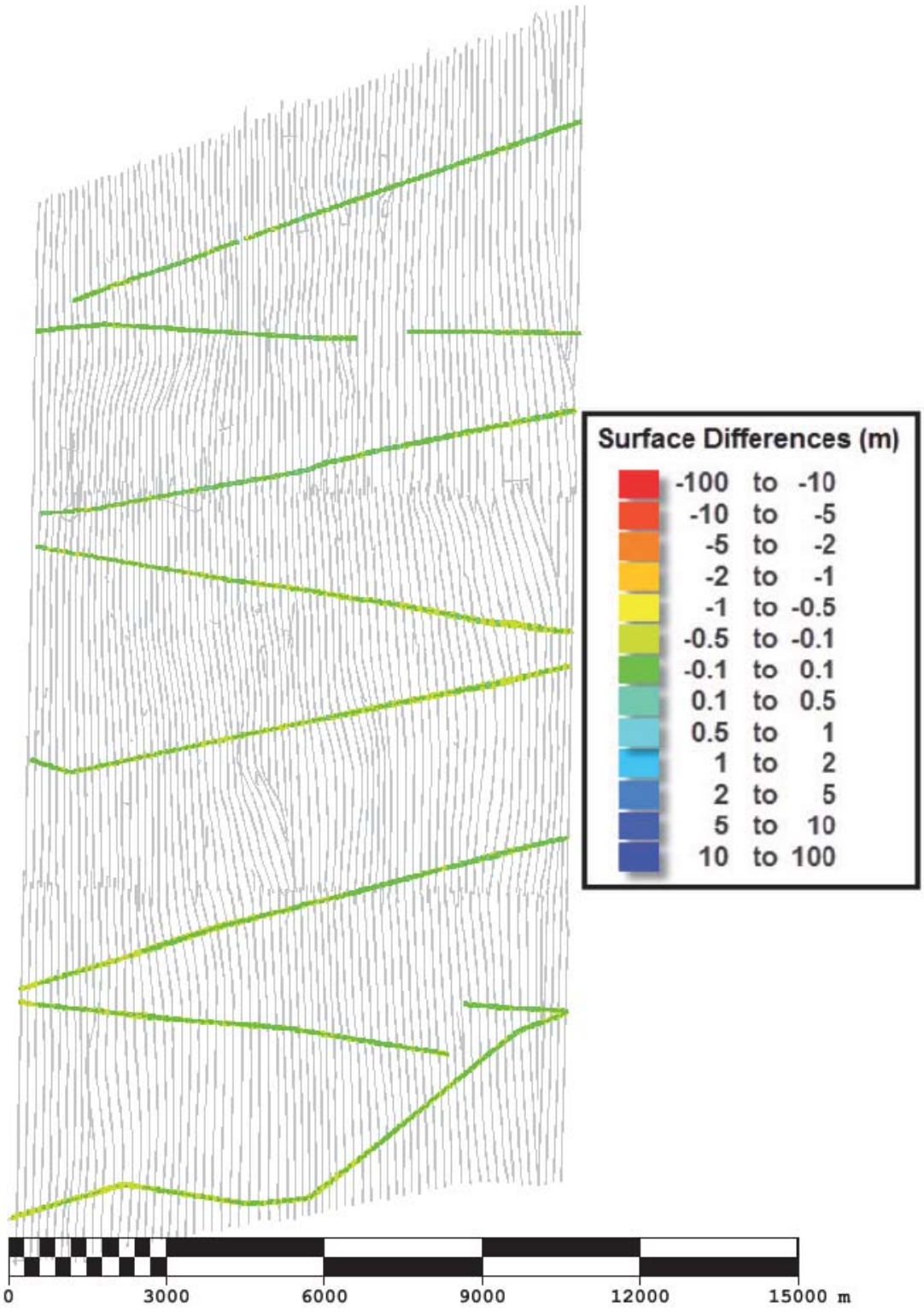
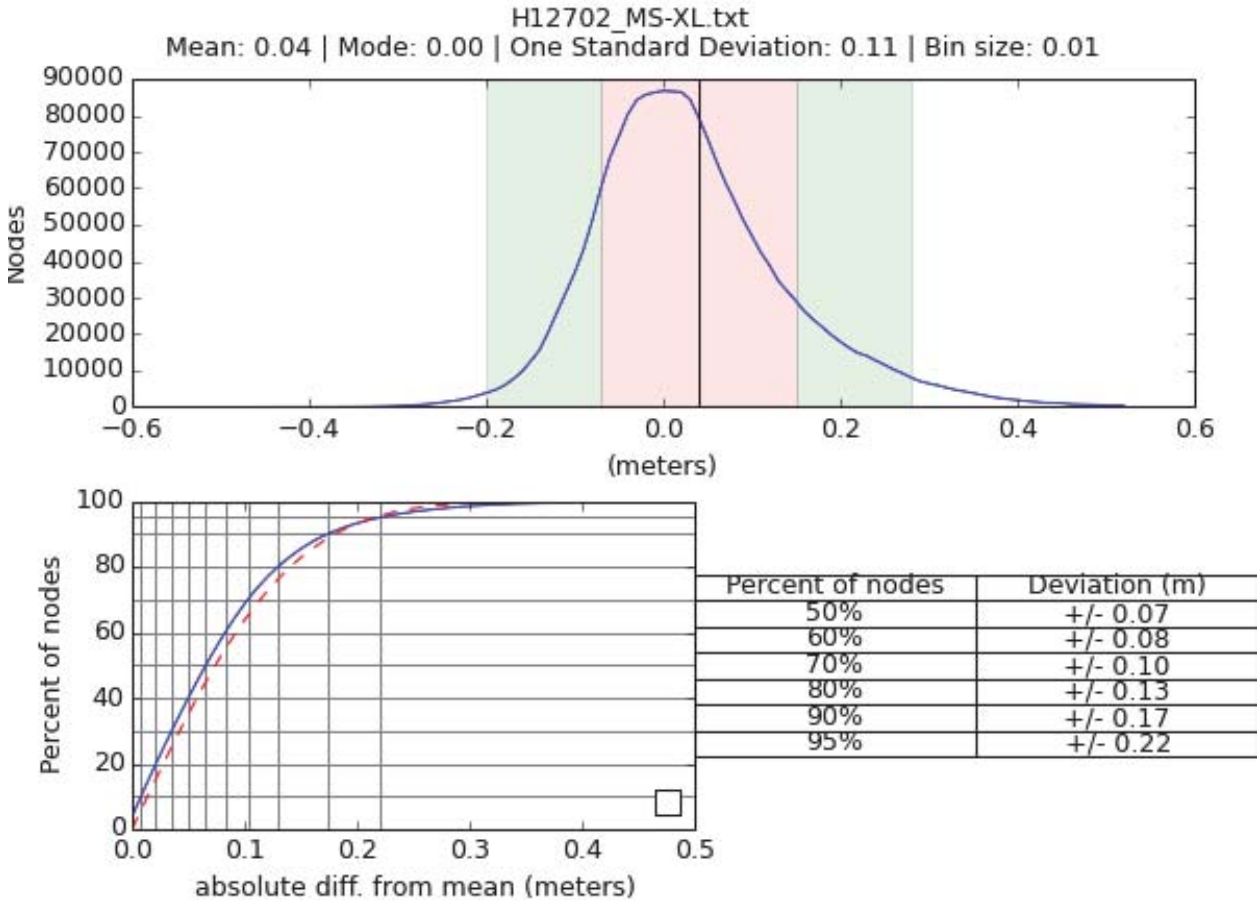


Figure 4: H12702 MBES crossline differences overlaid on mainscheme lines



Percent of nodes	Deviation (m)
50%	+/- 0.07
60%	+/- 0.08
70%	+/- 0.10
80%	+/- 0.13
90%	+/- 0.17
95%	+/- 0.22

Figure 5: H12702 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 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. Vertical uncertainty was calculated using the Delayed Heave RMS file.

B.2.3 Junctions

The areas of overlap between sheet H12702 and its junction sheets, shown in Figure 6, were reviewed for agreement. The junctioning surfaces were subtracted from the surface of H12702 to assess sounding consistency.

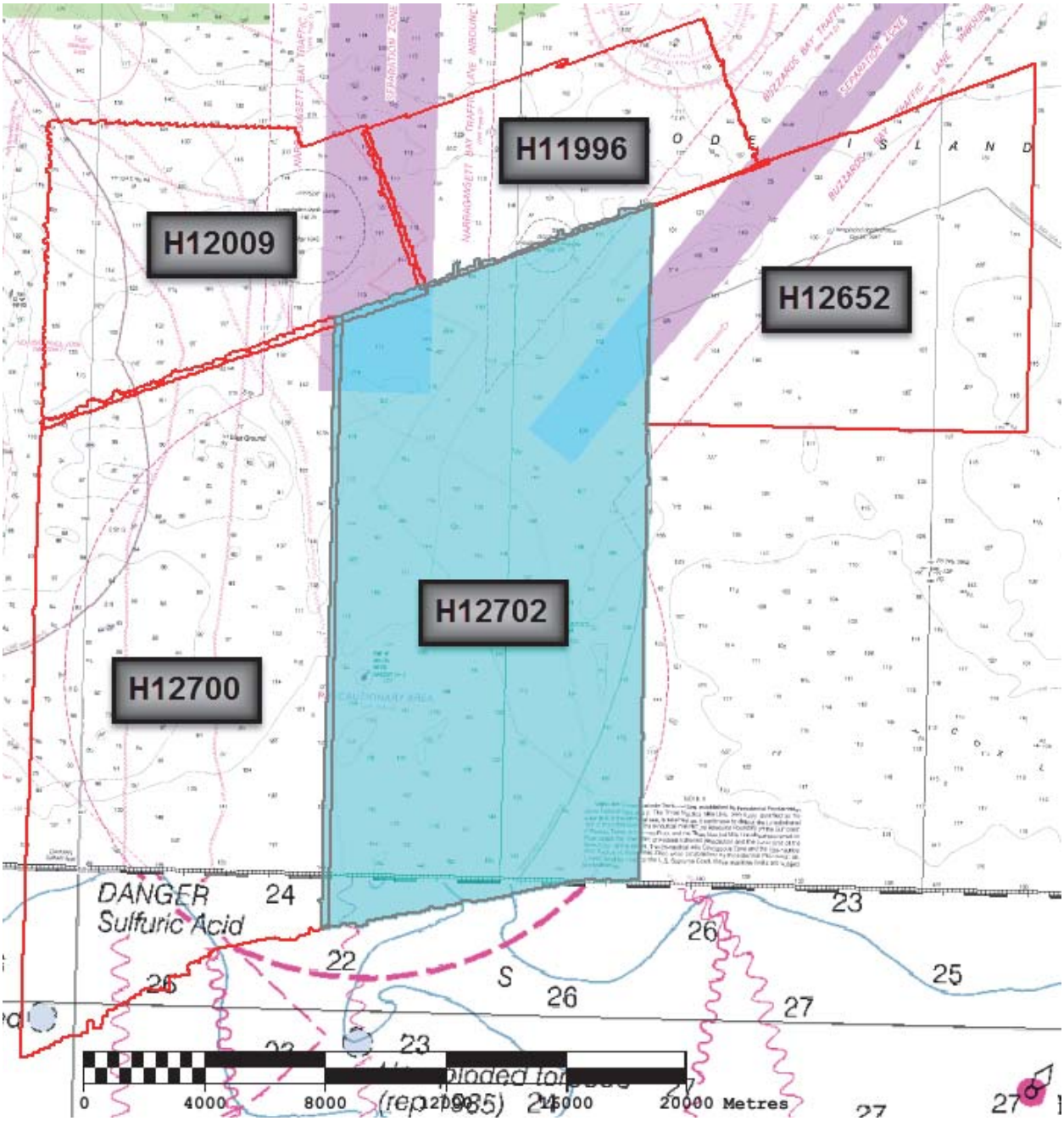


Figure 6: H12702 Junctions

The following junctions were made with this survey:

Registry Number	Scale	Year	Field Unit	Relative Location
H11996	1:10000	2008	NOAA Ship THOMAS JEFFERSON	N
H12009	1:20000	2009	NOAA Ship THOMAS JEFFERSON	N
H12652	1:40000	2014	NOAA Ship THOMAS JEFFERSON	E
H12700	1:40000	2014	NOAA Ship FERDINAND R. HASSLER	W

Table 8: Junctioning Surveys

H11996

Survey H11996 was conducted by NOAA Ship THOMAS JEFFERSON in 2008. The area of overlap includes a swath along the northern extents of H12702 (Figure 6) that includes over 250 thousand nodes. A differenced surface analysis between 2-meter surfaces for each survey showed H12702 to be on average 0.11 meters deeper than H11996, with a standard deviation of 0.11 meters (Figure 7). 95% of all differences are less than 0.20 meters from the mean.

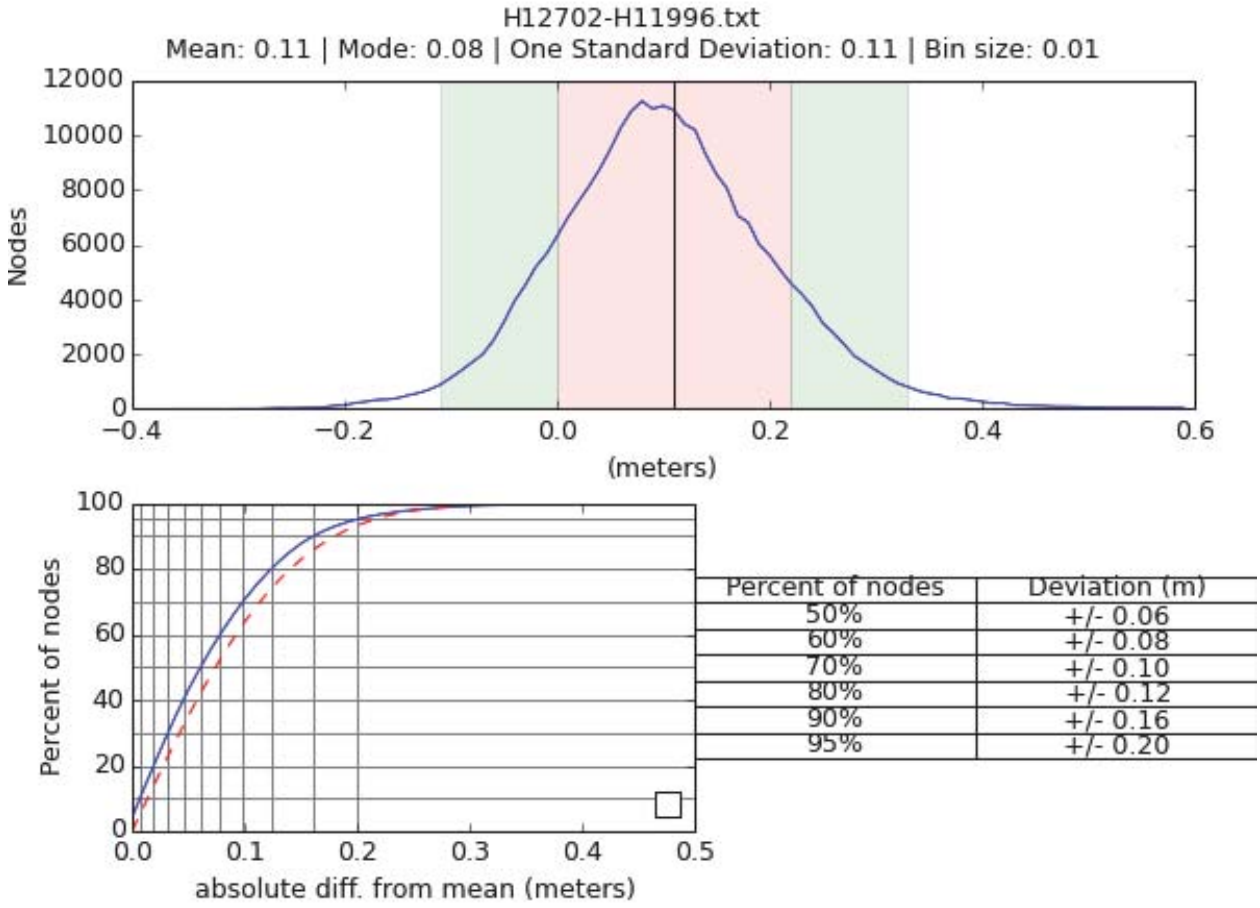


Figure 7: Differenced surface statistics - H12702 minus H11996

H12009

Survey H12009 was conducted by NOAA Ship THOMAS JEFFERSON in 2009. The area of overlap includes a swath along the northern edge of H12702 (Figure 6) that includes over 215 thousand nodes. A differenced surface analysis between 2-meter surfaces for each survey showed H12702 to be on average 0.03 meters deeper than H12009, with a standard deviation of 0.12 meters (Figure 8). 95% of all differences are less than 0.22 meters from the mean.

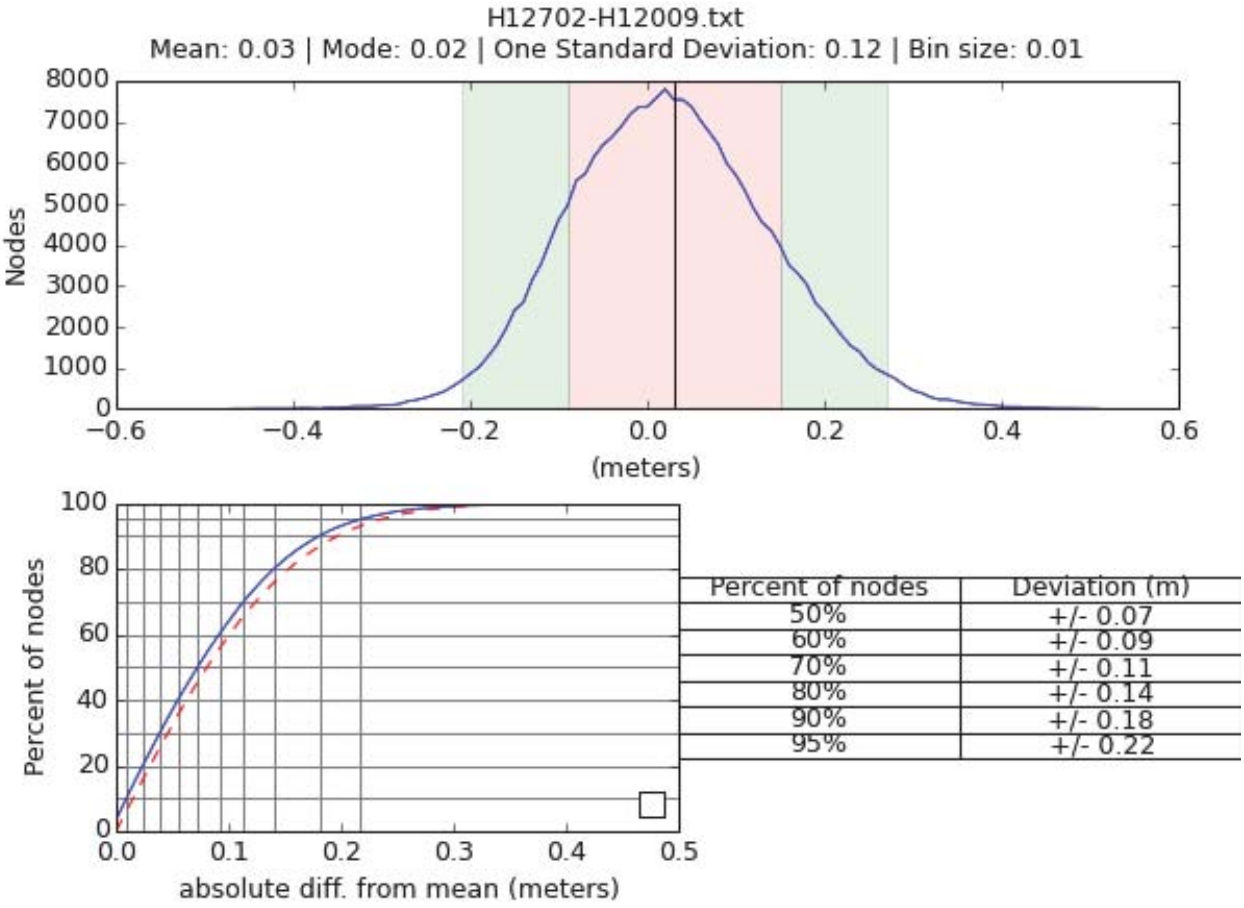


Figure 8: Differenced surface statistics - H12702 minus H12009

H12652

A junction comparison with survey H12652, which is assigned to the NOAA Ship THOMAS JEFFERSON, was not completed because the survey was not complete at the time of writing this report.

H12700

Survey H12700 was conducted by NOAA Ship FERDINAND R. HASSLER in 2014 as a part of project OPR-B307-FH-14. The area of overlap includes a swath along the entire western edge of H12702 (Figure 6) that includes over 1 million nodes. A differenced surface analysis between 2-meter CUBE surfaces for each survey showed H12702 to be on average 0.07 meters shallower than H12700, with a standard deviation of 0.14 meters (Figure 9). 95% of all differences are less than 0.27 meters from the mean.

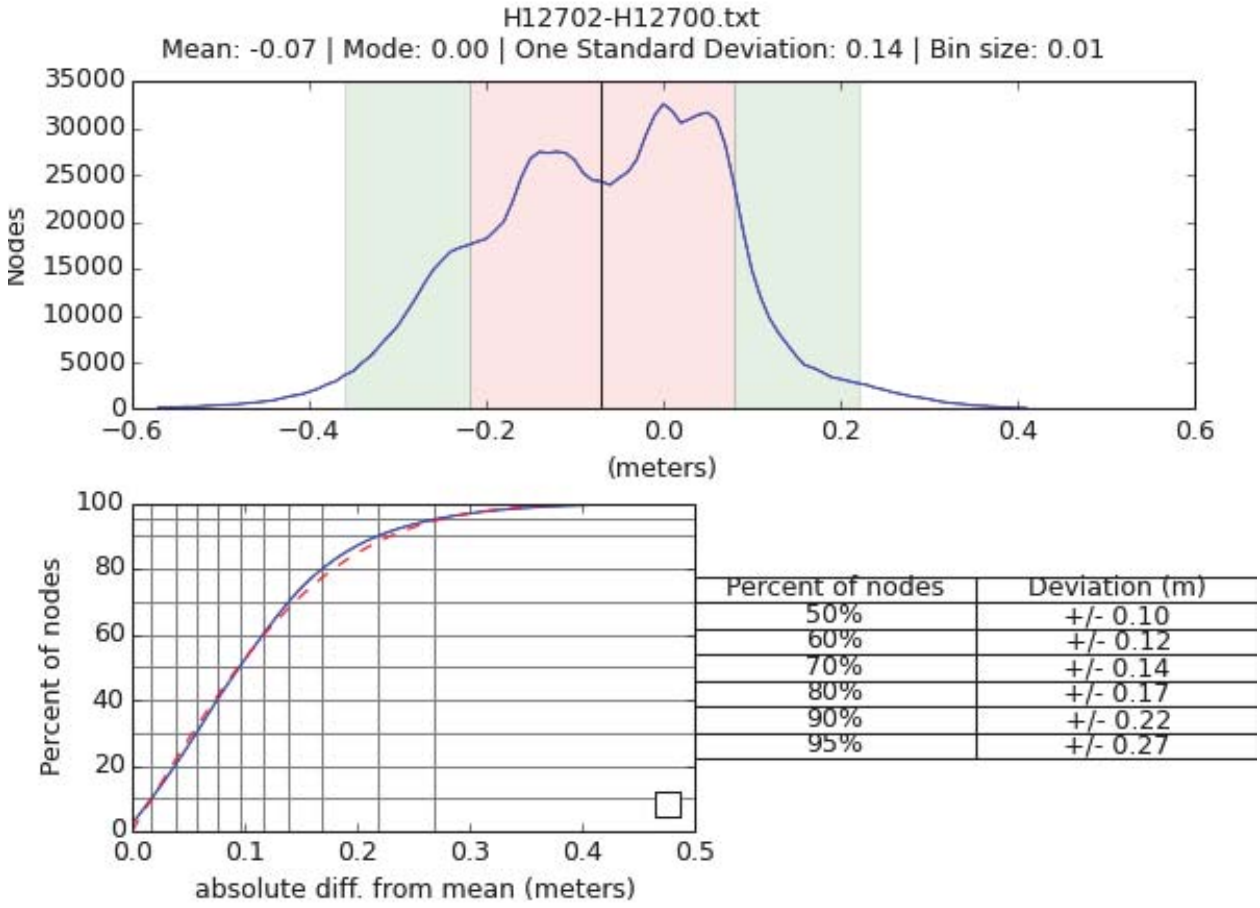


Figure 9: Differenced surface statistics - H12702 minus H12700

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 artifact

On Dn231 and Dn232 an artifact, shown in Figure 10, was noticed on the starboard 7125. The port 7125 was absent of this artifact (Figure 11). An attempt to normalize the elements of the echosounder was made prior to data collection. After a successful normalization there appeared to be no change. During acquisition the problem resulted in noisy data even with the aggressive use of real-time gates (Figure 12). The resultant fliers were rejected in CARIS HIPS Subset Editor.

The artifact is thought to be the result of a bad receiver card in the 7125 wet end. Plans are currently underway to get this issue addressed as soon as possible.

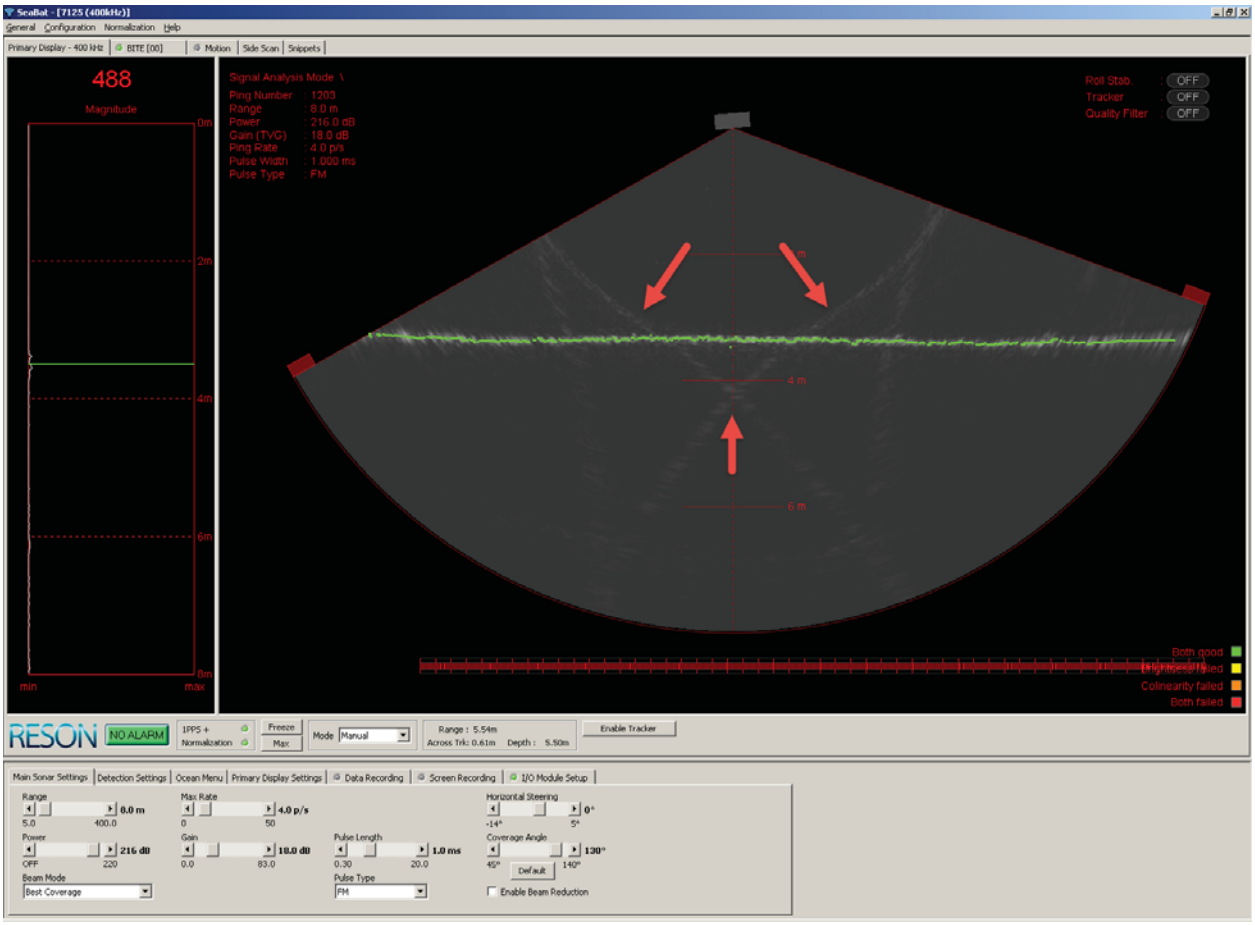


Figure 10: The artifact seen in the starboard RESON echosounder display

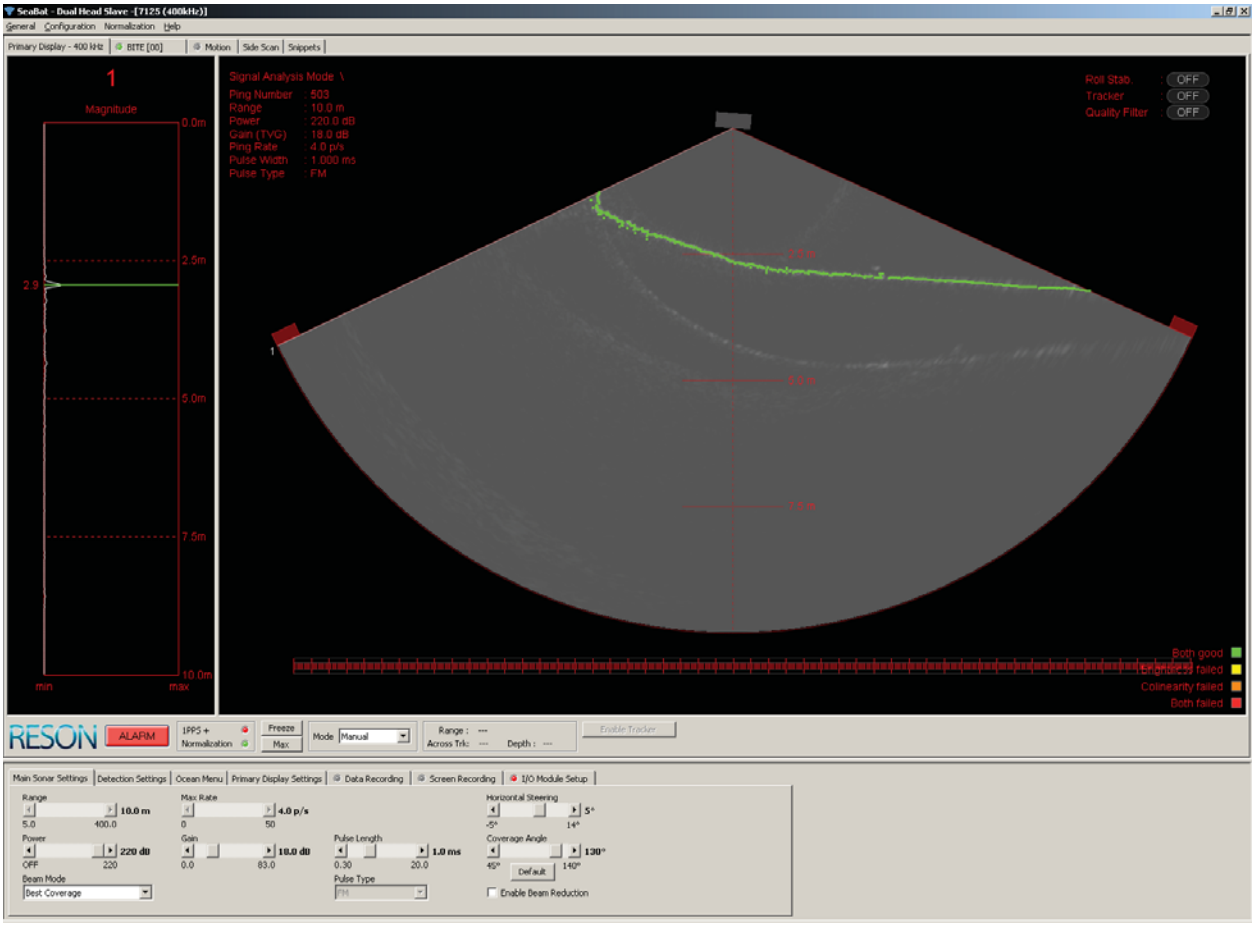


Figure 11: Absence of the artifact in the port RESON echosounder display under similar settings

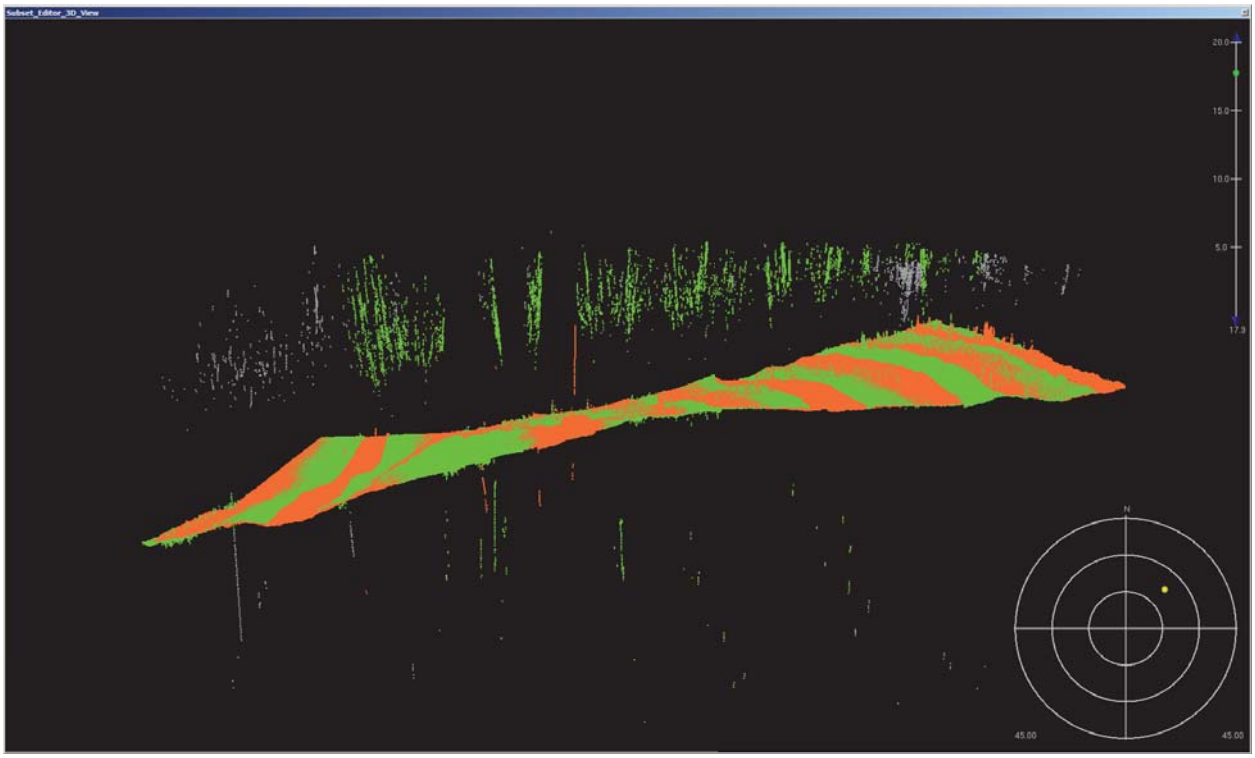


Figure 12: 3D subset of data collected on Dn232 colored by vessel. The starboard head is colored green and makes up the majority of noise displayed. Data were thoroughly cleaned to eliminate these erroneous soundings.

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 MVP200 or SBE 19+ were taken approximately every 2-3 hours.

Sound speed corrections were applied in CARIS using Nearest in Distance Within Time (NIDWT) of 4 hours for the entire survey (Figure 13). The Moving Vessel Profiler (MVP) towfish was snagged and lost on the first day of acquisition on sheet H12702. Static CTD casts were taken after the loss of the MVP towfish for Dn173 through Dn177. To try to minimize ship downtime during CTD casts, especially without use of an MVP, 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 changing sound speed was not sampled enough to capture all spatial and time variances when relying exclusively on manual SBE19+ casts. As shown in Figure 14, outer beam refraction error cause some areas of the MBES to vary up to 50 centimeters, which is still within specification. The submitted surfaces contain a stripe like pattern (Figure 15) which is the result of the sound velocity errors and the relatively flat topography.

The MVP towfish was recovered by contract divers and re-terminated in between acquisition legs. The MVP was used for the two final days of acquisition on Dn231 and Dn232.

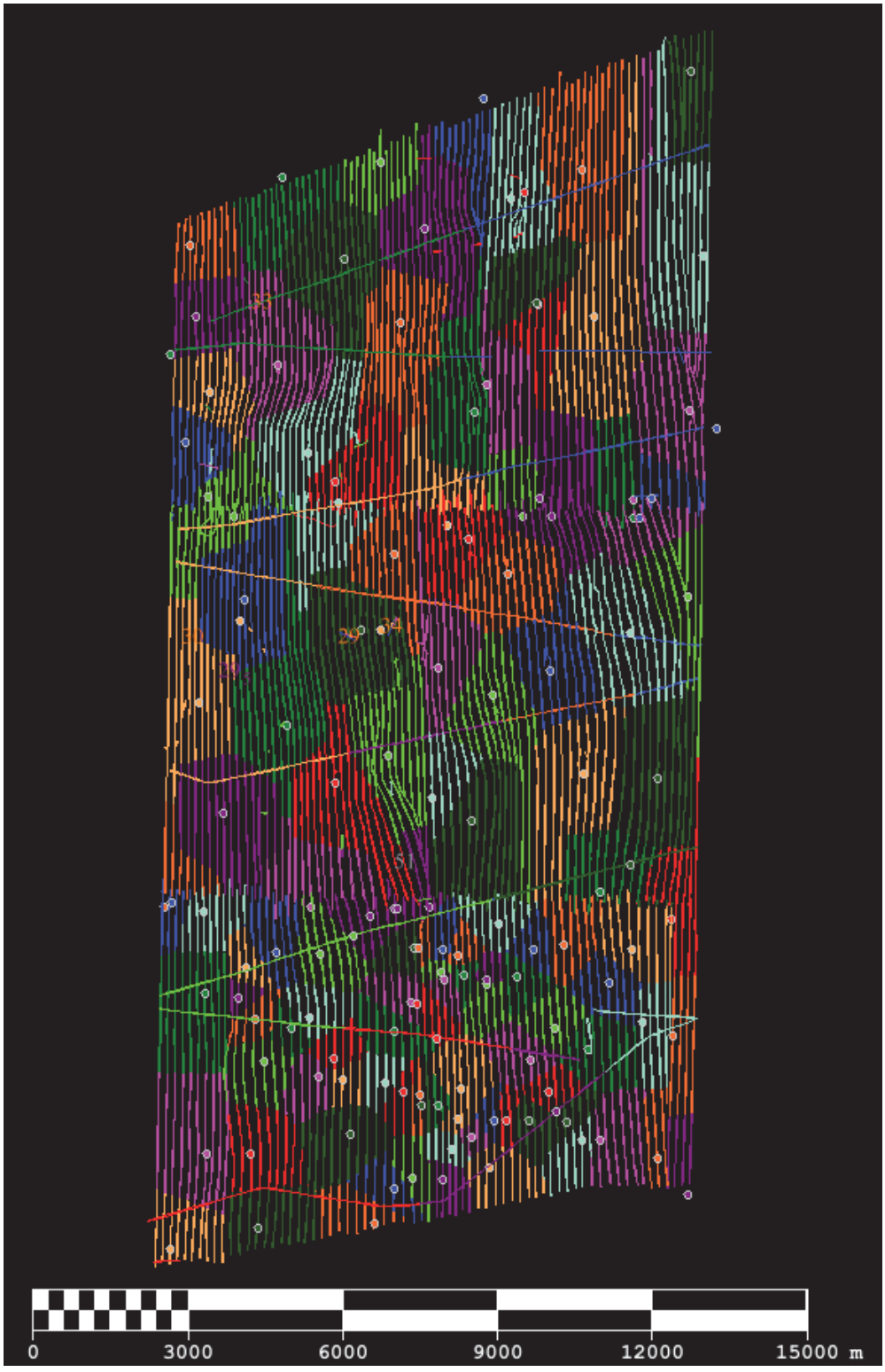


Figure 13: H12702 tracklines colored by SV profile. Nearest in Distance Within Time of 4 hours was used to apply SV profiles for the entire survey.

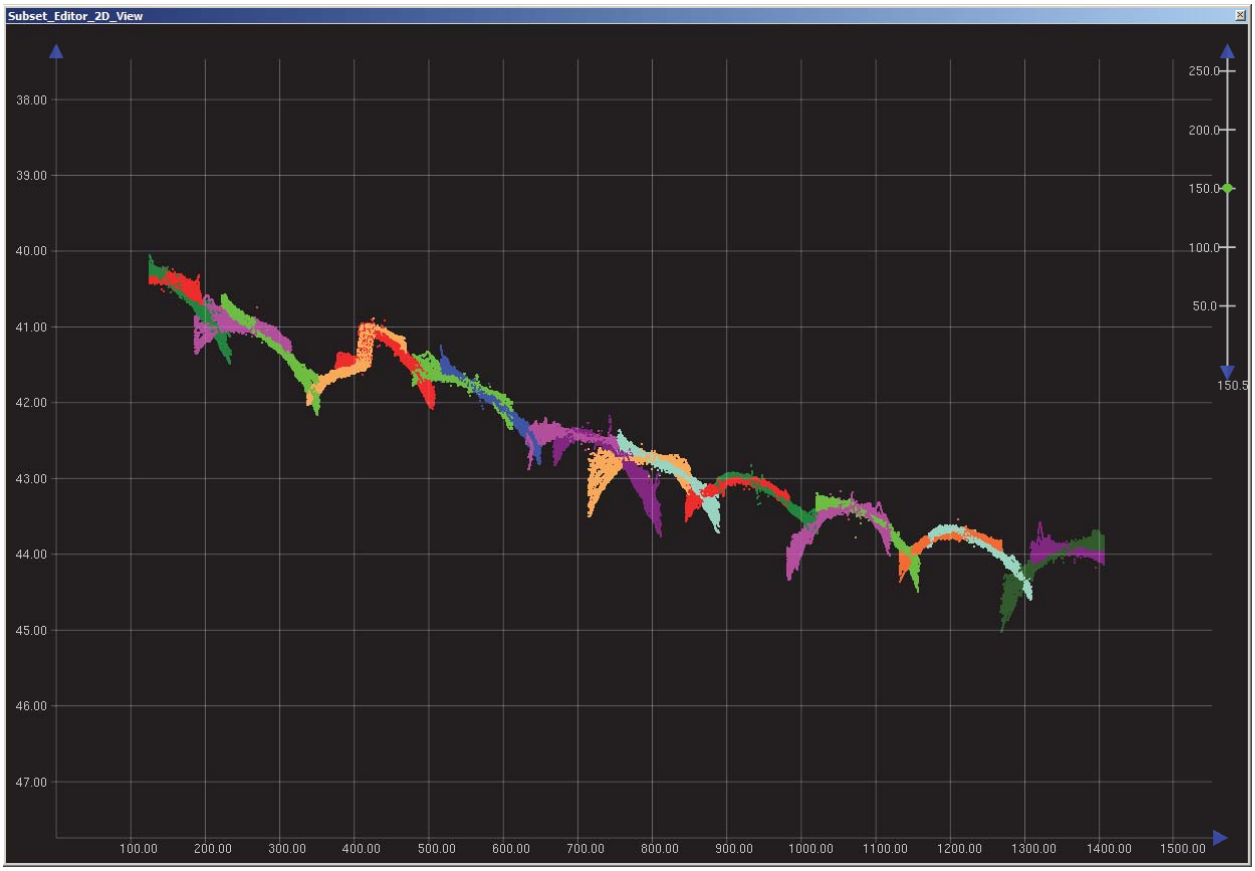


Figure 14: Outer beam refraction errors caused from changing sound velocity throughout the survey area. Data were cleaned thoroughly where outer beam errors exceeded allowable uncertainty values.

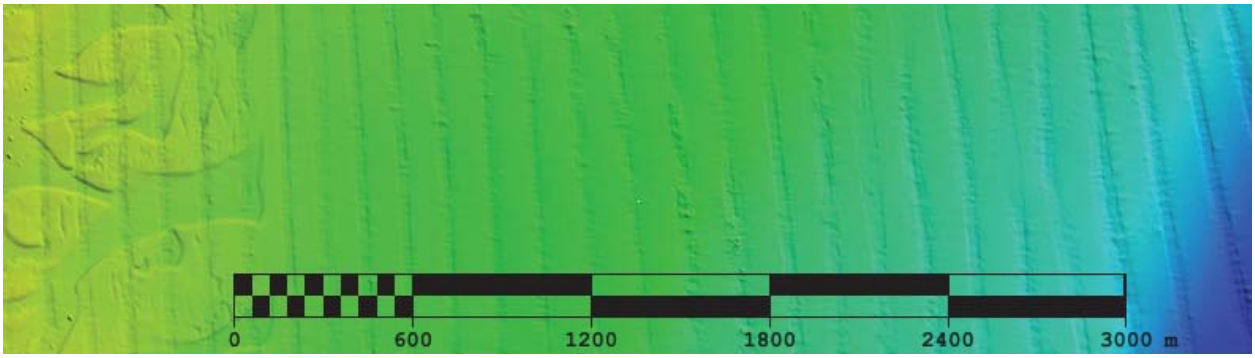


Figure 15: Striping artifact seen in a 10x exaggerated surface due to outer beam refraction errors.

B.2.8 Coverage Equipment and Methods

A density analysis was run to calculate the number of soundings per surface node. Five or more soundings per node are present in over 99.9% of the 2-meter and 4-meter surfaces. For additional detail refer to H12702_Standards_Compliance report submitted in Appendix II of this report.

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 H12702. 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
H12702_MB_4m_MLLW	CUBE	4 meters	28.54 meters - 63.95 meters	NOAA_4m	Complete MBES
H12702_MB_2m_MLLW	CUBE	2 meters	25.78 meters - 63.97 meters	NOAA_2m	Complete MBES
H12702_MB_1m_MLLW	CUBE	1 meters	25.54 meters - 64.73 meters	NOAA_1m	Object Detection
H12702_MB_4m_MLLW_Final	CUBE	4 meters	36.00 meters - 63.95 meters	NOAA_4m	Complete MBES
H12702_MB_2m_MLLW_Final	CUBE	2 meters	25.78 meters - 40.00 meters	NOAA_2m	Complete MBES
H12702_MB_1m_MLLW_Final	CUBE	1 meters	25.54 meters - 64.73 meters	NOAA_1m	Object Detection

Table 9: Submitted Surfaces

Two surfaces are being submitted for each depth range. 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, H12702_MB_1m_MLLW_Final surface is for least depths while H12702_MB_2m_MLLW_Final surface, covering the same depth range as the 1-meter, is being submitted for coverage.

B.5.4 Designated Soundings

Within the limits of H12702, eighteen soundings are submitted flagged as designated in CARIS HIPS and SIPS. Of theses eighteen soundings; two are designated for feature creation and sixteen 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. 100% of nodes with survey H12702 meet the vertical uncertainty standards of section 5.1.3 of the Hydrographic Surveys Specifications and Deliverables (2014). See H12702_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.

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
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 08/25/2014. The final tide note was received on 09/05/2014.

Preliminary zoning is accepted as the final zoning for project OPR-B307-FH-14, H12702, during the time period between June 22 - August 20, 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 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 results 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 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.

The following PPK methods were used for horizontal control:

Smart Base

Smooth Best Estimate of Trajectory (SBET) files have been loaded for all lines for survey H12702 and are used for post-processed horizontal positioning and attitude only.

The following CORS Stations were used for horizontal control:

HVCR Site ID	Base Station ID
ACUSHNET 5, Acushnet, MA	ACU5
ACUSHNET 6, Acushnet, MA	ACU6
GROTON, Groton, CT	CTGR
PUTNAM, Putnam, CT	CTPU
HLFX CACS-GSD, Halifax, Nova Scotia, Canada	HLFX
MORICHES 5, East Moriches, NY	MOR5
BODIE ISLAND, Bodie Island, NC	NCBI
BUXTON, Buxton, NC	NCBX
TARBORO, Tarboro, NC	NCTA
NEWPORT, Newport, RI	NPRI
CENTRAL ISLIP, Central Islip, NY	NYCI
RIVERHEAD, Riverhead, NY	NYRH
U OF RI COOP, Kingston, RI	URIL
MTS FOX COOP, Foxborough, MA	XMTS

Table 13: CORS Base Stations

DGPS was used for real-time positioning during acquisition. All lines submitted are corrected using post-processed horizontal solutions. DGPS correctors were switched to Acushnet for real-time correctors on Dn231 and Dn232 due to Moriches broadcasting at a reduced power level.

The following DGPS Stations were used for horizontal control:

DGPS Stations
Moriches, NY (293 kHz)
Acushnet, MA (306 kHz)

Table 14: USCG DGPS Stations

C.3 Additional Horizontal or Vertical Control Issues

3.3.1 Horizontal Offsets

Horizontal offsets exist in the data where the post-processed solutions are not as precise as expected. As shown in Figure 16, 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.

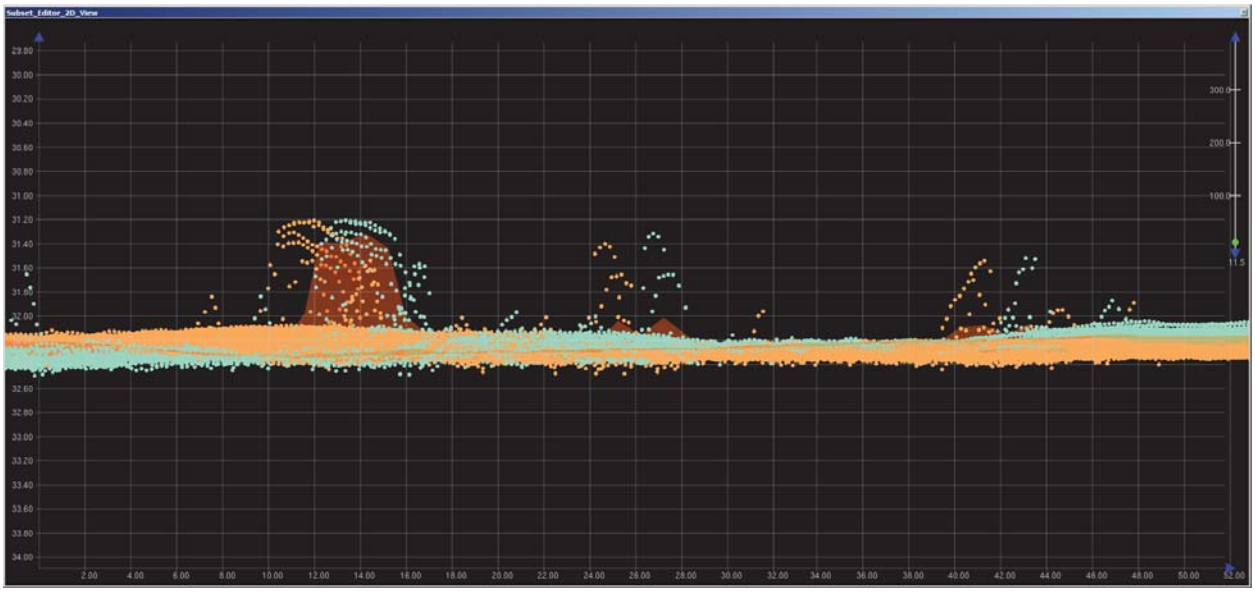


Figure 16: Horizontal offsets shown in 2D Subset Editor, soundings colored by line

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
13218	1:80000	42	07/2013	07/24/2014	07/24/2014
12300	1:400000	49	06/2012	04/17/2014	04/17/2014

Table 15: Largest Scale Raster Charts

13218

A comparison was performed with chart 13218 (1:80,000) using a CARIS sounding and contour layer based on the 4-meter combined surface.

Surveyed soundings and contours generally agree within 2-4 feet of charted depths and depth curves (Figure 17) with the exception of one area (see inset). For this area the 180-foot contour is significantly larger than charted and actually connects the two charted 180-foot depth curves.

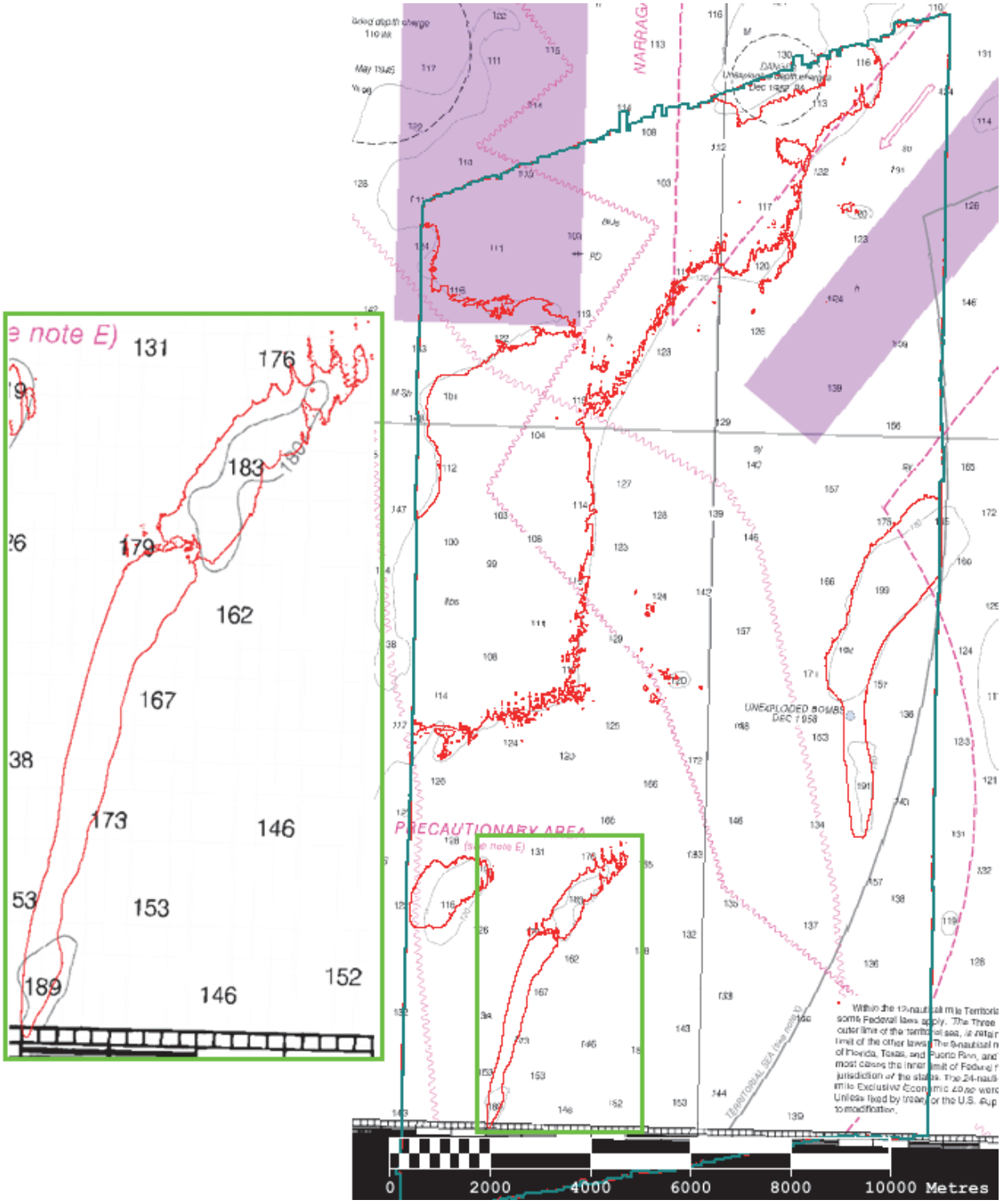


Figure 17: H12702 survey contours (shown in red) overlayed on RNC 13218. Soundings and contours generally agree with charted depths and depth curves except for inset shown.

12300

A comparison was performed with chart 12300 (1:400,000) using a CARIS sounding and contour layer based on the 4-meter combined surface.

The area of survey H12702 that was not covered by RNC 13218 was a small wedge on the southern end as shown in Figure 18 . RNC 12300 contained no depths in this area. The charted 25-fathom depth curves disagree slightly with surveyed contours (red arrow).

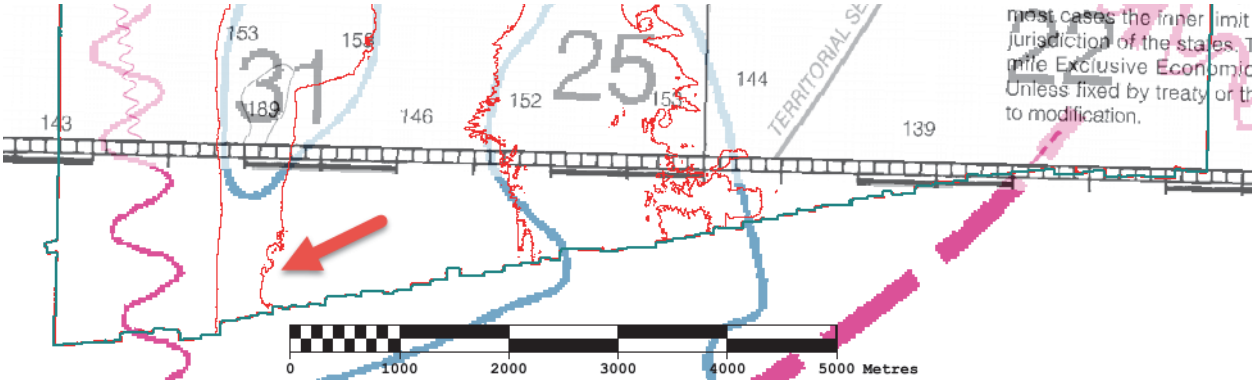


Figure 18: Section of H12702 not covered by RNC 13218. RNC 12300 contained no charted depths but surveyed contours disagree slightly from charted depth curves (red arrow).

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?
US4MA23M	1:80000	27	11/07/2013	07/28/2014	NO
US3NY01M	1:400000	32	01/24/2013	05/15/2014	NO

Table 16: Largest Scale ENCs

US4MA23M

No comparison was performed with ENC US4MA23M as it contained no soundings different than RNC 13218. See previous chart comparison discussion with RNC 13218.

US3NY01M

No comparison was performed with ENC US3NY01M as it contained no soundings different than RNC 12300. See previous chart comparison discussion with RNC 12300.

D.1.3 AWOIS Items

No AWOIS items were assigned for this survey.

D.1.4 Maritime Boundary Points

No Maritime Boundary Points were assigned for this survey.

D.1.5 Charted Features

The area surrounding the charted PD wreck was investigated using complete MBES techniques. Refer to the final feature file for remarks and recommendations.

The charted unexploded bombs obstruction was investigated using complete MBES techniques. While no evidence of the unexploded bombs were found in the survey data, the hydrographer recommends that this be retained as charted as objects are likely beyond the expected resolution of surface MBES techniques.

The charted unexploded depth charges was investigated within the limits of H12702 using complete MBES techniques. While no evidence of the unexploded depth charges were found in the survey data, the hydrographer recommends that this be retained as charted as objects are likely beyond the expected resolution of surface MBES techniques.

D.1.6 Uncharted Features

Two uncharted non-dangerous wrecks were discovered during the course of H12702. Both were fully developed with additional MBES and SSS coverage. Refer to the final feature file for remarks and recommendations. The least depth was designated for each wreck and compared to the sidescan sonar shadow heights for agreement. Rejected data surrounding the soundings is considered noise and should not be reaccepted.

Through research it was found that one of the wrecks meets the area and description of the TROYDON, a 90' hydraulic clam dredge that sunk in September 1995. No additional information could be found on the second wreck but from all acquired data is thought to be a sunken barge.

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

Survey H12702 is almost wholly contained by the confluence of the Narragansett Bay and Buzzards Bay traffic lanes and accompanying separation zones and precautionary area. During the times of hydrography traffic was observed to be following the charted pattern. Minimum depths observed during the course of survey H12702 are beyond the deepest drafts to be expected and are therefore not of concern.

D.1.10 Bottom Samples

Ten bottom samples, whose locations were obtained from OPS, were taken within the limits of H12702 and are submitted with the final feature file. Video coverage was obtained on most bottom samples and is submitted with the survey.

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

The RACON buoy RW "A" that was included in the project reference file (PRF) was removed from the chart during the latest notice to mariners update. It was not seen during survey operations and is therefore appropriately absent from current ENCs and RNCs.

D.2.4 Overhead Features

No overhead features exist for this survey.

D.2.5 Submarine Features

Charted cable areas were fully investigated within the limits of H12702. While no evidence of the cables were found in the survey data, the hydrographer recommends that this be retained as charted.

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	2014-09-01
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	09/01/2014	2014.09.13 11:25:26 -04'00'
LT Adam Reed, NOAA	Field Operations Officer	09/01/2014	
David T. Moehl	Senior Survey Technician	09/01/2014	

APPENDIX I

TIDES AND WATER LEVELS

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

PROVISIONAL TIDE NOTE FOR HYDROGRAPHIC SURVEY

DATE : September 02, 2014

HYDROGRAPHIC BRANCH: Atlantic
HYDROGRAPHIC PROJECT: OPR-B307-FH-2014
HYDROGRAPHIC SHEET: H12702
LOCALITY: 10NM SE of Block Island,Rhode Island Sound and Approaches,RI& MA
TIME PERIOD: June 22 - August 20, 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, H12702, during the time period between June 22 - August 20, 2014.

Please use the zoning file B307FH2014_RevCORP submitted with the project instructions for OPR-B307-FH-2014. Zones NA629 and NA630 are the applicable zones for H12702.

Refer to attachments for zoning information.

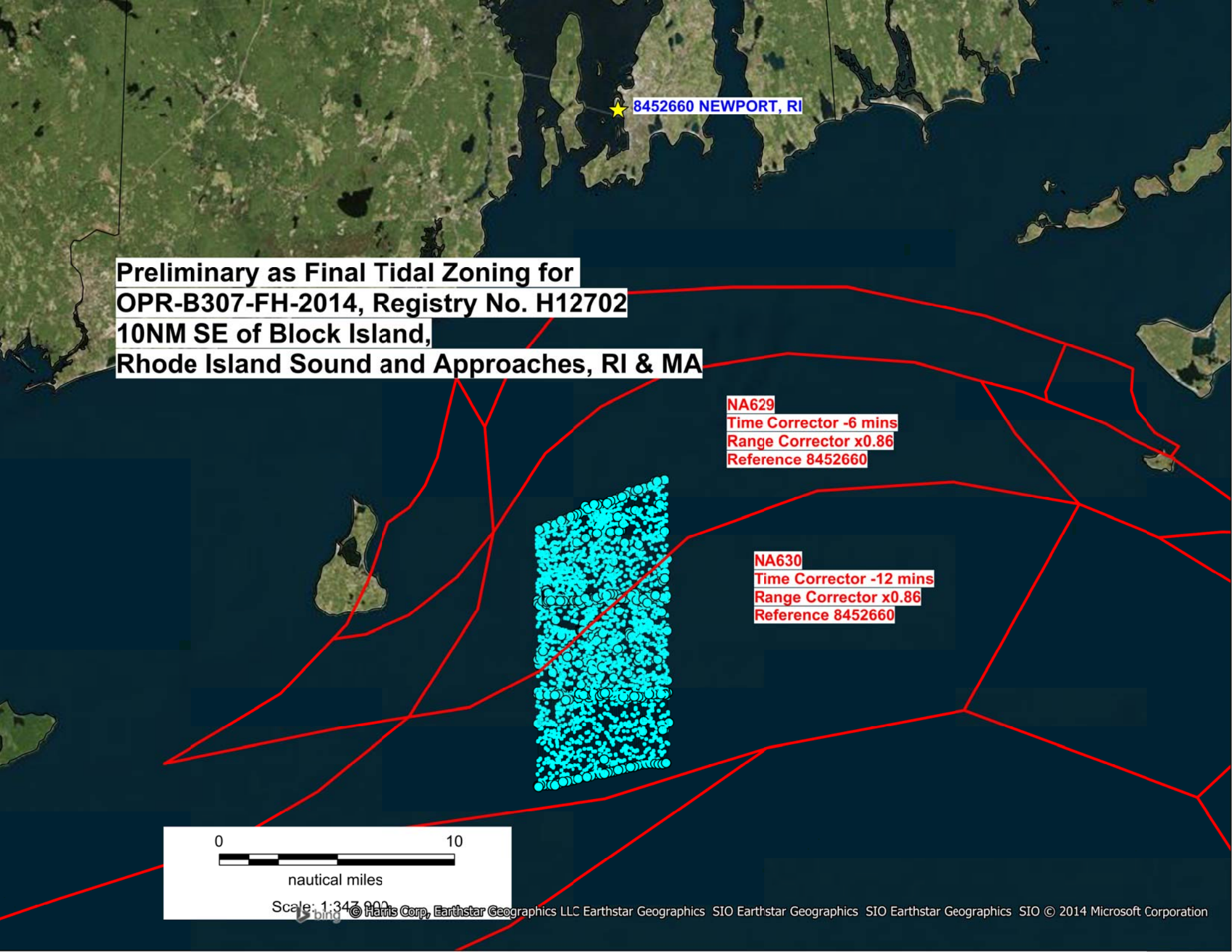
Note 1: Provided time series data are tabulated in metric units (meters), relative to MLLW and on Greenwich Mean Time on the 1983-2001 National Tidal Datum Epoch (NTDE).

Note 2: Annual leveling for Newport, RI (845-2660)was not completed in the past year. A review of the verified leveling records from June 2003 - June 2013 shows the tide station benchmark network to be stable within an allowable 0.009 m tolerance. This Tide Note may be used as final stability verification for survey OPR-B307-FH-2014, H12702. CO-OPS will immediately provide a revised Tide Note should subsequent leveling records indicate any benchmark network stability movement beyond the allowable 0.009 m tolerance.

HOVIS.GERALD.THOMAS.JR.1365860250

Digitally signed by HOVIS.GERALD.THOMAS.JR.1365860250
DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=OTHER, cn=HOVIS.GERALD.THOMAS.JR.1365860250
Date: 2014.09.05 12:09:08 -04'00'

CHIEF, PRODUCTS AND SERVICES BRANCH


8452660 NEWPORT, RI
Preliminary as Final Tidal Zoning for
OPR-B307-FH-2014, Registry No. H12702
10NM SE of Block Island,
Rhode Island Sound and Approaches, RI & MA
NA629
Time Corrector -6 mins
Range Corrector x0.86
Reference 8452660
NA630
Time Corrector -12 mins
Range Corrector x0.86
Reference 8452660
0
10
nautical miles
Scale: 1:343,900
© Harris Corp, Earthstar Geographics LLC Earthstar Geographics SIO Earthstar Geographics SIO Earthstar Geographics SIO © 2014 Microsoft Corporation

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NOAA Ship FERDINAND R. HASSLER (MOA-FH)
29 Wentworth Road
New Castle, NH 03854

August 21, 2014

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

FROM: LCDR Marc S. Moser, NOAA Ship FERDINAND R. HASSLER (MOA-FH)

SUBJECT: Request for Approved Tides/Water Levels

Please provide the following data:

1. Tide Note
2. Final zoning in MapInfo and .MIX format
3. Six Minute Water Level data (Co-ops web site)

Transmit data to the following:

NOAA Ship FERDINAND R. HASSLER (MOA-FH)
29 Wentworth Road
New Castle, NH 03854

Atlantic Hydrographic Branch (N/CS33)
439 West York St
Norfolk, VA 23510

These data are required for the processing of the following hydrographic survey:

Project No.:	OPR-B307-FH-14
Registry No.:	H12702
State:	Rhode Island
Locality:	Rhode Island Sound and Approaches
Sublocality:	10NM SE of Block Island

Attachments containing:

1) an Abstract of Times of Hydrography,
2) digital MID MIF files of the track lines from Pydro

cc: MOA-FH
N/CS33

Year_DOY	Min Time	Max Time
2014_173	08:58:24	23:59:57
2014_174	00:00:02	23:59:37
2014_175	00:14:20	23:58:19
2014_176	00:23:18	23:57:33
2014_177	00:14:53	19:48:51
2014_231	07:02:28	23:56:55
2014_232	00:15:53	20:06:47

APPENDIX II

SUPPLEMENTAL SURVEY RECORDS AND CORRESPONDENCE

Appendix II

Supplemental Survey Records and Correspondence

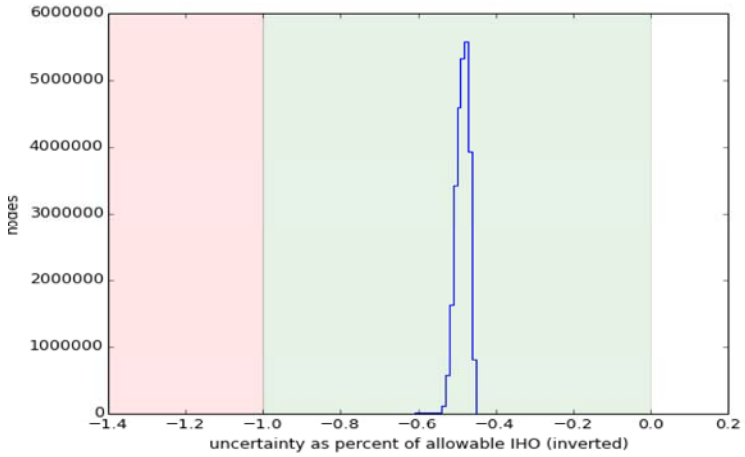
H12702_2m

The finalized surface has 26061887 nodes with 1479570199 soundings.

Uncertainty Standards

100.00% | PASS

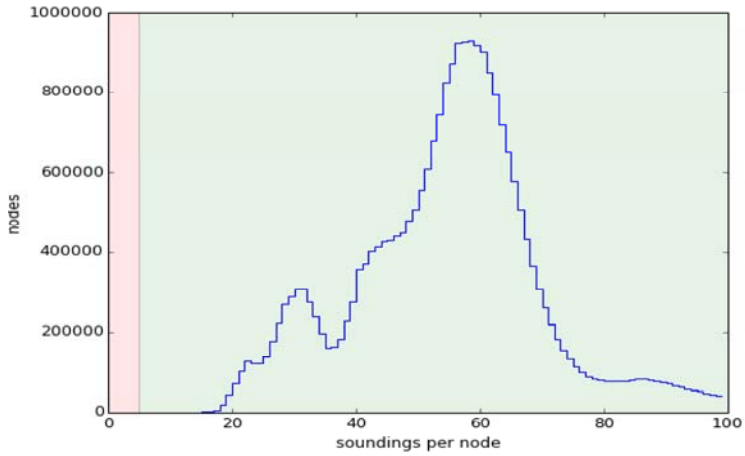
Nodes with Uncertainty less then or equal allowable IHO error **100.00%** (26061840/26061887).



Object Detection Coverage

99.99% | PASS

Nodes with 5 or more soundings **99.99%** (26058271/26061887).
Sounding count average is **56.77** soundings per node.
Sounding count mode is **59** soundings per node.



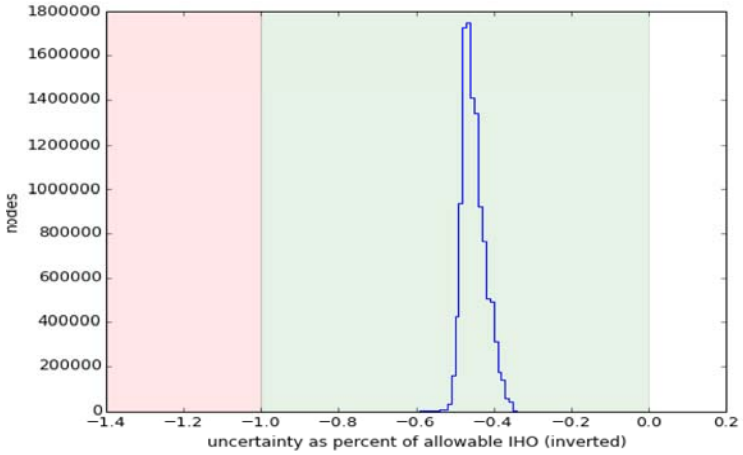
H12702_4m

The finalized surface has 11260703 nodes with 1984691584 soundings.

Uncertainty Standards

100.00% | PASS

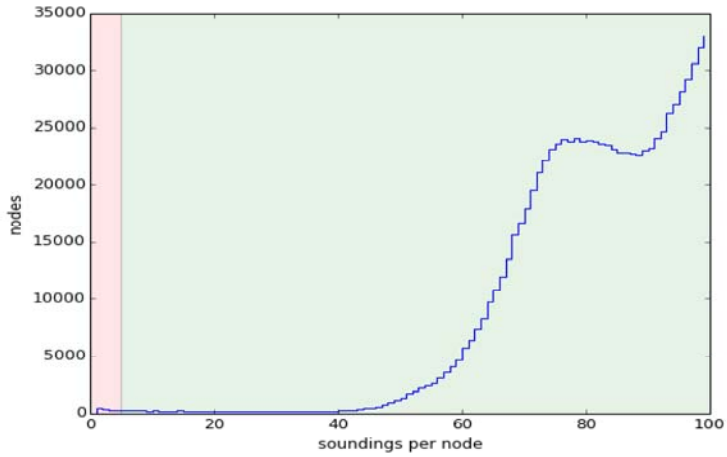
Nodes with Uncertainty less then or equal allowable IHO error **100.00%** (11260702/11260703).



Object Detection Coverage

99.99% | PASS

Nodes with 5 or more soundings **99.99%** (11259246/11260703).
Sounding count average is **176.25** soundings per node.
Sounding count mode is **100** soundings per node.



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.

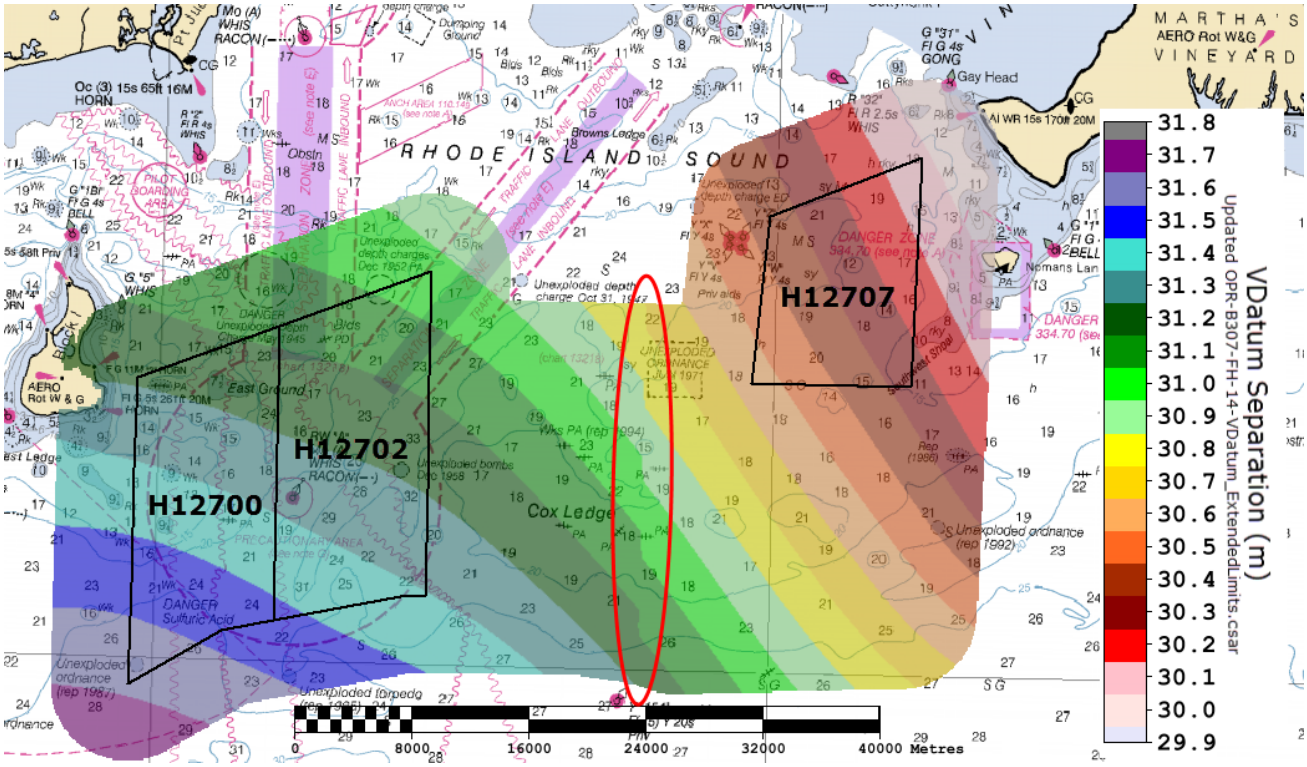


Figure 1: Updated OPR-B307-FH-14-VDatum_ExtendedLimits.csar separation model overlaid with H12700, H12702, and H12707 survey areas. Colored bands correspond to 10 cm intervals.

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.

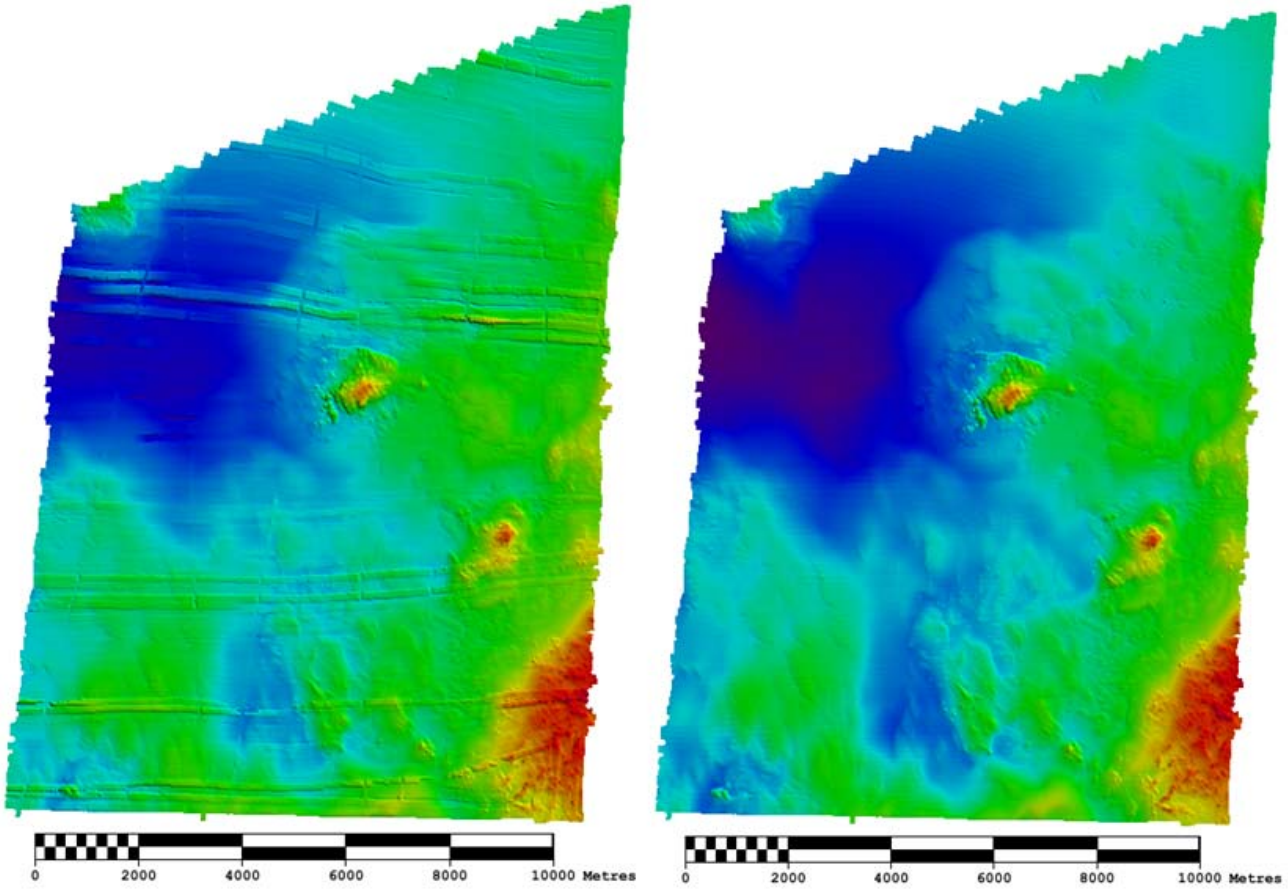


Figure 2: Survey H12707 CUBE surfaces; left surface is referenced to MLLW via VDatum and right is referenced to MLLW via discrete zoned tides. Numerous vertical anomalies, "ramping", are easily identified in the VDatum surface.

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.

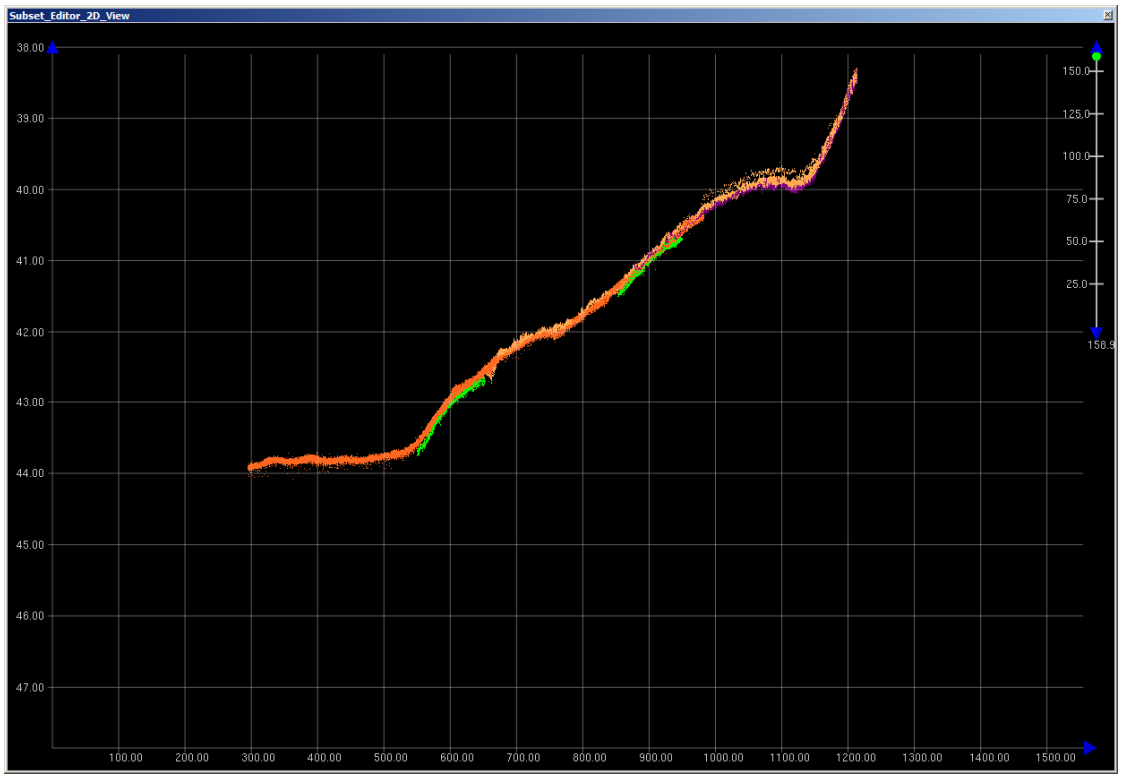


Figure 3: Soundings, colored by day, reduced by discrete zoned tides show general agreement.

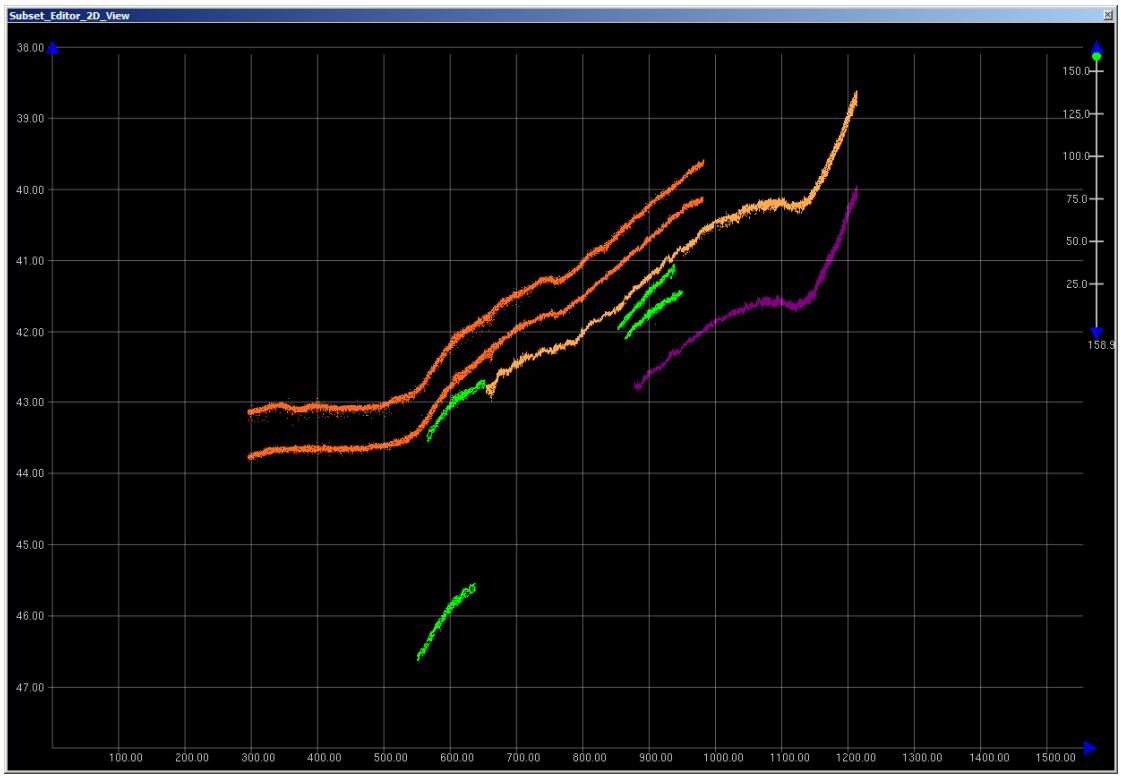


Figure 4: Soundings, colored by day, reduced by VDatum show strong disagreement.

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.

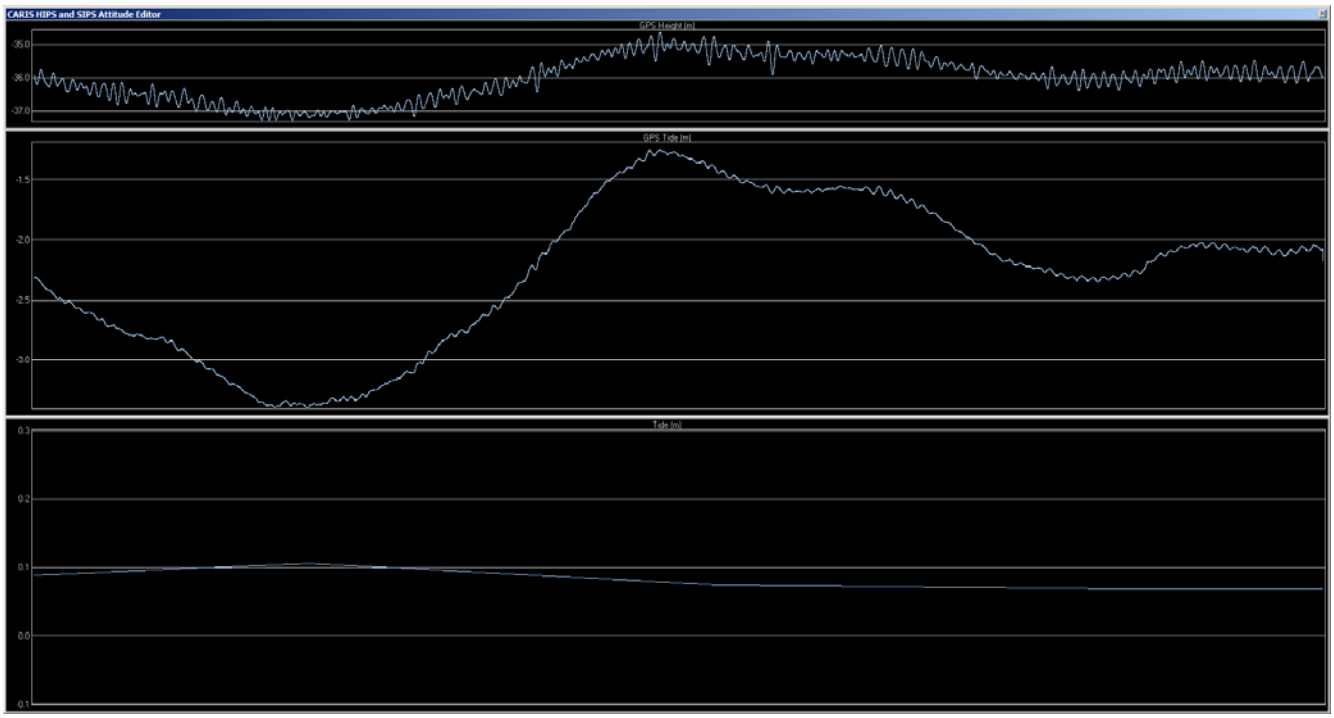


Figure 5: CARIS Attitude Editor showing an example of a ≈2 meter fluctuation in the GPS Tide value (middle). This fluctuation can also be visually interpolated from the GPS height values (top), demonstrating that it is evident before the application of the VDatum separation model.

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).

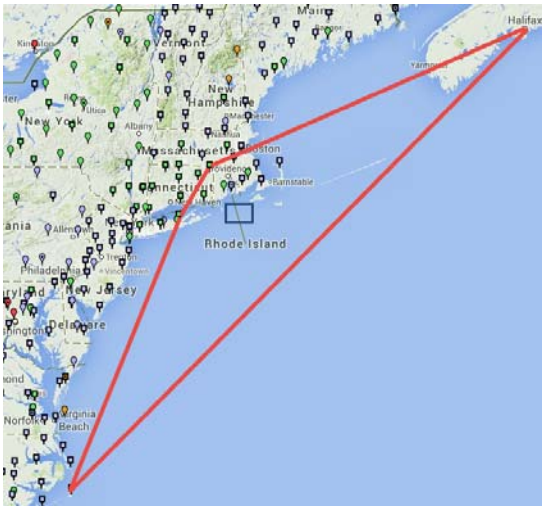


Figure 6: Typical SmartBase network configuration for OPR-B307-FH-14 outlined in red. Survey operations were conducted within the blue box.

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]

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

Survey Outline for OPR-B307-FH-14: H12702

1 message

FOO <ops.ferdinand.hassler@noaa.gov> Mon, Aug 25, 2014 at 2:05 PM
To: survey.outlines@noaa.gov
Cc: David Moehl - NOAA Federal <david.t.moehl@noaa.gov>, "CO.Ferdinand Hassler - NOAA Service Account" <CO.Ferdinand.Hassler@noaa.gov>

Good Morning,

Please find attached, the survey outline for OPR-B307-FH-14 survey H12702.

Thank you,
Adam

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

H12702_Survey_Outline.000
9K

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

Request for Final Tides, OPR-B307-FH-14; H12702

1 message

FOO <ops.ferdinand.hassler@noaa.gov> Mon, Aug 25, 2014 at 1:53 PM
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 H12702.

Thank you,
Adam

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

2 attachments

H12702_Request_for_tides.pdf
34K

H12702_Request_for_tides.zip
232K

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

Fwd: Final Tide Note for OPR-B307-FH-2014, H12702

1 message

CO.Ferdinand Hassler - NOAA Service Account <co.ferdinand.hassler@noaa.gov> Fri, Sep 5, 2014 at 8:10 PM
To: David Moehl - NOAA Federal <david.t.moehl@noaa.gov>

--
LCDR Marc S. Moser, NOAA
Commanding Officer
NOAA Ship *Ferdinand R. Hassler* (S-250)
CO cell: (240) 687-4602
ship's cell: (603) 812-8748
Land line: (603) 431-4500

---------- Forwarded message ----------
From: **Hua Yang - NOAA Affiliate** <hua.yang@noaa.gov>
Date: Fri, Sep 5, 2014 at 3:03 PM
Subject: Final Tide Note for OPR-B307-FH-2014, H12702
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: 09/05/2014

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-B307-FH-2014, Registry No. H12702 during the time period between June 25 - August 20, 2014. The accepted reference station for Registry No. H12702 is Newport, RI (845-2660).

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

H12702.pdf
637K

APPROVAL PAGE

H12702

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

- H12702_DR.pdf
- Collection of depth varied resolution BAGS
- Processed survey data and records
- H12702_GeoImage.pdf

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

Approved:_____

Lieutenant Commander Matthew Jaskoski, NOAA
Chief, Atlantic Hydrographic Branch