H12734

NOAA FORM 76-35A

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

DESCRIPTIVE REPORT

Type of Survey:	Navigable Area
Project Number:	OPR-J377-KR-15
Registry Number:	H12734

LOCALITY

State(s):	Louisiana
General Locality:	Gulf of Mexico
Sub-locality:	Entrance to Mississippi River-Gulf Outlet

2015

CHIEF OF PARTY
George G. Reynolds

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Date:

NOAA FORM 77-28	U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION	REGISTRY NUMBER:
HYDROGRAPHIC TITLE SHEET		**H12734**

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:	**Louisiana**
General Locality:	**Gulf of Mexico**
Sub-Locality:	**Entrance to Mississippi River-Gulf Outlet**
Scale:	**1:20000**
Dates of Survey:	**Jun 18, 2015 to Jul 28, 2015**
Instructions Dated:	**Apr 23, 2015**
Project No.:	**OPR-J377-KR-15**
Field Unit:	**Ocean Surveys, Inc.**
Chief of Party:	**George G. Reynolds**
Soundings by:	**Multibeam Echosounder**
Imagery by:	**Side Scan Sonar Multibeam Echosounder Backscatter**
Verification by:	**Atlantic Hydrographic Branch**
Soundings Acquired in:	**meters at Mean Lower Low Water**

Remarks:

The purpose of this survey is to update existing NOS nautical charts in a high commercial traffic area. All times are recorded in UTC. Data recorded and presented relative to UTM Zone 16 North. THE INFORMATION PRESENTED IN THIS REPORT AND THE ACCOMPANYING BASE SURFACES REPRESENTS THE RESULTS OF SURVEYS PERFORMED BY OCEAN SURVEYS, INC. DURING THE PERIOD OF 18 JUNE TO 28 JULY 2015 AND CAN ONLY BE CONSIDERED AS INDICATING THE CONDITIONS EXISTING AT THAT TIME. REUSE OF THIS INFORMATION BY CLIENT OR OTHERS BEYOND THE SPECIFIC SCOPE OF WORK FOR WHICH IT WAS ACQUIRED SHALL BE AT THE SOLE RISK OF THE USER AND WITHOUT LIABILITY TO OSI.

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

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Descriptive Report to Accompany Survey H12734

Project: OPR-J377-KR-15

Locality: Gulf of Mexico

Sublocality: Entrance to Mississippi River-Gulf Outlet

Scale: 1:20000

June 2015 - July 2015

Ocean Surveys, Inc.

Chief of Party: George G. Reynolds

A. Area Surveyed

This survey provides hydrographic data for the Gulf of Mexico waters at the entrance to the Mississippi River-Gulf Outlet. The general locations of the survey limits are presented in Table 1.

A.1 Survey Limits

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
29° 26" 19.28' N 89° 3" 49.67' W	29° 17" 56.11' N 88° 58" 25.38' W

Table 1: Survey Limits

A.2 Survey Purpose

The purpose of this survey is to provide NOAA with accurate hydrographic data to update existing National Ocean Service (NOS) nautical charts in a high commercial traffic area located in the Gulf of Mexico east of the Mississippi River delta. The survey area includes multiple offshore platforms and pipelines.

A.3 Survey Quality

The entire survey is adequate to supersede previous data.

A.4 Survey Coverage

Survey Coverage is in accordance with the requirements in the Hydrographic Survey Project Instructions (April 23, 2015), the Statement of Work, 2015 (SOW), and the Hydrographic Specifications and Deliverables, April 2014 (HSSD). In all waters shallower than 20 meters, one hundred percent (100%) side scan sonar (SSS) coverage with concurrent multibeam echosounder (MBES) with backscatter coverage were collected with Set Line Spacing. In waters 20 meters and deeper, Complete Multibeam with backscatter coverage was acquired. Additional SSS and MBES coverage was obtained as necessary to fill gaps in coverage, to provide a least depth for all significant SSS contacts and for charted feature disprovals. Gaps in the 100% SSS coverage were addressed with SSS fill-in lines or covered with complete MBES data. The final survey area covers 32.44 square nautical miles (Figure 1).

At times, the towed EdgeTech 4200 and mounted EdgeTech 4125 SSS systems were operated simultaneously providing that the systems were not interfering with each other and the data quality was good. During data processing, the low frequency (600 kHz) 4125 data and the low frequency (300 kHz) 4200 data were converted, but only one of the simultaneous lines were used for SSS coverage and for contact selection and the secondary SSS line was removed from the final CARIS HDCS data set. In one instance, the secondary SSS data, i.e. the towed 4200, was used to fill a gap in coverage where data was rejected from the primary SSS line.

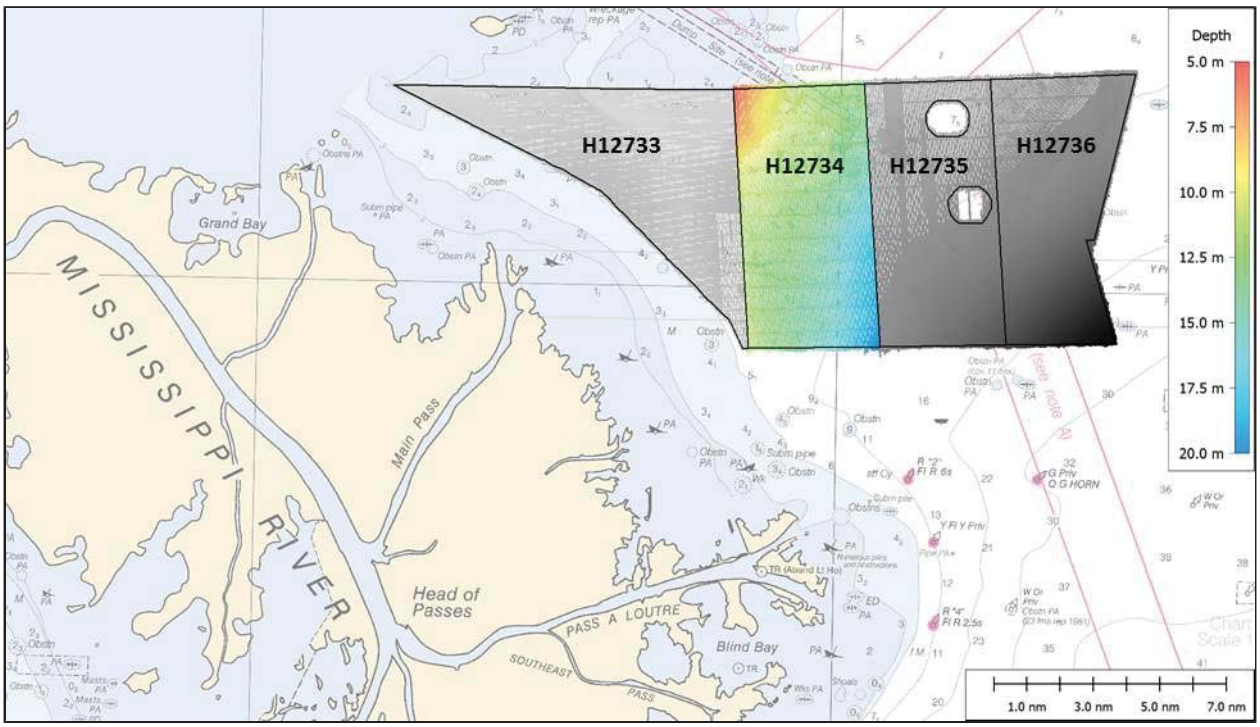


Figure 1: Survey H12734 MBES coverage overlaid on RNC 11366.

A.5 Survey Statistics

The following tables list the survey statistics (Table 2) and the dates of hydrography (Table 3).

	Hull ID	*R/V Ocean Explorer*	*Total*
LNM	**SBES Mainscheme**	0	0
	MBES Mainscheme	85.12	84.58
	Lidar Mainscheme	0	0
	SSS Mainscheme	0	0
	SBES/MBES Mainscheme	0	0
	SBES/SSS Mainscheme	0	0
	MBES/SSS Mainscheme	513.64	513.64
	SBES/MBES Cross Lines	45.93	45.93
	Lidar Cross Lines	0	0
Number of Bottom Samples			8
Number of AWOIS Items Investigated			0
Number of Maritime Boundary Points Investigated			0
Number of DPs			0
Number of Items Investigated by Dive Ops			0
Total Number of SNM			32.44

Table 2: Hydrographic Survey Statistics

Survey Dates	Julian Day Number
06/20/2015	171
06/21/2015	172
06/22/2015	173
06/23/2015	174
06/24/2015	175
06/25/2015	176
07/10/2015	191
07/11/2015	192
07/12/2015	193
07/16/2015	197
07/17/2015	198
07/18/2015	199
07/20/2015	201
07/21/2015	202
07/25/2015	206
07/28/2015	209

Table 3: Dates of Hydrography

The lineal nautical miles (LNM) for MBES only development lines were included under the heading "Mainscheme MBES" along with the LNM for the Complete Multibeam mainscheme lines in Table 2. Hydrographic Survey Statistics.

B. Data Acquisition and Processing

B.1 Equipment and Vessels

Refer to the OPR-J377-KR-15 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

Survey operations were conducted from the R/V Ocean Explorer. The R/V Ocean Explorer, O.N. 905425, is an 18-meter aluminum vessel, with a 5.1-meter beam and nominally 2-meter draft, powered by two 1,000 HP Iveco diesel engines.

Hull ID	***R/V Ocean Explorer***
LOA	18 meters
Draft	2 meters

Table 4: Vessel Used

B.1.2 Equipment

Table 5 summarizes the primary equipment used to acquire MBES and SSS data. All equipment was installed, calibrated and operated in accordance with the DAPR.

Manufacturer	**Model**	**Type**
Reson	7125	MBES
EdgeTech	4125	SSS
EdgeTech	4200	SSS
ODIM	MVP30 w/AML SVPT	Sound Speed System
AML	Micro-X	Sound Speed System
Applanix	POS MV 320 V.4	Positioning and Attitude System
Trimble	MS750	Positioning System
Trimble	ProBeacon	Positioning System

Table 5: Primary Survey Equipment

B.2 Quality Control

B.2.1 Cross Lines

A total of 45.93 nm of cross line data were acquired June 20, 2015 (DN 171). Cross line mileage equaled 9.2% of the 501.90 nm of mainscheme MBES lines. Cross lines were run nominally perpendicular to mainscheme lines (Figure 2).

Soundings from mainscheme lines and cross lines were compared periodically throughout survey operations reviewing preliminary MBES surfaces and using CARIS HIPS Subset Editor. Cross line comparisons provided confirmation that the system offsets and biases were entered correctly and verified the accuracy of sounding correctors (i.e. tide, sound speed, TrueHeave).

Statistical quality control information was compiled from a difference surface, generated in CARIS HIPS, between the depth layer of a 2-meter CUBE (Combined Uncertainty and Bathymetric Estimator) surface composed only of cross line data and the depth layer of a 2-meter CUBE surface composed only of mainscheme data. The cross line analysis results demonstrate excellent agreement between cross line soundings and mainscheme soundings, with the depth differences less than or equal to 0.27 meters. The allowable TVU for the range of water depths within Survey H12734 is greater than 0.50 meters. Figure 3 is a histogram showing the distribution of depth differences for all comparison grid cells considered. The total number of 2-meter comparison cells equaled 480,213. Of 480,213 possible comparison cells, 480,015 or 99.96% of the cells include cross line and mainscheme soundings that match within +/- 20 centimeters.

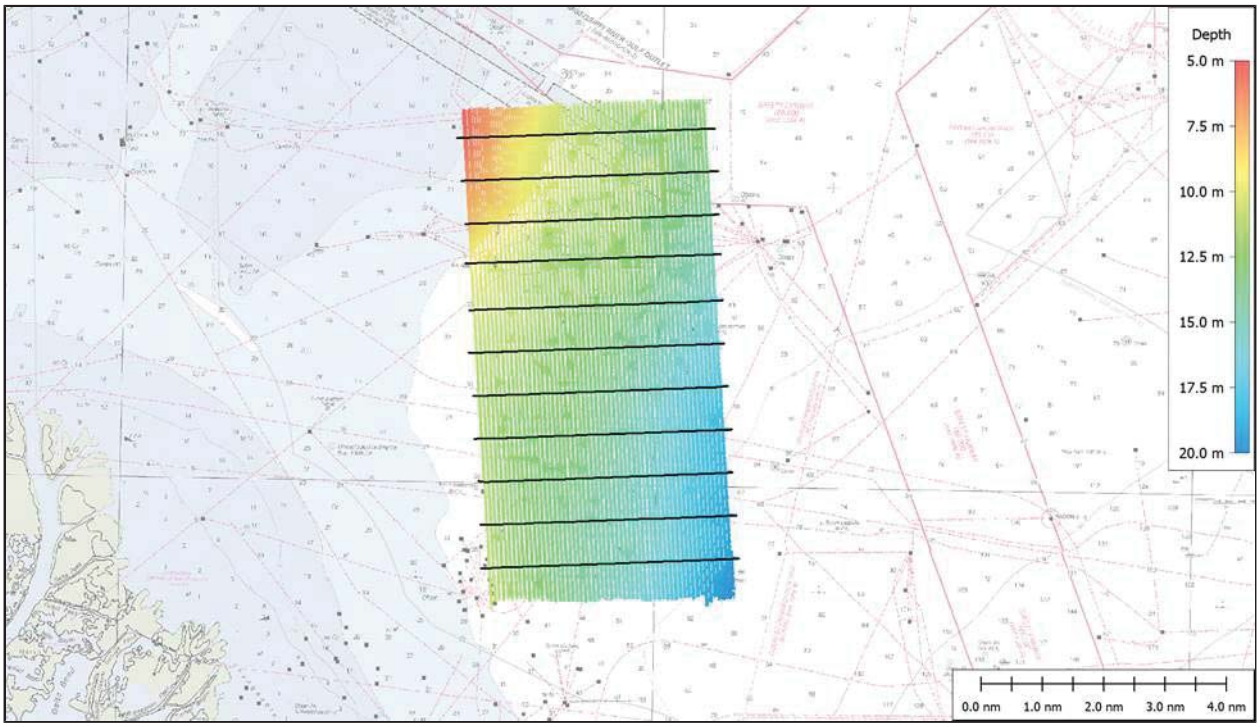


Figure 2: An overview of the cross line layout on a 2-meter surface created from mainscheme MBES data and colored by depth. RNCs 11363 and 11361 are visible in the background.

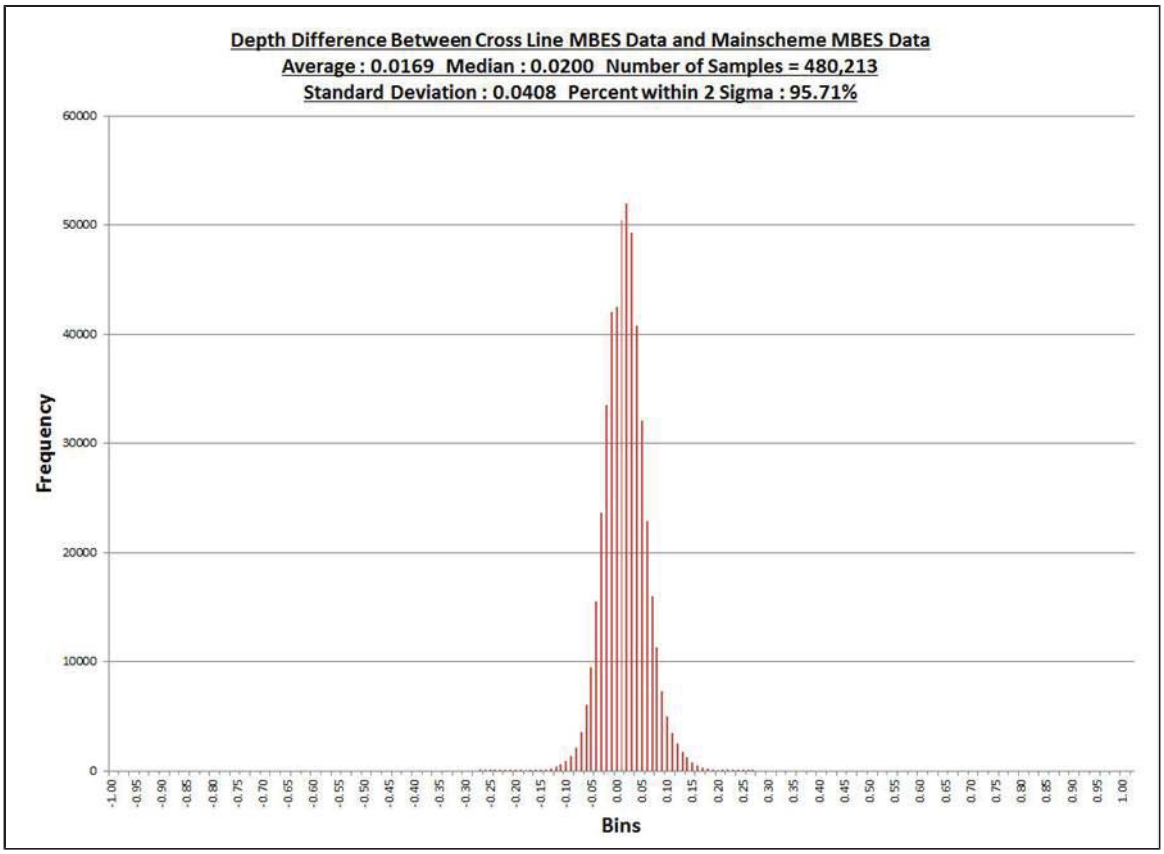


Figure 3: The graph shows a frequency distribution of the depth differences between the H12734 cross line data and the H12734 mainscheme MBES data. Statistics from the depth difference sample set are displayed above the graph.

B.2.2 Uncertainty

The following two tables list the tide and sound speed uncertainty parameters that were used to compute Total Propagated Uncertainty (TPU) 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
R/V Ocean Explorer		2 meters/second	2 meters/second

Table 7: Survey Specific Sound Speed TPU Values

The methods used to minimize the uncertainty in the corrections to echo soundings are described in detail in Section B. Processing and Quality Control of the project DAPR. Survey H12734 did not deviate from the methods documented in the DAPR.

The Total Vertical Uncertainty Quality Check (TVU QC) "Ratio Method" was used to evaluate IHO uncertainty for all finalized surfaces. The TVU QC "Ratio Method" is described in the Chapter 4 Appendices of the NOAA OCS Field Procedures Manual (FPM) dated April 2014. Per the FPM TVU QC section, "The hydrographer should use the finalized surface because this surface will identify areas where either the uncertainty or the standard deviation exceeded the maximum allowable error and the greater of these two values is used in addition to having the uncertainty scaled to a 95% CI, whereas unfinalized surface uncertainties are reported at the 68% CI." The FPM TVU QC section also states that, "[ratio] values which do not require further examination are from -1 to 0 and the values which do require further examination are from -100 to -1". It should be noted that finalized surfaces were used in this analysis.

Thirty-two (32) MBES CUBE surfaces were delivered along with Survey H12734 including "H12734_MB_4m_MLLW_Final", "H12734_MB_2m_MLLW_Final", and thirty (30) 50-centimeter surfaces intended to satisfy "Object Detection" coverage and density requirements for significant features. The 4-meter surface is intended to satisfy "Set Line Spacing" coverage and sounding density requirements and the 2-meter surface is intended to satisfy "Complete Multibeam" coverage and density requirements in water depths over 20 meters. Results from the TVU QC indicate that 100% of the nodes from all submitted surfaces meet IHO Order 1 uncertainty specifications, i.e. the ratio values of all nodes is less than -1. The maximum ratio range of all comparison cells from all submitted surfaces is -0.55 to -0.69.

B.2.3 Junctions

One prior and two contemporary surveys junction with Survey H12734. Figure 4 displays the location of the prior and contemporary junction surveys for Project OPR-J337-KR-15.

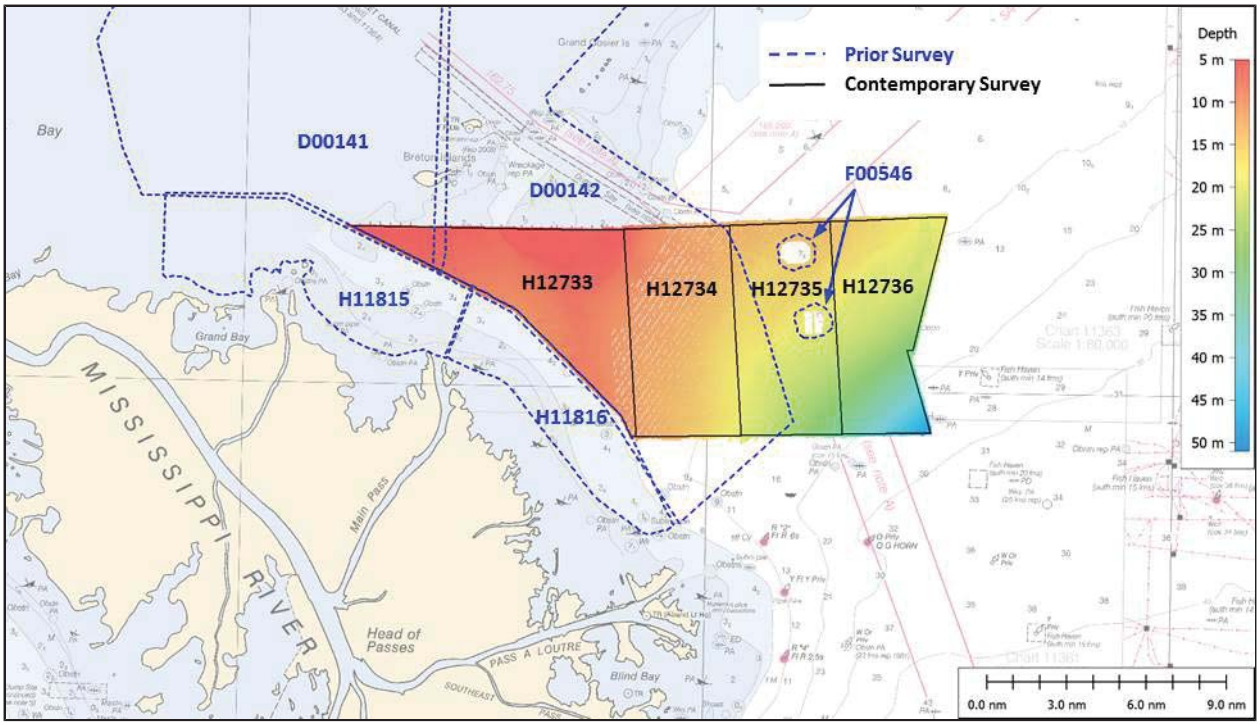


Figure 4: *Survey junctions for Project OPR-J377-KR-15. RNC 11366 is displayed in the background.*

Registry Number	Scale	Year	Field Unit	Relative Location
D00142	1:40000	2008	Terrasond, Ltd.	N
H12733	1:20000	2015	Ocean Surveys, Inc.	W
H12735	1:20000	2015	Ocean Surveys, Inc.	E

Table 8: Junctioning Surveys

D00142

Terrasond, Ltd.'s survey D00142, a reconnaissance survey conducted in 2008, overlapped nearly the entire survey area for H12734. Given that Survey D00142 was acquired with a Singlebeam Echosounder (SBES) and the majority of Survey H12734 was Set Line Spacing coverage, the junction area between the two surveys was sparse. Depth data for Survey D00142 were downloaded from the National Geophysical Data Center

website (http://www.ngdc.noaa.gov) in the form of a 5-meter resolution Bathymetric Attributed Grid (BAG), "D00142_5m_MLLW1of1".

To conduct the junction comparison a finalized 5-meter CUBE surface was generated from the entire MBES data set for survey H12734, "H12734_MB_5m_MLLW." In CARIS HIPS, depths from the "D00142_5m_MLLW1of1" BAG were subtracted from the depths in the "H12734_MB_5m_MLLW" CUBE surface using the CARIS HIPS Difference Surface function. A histogram of the differences is shown in Figure 5. Depths from the H12734 survey show good agreement with depths from the D00142 survey. Depth discrepancies generally equaled 40 centimeters or less with a mean difference of -23 centimeters. The largest discrepancy between survey depths, -1.08 meters, is at the location of a depression that appears to be associated with the seafloor's natural topography (Figure 6). Several factors including the comparison of singlebeam and multibeam data, degraded horizontal accuracy associated with DGPS positioning (used for both surveys), and a slight misalignment between the surface grid nodes may have resulted in a depth offset between the two surveys.

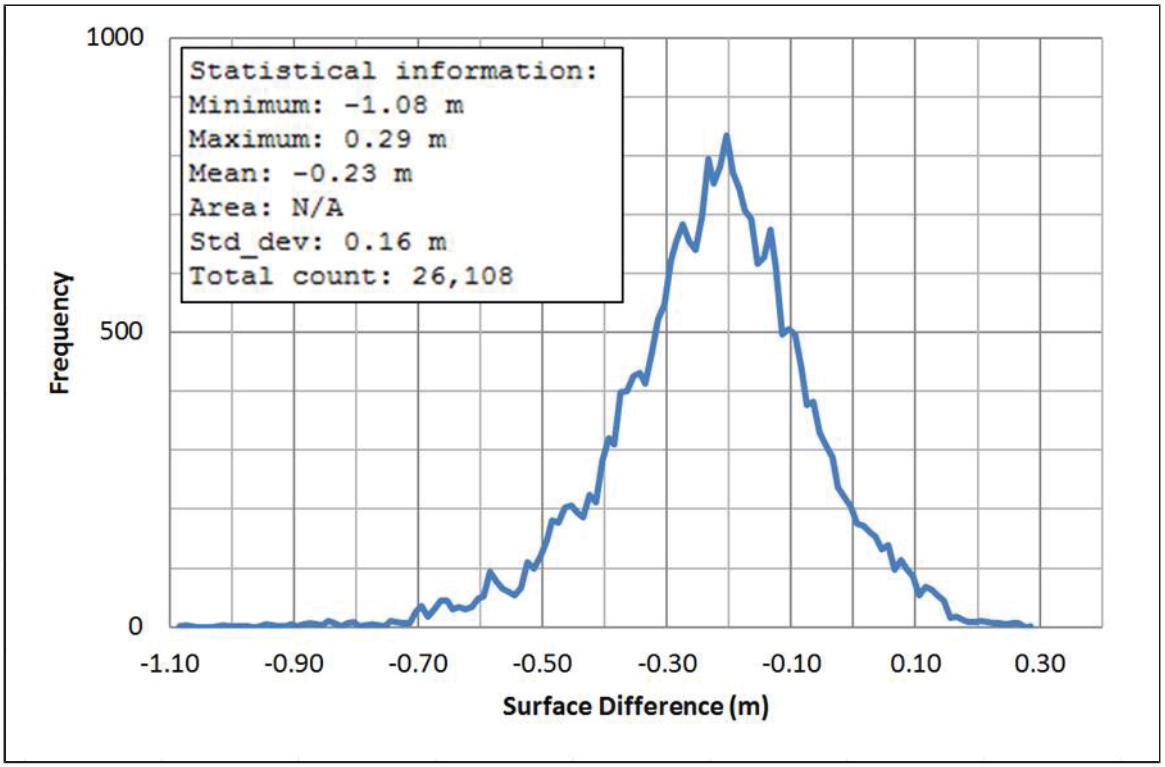


Figure 5: *Surface-to-surface difference histogram comparing Survey H12734 to Survey D00142.*

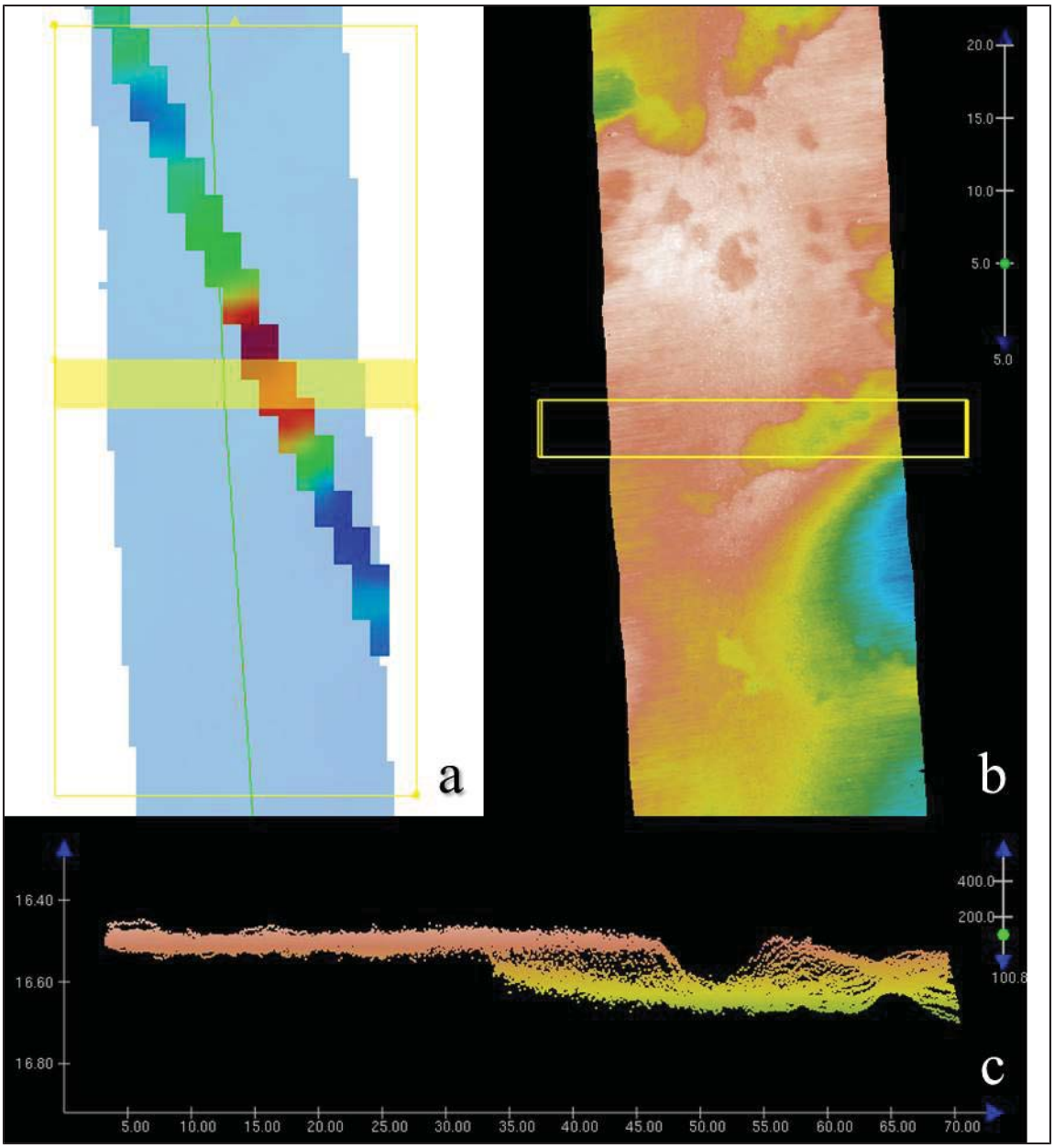


Figure 6: *Image (a) is a screen grab from the CARIS display window that shows the junction difference surface overlaid on a depth surface from Survey H12734 with a subset window drawn over the location of the largest depth discrepancy between Surveys H12734 and D00142. (b, c) Images featuring the MBES data from Survey H12734 loaded into CARIS Subset Editor's 3D and 2D windows highlight multiple seafloor depressions.*

H12733

The horizontal overlap between the bathymetric data from contemporary Surveys H12734 and H12733 varied between approximately 50 and 500 meters. Given that the overlap between the two surveys was in Set Line Spacing Coverage collection areas, the junction area between the two surveys was patchy. Depths from

2-meter BASE surfaces compiled from the MBES data from each survey, "H12734_MB_2m_MLLW" and "H12733_MB_2m_MLLW," were compared using the CARIS HIPS Difference Surface function. A histogram of the differences is shown in Figure 7. Depths from the H12734 survey show good agreement with the depths from the H12733 survey. Depth discrepancies generally equaled 20 centimeters or less with a mean difference of 5 centimeters.

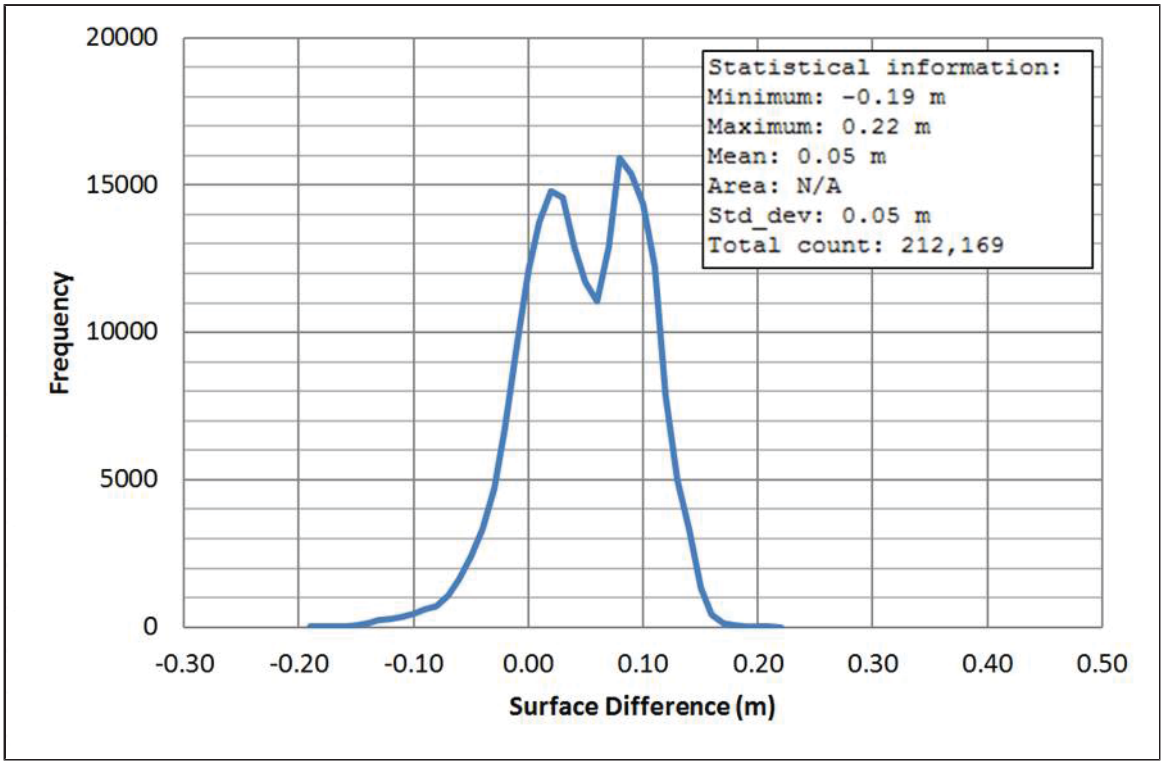


Figure 7: Surface-to-surface difference histogram comparing Survey H12734 to Survey H12733.

H12735

The horizontal overlap between the bathymetric data from contemporary Surveys H12734 and H12733 varied between approximately 0 and 500 meters. Given that the majority of the overlap between the two surveys was in Set Line Spacing Coverage collection areas, the junction area between the two surveys was patchy. Depths from 2-meter BASE surfaces compiled from the MBES data from each survey, "H12734_MB_2m_MLLW" and "H12735_MB_2m_MLLW," were compared using the CARIS HIPS Difference Surface function. A histogram of the differences is shown in Figure 8. Depths from the H12734 survey show good agreement with the depths from the H12735 survey. Depth discrepancies generally equaled 15 centimeters or less with a mean difference of 1 centimeter.

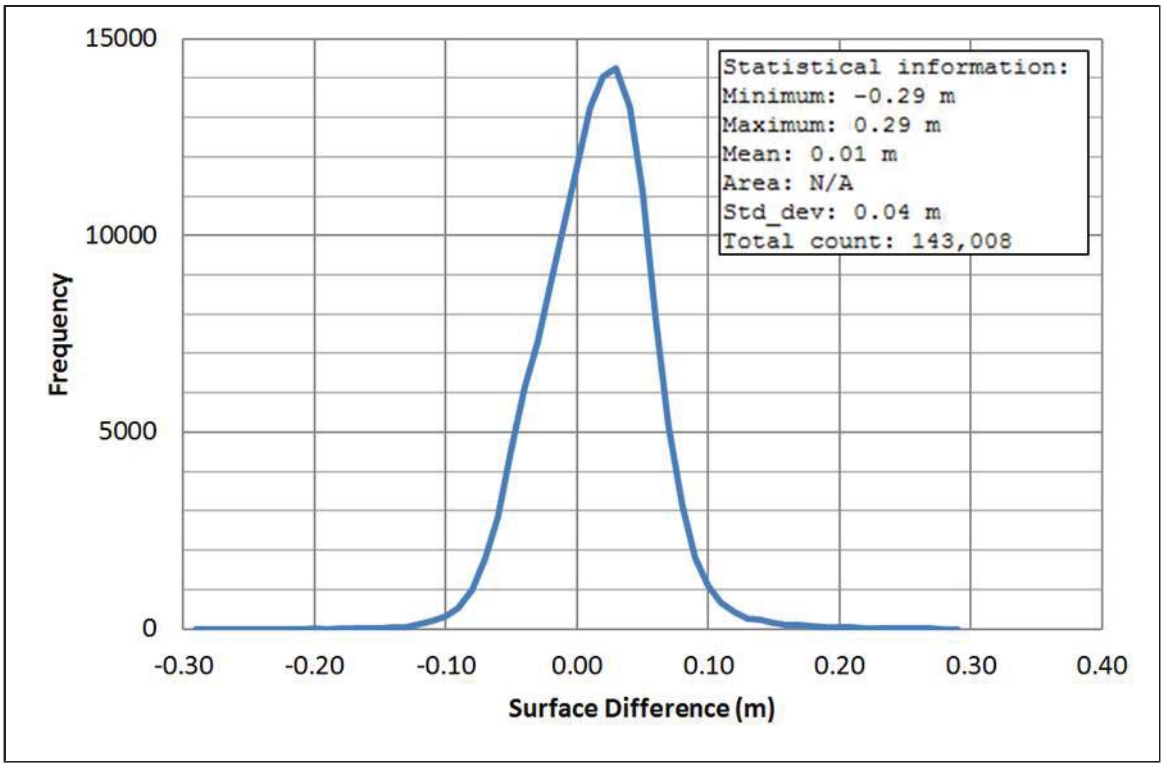


Figure 8: *Surface-to-surface difference histogram comparing Survey H12734 to Survey H12735.*

B.2.4 Sonar QC Checks

Sonar system quality control checks were conducted as detailed in the Quality Control section of the DAPR. Results from the weekly MBES bar checks are included in Appendix II of the DAPR.

B.2.5 Equipment Effectiveness

MBES "Blowouts"

The Reson 7125 system experienced periodic bursts of motion-induced noise or “blowouts,” typically affecting between 1 and 4 sequential profiles. Efforts were made to reduce this noise during acquisition, including adjustments to system gain and power, in addition to the multibeam pole fairing that was installed to reduce cavitation effects. The frequency of the noise bursts would typically increase as sea state worsened. Therefore, operations were suspended when the frequency or length of blowouts became too high. Accepted data effected by blowouts did not show any nadir gaps in coverage in excess of 3 nodes in the along-track direction.

MBES Feature Height Exaggeration

The Reson 7125 system displayed a trend in which the heights for features detected with the outer beams were exaggerated. When a feature was detected with an outer beam, the soundings would seem to "ramp up" to an exaggerated height not supported by the 7125 MBES investigation data acquired closer to nadir (Figure 9). In these cases the outer beams were rejected in favor of soundings closer to nadir and when available the SSS contact heights were used to corroborate the feature's least depth. This system issue is discussed in the August 2013 Reson 7125 manual (Reson Part Number 86000179), "…using Equi-Distant mode over complex structures can cause magnified artifacts due to the large overlap between beams towards the edge of the sector."

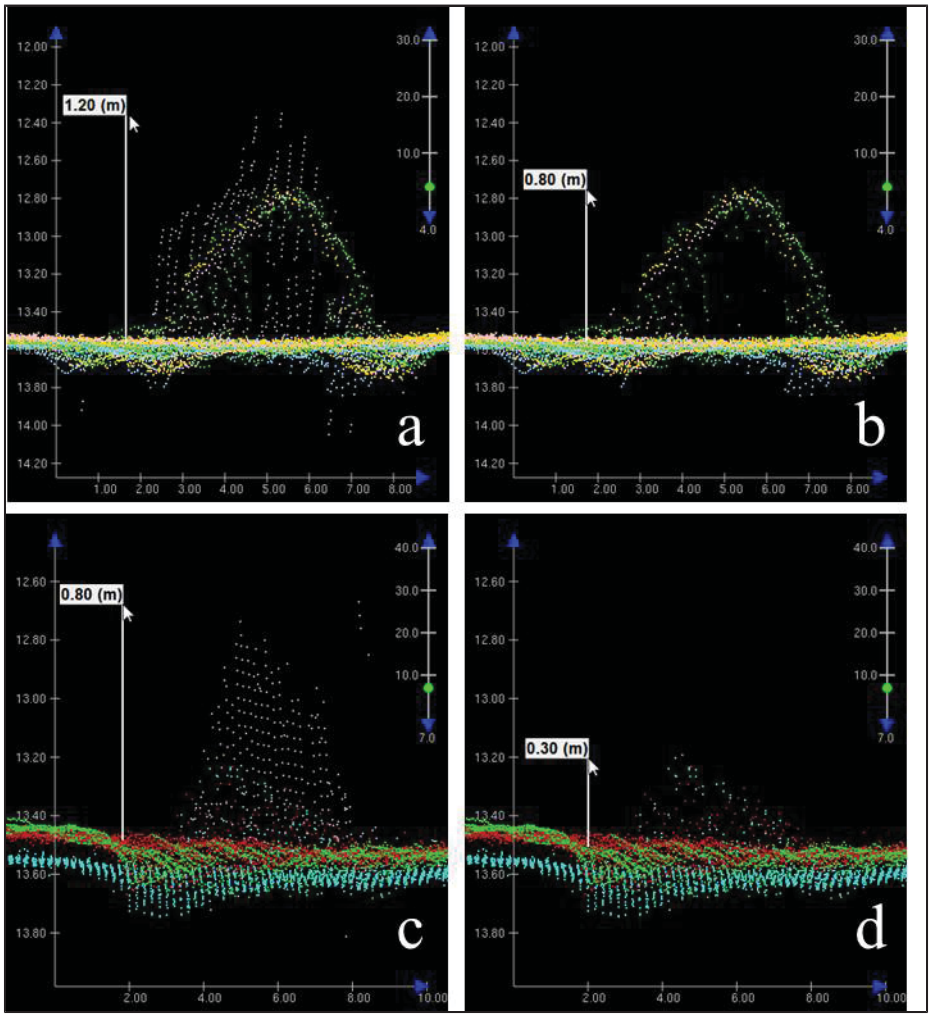


Figure 9: *Two examples of the Reson 7125 outer beam detection issue where the system exaggerates the height of a feature, in this case two pipeline features. Outer beam soundings from two Reson 7125 lines (colored in grey) exaggerated the pipelines' heights by 40 to 50 centimeters (a,c). The true feature least depths were represented in the finalized surfaces (b,d). Depths and distances are in meters.*

MBES Outer Beam Irregularity

At times of extreme variability in surface sound speed, the MBES profiles of the Reson 7125 showed an irregularity in the outer beam data that simulated the expected signature of a roll error. It is not uncommon to see a “smile” or “frown” in a multibeam profile if the water column sound speed profile is not properly acquired or applied. In this case, the profile appears convex on the port side and concave on the starboard side thereby mimicking a roll bias. Regular and frequent roll patch testing confirmed that the multibeam mounting apparatus was stable, i.e. there was not an intermittent roll error in the system. Based on review of past Reson 7125 datasets, OSI is led to conclude that this phenomenon is either a Reson 7k system limitation or a site limitation of surveying in the freshwater plume of the Mississippi River that no sounding system could be expected to overcome. An example of the Reson 7125 "S-shape" anomaly sounding system error is shown in Figure 10.

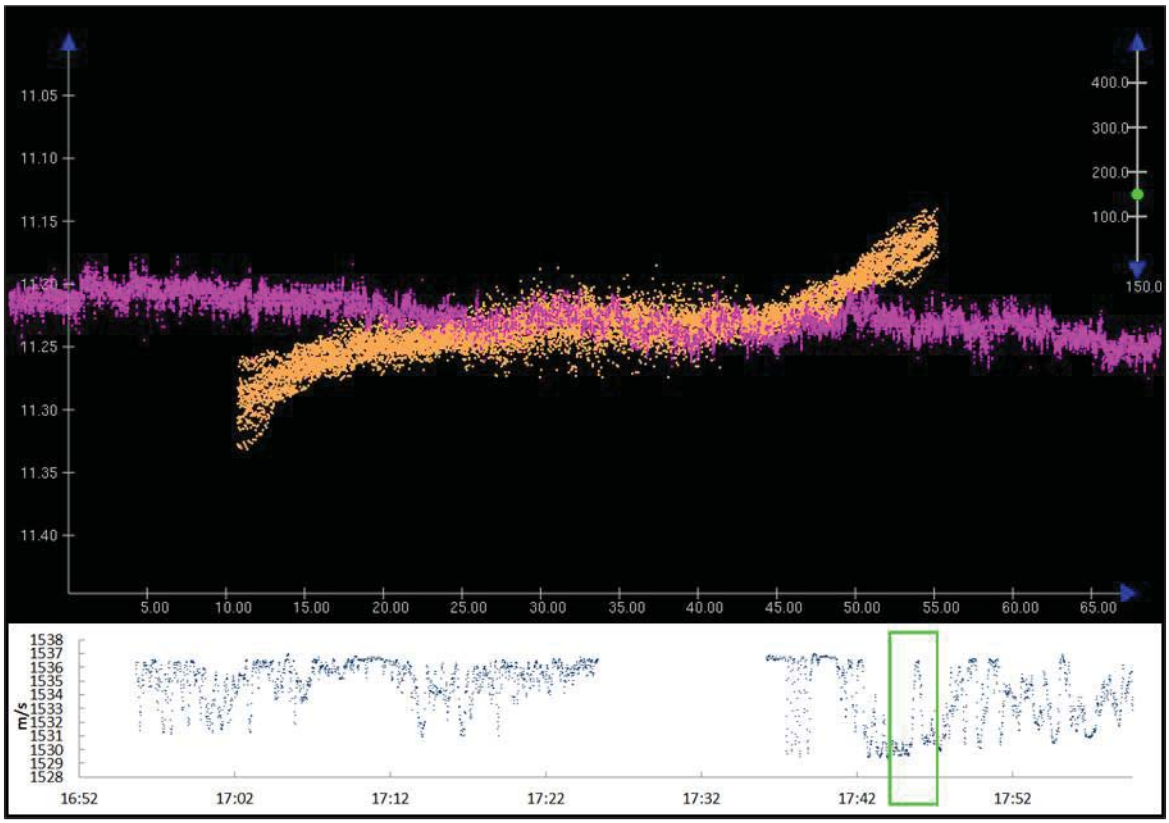


Figure 10: *The top image is an example of the Reson 7125 S-shaped outer beam sounding irregularity (orange line) which was observed on a day with highly variable surface sound speed. The bottom image shows a time series of the surface sound speed values for two of the lines collected on DN 171. The green box highlights the dynamic variation in surface speed of sound that correlates with the time of the orange-colored soundings in the top image. Depths and distances are in meters.*

Surface noise in port side of EdgeTech 4125 SSS

On some of the pole-mounted EdgeTech 4125 SSS lines, persistent refraction was noted beyond the 25-meter range on the port side of the SSS record while the starboard side of the record was unaffected (Figure 11), though the artifact was not constant across an entire collection day. Analysis of the data pattern led the hydrographers to conclude that data on the port side of the mounted SSS, the side closest to the vessel hull, was being affected by water turbulence across the hull and/or the mixing of the sharply stratified surface sound speed. The aforementioned cause and effect appeared to vary widely depending on vessel heading and current-induced crabbing. To mitigate this effect, the transducer pole was lowered to its maximum draft on July 5, 2015 (DN 185), as documented in the project DAPR. To ensure that 100% coverage of high quality SSS data was acquired, the Georeferenced Backscatter Rasters (GeoBars) created in CARIS Mosaic Editor from the processed imagery of SSS lines affected by the artifact were cropped to a distance of 25 meters on the port side. SSS fill-in lines were acquired over the mosaic coverage gaps. Lowering the draft for the 4125 SSS transducer reduced the impact of the water turbulence on the port side imagery.

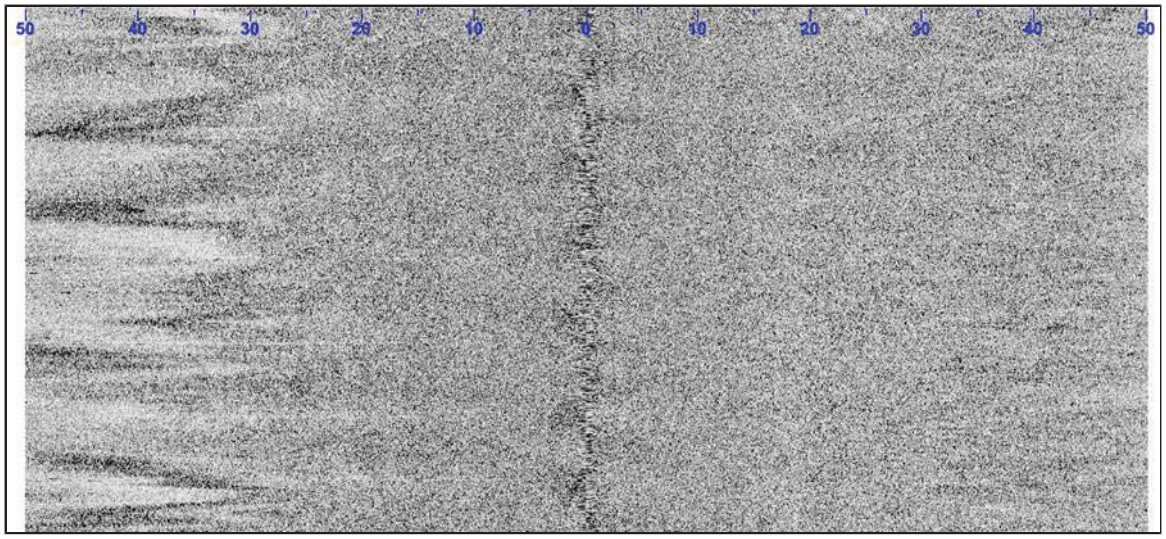


Figure 11: *Example of the conditional port-side artifact in the pole-mounted EdgeTech 4125 SSS.*

B.2.6 Factors Affecting Soundings

Water Column and Surface Sound Speed Variability

The sound speed profiles acquired throughout the limits of the survey area showed high variability, particularly near the surface (Figure 12). A drastic change in sound speed was often observed near the surface, where sound speed values would change by over 10 m/s in the top 5 meters of the water column. At times the high sound speed variability near the surface adversely affected the depth and positioning of outer beam soundings (Figure 13). Sound speed changes in the water column were time and space dependent and appear to be attributed to the influx of fresh water from the Mississippi River and the temperature changes throughout the day. To

ensure that compromised data were not included in the final surface, outer range swath trimming was effected, as needed, on a case-by-case basis.

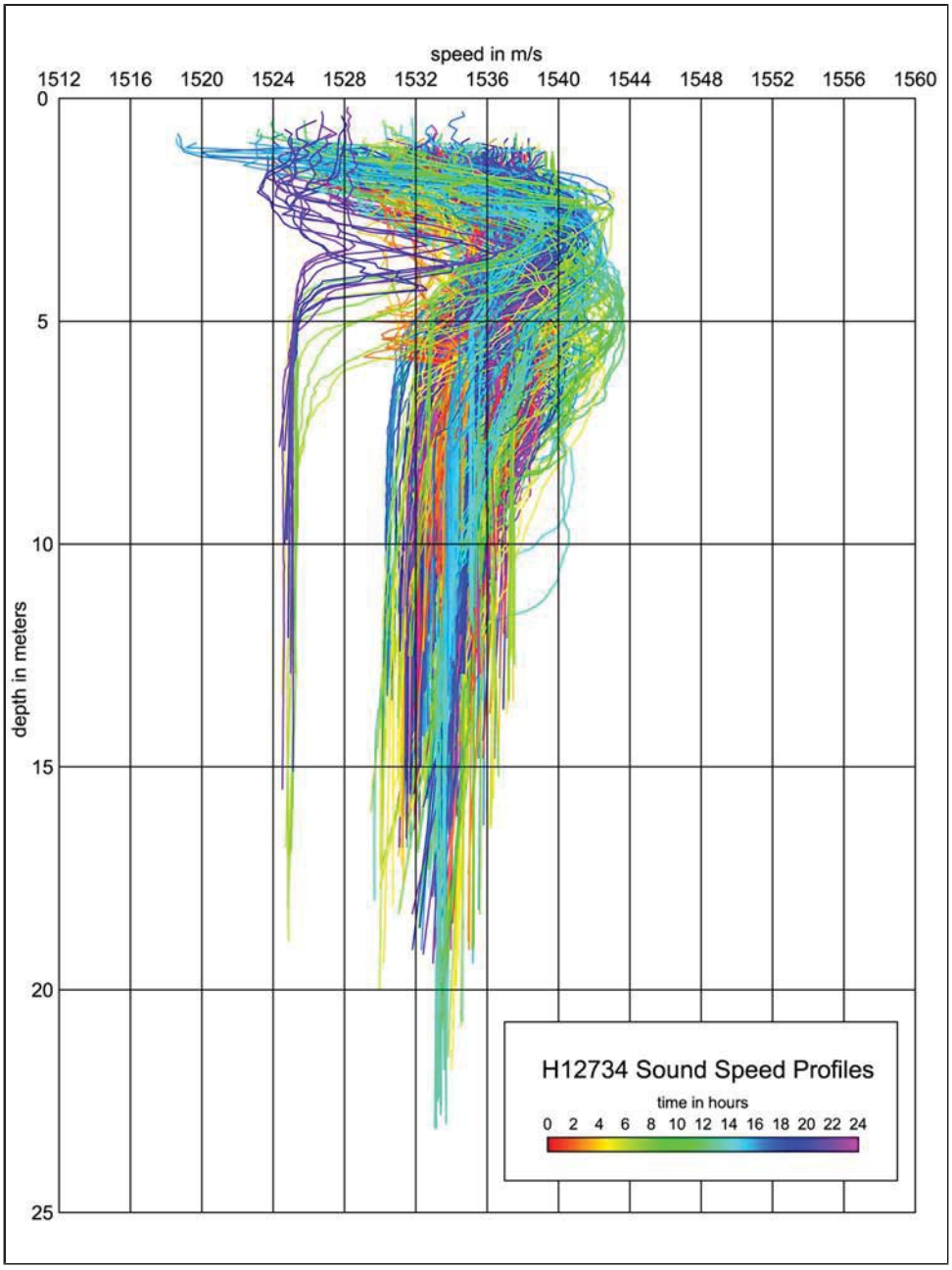


Figure 12: *The image above represents all H12734 sound speed profiles colored by cast time. The profiles showed high variability in sound speed measurements spatially and temporally, with the change most pronounced near the surface.*

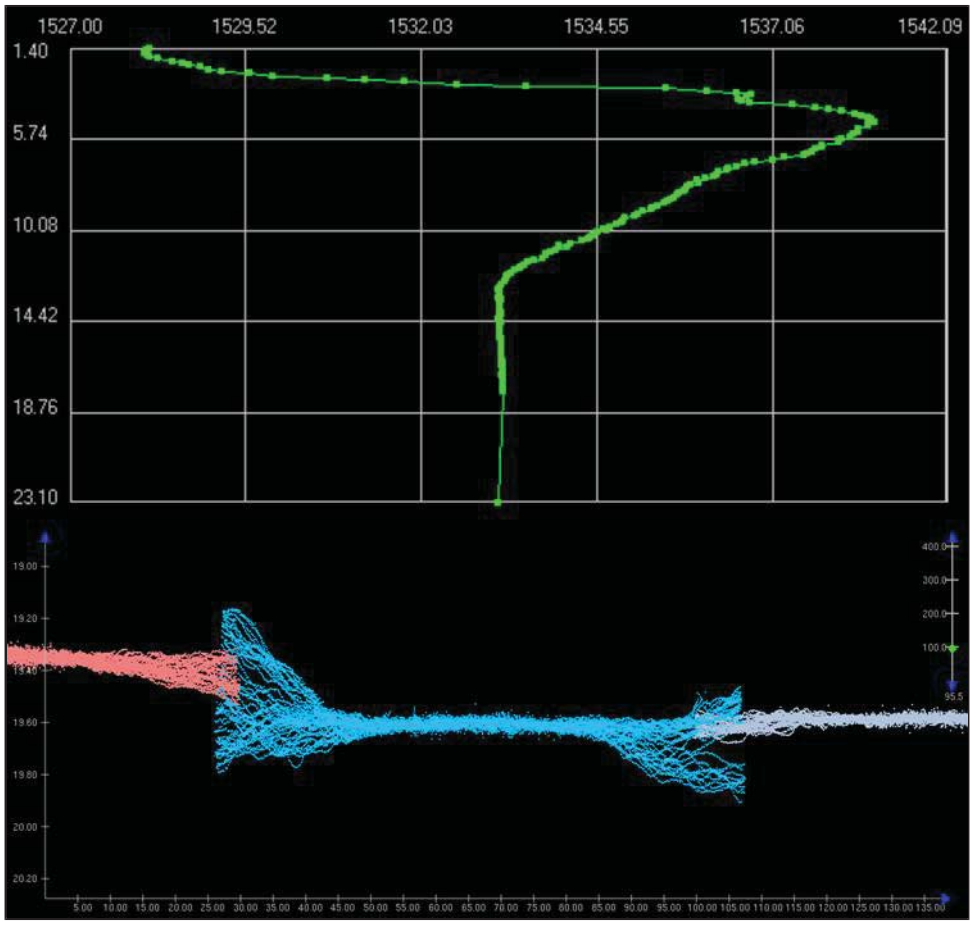


Figure 13: *The top image shows a sound speed profile taken with the MVP on July 12, 2015 (DN 193). The sound speed value increases by 10 m/s in the top 5 meters of water. The bottom image highlights a Reson 7125 line in blue with the outerbeams showing a "thickening " indicative of a sound speed error. Depths and distances are in meters.*

SSS Refraction

The dynamic sound speed changes affected the SSS imagery at times, causing refraction in the outer ranges of the SSS swath. When practical, to lessen the impact of refraction in the towed SSS, the EdgeTech 4200 tow fish was flown below the refractive sound speed lens.

Tide Offset

Review of surface data indicated that there were minor tide-related offsets between MBES data collected on different days scattered throughout Survey H12734. However, there were no noteworthy tide events that affected this survey. Overall, the tide correctors were modeled well for Survey H12734, showing good agreement between survey days. Tide offsets generally equaled 20 cm or less and are likely associated with local environmental effects, i.e. wind setup. An example of one of the larger magnitude tide related offsets for Survey H12734 is presented in Figure 14.

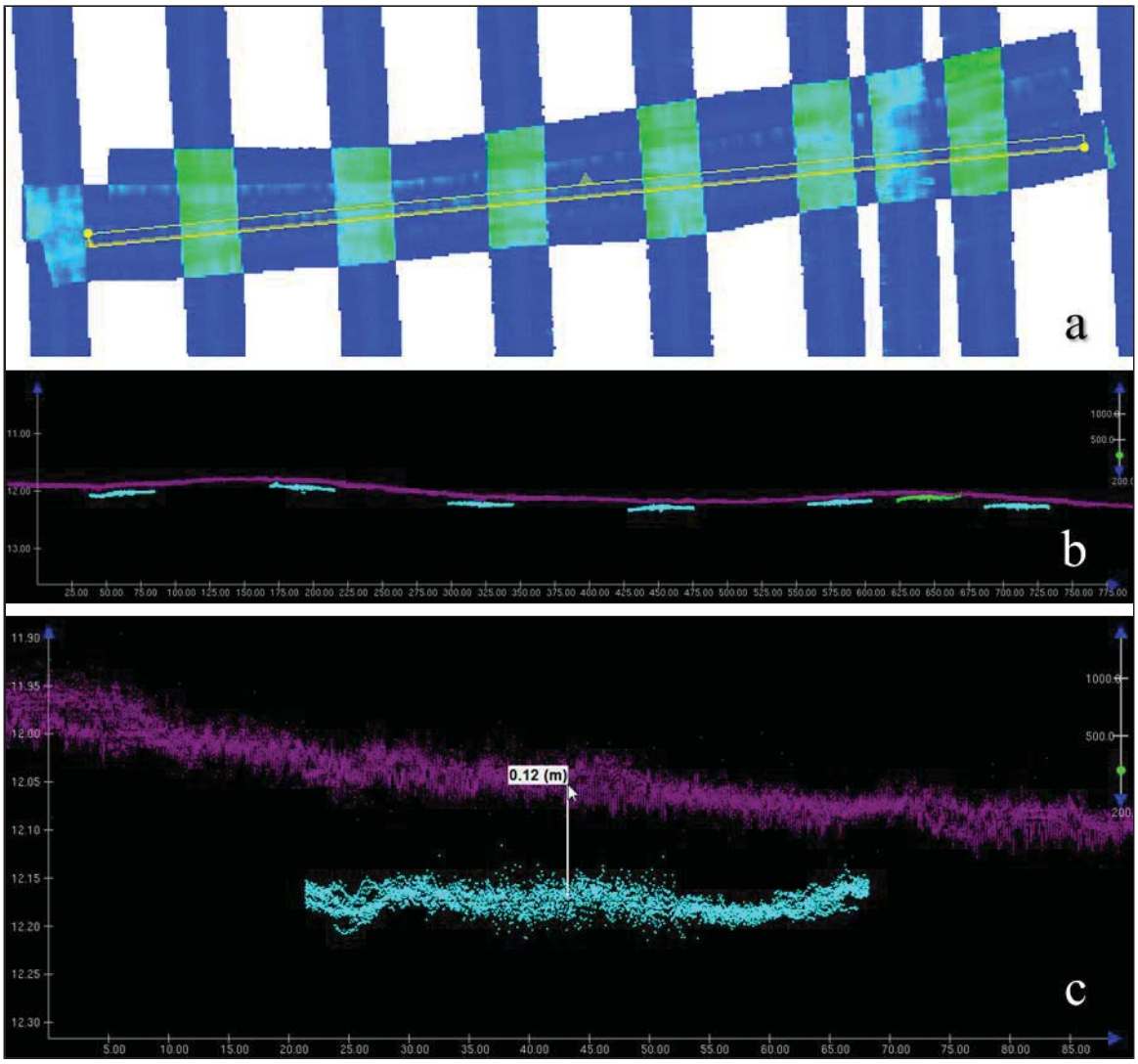


Figure 14: *Image (a) shows a subset window displayed over the Standard Deviation layer from the H12734 2-meter CUBE surface. The green and cyan colors indicate areas of higher standard deviation in the surface due to a minor tide offset. Images (b) and (c) display MBES data loaded into CARIS Subset Editor as an example of a tide-related vertical offset between mainscheme soundings collected on DN 175 (turquoise) and DN 202 (green), and investigation lines collected on DN 197 (purple) shown in CARIS HIPS Subset Editor 2D view. Depths and distances are in meters.*

Vessel Wakes and Sea Surface Noise in SSS Imagery

There were occasional wakes recorded in the side scan imagery from vessel traffic associated with commercial fishing and oil field support vessels (Figure 15). The wakes were noted in the acquisition and processing logs. When a large wake was identified in the coverage mosaic, the coverage gap was filled with SSS or MBES development lines.

In addition to vessel wakes, the towed 4200 SSS occasionally recorded reflections off of large floating mats of seaweed and large balls of fish located above the tow fish in the water column. The surface noise appeared as shadowless dark spots in the SSS imagery (Figure 16). Lines that were affected by surface noise were carefully scrutinized to ensure all possible SSS contacts were selected.

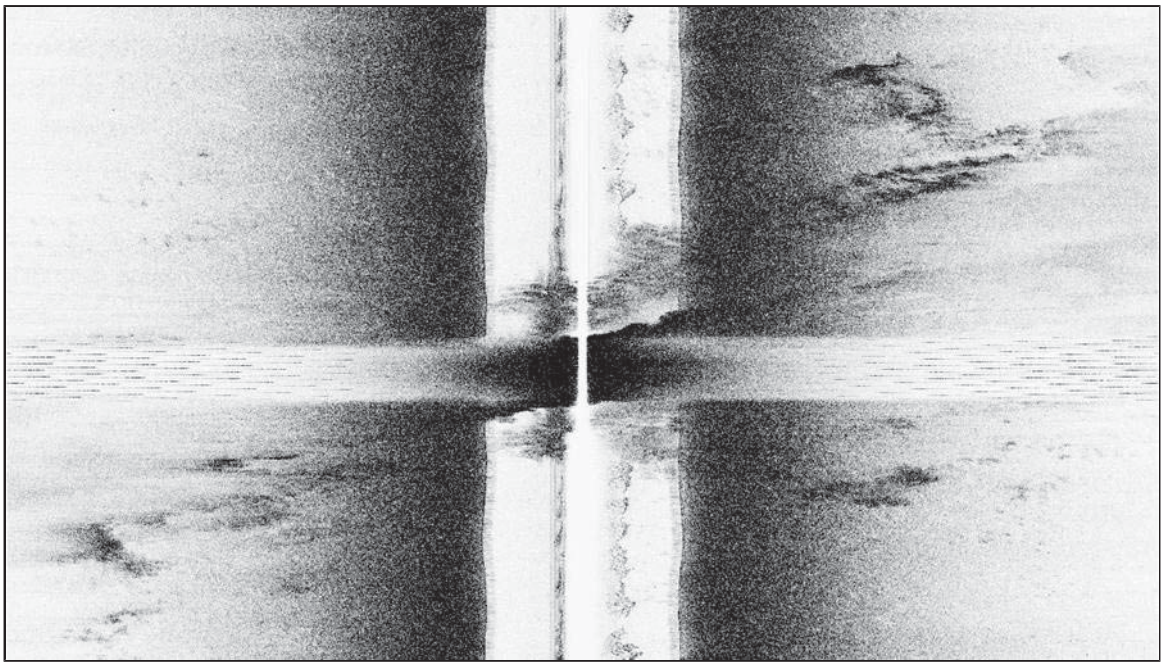


Figure 15: *A vessel wake as recorded in the pole-mounted 4125 SSS imagery.*

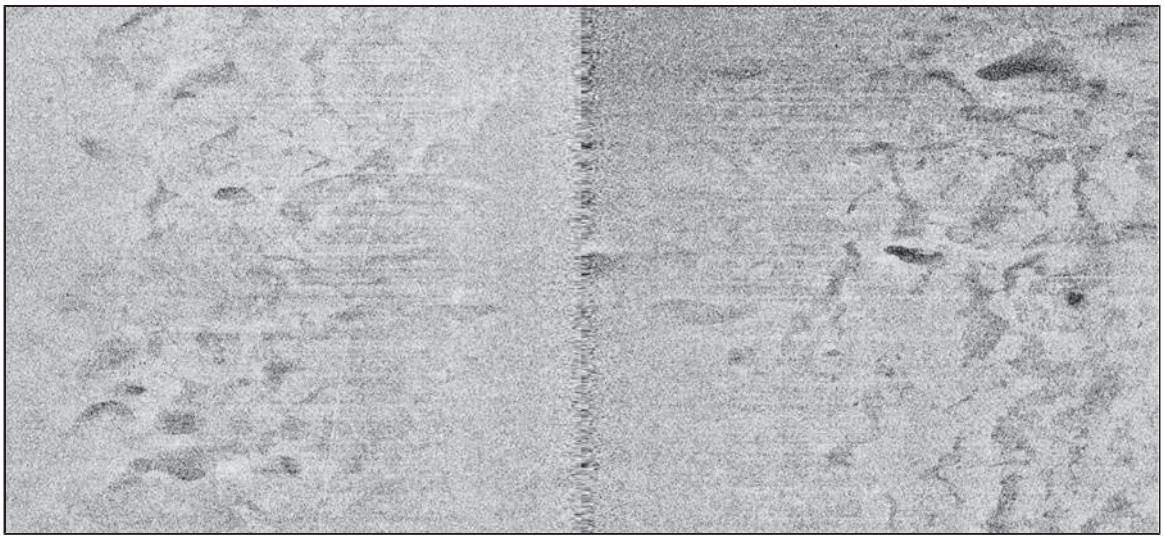


Figure 16: *An example of reflections off of fish in the water column above the towed SSS as it appears in the SSS imagery displayed in CARIS Side Scan Editor.*

Fish in SSS Imagery and MBES data

An abundance of fish and/or marine mammals were seen in the SSS and MBES data, either as lone swimmers or in schools (Figures 17 and 18). Fish and dolphins were noted in the acquisition log by the field team, and these areas were carefully reviewed during data processing. Shadows in the SSS, usually detached from a dark return, were typically associated with fish either in the water column or at a position closer to nadir. In the cases where a visible shadow was recorded in the SSS, the contact was designated as a fish, for two reasons: 1) the possibility that the assumed fish was actually a feature and 2) to assist processors in rejecting fish-related noise from the MBES data.

Dolphin pods were a persistent presence within the survey area, as well as large schools of fish, which at times created large shadows in the SSS imagery and gaps in the MBES data where fish and dolphins were rejected (Figure 19). To ensure that possible significant features were not located in these fish and dolphin shadows, these fish/dolphin related coverage gaps were developed with object detection MBES coverage.

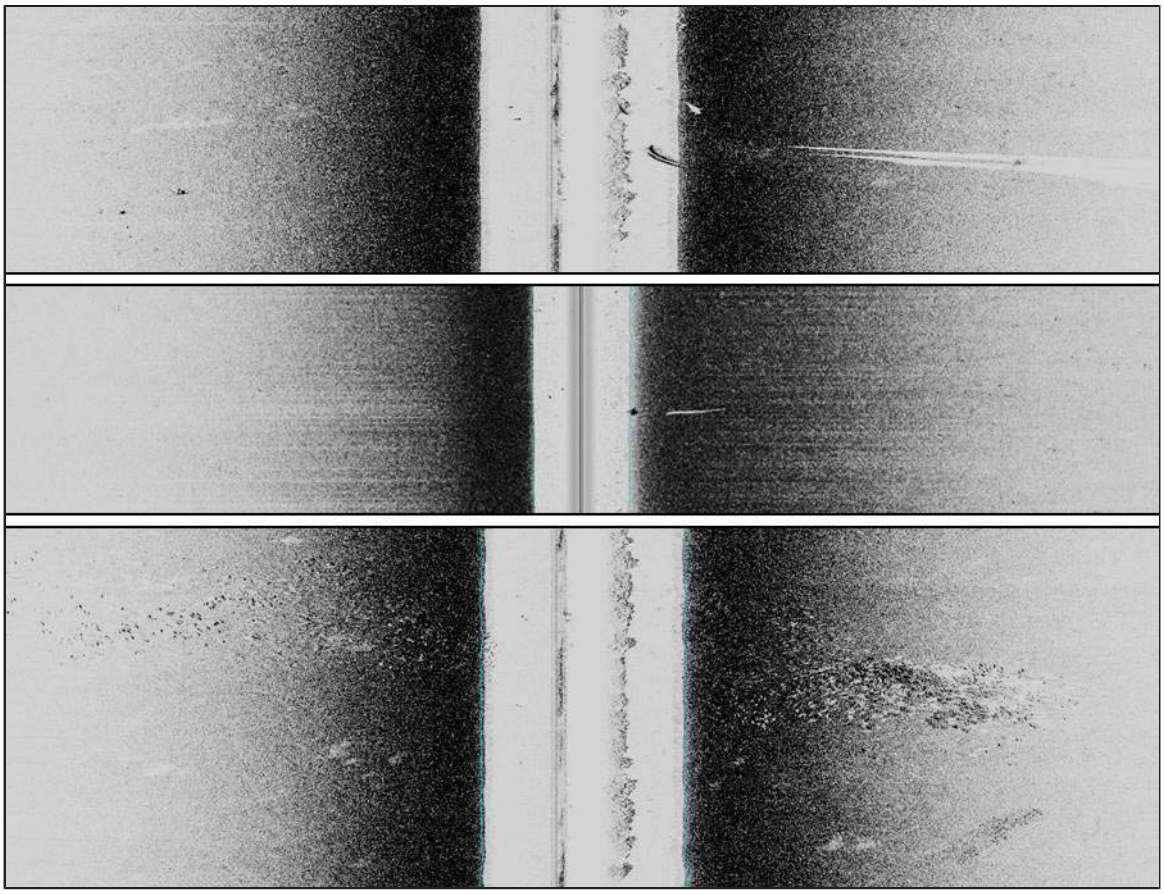


Figure 17: *Examples of fish schools, dolphins, and lone swimmers as they appear in the side scan imagery. The screen grabs were of the raw, un-slant range corrected imagery to show the fish returns in the water column.*

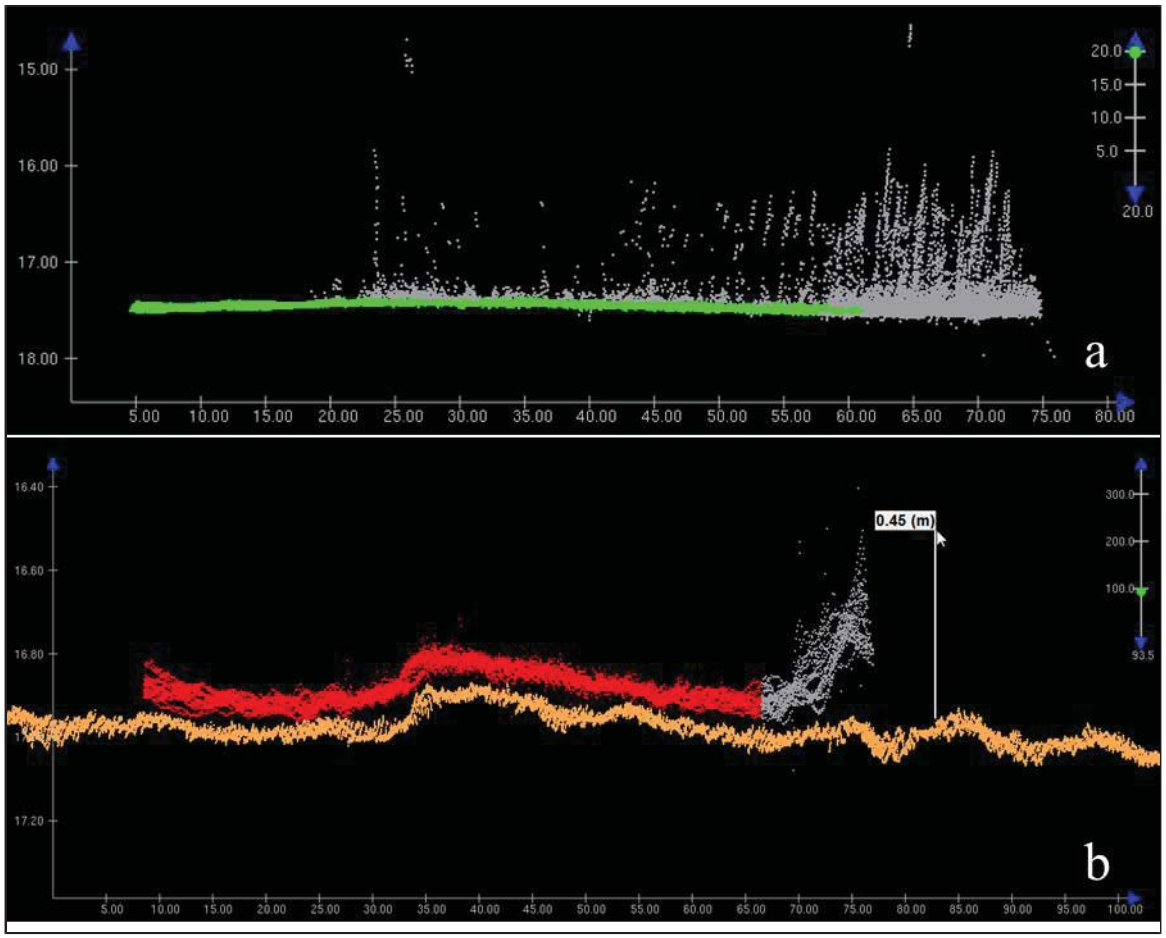


Figure 18: *Two examples of fish as they appear in the Reson 7125 data. In image (a), a school of fish near the seafloor was rejected from the data. In image (b), fish detected in the outer range of the 7125 line colored in red influenced the system's outer beam forming the "ramp-up " effect discussed in the previous section. Rejected soundings are colored grey. Depths and distances are in meters.*

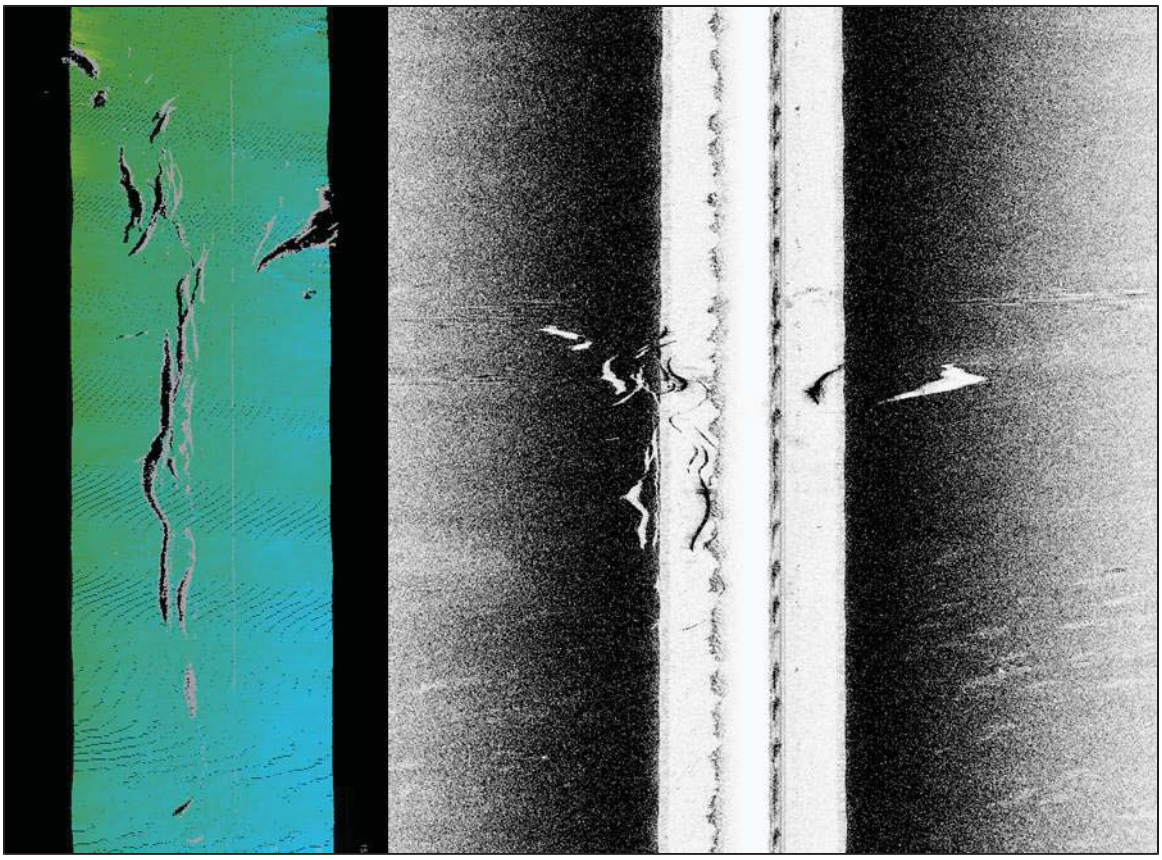


Figure 19: *A pod of dolphins as it was ensonified with the Reson 7125, on the left, and with the pole-mounted 4125 SSS, on the right. The dolphin produced shadows in both sonar coverages.*

Seaweed and Floating Debris Catching on Pole Mount

Seaweed and other floating debris would often snag on the forward guy wire of the pole mount apparatus. The snagged weeds would present as a white/black line of brief duration across the 4125 SSS record and would be visible as noise near the surface in the Reson real-time acquisition waterfall display. The degree to which the snagged seaweed impacted the data was dependent on vessel heading and the amount of current-induced vessel crabbing. The field team mitigated the problem by occasionally raising the pole mount and clearing any weeds or other dangling debris from the wires. Figure 20 is an example of how the white line presented in the CARIS Side Scan Editor waterfall window; the line presented as black in the SSS acquisition display.

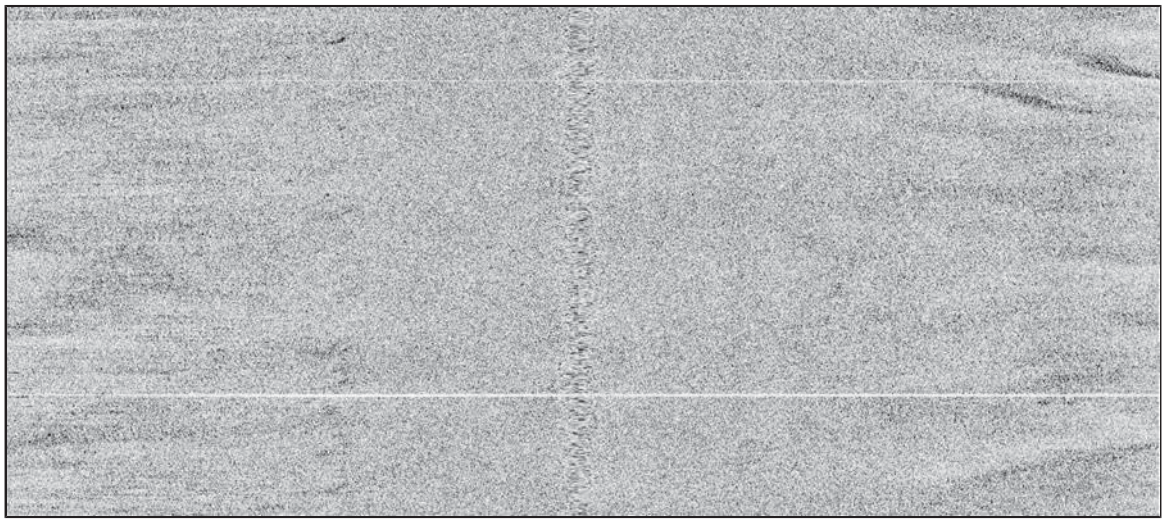


Figure 20: *An example of the sporadic white line across the 4125 SSS imagery as displayed in CARIS Side Scan Editor.*

B.2.7 Sound Speed Methods

Sound speed measurements were acquired and processed as documented in the DAPR. All MBES lines were sound speed corrected using CARIS HIPS' "Nearest in Distance Within Time" method with the time set to two (2) hours.

B.2.8 Coverage Equipment and Methods

This survey was conducted to develop 100% SSS coverage along with concurrent MBES with backscatter to a depth of 20 meters, i.e. Set Line Spacing Coverage as defined in Section 5.2.2.3 of the HSSD. In depths over 20 meters, Complete Multibeam coverage with backscatter was acquired. There were eleven (11) gaps in the 100% side scan coverage mosaic within the survey limits for H12734. The gaps occurred where the survey vessel deviated from the line plan to maneuver safely around offshore platforms. Per the OPR-J377-KR-15 Project Instructions which stated "Gaps in SSS coverage should be treated as gaps in MBES coverage and addressed accordingly," gaps in SSS coverage and holidays caused by fish, dolphins, or boat wakes were developed with Complete Multibeam coverage. This methodology was confirmed with OSI's NOS Contracting Officer (COR) through an email correspondence dated July 21, 2015. Text from the emails discussing SSS holidays are included in the DR Appendix II, Supplemental Survey Records and Correspondence.

All potentially significant features located with mainscheme SSS or MBES were developed with high density multibeam sonar data to meet the HSSD requirement for "Object Detection Coverage."

Of the item investigation coverage surfaces, 100% of surface nodes were populated with ≥ 5 soundings/cell except for one surface, H12734_MB_50cm_MLLW_Lin_Obstn_Final. This object detection surface had a

holiday due to the acoustic shadow from a linear feature ensonified with mainscheme MBES data that was not developed as an investigation item.

The survey methods used to meet coverage requirements did not deviate from those described in the DAPR.

B.2.9 Density

To confirm the HSSD coverage requirement that at least 95% of the surface nodes shall be populated with at least 5 soundings for Object Detection coverage surfaces and at least 3 soundings for Set Line Spacing coverage surfaces, the Compute Statistics tool was utilized within CARIS HIPS and SIPS to generate statistics for the Density layer for each finalized BASE surface. For the purpose of obtaining the most accurate surface density statistics, the surfaces used for the Density QC check were finalized with the "Apply Designated Soundings" box unchecked, as it was discovered that when this option was selected during surface finalization a density value of one (1) was assigned to all nodes containing a designated sounding, regardless of the node's sounding density value pre-finalization. That said, all MBES coverage surfaces included with the survey deliverables were re-finalized with the "Apply Designated Soundings" option selected.

The Compute Statistics tool generates an ASCII export containing two columns: 1) sounding density value and 2) the number of nodes that returned that value. This export was used to determine the percentage of nodes with a sounding density ≥ 5 for every object detection coverage CUBE surface and the percentage of nodes with a sounding density ≥ 3 for the set line spacing coverage CUBE surface. The percentage of nodes with density greater than or equal to 3 soundings for the Set Line Spacing coverage surface was as follows: H12734_MB_4m_MLLW_Final = 99.90%.

The percentage of nodes with density greater than or equal to 5 soundings for the Complete Multibeam coverage surface was as follows: H12734_MB_2m_MLLW_Final = 99.66%.

Twenty-nine (29) of the thirty (30) Object Detection surfaces had 100% of the nodes populated with a density greater than or equal to 5 soundings. The percentage of nodes with density greater than or equal to 5 soundings for surface H12734_MB_50cm_MLLW_Lin_Obstn_Final was 95.99%, as mentioned in the prior section.

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

The following calibrations were conducted after the initial system calibration discussed in the DAPR:

Calibration Type	Date	Reason
Reson 7125 Patch Test	2015-07-05	Change in transducer draft.

Table 9: Calibration following initial patch test.

System calibrations were performed as documented in Section C. of the DAPR. The initial MBES system calibration, or patch test, was performed on June 18, 2015 (DN 169). On July 5, 2015 (DN 185) the draft of the Reson 7125 transducer was deepened along with the pole-mounted 4125 SSS, in order to reduce the impact of water turbulence from the survey vessel's hull on the SSS imagery. A new calibration was performed after lowering the transducer draft.

B.4 Backscatter

Backscatter data were acquired concurrent with bathymetry data for Survey H12734. Per the Hydrographic Survey Project Instructions, MBES bathymetry was the priority on this project; therefore, the multibeam system settings were optimized for acquisition of bathymetry.

Backscatter data were recorded with HYSWEEP SURVEY in .7K format. These data were periodically reviewed to ensure function of the backscatter acquisition process. However, per the Project Instructions, OSI was not required to “process or create any additional backscatter products.” As such, these data are delivered in raw format in the “Backscatter” directory.

B.5 Data Processing

B.5.1 Software Updates

The following Feature Object Catalog was used: NOAA Extended Attribute object catalogue V 5.3.2.

Software versions described in Section A of the DAPR were used throughout acquisition and processing of data for Project OPR-J377-KR-15.

B.5.2 Surfaces

The following CUBE surfaces and mosaics were submitted to the Processing Branch:

Surface Name	Surface Type	Resolution	Depth Range	Surface Parameter	Purpose
H12734_MB_4m_MLLW_Final	CUBE	4 meters	5.13 meters - 20.00 meters	NOAA_4m	Set Line Spacing Coverage
H12734_MB_2m_MLLW_Final	CUBE	2 meters	18.00 meters - 20.25 meters	NOAA_2m	Complete MBES
H12734_MB_50cm_MLLW_B-003_Final	CUBE	0.5 meters	10.32 meters - 11.50 meters	NOAA_0.5m	Object Detection
H12734_MB_50cm_MLLW_B-005_Final	CUBE	0.5 meters	10.38 meters - 11.67 meters	NOAA_0.5m	Object Detection
H12734_MB_50cm_MLLW_B-006_Final	CUBE	0.5 meters	8.84 meters - 10.65 meters	NOAA_0.5m	Object Detection
H12734_MB_50cm_MLLW_B-008_Final	CUBE	0.5 meters	8.16 meters - 9.66 meters	NOAA_0.5m	Object Detection
H12734_MB_50cm_MLLW_B-025_Final	CUBE	0.5 meters	9.13 meters - 10.67 meters	NOAA_0.5m	Object Detection
H12734_MB_50cm_MLLW_B-030_Final	CUBE	0.5 meters	9.78 meters - 10.97 meters	NOAA_0.5m	Object Detection
H12734_MB_50cm_MLLW_B-033_Final	CUBE	0.5 meters	11.03 meters - 12.25 meters	NOAA_0.5m	Object Detection
H12734_MB_50cm_MLLW_B-058_Final	CUBE	0.5 meters	10.65 meters - 12.60 meters	NOAA_0.5m	Object Detection
H12734_MB_50cm_MLLW_B-064_Final	CUBE	0.5 meters	6.32 meters - 11.69 meters	NOAA_0.5m	Object Detection
H12734_MB_50cm_MLLW_B-068_Final	CUBE	0.5 meters	7.11 meters - 11.95 meters	NOAA_0.5m	Object Detection
H12734_MB_50cm_MLLW_B-069_Final	CUBE	0.5 meters	11.19 meters - 13.30 meters	NOAA_0.5m	Object Detection

Surface Name	Surface Type	Resolution	Depth Range	Surface Parameter	Purpose
H12734_MB_50cm_MLLW_B-070_Final	CUBE	0.5 meters	10.90 meters - 12.14 meters	NOAA_0.5m	Object Detection
H12734_MB_50cm_MLLW_B-072_Final	CUBE	0.5 meters	11.92 meters - 13.17 meters	NOAA_0.5m	Object Detection
H12734_MB_50cm_MLLW_B-073_Final	CUBE	0.5 meters	12.73 meters - 14.63 meters	NOAA_0.5m	Object Detection
H12734_MB_50cm_MLLW_B-075_Final	CUBE	0.5 meters	10.23 meters - 11.33 meters	NOAA_0.5m	Object Detection
H12734_MB_50cm_MLLW_B-077_Final	CUBE	0.5 meters	13.18 meters - 14.31 meters	NOAA_0.5m	Object Detection
H12734_MB_50cm_MLLW_B-083_Final	CUBE	0.5 meters	9.74 meters - 13.29 meters	NOAA_0.5m	Object Detection
H12734_MB_50cm_MLLW_B-085_Final	CUBE	0.5 meters	11.48 meters - 13.55 meters	NOAA_0.5m	Object Detection
H12734_MB_50cm_MLLW_B-091_Final	CUBE	0.5 meters	13.60 meters - 16.24 meters	NOAA_0.5m	Object Detection
H12734_MB_50cm_MLLW_B-092_Final	CUBE	0.5 meters	14.68 meters - 17.30 meters	NOAA_0.5m	Object Detection
H12734_MB_50cm_MLLW_B-094_Final	CUBE	0.5 meters	10.57 meters - 13.47 meters	NOAA_0.5m	Object Detection
H12734_MB_50cm_MLLW_B-095_Final	CUBE	0.5 meters	14.02 meters - 16.16 meters	NOAA_0.5m	Object Detection
H12734_MB_50cm_MLLW_B-100_Final	CUBE	0.5 meters	11.87 meters - 14.31 meters	NOAA_0.5m	Object Detection
H12734_MB_50cm_MLLW_B-101_Final	CUBE	0.5 meters	13.23 meters - 14.53 meters	NOAA_0.5m	Object Detection

Surface Name	Surface Type	Resolution	Depth Range	Surface Parameter	Purpose
H12734_MB_50cm_MLLW_B-127_Final	CUBE	0.5 meters	10.45 meters - 12.94 meters	NOAA_0.5m	Object Detection
H12734_MB_50cm_MLLW_B-134_Final	CUBE	0.5 meters	13.30 meters - 14.49 meters	NOAA_0.5m	Object Detection
H12734_MB_50cm_MLLW_B-141_Final	CUBE	0.5 meters	7.10 meters - 11.19 meters	NOAA_0.5m	Object Detection
H12734_MB_50cm_MLLW_B-142_Final	CUBE	0.5 meters	10.60 meters - 11.51 meters	NOAA_0.5m	Object Detection
H12734_MB_50cm_MLLW_B-143_Final	CUBE	0.5 meters	12.62 meters - 13.48 meters	NOAA_0.5m	Object Detection
H12734_MB_50cm_MLLW_Lin_Obstn_Final	CUBE	0.5 meters	11.04 meters - 13.33 meters	NOAA_0.5m	Object Detection
H12734_SSS_100	SSS Mosaic GeoTiff	1 meters	-	N/A	100% SSS
H12734_SSS_200	SSS Mosaic GeoTiff	1 meters	-	N/A	200% SSS

Table 10: Submitted MBES and SSS Coverage Surfaces

Thirty-two (32) MBES CUBE surfaces and two (2) SSS mosaics comprise the total surfaces delivered with Survey H12734. To demonstrate MBES coverage requirements were met for Set Line Spacing, a 4-meter CUBE surface was generated for the entire survey area and finalized according to depth, with a depth range of 0 to 20 meters. To satisfy the MBES coverage requirement of Complete Multibeam coverage in depths over 20 meters, a 2-meter CUBE surface was generated for the entire survey area and then finalized according to depth such that the minimum depth range for the finalized 2-meter surface was 18 meters, per Section 5.2.2.2 in the HSSD. Thirty (30) small field sheets were generated over significant features and populated with 50-centimeter CUBE surfaces to demonstrate Object Detection coverage.

Two 1-meter SSS mosaics were submitted as GeoTIFFs to satisfy the SSS coverage requirements of 100% coverage and 200% coverage over charted feature disprovals. In addition, a higher resolution, 25-centimeter SSS mosaic image composed of all SSS lines was submitted in the ECW (Enhanced Compressed Wavelet) format to assist with the survey review.

C. Vertical and Horizontal Control

Additional information discussing the vertical or horizontal control for this survey can be found in the accompanying Horizontal and Vertical Control Report (HVCR) for Project OPR-J377-KR-15.

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) station served as datum control for this survey:

Station Name	Station ID
Pilots Station East, SW Pass, LA	876-0922

Table 11: NWLON Tide Station

A final verified tide file was created from verified tide data obtained from the CO-OPS website upon completion of survey operations. As documented in the HVCR, with CO-OPS approval OSI removed numerous short period "data spikes" from the verified tide data via application of a fourth-order, zero-lag, Butterworth low-pass filter. The source of the abundant data spikes is suspected to be wakes from passing ships as they enter Southwest Pass.

Discrete zoning methods were utilized to apply tide correctors in CARIS HIPS and SIPS. The survey area is located within Zones CGM131, CGM125, CGM123, CGM119 and CGM119a as provided in the preliminary tidal zoning scheme included with the project SOW. Based on the results of cross line analysis, the time and range factors as provided in the preliminary zoning scheme were adequate. Preliminary zoning, provided by CO-OPS, was accepted as the final zoning for Project OPR-J337-KR-15.

File Name	Status
8760922.tid	Final Approved

Table 12: Water Level File

File Name	Status
J377KR2015RevCORP.zdf	Final

Table 13: Tide Corrector File

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 16 North.

All data products, except the S-57 Final Feature File (FFF) are referenced to Latitude/Longitude, UTM Zone 16 North. The S-57 Final Feature File, H12734.FFF.000, is referenced to the World Geodetic System Datum of 1984 (WGS 84) as specified in Section 8.2 S-57 Format Features Deliverables of the HSSD.

All MBES and SSS line and item investigation position data were acquired using an Applanix POS-MV operating in Differential GPS (DGPS) mode. The unit was configured to receive USCG Differential beacon correctors from the English Turn, LA station. Differential beacon correctors from the Eglin Air Force Base station were used by the secondary navigation system (Trimble MS750) to facilitate real-time horizontal control confidence checks.

Prior to and during the course of the survey the accuracy of the primary positioning system was verified by means of a physical measurement to one of two horizontal control points established at the vessel's base of operation, the USCG Station in Venice, LA. Position confidence checks were accomplished, when possible, during fuel or weather stops. Refer to the DAPR and HVCR for additional details.

On one occasion, June 24, 2015 (DN 175), the English Turn, LA DGPS signal was lost for a period of less than 0.5 hours most likely due to thunderstorm activity between the DGPS station and the survey vessel. Operations were suspended during the outage until the signal was reacquired. Prior to recommencing operations, the position integrity alarm window was consulted as a confidence check to ensure that the POS-MV navigation solution was within expected accuracy limits in reference to the independently derived DGPS solution from the Trimble MS750.

The following DGPS stations were used for horizontal control:

DGPS Stations
English Turn, LA (primary), 293 kHz
Eglin Air Force Base, FL (secondary), 295 kHz

Table 14: USCG DGPS Stations used for Horizontal Control

D. Results and Recommendations

D.1 Chart Comparison

Chart comparisons were performed in CARIS HIPS/SIPS and Notebook using finalized BASE surfaces and contours and selected soundings. The latest editions of the NOAA NOS Raster Nautical Charts (RNC) and

Electronic Nautical Charts (ENC) were downloaded from the NOAA Office of Coast Survey website (http://www.nauticalcharts.noaa.gov/) weekly during survey operations, and after the survey was completed for final comparisons. The RNCs and ENCs used for final comparisons were downloaded on September 11, 2015 and are submitted with the survey deliverables.

Local Notice to Mariners (LNM) and Notice to Mariners (NM) spanning the period beginning at the date of issuance of the Hydrographic Project Instructions (April 23, 2015) and ending on August 26, 2015 were consulted in conjunction with the foregoing chart comparison.

The following sections adhere to the Descriptive Report sounding rounding system as described in Section 5.1.2 of the HSSD. Specifically, features described below having "precision" depths are presented in the following manner:

ff feet (mm.mm meters, ±t.tt TPU) where ff = depth expressed in feet (chart units) having been rounded based on the precise meters expression of the depth using the 0.75 round value rule.

mm.mm = depth expressed in meters
±t.tt = Total Propagated Uncertainty (TPU) expressed in meters

An example of this notation follows: 80 feet (24.58 meters, ±0.24 TPU).

During the chart comparison it was found that the least depth soundings for charted regions were on obstruction features; however, the chart comparisons documented below will discuss general seafloor changes, shoaling and deepening trends. All new or charted features identified, updated or disproved within Survey H12734 were addressed and attributed in the S-57 Final Feature File. For more information on the methodology that was used to build the FFF see Section B.2.5 Feature Verification in the DAPR.

An overview of the areas of change between charted depths and H12734 surveyed soundings is shown in Figure 21. The figure displays a difference surface made by subtracting a 10-meter resolution depth surface generated from the H12734 MBES data from a 250-meter resolution depth surface interpolated from the charted ENC soundings within the project area. Regions of shoaling are represented by positive depth differences and regions of deepening are represented by negative depth differences. The greatest amount of change was identified in the northeast corner of the survey area, where surveyed soundings were predominantly deeper than charted depths. A detailed description of each chart comparison follows.

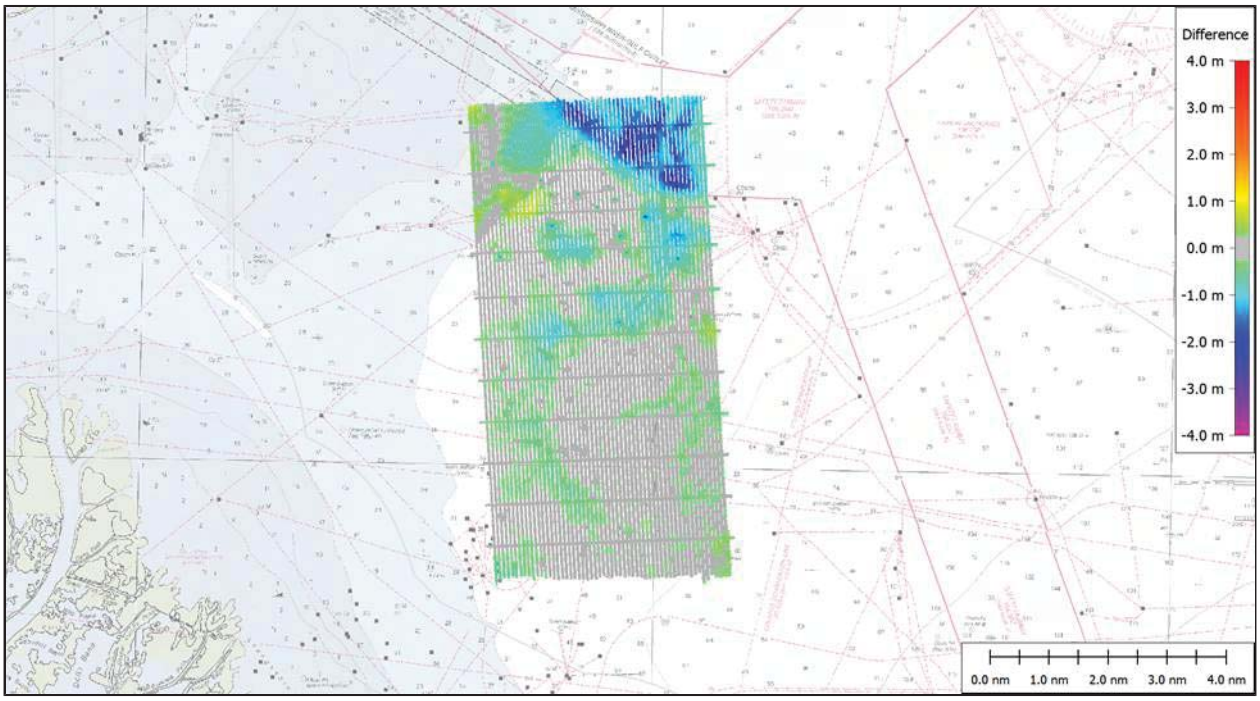


Figure 21: *A depth difference surface overlaid on RNCs 11363 and 11361 provides an overview of the areas of change between charted depths and H12734 surveyed soundings.*

D.1.1 Raster Charts

The following table summarizes pertinent epoch details about the largest scale RNCs assigned for the survey area.

Chart	Scale	Edition	Edition Date	LNM Date	NM Date
11353	1:40000	7	03/2014	08/04/2015	08/08/2015
11363	1:80000	44	02/2013	08/04/2015	08/08/2015
11361	1:80000	78	06/2015	08/04/2015	08/08/2015

Table 15: Largest Scale Raster Charts

11353

There is good agreement between the majority of surveyed and charted depths, with soundings differing by approximately 0 to 3 feet (0.9 meters). Surveyed depths are deeper than charted depths within the charted dump site and spoil area that intersect the northern part of the survey area. Surveyed depths within the Dump Site extending into the northeast corner of the survey area are 3 to 7 feet deeper than charted depths (Figure 22).

Charted information regarding the dump site include "Discontinued," "dredged material," and "Depths from surveys of 1922 - 2002."

A charted 29-foot shoal sounding located within the Dump Site at 29-25-24.68 N, 89-00-43.10 W was disproved with MBES coverage. The surrounding surveyed depths are 7 to 9 feet deeper than the charted 29-foot depth (Figure 23). The charted 30-foot contour encircling the shoal depth was also disproved.

A charted 30-foot shoal sounding located within the Dump Site at 29-25-34.24 N, 89-01-15.83 W was disproved with MBES coverage. Surveyed depths are 5 feet deeper than the charted 30-foot depth.

The 18-foot contour intersects the northwest corner of the H12734 survey area and surveyed depths confirm the charted contour's location. The charted 18-foot contour is delineated with a dashed line which, according to the NOAA publication U.S. Chart No. 1, indicates that it is an approximate depth contour.

The 30-foot contour intersects the northwestern portion of the H12734 survey area. Beginning where the contour intersects the western limit of the survey area and following from southwest to northeast, the surveyed depths agree with the charted contour location until the surveyed depth curve location begins to deviate west of the charted contour at the approximate location of 29-24-32.63 N, 89-02-40.72 W. Near the northern survey limit the surveyed 30-foot depth curve is positioned over 2.5 kilometers west of the charted contour (Figure 24). A portion of the charted 30-foot contour that intersects with Survey H12734 is charted with a dashed line that indicates it is an approximate depth contour.

The 60-foot contour intersects the southeastern portion of the H12734 survey area. The surveyed 60-foot depth curve intersects the charted 60-foot contour at the southern extent of RNC 11353, then the surveyed and charted 60-foot contour deviate significantly, with the surveyed depths indicating the 60-foot depth curve has migrated 1 kilometer east of the charted contour (Figure 25). The majority of the 60-foot contour on RNC 11353 that intersects with survey H12734 is charted as a dashed line, indicating it is an approximate depth contour.

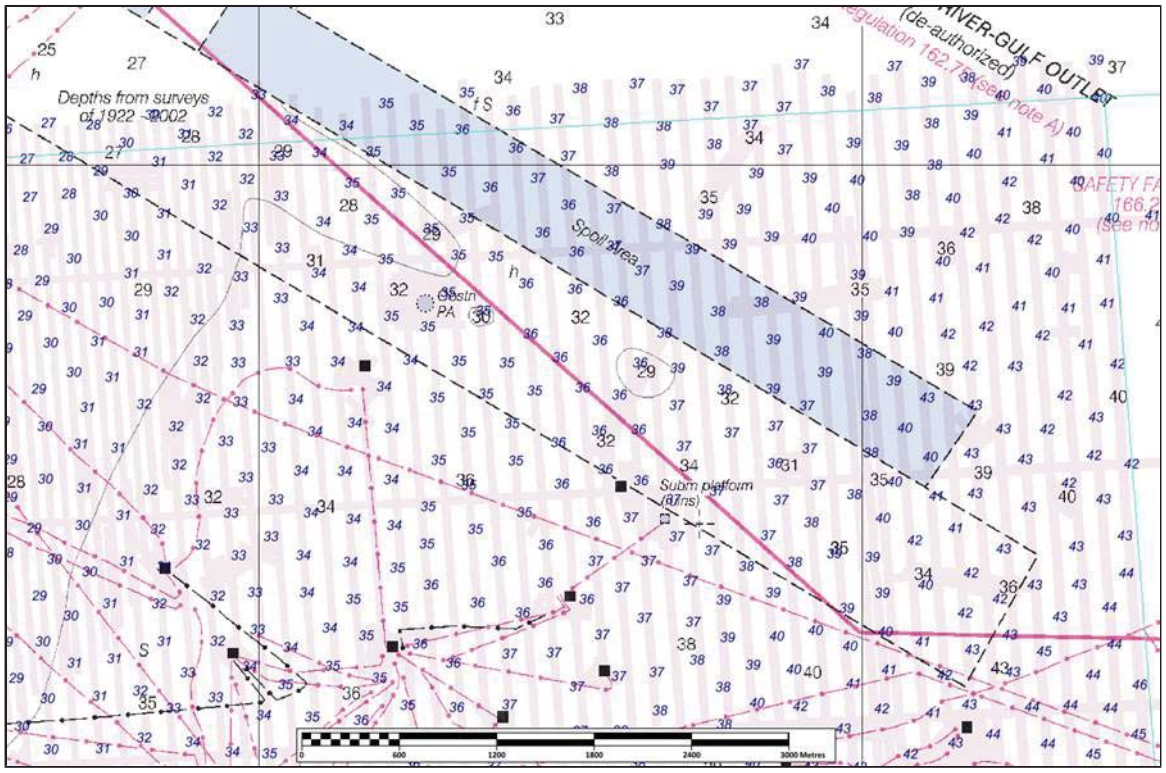


Figure 22: *Surveyed soundings shown in blue are overlaid on RNC 11353. Surveyed depths were consistently deeper than charted depths within and to the northeast of the charted Dump Site and Spoil Area. All depths are in feet. Survey H12734 MBES coverage extents are visible in the background as a transparent 4-meter CUBE surface.*

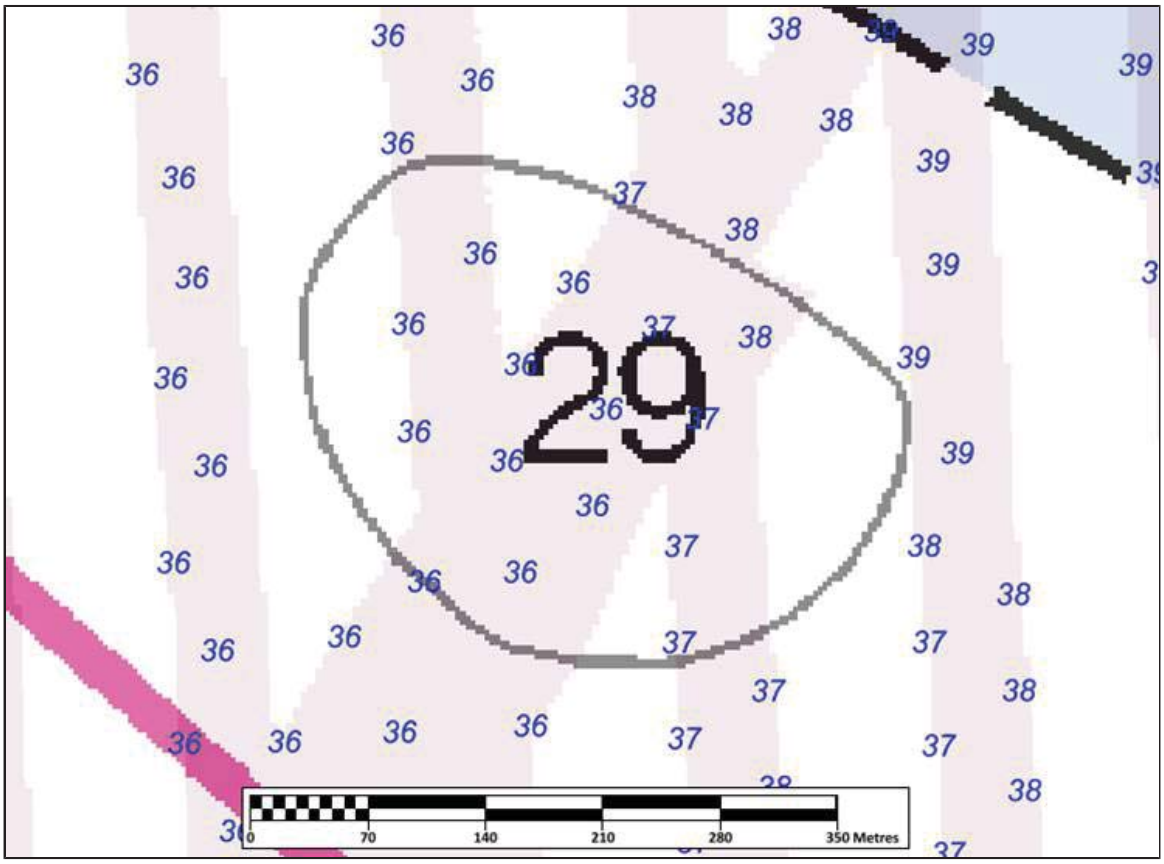


Figure 23: *Surveyed soundings shown in blue are overlaid on RNC 11353. A charted shoal sounding was disproved with MBES coverage. All depths are in feet. Survey H12734 MBES coverage extents are visible in the background as a transparent 4-meter CUBE surface.*

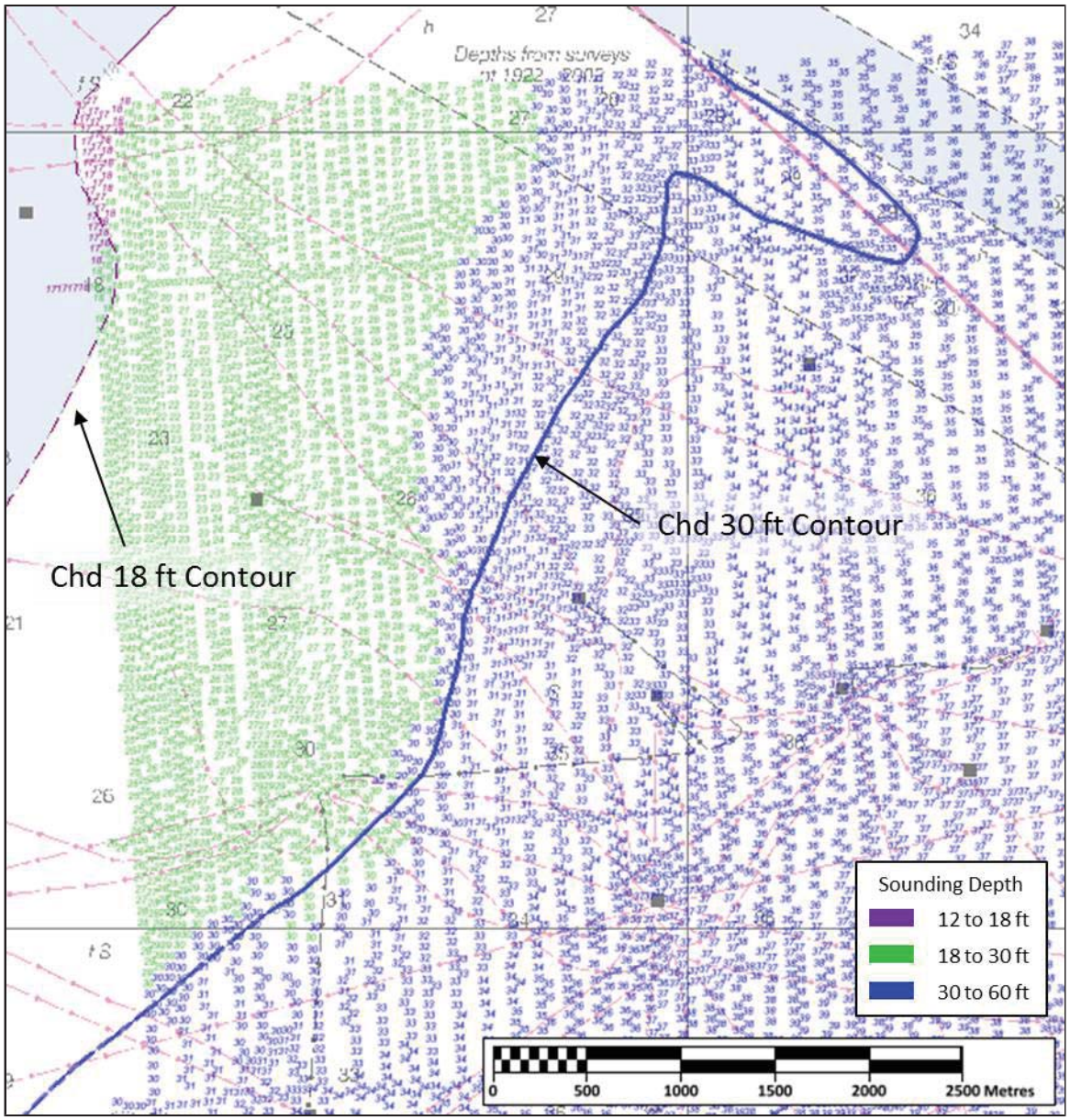


Figure 24: *Survey H12734 soundings colored by depth are overlaid on RNC 11353. The northern portion of the 30-foot contour that intersects the survey area has migrated over 2.5 kilometers west of its charted location. All depths are in feet.*

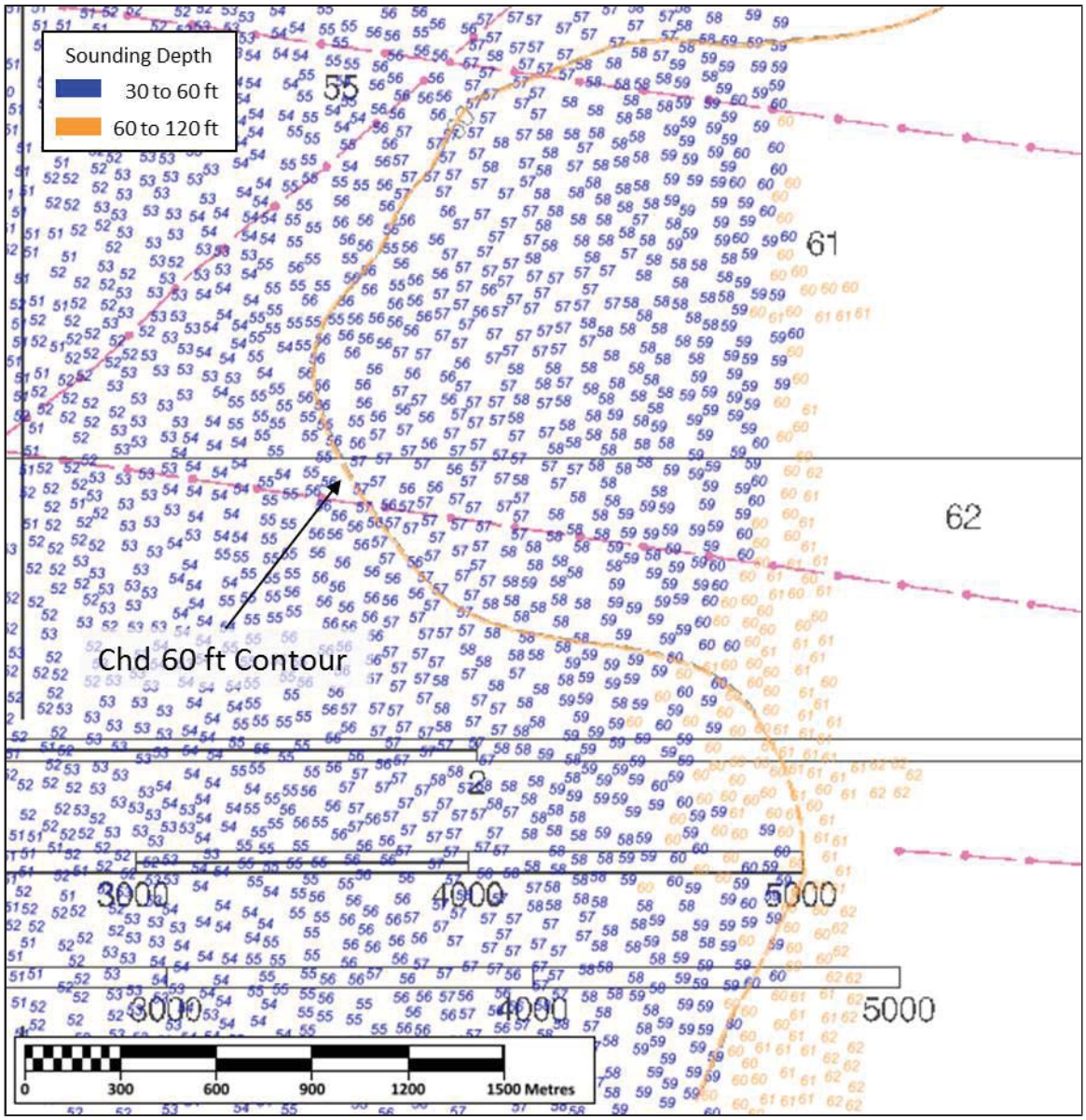


Figure 25: *Survey H12734 soundings colored by depth are overlaid on RNC 11353. In the southeastern section of the survey area, the 60-foot contour has migrated over 1 kilometer east of its charted location. All depths are in feet.*

11363

All the charted depths on RNC 11363 located within the H12734 survey area coincided with depths from the larger scale chart RNC 11353; therefore, the results from the chart comparison for RNC 11363 are nearly identical to those of the RNC 11353 chart comparison. The surveyed depths agree well with the charted depths except in the northeast portion of the H12734 survey area, where surveyed depths are deeper. On RNC 11363, the same 29-foot shoal charted on RNC 11353 was disproved with MBES coverage.

The aspect in which the chart comparisons differed is that the 60-foot contour on RNC 11363 shows good agreement with the surveyed depths, where the 60-foot contour on RNC 11353 is charted significantly west (Figure 26). The portion of the RNC 11363 60-foot contour that intersects with Survey H12734 is charted as a dashed line, indicating it is an approximate depth contour.

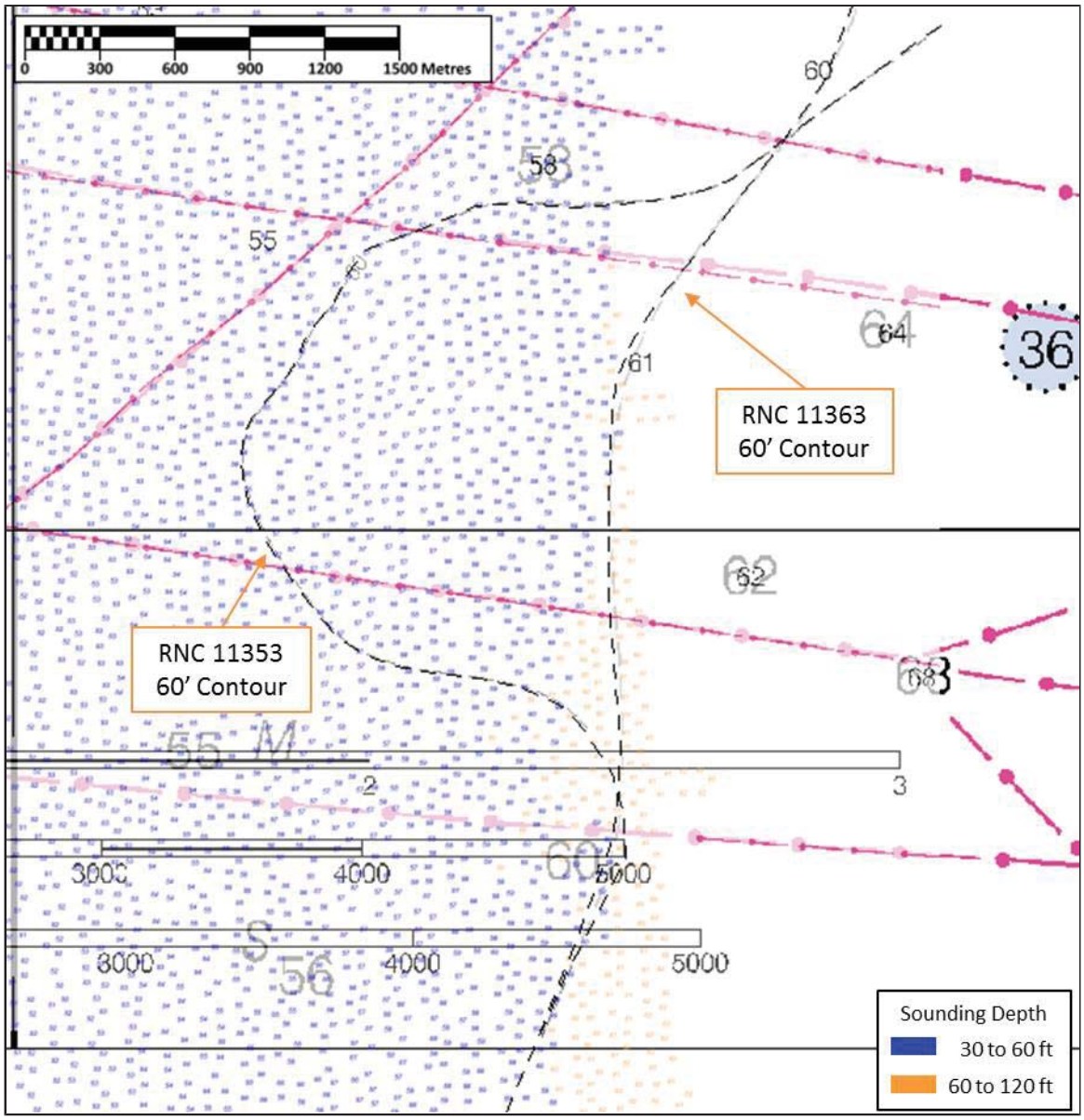


Figure 26: *Survey H12734 soundings colored by depth are overlaid on RNCs 11353 and 11363. The 60-foot contour as charted on RNC 11363 agrees well with the H12734 surveyed depths. There is a discrepancy between RNCs 11353 and 11363 regarding the charted 60-ft contour's location. All depths are in feet.*

11361

There is good agreement between the surveyed depths and the depths charted on RNC 11361, with soundings differing by 0 to 1 foot (0.3 meters). Surveyed depths also agree well with the RNC 11361 60-foot contour, an approximate depth contour.

D.1.2 Electronic Navigational Charts

The following table summarizes pertinent epoch details about the largest scale ENCs assigned for the survey area.

ENC	Scale	Edition	Update Application Date	Issue Date	Preliminary?
US5LA24M	1:40000	39	09/19/2014	09/09/2015	NO
US4LA33M	1:80000	27	08/21/2013	09/09/2015	NO
US4LA34M	1:80000	29	01/06/2015	09/16/2015	NO

Table 16: Largest Scale Electronic Charts

US5LA24M

RNC 11353 is the source for ENC US5LA24M; therefore, the positions and values of the soundings and contours included in ENC US5LA24M are identical to those charted on RNC 11353. All chart comparison notes entered under the RNC 11353 apply to US5LA24M.

US4LA33M

RNC 11361 is the source for ENC US4LA33M; therefore, the positions and values of the soundings included in ENC US4LA33M that coincide with H12734 are identical to those charted on RNC 11361. There is good agreement between the surveyed depths and the soundings from ENC US4LA33M, with soundings differing by 0 to 1 foot (0.3 meters). Surveyed depths also agree well with the ENC US4LA33M 60-foot contour, an approximate depth contour.

US4LA34M

RNC 11363 is the source for ENC US4LA34M; therefore, the positions and values of the soundings included in ENC US5LA34M that coincide with H12734 are identical to those charted on RNC 11363. All chart comparison notes entered under RNC 11363 apply to US4LA34M, except for the comment regarding the 60-foot contour. The charted 60-foot contour on ENC US4LA34M does not intersect with H12734.

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

An Obstn PA located at 29-25-36.04 N, 89-01-26.89 W positioned within a charted Dump Site was disproved with 200% SSS and Complete MBES coverage. No evidence of an obstruction was identified within or on the periphery of the area defined by a 100-meter search radius. It is recommended that the Obstn PA be removed from all charts.

A wreck PA located at 29-23-30.06 N, 88-59-29.98 W nearby a charted platform was disproved with 100% SSS and Complete MBES coverage. No evidence of a wreck was identified within or on the periphery of the area defined by a 100-meter search radius. It is recommended that the wreck PA be removed from all charts.

D.1.6 Uncharted Features

No uncharted features from miscellaneous sources were provided for investigation for Survey H12734. However, multiple new, uncharted obstructions were identified and are included in the S-57 Final Feature File. Several of the most navigationally significant obstructions are discussed below.

An obstruction with a least depth of 23 feet (7.10 m, ± 0.31 TPU) was developed with Object Detection MBES coverage at 29-24-38.19 N, 89-01-26.71 W. The obstruction, the shallowest depth surveyed in the surrounding area, appears to be a bent pipe protruding from the seafloor to a height of 12.8 feet (3.9 meters) (Figure 27). It is located in the vicinity of a charted platform, which is a focal point for a large number of charted pipelines. The obstruction's least depth is 11 to 15 feet shallower than the nearest charted soundings on the largest scale chart RNC 11353. It is included as an obstruction in the S-57 Final Feature File.

An obstruction with a least depth of 34 feet (10.57 m, ± 0.31 TPU) was developed with Object Detection MBES coverage at 29-25-30.86 N, 88-59-19.68 W, located inside a charted Safety Fairway. The obstruction's height above the seafloor was 7.5 feet (2.3 meters) and its least depth represented the shoal sounding surveyed in the surrounding area, the northeast corner of H12734 (Figure 28).

A new obstruction that has the appearance of a crane lattice was developed with Object Detection MBES coverage at 29-24-15.27 N, 89-02-49.26 W located between multiple charted pipelines. The obstruction's least depth of 27 feet (8.17 meters, ± 0.31 TPU) was located offshore of the charted 30-foot contour and represents the shoal depth for the surrounding area (Figure 29).

A linear obstruction with the appearance of an arched, 6.8-foot (2.1-meter) tall pipeline feature was located with MBES data at 29-21-57.55 N, 89-01-02.56 W. The obstruction's least depth is 36 feet (11.04 meters, + 0.33 TPU). It is not known whether the obstruction is a pipeline feature given that it is located over 300 meters west of the nearest charted pipeline. The feature was not investigated with object detection coverage; however, the acoustic shadow of the arched feature indicates that the feature's least depth was captured with the mainscheme MBES line (Figure 30). The obstruction's least depth is 4 to 9 feet shallower than the surrounding charted depths on the largest scale chart RNC 11353.

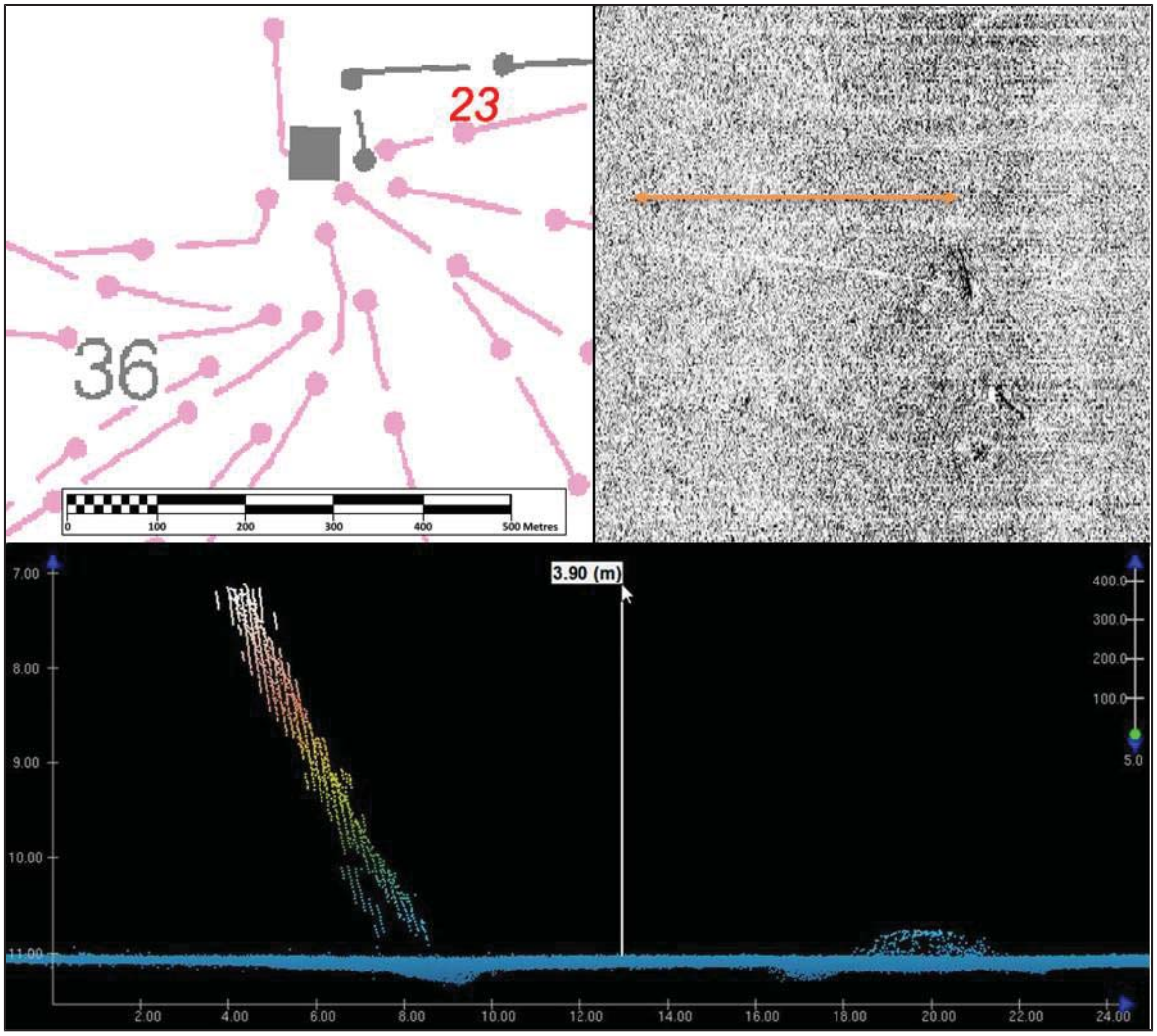


Figure 27: *A 12.8-foot tall obstruction, a possible broken pipeline feature, was positioned among multiple charted pipelines, with its least depth position (in feet) represented by the red sounding overlaid on RNC 11353 in the upper left image. Screengrabs of the pipe obstruction are also shown in the CARIS Side Scan Editor Waterfall (top right) and the Subset Editor 2D Window (bottom).*

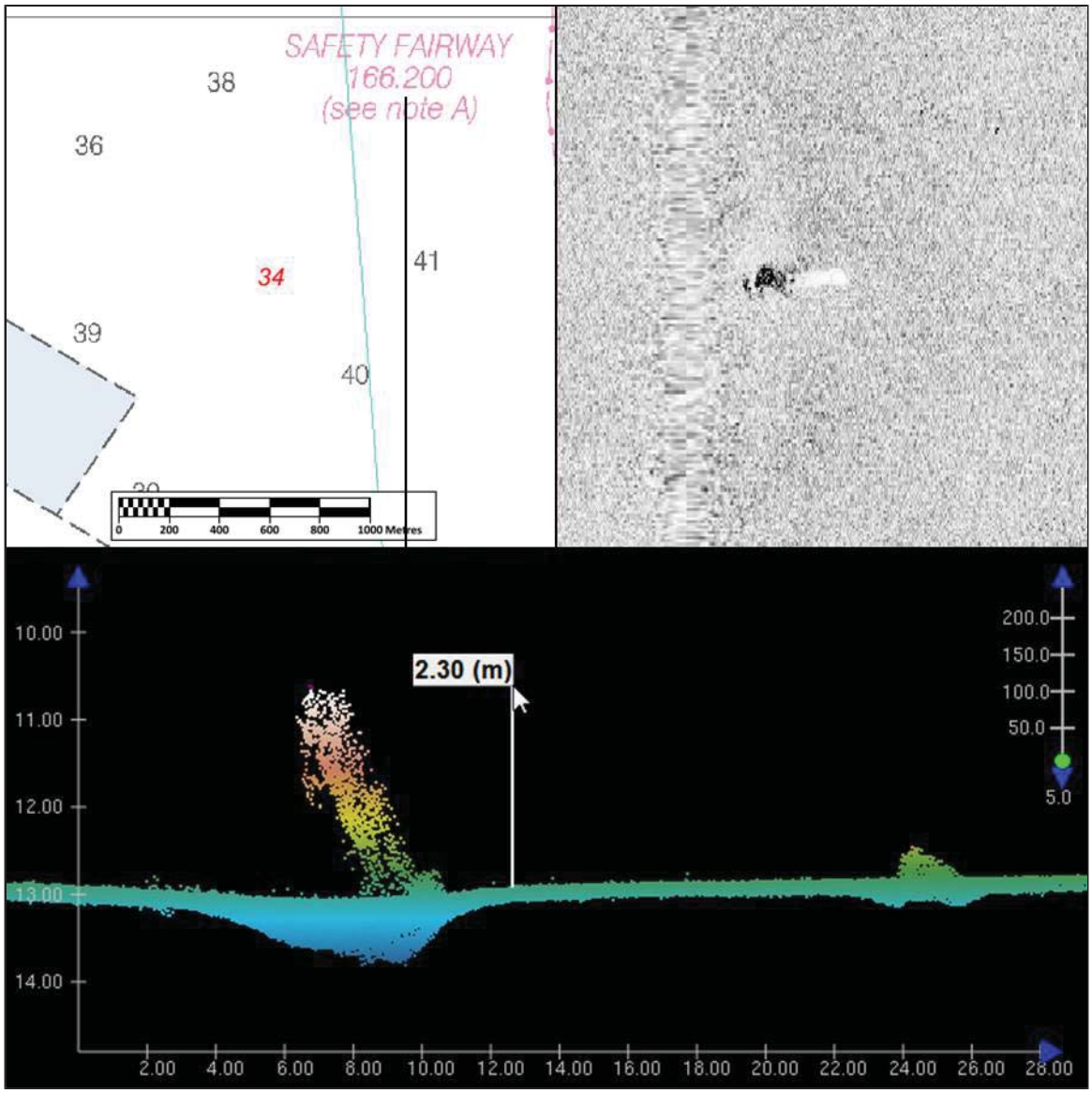


Figure 28: *A 7.5-foot tall obstruction, was positioned in the northeastern corner of H12734 within a Safety Fairway. In the upper left image, its least depth position (in feet) is represented by the red sounding overlaid on RNC 11353, with the eastern survey limit shown in cyan. Screengrabs of the obstruction are also shown in the CARIS Side Scan Editor Waterfall (top right) and the Subset Editor 2D Window (bottom).*

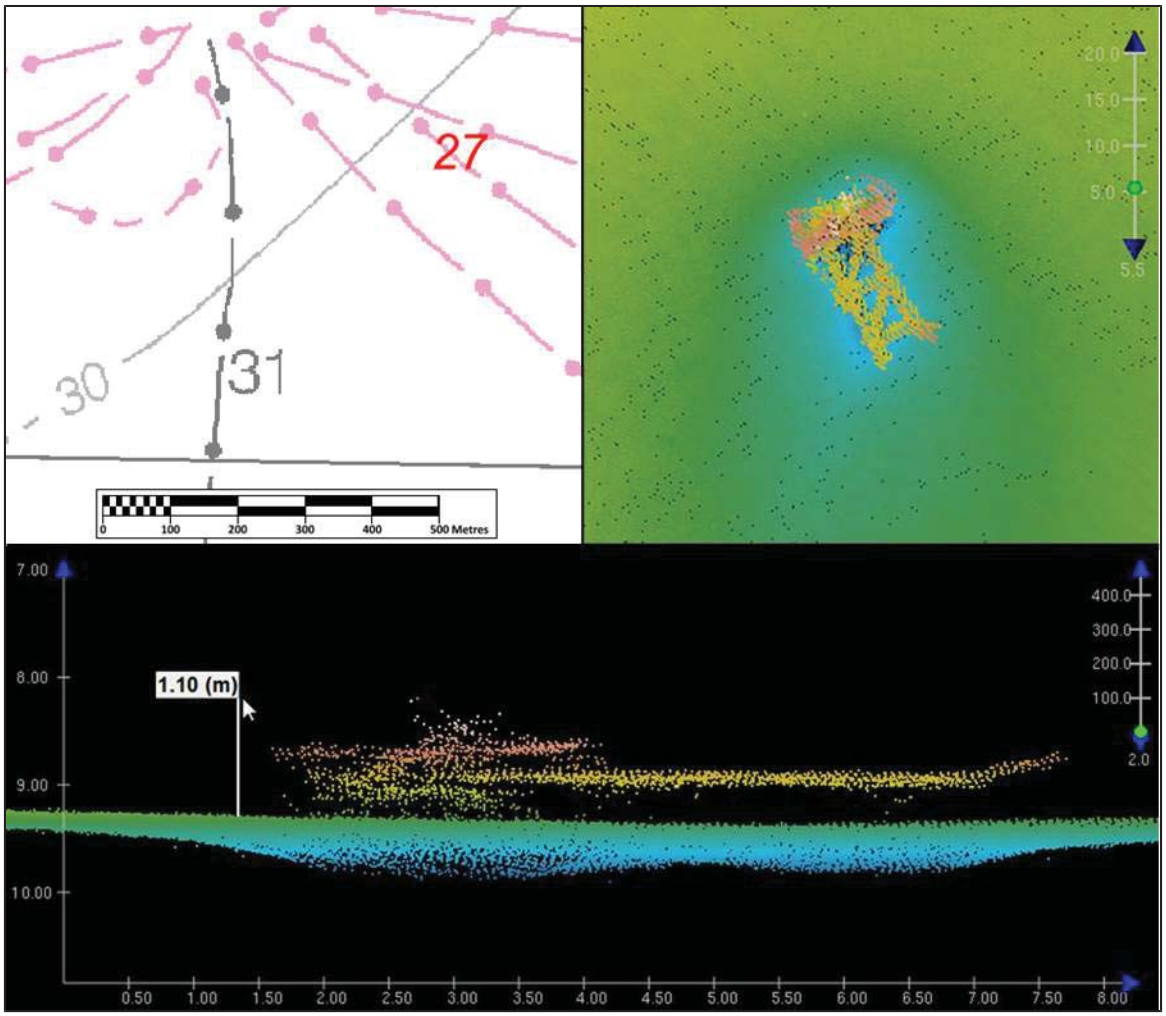


Figure 29: *An obstruction, a possible crane lattice feature, was positioned among multiple charted pipelines, its least depth position (in feet) is represented by the red sounding overlaid on RNC 11353 in the upper left image. Screengrabs of the obstruction are also shown in the CARIS Subset Editor 3D Window (top right) and the Subset Editor 2D Window (bottom).*

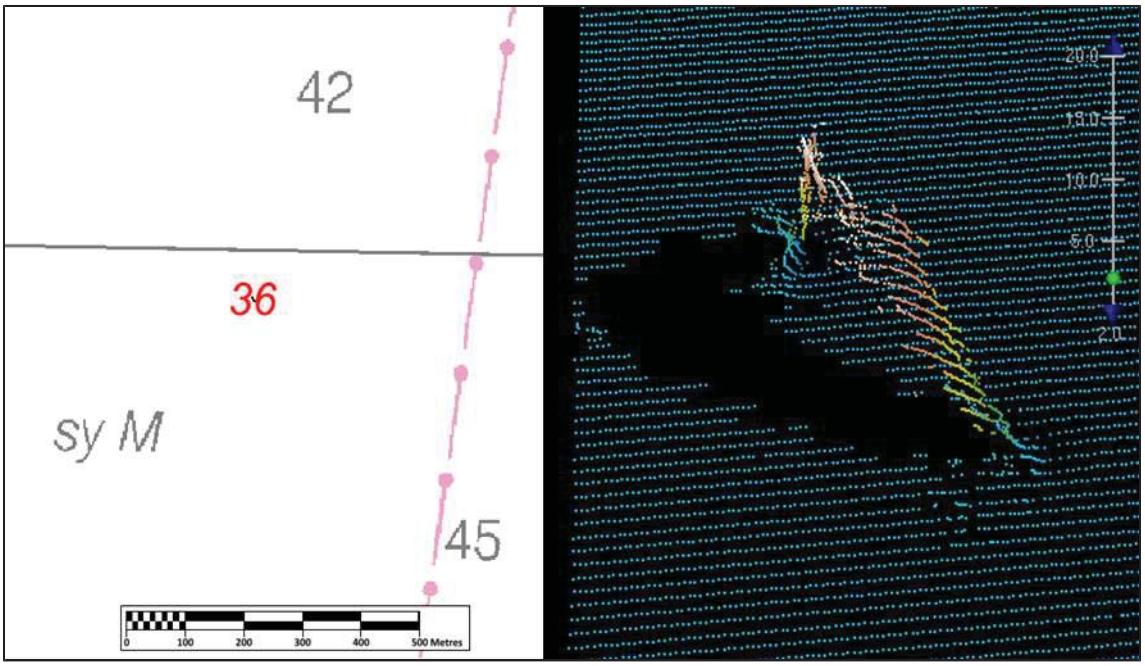


Figure 30: *A linear obstruction, a possible pipe feature was positioned over 300 meters west of the nearest charted pipeline. The image on the left, the obstruction's least depth (in feet) is represented by the red sounding overlaid on RNC 11353. On the right, a screengrab of the arched feature is displayed in CARIS Subset Editor with the soundings colored by depth.*

D.1.7 Dangers to Navigation

The following DTON reports were submitted to the processing branch:

DTON Report Name	Date Submitted
H12734_DtoN_1.000	2015-07-28
H12734_DtoN_2.000	2015-09-11
H12734_DtoN_3.000	2015-10-09

Table 17: DTON Reports

Three (3) Danger to Navigation (DtoN) S-57 files (.000) were submitted to the Atlantic Hydrographic Branch (AHB) for Survey H12734. All features submitted with the three DtoN files were possible exposed pipelines. The DtoN 1 submission include the most navigationally significant of the exposed pipeline features: two arched pipes that were 13 to 16 feet (4 to 5 meters) tall. Included in the three H12734 DtoNs are a total of ninety-one (91) possible exposed pipeline features that were submitted as DtoNs following guidance found in Section 8.1.3 of the 2014 HSSD which states that "Dangers to Navigation shall be recommended for," among other things, "Exposed or leaking submerged pipelines." AHB chose not to submit the pipeline DtoNs to the Marine Chart Division. AHB's reasoning, shared with OSI in an email pertaining to DtoN #1 and sent on July 29,

2015, holds true for all 91 of the H12734 DtoN features. The email states, "AHB will not be submitting these features to Nautical Data Branch and Marine Chart Division based upon the fact it does appear to be elevated pipelines and the location is on and/or near charted pipelines. The charted pipelines are linear obstructions and the chart includes a note to exercise caution in pipeline areas." AHB submitted the reported features to NOAA's Central Gulf Coast Navigation Manager Tim Osborn such that the information could be relayed to the proper authorities. See DR Appendix II for correspondence regarding the pipeline DtoN submissions.

The DtoNs are included in the H12734 S-57 Final Feature File, H12734.FFF.000. Danger to Navigation Reports are included in Appendix II of this report.

D.1.8 Shoal and Hazardous Features

A charted Dump Site and a charted Spoil Area, categorized as dumping ground areas (DMPGRD) in the ENCs, intersect with the northern sector of Survey H12734. The dumping grounds parallel the southern border of the Mississippi River-Gulf Outlet waterway. A deepening trend was surveyed within the Dump Site, which is charted as containing "dredged material" and described as "discontinued." Evidence of dredging spoils was not apparent in the survey data; however, a triangular obstruction was developed with object detection coverage within the Dumping Ground area located at 29-26-03.38 N, 89-01-59.68 W, with a least depth of 30 feet (9.13 m, ± 0.31 TPU).

A large Caution Area (CTNARE) encompassing the Mississippi River-Gulf Outlet is charted on RNC 11353, 11363, and ENC US5LA24M. The Caution Area intersects the northeast corner of H12734, overlapping the charted dump site and spoil area. For ENC US5LA24M, the INFORM field for the CTNARE feature states: "Mississippi River-Gulf Outlet (de-authorized) Regulation 33 CFR 162.75." Chapter 2, Part 162 of the Code of Federal Regulations (CFR) for Navigation and Navigable Waters covers Inland Waterways Navigation Regulations, and 162.75 covers "All waterways tributary to the Gulf of Mexico (except the Mississippi River, its tributaries, South and Southwest Passes and Atchafalaya River) from St. Marks, FL, to the Rio Grande." This note pertains to regulations regarding vessel operation within the waterway. No features or shoals were identified within the portion of the Caution Area that overlaps the H12734 survey area that would impede safe navigation within the Mississippi-River Gulf Outlet.

A second Caution Area encompasses all the affected charts within the OPR-J377-KR-15 project area. The CTNARE's Information field states: "Uncharted platforms, gas and oil well structures, pipes, piles and stakes can exist within the limits of this chart." The large number of exposed pipe features and multiple stake/pile-like obstructions that were identified with the MBES and SSS data within the H12734 survey data corroborated the caution area statement.

D.1.9 Channels

RNC 11363, RNC 11353, and ENC US4LA34M included a Safety Fairway (FAIRWY) for the Mississippi River-Gulf Outlet, a portion of which intersects H12734. No controlling depth is reported for the Safety Fairway, however, the H12734 survey depths within the charted fairway are 2 to 6 feet deeper than the charted depths. One obstruction, the 7.5 foot (2.3 meter) tall obstruction discussed in the Uncharted Feature section

above, was developed within the Fairway. The obstruction's least depth of 34 feet (10.57 m, ± 0.31 TPU) is 2 to 6 feet shallower than the surrounding charted depths.

D.1.10 Bottom Samples

Eight (8) bottom samples were acquired to determine bottom characteristics. Bottom samples were assigned in the PRF provided with the Hydrographic Survey Project Instructions. There were no deviations from the assigned bottom sampling plan. A position and description of each sample are provided as attributed SBDARE objects in the FFF. Digital images with identification reference numbers are submitted with the survey data and referenced in the NOAA extended attributes 'images' field.

D.2 Additional Results

D.2.1 Shoreline

No shoreline exists within this survey.

D.2.2 Prior Surveys

Prior survey data exists for this survey area. However, with the exception of the assigned junction surveys, prior data were not investigated.

D.2.3 Aids to Navigation

No Aids to navigation (ATONs) were located within the survey area.

D.2.4 Overhead Features

Overhead features do not exist for this survey.

D.2.5 Submarine Features

An abundance of charted pipelines are located within Survey H12734. Pipes colored magenta represent supply pipelines for oil, gas, chemicals, or water, and pipes colored black represent outfall and intake pipelines for water, sewer, outfall and intake, according to Chart No. 1: Nautical Chart Symbols, Abbreviations and Terms downloaded from the Office of Coast Survey (OCS) website (Figure 31).

None of the charted pipelines have a buried depth value (BURDEP). That being said, the majority of the charted pipelines were not visible in the SSS or MBES data.

Multiple linear contacts presumed to be exposed sections of charted pipelines were selected in the side scan records. Most were confirmed with MBES coverage. Some sections of pipeline had a measurable height above the seafloor while others had little to no vertical relief. All pipelines visible in the SSS record, were digitized in CARIS SIPS Side Scan Editor as linear pipeline contacts whether buried in a trench or lying exposed on the surface. As mentioned in the DtoN section of this report, 91 exposed pipeline sections were presented within three DtoN submissions for this survey. The exposed pipeline sections and relevant attribution are included in the H12734 S-57 Final Feature File.

Review of information contained in a shape file (.SHP) downloaded from the Bureau of Ocean Energy Management (BOEM) on October 3, 2014 suggests that there may be several uncharted pipelines within Survey H12734. The BOEM pipeline shape file that intersects with the OPR-J337-KR-15 project area was reprojected to UTM Zone 16N, NAD83 and saved as a .DXF file. The BOEM pipeline DXF file was then visually compared to the charted pipelines within the project area to identify any uncharted BOEM pipelines. Figure 32 provides an overview of the disparity between charted and BOEM-defined pipelines within Survey H12734.

The shape file, "ppl_arcs.shp" and re-projected .DXF file, "Pipelines_UTM_16N_NAD83_Meters.dxf" are included with the digital deliverables along with the RNC/ENC charts considered in the chart comparison. BOEM pipeline data were obtained at the following web address:

http://www.data.boem.gov/homepg/data_center/mapping/geographic_mapping.asp.

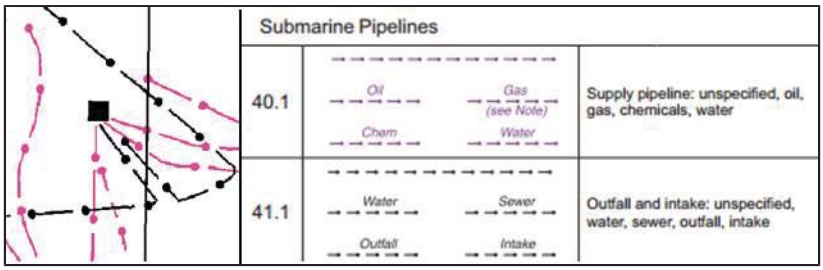


Figure 31: *On the left, an example of charted pipelines from RNC 11353. On the right, a screen grab from Chart No. 1, Section L Offshore Installations, explains the NOAA chart symbols for the submarine pipelines encountered within Survey H12734.*

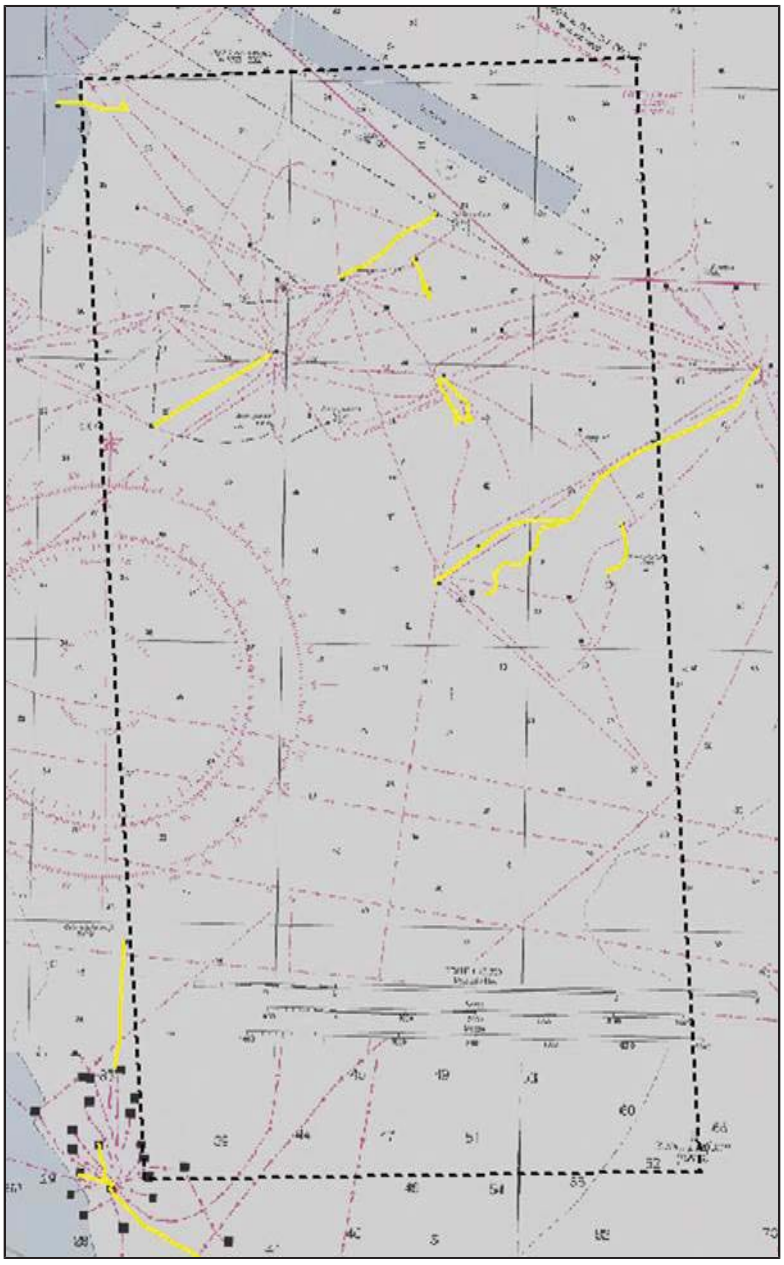


Figure 32: *The yellow lines represent BOEM-defined pipelines that are not depicted on RNCs 11353, 11363, and 11361.*

D.2.6 Ferry Routes and Terminals

No ferry routes or terminals are located within the survey.

D.2.7 Platforms

Thirty “assigned” platforms were included in the Composite Source File (CSF). Twenty-five (25) of the platforms were verified visually on the surface and positioned with SSS and/or MBES coverage. New positions are recommended for six (6) of the charted platforms, where the difference between the platform's surveyed position and its charted position was greater than 2mm at the scale of the survey (e.g. 40m for 1:20,000). Of the six platforms with updated positions, the charted platform point symbol at 29-24-04.36 N, 89-02-05.08 W did not capture the full extent of the expansive 3-towered platform connected by pedestrian walkways. It is recommended that the expansive platform be represented by two platform point symbols located at the surveyed positions of the eastern and western platform towers (Figure 33).

During a pre-survey chart review, an additional charted platform was identified on RNC 11363 and ENC US4LA34M at position 29-25-58.16 N, 89-02-25.14 W. The platform was not charted on the largest scale charts for the area: RNC 11353 and ENC US5LA24M. This platform was not assigned in the project Composite Source File (CSF); however, it was investigated by the field team and disproved with 200% SSS coverage. It is recommended that the platform be removed from RNC 11363 and ENC US4LA34M.

All five (5) of the charted submerged platforms were disproved with Complete MBES coverage.

For specific information regarding each verified, updated, or deleted platform see the FFF. Existing platform pictures are included under the NOAA Extended Attribute "images."

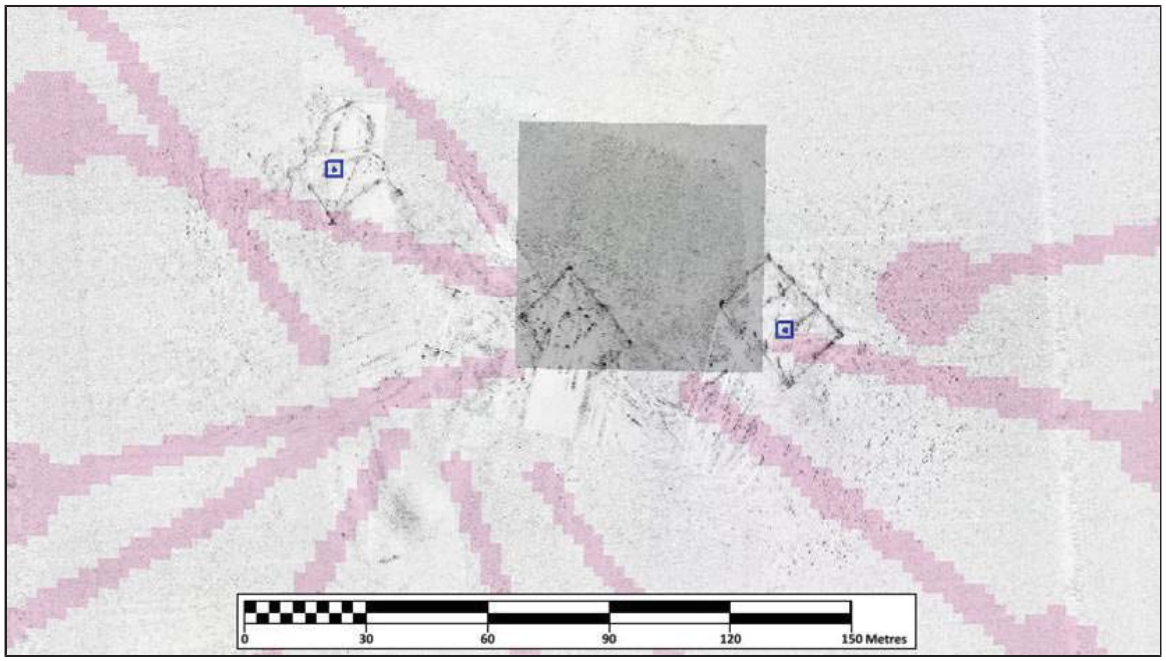


Figure 33: *The surveyed positions of the three-towered platform visible in a SSS mosaic are shown in respect to the charted platform position on RNC 11353, with the recommended new platform positions shown in blue.*

D.2.8 Significant Features

No features of unusual or unique scientific value exist for this survey.

D.2.9 Construction and Dredging

No construction or dredging was encountered within the survey limits.

D.2.10 New Survey Recommendation

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

D.2.11 New 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
Data Acquisition and Processing Report	2015-11-19
Horizontal and Vertical Control Report	2015-11-19

Approver Name	Approver Title	Approval Date	Signature
George G. Reynolds	Chief of Party	11/19/2015	

Digitally signed by George G. Reynolds
Date: 2015.11.17 17:48:10 -05'00'

APPENDIX I

TIDES AND WATER LEVELS

The following table summarizes the days in which data were collected that contribute to the final accepted data set.

Table 1
Abstract of Times of Hydrography

Date	Day Number	Min. Time UTC	Max. Time UTC
06/19/2015	170	18:25:49	21:42:00
06/20/2015	171	20:14:54	23:46:21
06/21/2015	172	00:40:37	18:29:55
06/28/2015	179	22:29:44	23:53:04
06/29/2015	180	00:43:43	23:52:57
06/30/2015	181	00:28:58	23:52:59
07/01/2015	182	00:30:47	23:48:50
07/02/2015	183	00:33:57	11:09:06
07/05/2015	186	19:14:21	23:52:34
07/06/2015	187	04:45:31	23:56:17
07/07/2015	188	00:42:09	17:08:30
07/08/2015	189	00:23:12	23:55:18
07/09/2015	190	00:35:53	23:56:55
07/10/2015	191	00:30:15	22:06:48
07/11/2015	192	15:03:20	16:20:22
07/12/2015	193	11:38:15	12:02:42
07/13/2015	194	20:24:41	23:51:17
07/14/2015	195	00:18:48	22:53:38
07/15/2015	196	00:48:07	07:28:40
07/16/2015	197	02:02:11	12:02:02
07/19/2015	200	02:07:00	23:54:41
07/20/2015	201	00:29:38	23:53:17
07/21/2015	202	00:16:09	02:14:19
07/23/2015	204	11:55:36	13:22:16
07/24/2015	205	00:58:05	23:53:29
07/25/2015	206	00:33:02	23:49:40
07/26/2015	207	00:20:37	01:13:44

Water level data from NOS-NOAA tide station 876-0922, Pilots Station East, SW Pass, LA was used for vertical control. Predicted tide files were used during preliminary processing. Preliminary tides from the Pilots Station East station were downloaded and reviewed for data gaps. Verified tides were downloaded and reviewed when available.

The Verified tide curve contains numerous short period "data spikes" of relatively large magnitude, e.g. some spikes were over 50% of the total range of tide on a given day. While the true cause of the data spikes is not know it is suspected that wakes caused by passing ships are to blame. With CO-OPS approval OSI removed the spurious tide data via application of a fourth-order, zero-lag, Butterworth low-pass filter using a sampling frequency of 120 with a cut-off frequency of 5. The e-mail chain regarding verified tide data filtering is included below and also in DR Appendix II along with other key project correspondence.

Final project data are delivered with filtered, verified tides applied using the zoning file "J377KR2015RevCORP.zdf" provided by CO-OPS and verified by OSI.

Based on the results of cross line analysis, it appears that the time and range factors as provided in the preliminary zoning scheme are adequate in light of the tide error budget for this project which is defined in the Tides SOW as 0.30 meters.

Coordinated Universal Time (UTC) was used to annotate the tide records and all other data obtained in this project.

Table 2
Tide Zones Associated with Project OPR-J377-KR-15

Zone	Time Correction	Range Correction
CGM228	+12	1.01
CGM115	+24	1.01
CGM116	+24	1.05
CGM119	+36	1.01
CGM120	+36	1.09
CGM119a	+30	0.97
CGM123	+48	1.01
CGM124	+48	1.09
CGM125	+60	1.01
CGM131	+66	1.01
CGM100	+78	1.05
CGM101	+90	1.05
CGM102	+102	1.09
CGM103	+114	1.09

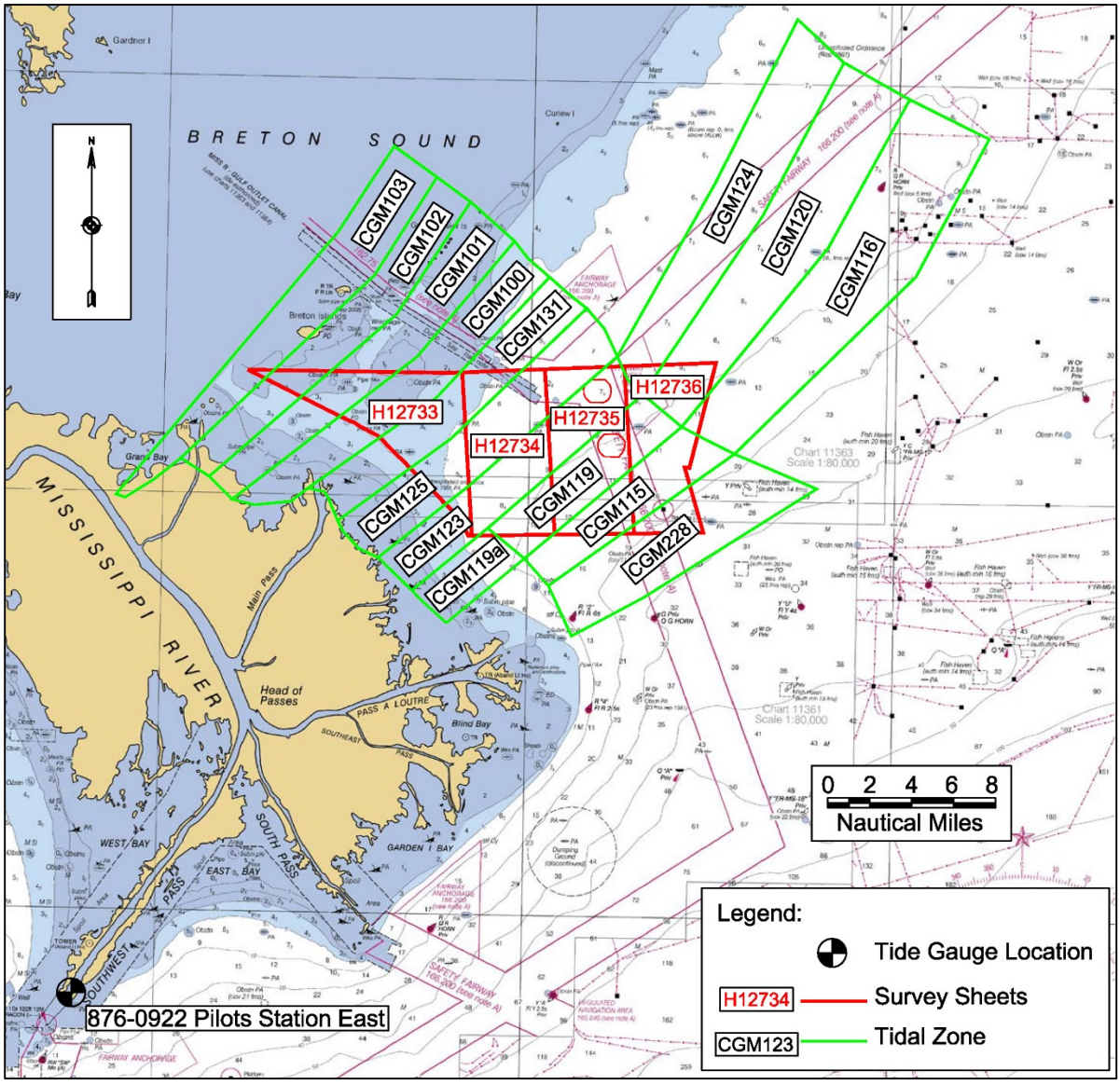


Figure 1. Project survey boundaries (red lines), tidal zone boundaries (green lines), and the Pilots Station East, LA tide station location.

E-mail Chain Regarding Verified Tide Data Filtering

From: Paul Turner - NOAA Federal <paul.turner@noaa.gov>
Date: 09/03/2015 10:39 AM (GMT-05:00)
To: David Somers <dts@oceansurveys.com>, George Reynolds <ggr@oceansurveys.com>
Cc: Katrina Wyllie - NOAA Federal <Katrina.Wyllie@noaa.gov>, Michael Gonsalves - NOAA Federal <michael.gonsalves@noaa.gov>
Subject: Re: Pilots Station gauge data

Hi Dave-

I've received a feed-back from CO-OPS regarding your tides questions and have copied it below:

'OSI may proceed with using the filtered data set for Pilots Station East. The filtered data

captures the tide signal well' Please let me know if you have any other questions.

Paul

From: Paul Turner - NOAA Federal <paul.turner@noaa.gov>
To: David Somers <dts@oceansurveys.com>
Cc: "Katrina.Wyllie@noaa.gov" <Katrina.Wyllie@noaa.gov>; George G. Reynolds <ggr@oceansurveys.com>
Sent: Tuesday, September 1, 2015 1:42 PM

Subject: Re: Pilots Station gauge data

HI Dave-

I forwarded you request over to CO-OPS last week and will follow-up with them to check on this.

I will forward the response to you as soon I hear back from them.

Paul

On Tue, Sep 1, 2015 at 9:18 AM, David Somers <dts@oceansurveys.com> wrote: Hi Paul,

Has CO-OPs had a chance to review our smoothed tides? We'd like to apply final tides as soon as possible.

Thanks,
Dave

From: David Somers <dts@oceansurveys.com>
To: "paul.turner@noaa.gov" <paul.turner@noaa.gov>; "Katrina.Wyllie@noaa.gov" <Katrina.Wyllie@noaa.gov>
Cc: George G. Reynolds <ggr@oceansurveys.com>; Bonnie Johnston <blj@oceansurveys.com>
Sent: Friday, August 21, 2015 12:12 PM
Subject: Re: Pilots Station gauge data

Hi Paul,

OSI would like CO-OPS to review our application of a low pass filter to the Pilots Station East (8760922) data.

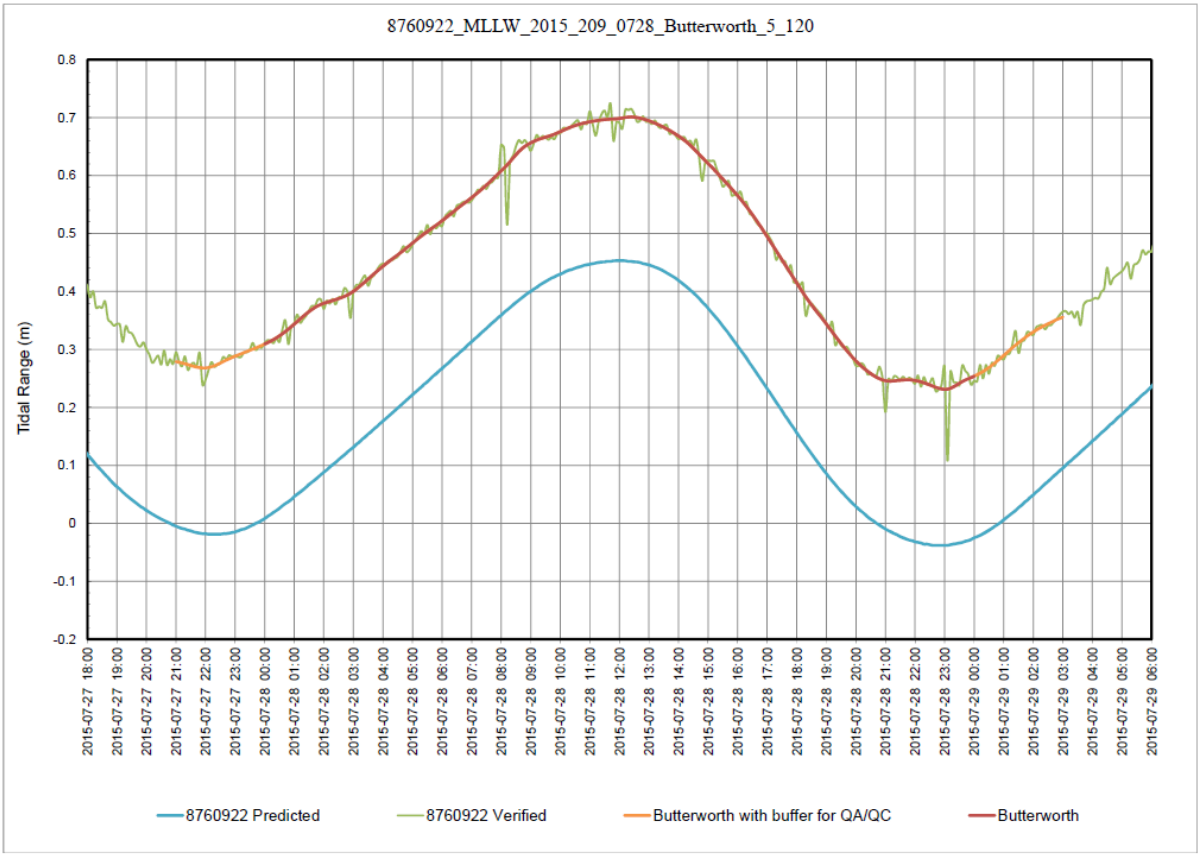
We applied a fourth-order zero-lag Butterworth low-pass filter on the Pilots Station East, LA (8760922) verified 6-minute MLLW water level data using a sampling frequency of 120 with a cut-off frequency of 5 to produce final processed data. It is our intent to use the filtered data in conjunction
with the project tidal zoning scheme provided by CO-OPS.

Attached is a PDF with daily tide graphs for the duration of our survey and a zip file containing unfiltered and filtered 6 min ASCII data in *.tid
format.

Please let me know if you need anything else or have questions.

Thanks,
Dave

Example of daily tide graph included in this e-mail chain.



-----Original Message-----
From: Paul Turner - NOAA Federal [mailto:paul.turner@noaa.gov] Sent:
Tuesday, May 5, 2015 1:56 PM
To: George Reynolds <ggr@oceansurveys.com>
Cc: Katrina Wyllie - NOAA Federal <Katrina.Wyllie@noaa.gov>; Michael Gonsalves
- NOAA Federal <michael.gonsalves@noaa.gov>
Subject: Pilots Station gauge

Hi George-

Do you have a few minutes to talk about the Tides question you had for the Brenton Sound project. We heard back from CO-OPS regarding your proposed approach of applying a low pass filter through the data for the Pilots
Station gauge which is acceptable.

Let me know what you'd like to do and I can be reached at 301-713-2777 ext 153 if you'd like to discuss this.

Paul
--
Paul Turner Program
Analyst

Tides Statement of Work

STATEMENT OF WORK
OPR-J377-KR-2015 Vicinity of Breton Sound, LA (Revised)
(12/09/2014 HY)

1.0. TIDES AND WATER LEVELS

1.1. Specifications

Tidal data acquisition, data processing, tidal datum computation and final tidal zoning shall be performed utilizing sound engineering and oceanographic practices as specified in National Ocean Service (NOS) Hydrographic Surveys Specifications and Deliverables (HSSD), dated April 2014.

1.2. Vertical Datums

The tidal datums for this project are Chart Datum, Mean Lower Low Water (MLLW) and Mean High Water (MHW). Soundings are referenced to MLLW and heights of overhead obstructions (bridges and cables) are referenced to MHW.

1.2.1. The Hydro Hot List (HHL)

Please contact CO-OPS' Hydrographic Planning Team (HPT) at nos.coops.hpt@noaa.gov and CO-OPS' Operational Engineering Team (OET) at nos.coops.oetteam@noaa.gov at least three business days before survey operations begin, and within 1 business day after survey operations are completed so that the appropriate CO-OPS National Water Level Observation Network (NWLON) control water level station(s) is/are added to or removed from the CO-OPS Hydro Hotlist (HHL) (http://tidesandcurrents.noaa.gov/hydro). Include start and end survey dates, full project number (e.g. OPR-H355-TJ-10), and control and subordinate station numbers. The notification must be sent to both teams.

Station	Station ID	Control or Subordinate	Type (e.g. NWLON, PORTS©, etc)	Comment
Pilots Station East, LA	8760922	Control	NWLON	

Table 1: All stations that need to be added to the HHL in support of OPR-J377-KR-2015 (Revised)

It is important to know that the addition of a water level station to the HHL ensures the station is monitored by CORMS and any problems are reported daily. However, platforms should view the HHL each morning of active survey operations and click on the "Plot" to double check that there are not problems with the required stations on that day. If a platform notices problems with data on their survey day of operation, please contact HPT at nos.coops.hpt@noaa.gov, CORMS at CORMS@noaa.gov, and their respective headquarters point of contact at HSD or NSD. Stations on the HHL are given priority for maintenance should a station cease normal operation during scheduled times of hydrography. CO-OPS will notify a field unit within 1 business day if a HHL water level station ceases operation during scheduled times of hydrography. This is in addition to the daily CORMS report that CORMS sends to NOAA field units, if the field unit's e-mail address is added to

the CORM's daily e-mail list. To be added to the CORMS daily HHL report, the platform should contact CO-OPS' Data Monitoring and Analysis Team (DMAT) at nos.co-ops.dmat@noaa.gov and request to be added.

If the stations are listed on HHL, then weekly priority processing will occur and, for those water level stations, verified 6-minute water level data will be made available every week on Monday or Tuesday. If Monday happens to be a federal holiday, then the 6-minute verified water level data will be made available on the following Tuesday or Wednesday. In order to ensure that verified data is correctly downloaded please **select a date that is more than 7 days prior to the day of interest** in the 'From' field on the CO-OPS website.

1.3. Tide Reducer Stations

The operating water level station at Pilots Station East, LA (8760922) will provide water level reducers for this project. Therefore it is critical that it remains in operation during the survey.

1.3.1. CO-OPS Long Term Water Level Station Operation and Maintenance

During periods of hydrography, CO-OPS is only responsible for the operation and maintenance of NWLON control stations and the contractor is responsible for the maintenance and operations of all contractor installed (tertiary) stations. The contractor is required to monitor the NWLON control water level data via the CO-OPS website at http://tidesandcurrents.noaa.gov/hydro.shtml or through regular communications with the OCS COTR or the OCS COTR's CO-OPS authorized point of contact (Colleen Fanelli at 301-713-2877 ext. 167 or via email: nos.coops.hpt@noaa.gov) before and during operations. The OCS COTR or the COTR's CO-OPS authorized point of contact (Colleen Fanelli) will serve as liaison between the contractor and NOS/CO-OPS to confirm operation of this station and to ensure the acquisition of NWLON control water level data during periods of hydrography. Problems or concerns regarding the acquisition of valid water level data identified by the contractor shall be communicated with the OCS COTR or the COTR's CO-OPS authorized point of contact (Colleen Fanelli) to coordinate the appropriate course of action to be taken such as gauge repair and/or developing contingency plans for hydrographic survey operations.

1.3.2. Subordinate Station Requirements

No subordinate water level stations are required for this project; however, supplemental and/or back-up water level stations may be necessary depending on the complexity of the hydrodynamics and/or the severity of the environmental conditions of the project area. The installation and continuous operation of water level measurement systems (tide gauges) at subordinate station locations are left to the discretion of the contractor, subject to the approval of the COTR. If the contractor decides to install additional water level stations, then a 30-day minimum of continuous data acquisition is required. For all subordinate stations, data must be collected throughout the entire survey period for which they are applicable, and not less than 30 continuous days. This is necessary to facilitate the computation of an accurate datum reference as per NOS standards.

1.3.3. Tide Component Error Estimation

The estimated tidal error contribution to the survey area is 0.30 meters at the 95% confidence level, and includes the estimated gauge measurement error, tidal datum computation error, and tidal zoning error. Based on this analysis no subordinate stations will be required. It should be noted that the tidal

error component can be significantly greater than stated if a substantial meteorological event or condition should occur during time of hydrography.

1.3.4. Water Level Records: If subordinate water level stations are installed, submit water level data, such as leveling records, field reports, and any other relevant data/reports, including the data downloaded onto diskette/CD as specified in the latest version of the NOS Specifications and Deliverables document.

1.3.4.1. Water level records should be forwarded to the following address:

NOAA/National Ocean Service/CO-OPS
Chief, Engineering Division
N/OPS1 - SSMC4, Station 6531
1305 East-West Highway
Silver Spring, MD 20910

1.3.5. This section is not applicable to this project.

1.3.5.1. This section is not applicable to this project.

1.3.6. This section is not applicable to this project.

1.4. Zoning

1.4.1. The water level station at Pilots Station East, LA (8760922) is the reference station for predicted tides for hydrography in the vicinity of Breton Sound, LA. The time and height correctors listed below for applicable zones should be applied to the predicted tides at the station indicated during the acquisition and preliminary processing phases of this project.
Preliminary data may be retrieved in one month increments over the Internet from CO-OPS SOAP web services at http://opendap.co-ops.nos.noaa.gov/axis/text.html. The contractor must notify the COTR or the COTR's authorized representative immediately of any problems concerning the predicted tides. Preliminary data are six-minute time series data relative to MLLW in metric units on Greenwich Mean Time. For the time corrections, a negative (-) time correction indicates that the time of tide in that zone is earlier than (before) the predicted tides at the reference station. A positive (+) time correction indicates that the time of tide in that zone is later than (after) the predicted tides at the reference station. For height corrections, the water level heights **relative to MLLW** at the reference station are multiplied by the range ratio to estimate the water level heights relative to MLLW in the applicable zone.

Zone	Time Corrector (min)	Range Ratio	Predicted Reference Station
CGM100	+78	x1.05	8760922
CGM101	+90	x1.05	8760922
CGM102	+102	x1.09	8760922
CGM103	+114	x1.09	8760922
CGM115	+24	x1.01	8760922
CGM116	+24	x1.05	8760922
CGM119	+36	x1.01	8760922
CGM119a	+30	x0.97	8760922

CGM120	+36	x1.09	8760922
CGM123	+48	x1.01	8760922
CGM124	+48	x1.09	8760922
CGM125	+60	x1.01	8760922
CGM131	+66	x1.01	8760922
CGM228	+12	x1.01	8760922

1.4.2. Polygon nodes and water level corrections referencing Pilots Station East, LA (8760922) are provided in ASCII format denoted by a *.zdf extension file name. Zoning diagrams, created in MapInfo, are provided in both digital and hard copy format to assist with the zoning. Longitude and latitude coordinates are in decimal degrees. Negative (-) longitude is a MapInfo representation of West longitude.

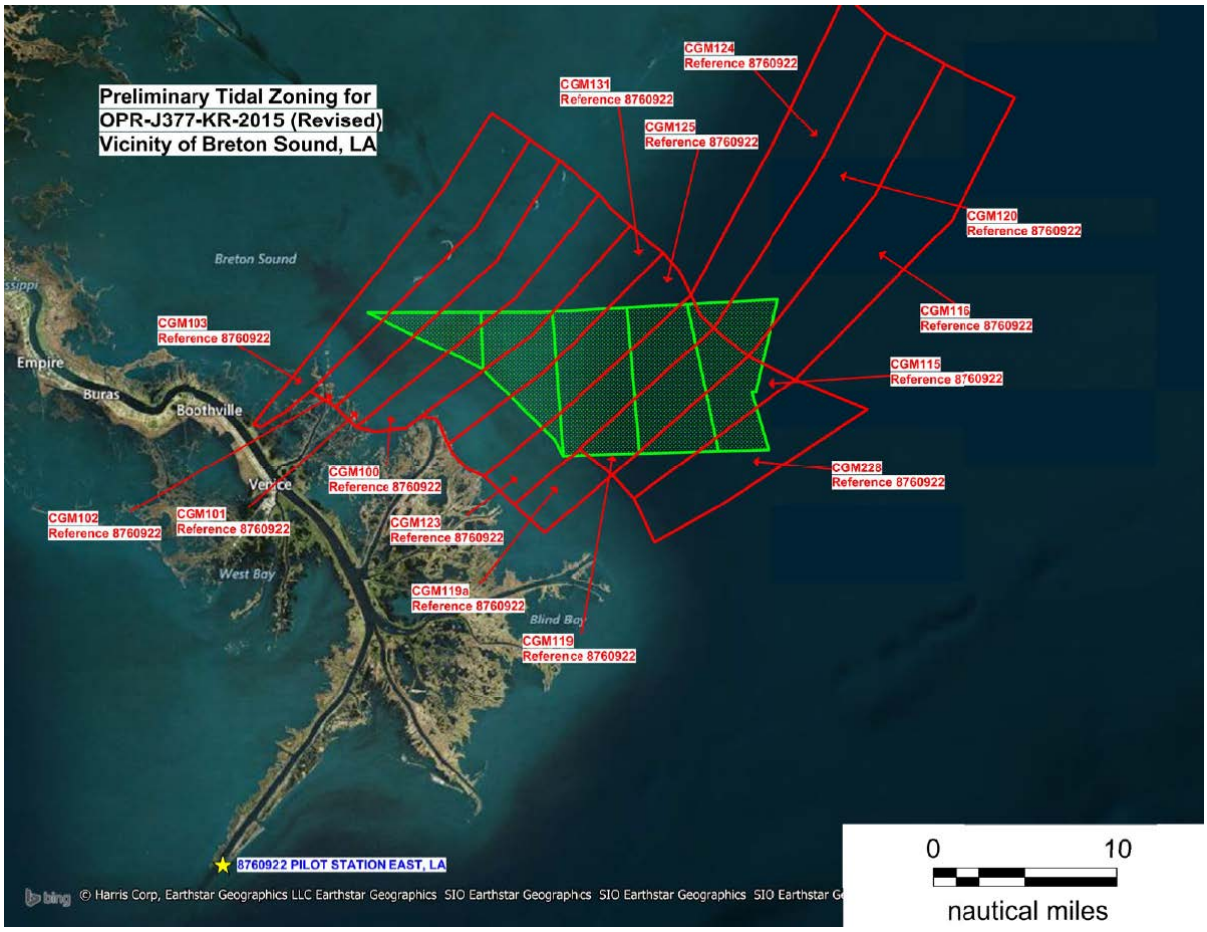
"Preliminary" data for the control water level station, Pilots Station East, LA (8760922), are available in near real-time and verified data will be available on a weekly basis for the previous week. **These water level data may be obtained from CO-OPS SOAP web services at http://opendap.co-ops.nos.noaa.gov/axis/text.html.**

1.4.3 Zoning Diagram(s)

Zoning diagrams, created in MapInfo® and Adobe PDF, are provided in digital format to assist with the zoning in section 1.4.1.

1.5. Final Zoning

1.5.1. For final processing, apply tidal zoning correctors to "verified" observed data of the NOS control station and/or the final processed data of the subordinate stations.


Preliminary Tidal Zoning for
OPR-J377-KR-2015 (Revised)
Vicinity of Breton Sound, LA
CGM124
Reference 8760922
CGM131
Reference 8760922
CGM125
Reference 8760922
CGM120
Reference 8760922
CGM116
Reference 8760922
CGM115
Reference 8760922
CGM228
Reference 8760922
CGM103
Reference 8760922
CGM100
Reference 8760922
CGM102
Reference 8760922
CGM101
Reference 8760922
CGM123
Reference 8760922
CGM119a
Reference 8760922
CGM119
Reference 8760922
Breton Sound
Empire
Buras
Boothville
Venice
West Bay
Blind Bay
8760922 PILOT STATION EAST, LA
© Harris Corp, Earthstar Geographics LLC Earthstar Geographics SIO Earthstar Geographics SIO Earthstar Geographics SIO Earthstar G
0
10
nautical miles

APPENDIX II

SUPPLEMENTAL SURVEY RECORDS AND CORRESPONDENCE

No supplemental survey records or correspondence provided from the field unit for survey H12734.

APPROVAL PAGE

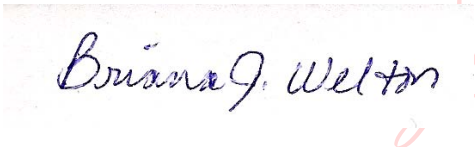
H12734

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

The following products will be sent to NCEI for archive

- H12734_DR.pdf
- Collection of depth varied resolution BAGS
- Processed survey data and records
- H12733_H12734_H12735_H12736_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.



Digitally signed by
WELTON.BRIANA.JANE.1267667531
DN: c=US, o=U.S. Government, ou=DoD, ou=PKI,
ou=NOAA, cn=WELTON.BRIANA.JANE.1267667531
Date: 2017.03.10 09:46:04 -05'00'

Approved: _____

Lieutenant Commander Briana Welton, NOAA
Chief, Atlantic Hydrographic Branch