

H12387

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

DESCRIPTIVE REPORT

Type of Survey: Navigable Area

Registry Number: H12387

LOCALITY

State(s): Texas

General Locality: Galveston, TX

Sub-locality: Galveston Bay Entrance

2016

CHIEF OF PARTY
Dan Jacobs

LIBRARY & ARCHIVES

Date:

HYDROGRAPHIC TITLE SHEET

H12387

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

State(s): **Texas**

General Locality: **Galveston, TX**

Sub-Locality: **Galveston Bay Entrance**

Scale: **10000**

Dates of Survey: **08/19/2016 to 09/20/2016**

Instructions Dated: **09/29/2016**

Project Number: **OPR-K414-NRT4-2016**

Field Unit: **NRT4**

Chief of Party: **Dan Jacobs**

Soundings by: **Multibeam Echo Sounder**

Imagery by:

Verification by: **Pacific Hydrographic Branch**

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

Remarks:

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

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Descriptive Report to Accompany Survey H12387

Project: OPR-K414-NRT4-2016

Locality: Galveston, TX

Sublocality: Galveston Bay Entrance

Scale: 1:10000

August 2016 - September 2016

NRT4

Chief of Party: Dan Jacobs

A. Area Surveyed

Object Detection MBES operations for H12387 commenced on 19AUG2016. The last day of acquisition was 20SEP2016. Hydrography proved challenging for this sheet as NRT4 was short staffed and sea conditions often precluded quality data collection in this turbulent bottleneck of Galveston Bay, TX. Per project instructions, NRT4 "squared off" H12387 MBES coverage on 20SEP2016, with the intent to cease operations entirely if unsatisfactory seas persisted. As such, NRT4 completed only one-fifth of the assigned survey sheet, an area of approximately 1 square nautical mile.

Note: as the Tide Note shows, Hydrography for this area included one extra day, DN264. This was a blunder on the part of the Hydrographer as data collected on that day facilitated a crossline comparison for a separate project.

A.1 Survey Limits

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
29° 20' 38.55" N 94° 40' 7.87" W	29° 19' 3.35" N 94° 42' 12.79" W

Table 1: Survey Limits

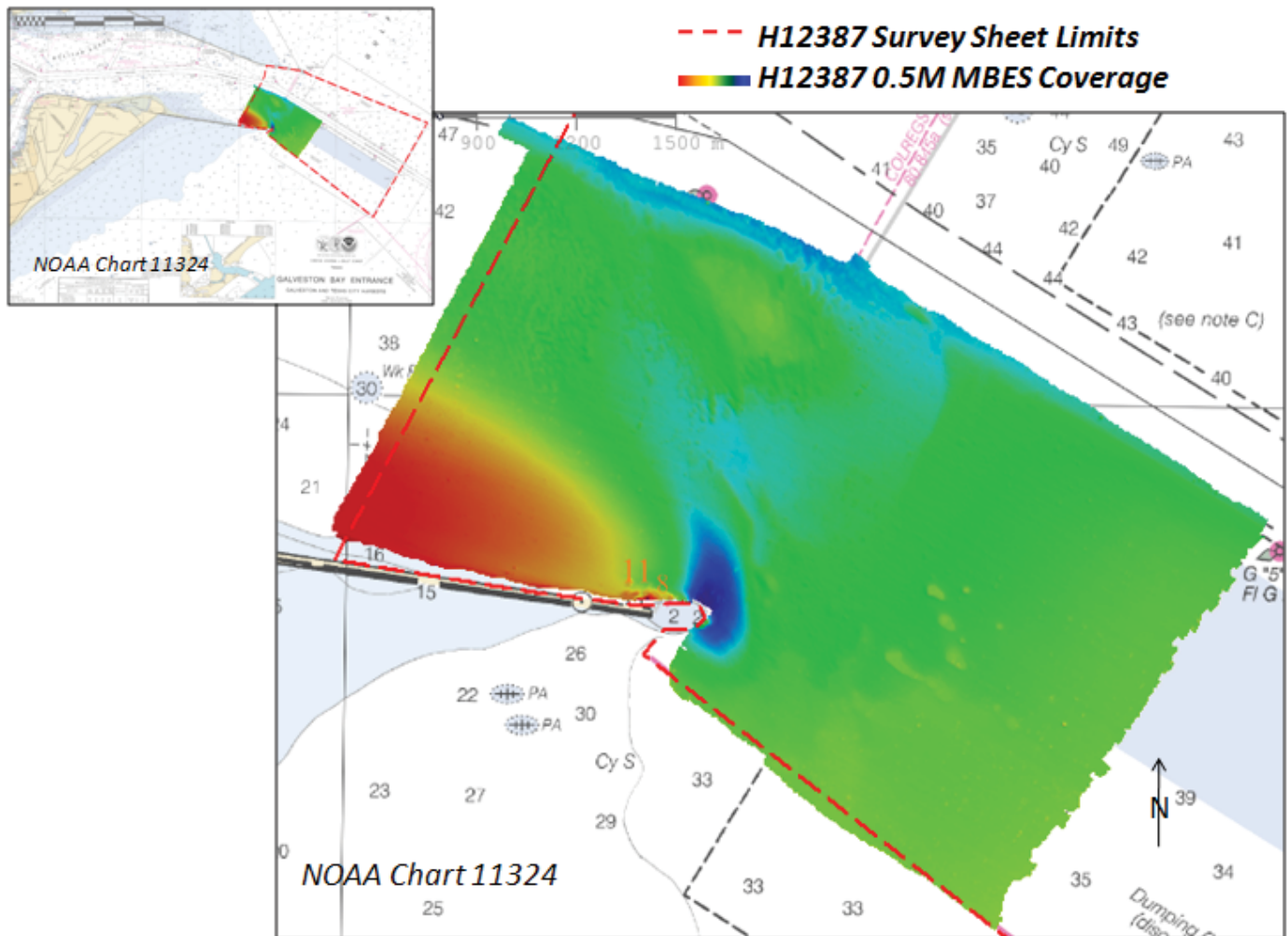


Figure 1: H12387 Survey Sheet Limits and MBES Coverage, Chart 11324, 39th Ed.

Only one-fifth (approximately 1 square nautical mile) of hydrography was completed for Sheet H12387 on account of heavy seas and personnel staffing challenges.

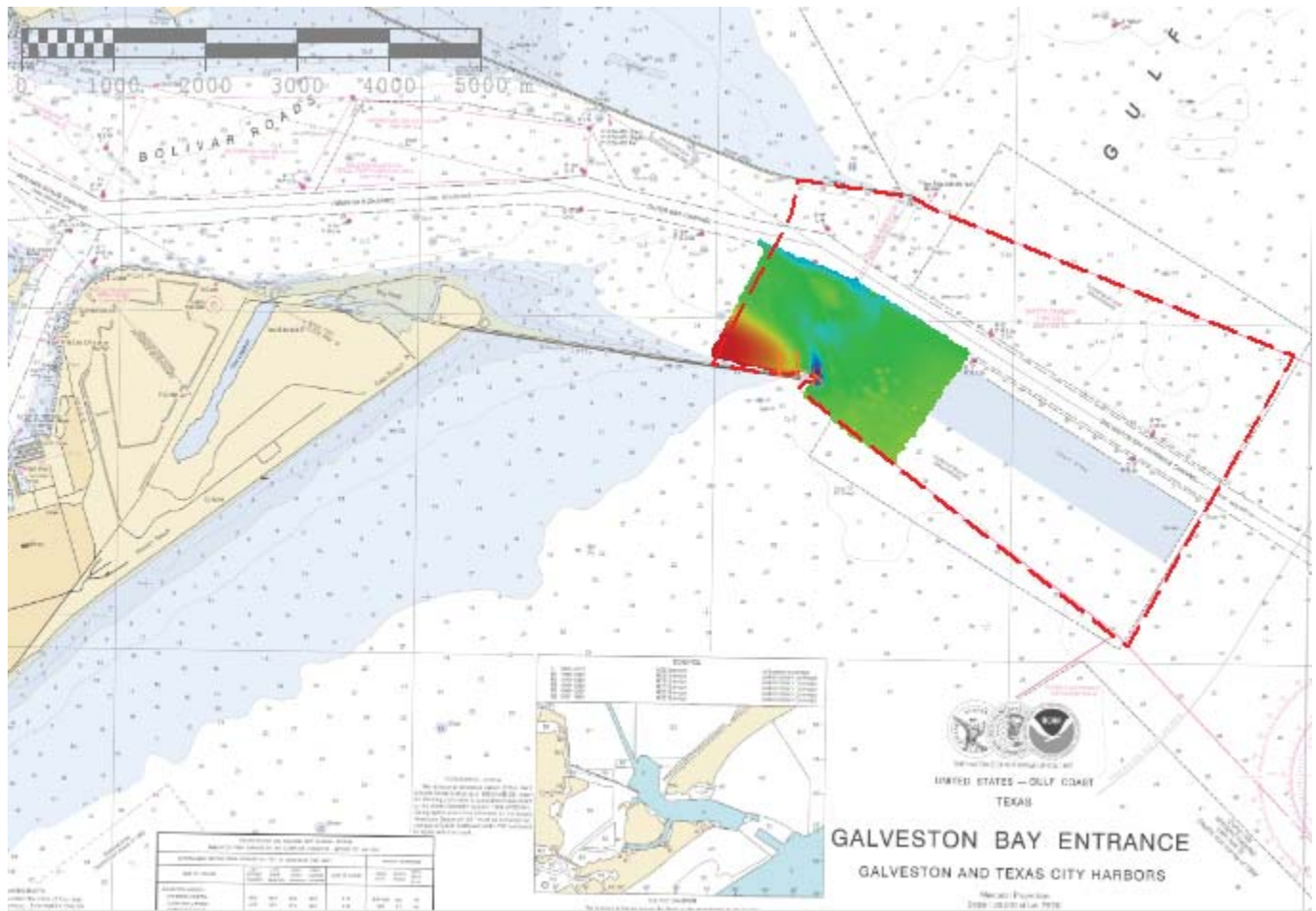


Figure 2: H12387 Survey Sheet Limits and MBES Coverage

A.2 Survey Purpose

The regional Navigation Manager has received pilot and port authority requests for hydrographic surveys in Galveston Bay and vicinity. The main purpose of this project is to survey the newly charted barge channels along the main Houston Ship Channel. Another priority area is a section of a proposed anchorage south of the Outer Bar Channel that has not been recently surveyed. This area is located in the southwest corner of sheet H12387. NOAA's Marine Chart Division has also requested investigation of shoreline and numerous charted features in the area, to help reduce localized chart clutter. The shoreline investigation will use the CSF file and the nautical charts to do the investigations. This survey is intended to supersede all bathymetry, seafloor features, and bottom characteristics within the assigned survey area as defined by these instructions for updating of NOAA charts 11324, 11326, 11327 and 11328.

A.3 Survey Quality

The entire survey is adequate to supersede previous data.

Hydrographic data quality meets or exceeds density and IHO quality standards despite area coverage deficiency.

A.4 Survey Coverage

The following table lists the coverage requirements for this survey as assigned in the project instructions:

Water Depth	Coverage Required

Coverage requirements were not fully obtained due to excessive wave energy at Galveston Bay's entrance and/or personnel staffing issues. Weather and sea conditions precluded safe collection of good quality data on most days, August through November. Additionally, 7 density holidays and two much larger were discovered implementing the NOAA Pydro density holiday QC tool, Version 1. See following graphics, below.

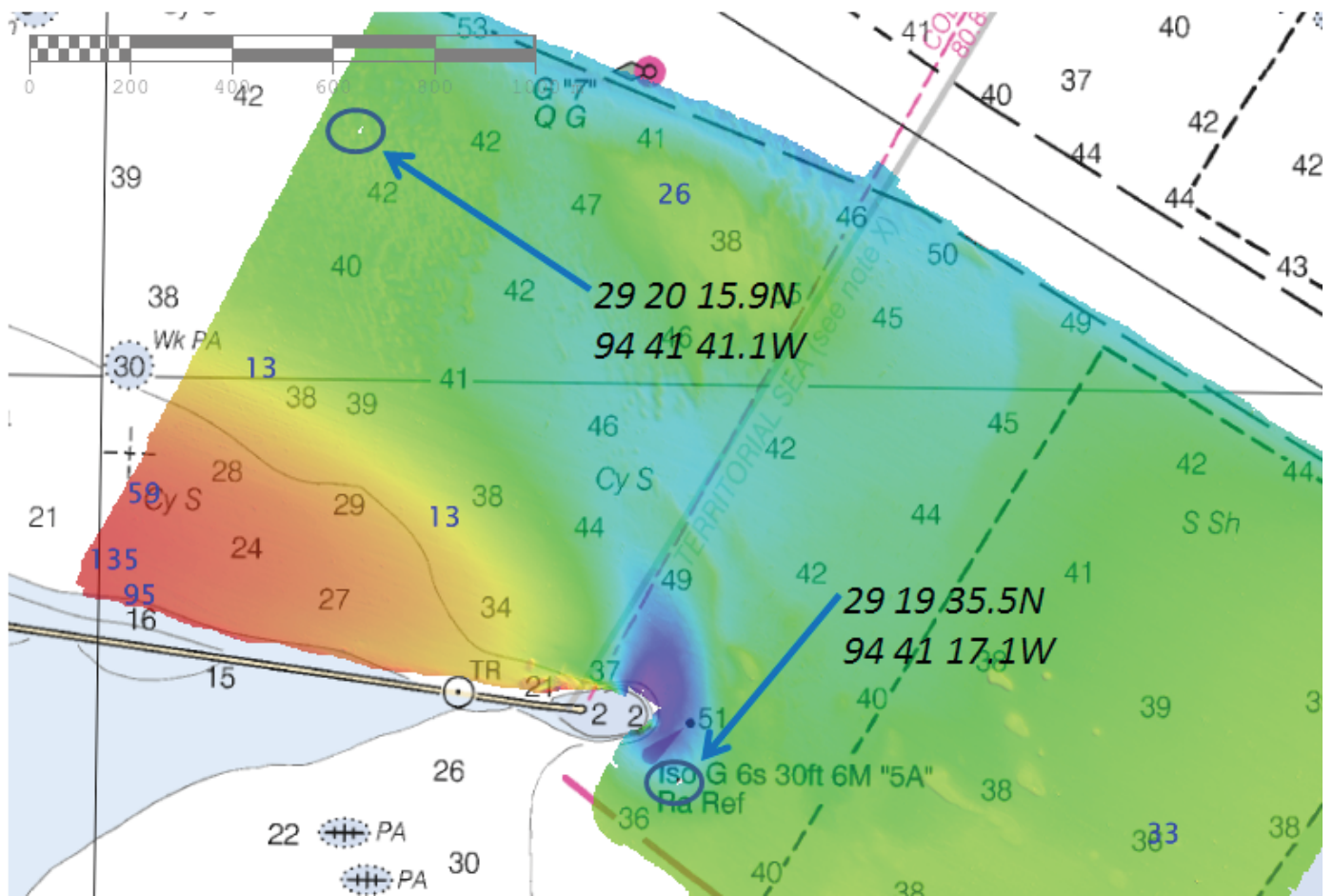


Figure 3: H12387 Holidays

Coverage requirement table was not filled out with information from Project Instructions. The coverage table should have been populated with the following information from the Project Instructions:
Water Depth: All waters in survey area Coverage Required: Object Detection Coverage accomplished using either: A) Object detection MBES depth and backscatter data, or B) 200% SSS coverage with concurrent set line spacing SBES depth data or MBES depth and backscatter data, except as noted below. Object detection MBES depth and backscatter data inside the barge lanes and 50 meters shoreward from the outer limits of the barge lanes, extending as necessary to define the 12 ft contour. Refer to HSSD Section 5.2.2.1 and 5.2.2.2 Due to safety reasons the 3m contour was not achieved. Field unit provided explanation of NALL via email correspondence with reviewer which can be found in the \Descriptive_Report\Appendices\II_Supplemental_Survey_Records___Correspondence\ folder

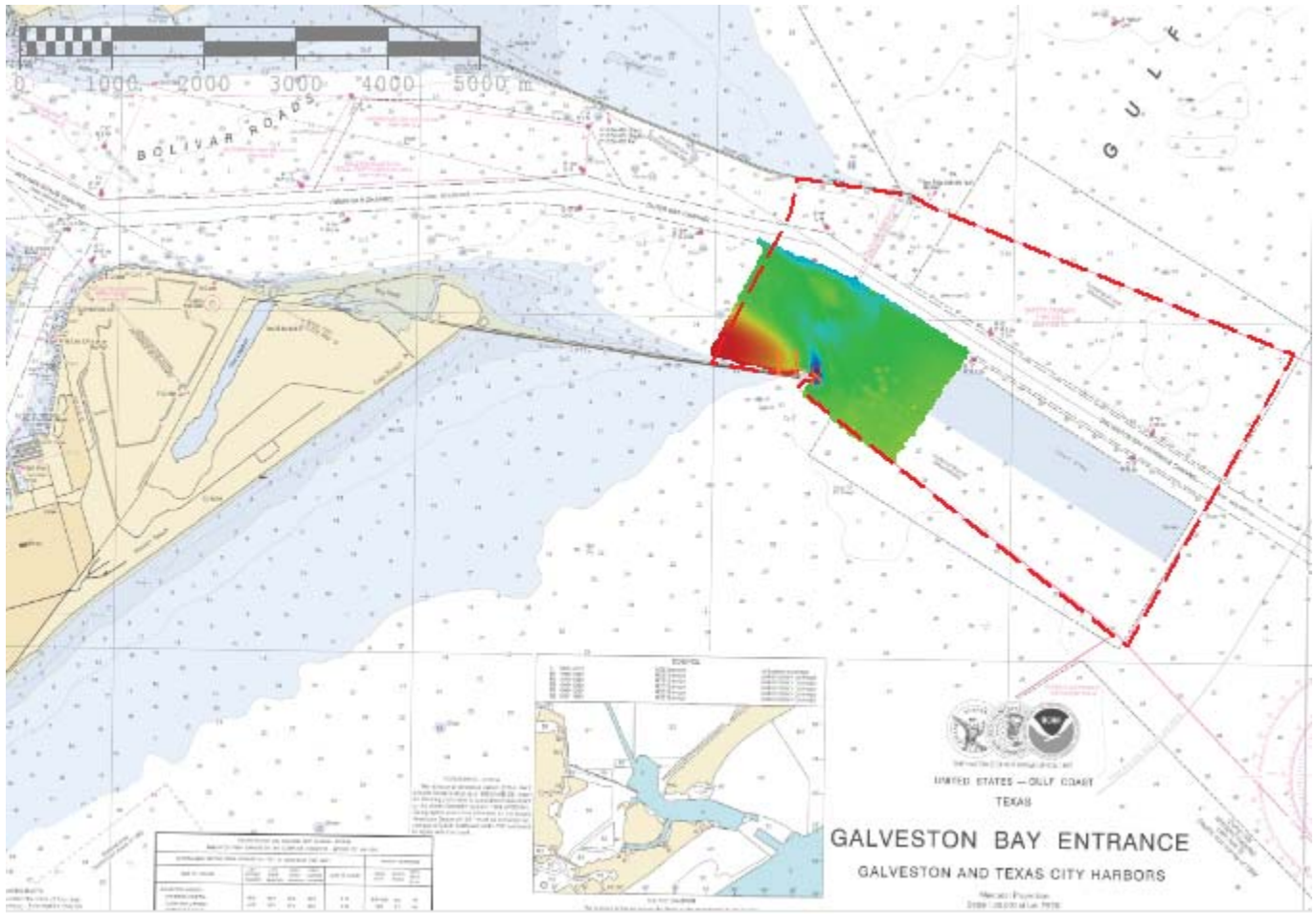


Figure 4: H12387 Survey Sheet Limits and MBES Coverage

A.5 Survey Statistics

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

	HULL ID	<i>S1211</i>	<i>Total</i>
LNM	SBES Mainscheme	0	0
	MBES Mainscheme	116032	116032
	Lidar Mainscheme	0	0
	SSS Mainscheme	0	0
	SBES/SSS Mainscheme	0	0
	MBES/SSS Mainscheme	0	0
	SBES/MBES Crosslines	10048	10048
	Lidar Crosslines	0	0
Number of Bottom Samples			0
Number Maritime Boundary Points Investigated			0
Number of DPs			0
Number of Items Investigated by Dive Ops			0
Total SNM			0.92

Table 2: Hydrographic Survey Statistics

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

Survey Dates	Day of the Year
08/19/2016	232
08/22/2016	235

Survey Dates	Day of the Year
08/23/2016	236
08/25/2016	238
09/08/2016	252
09/09/2016	253
09/13/2016	257
09/16/2016	260

Table 3: Dates of Hydrography

Object Detection MBES operations for H12387 commenced on 19AUG2016 and concluded on 16SEP2016. Note: The tide note shows, Hydrography for this area included one extra day, DN264 (20SEP2016). This was a blunder on the part of the Hydrographer. Data collected on that day facilitated a crossline comparison with historical soundings for a separate project.

Units in Table 2 above for LNM for MBES Mainscheme and SBES/MBES Crosslines are in Meters. MBES Mainscheme = 62.65 LNM and SBES/MBES Crosslines = 5.43 LNM.

B. Data Acquisition and Processing

B.1 Equipment and Vessels

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

B.1.1 Vessels

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

Hull ID	<i>SI211</i>
LOA	10 meters
Draft	0.5 meters

Table 4: Vessels Used



Figure 5: S1211

S1211 is a 30 foot SeaArk Commander. Its beam is 8 feet and draft is nominally 2 feet. S1211 is powered by two Honda 200 horsepower, 4 cycle, gasoline outboards.

B.1.2 Equipment

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

Manufacturer	Model	Type
Kongsberg	EM3002	MBES
Edgetech	4125	SSS

Table 5: Major Systems Used

Please reference NRT4's 2016 DAPR for equipment specifications.

The following three additional equipment "major systems" should be listed. These were found in the DAPR but not listed in the field Descriptive Report:

Applanix - POS MV5 - Positioning and Attitude System

YSI - CastAway - Conductivity, Temperature, and Depth Sensor

Odom - Digibar Pro - Sound Speed System

B.2 Quality Control

B.2.1 Crosslines

Crosslines acquired for this survey totaled 8.66% of mainscheme acquisition.

In accordance with the 2014 Field Procedures Manual, 5.43 LNM of MBES crosslines (8 percent of the total mainscheme line lengths) were collected and compared to object detection, mainscheme coverage using the CARIS HIPS Surface Difference Tool. Soundings demonstrated good agreement as 95 percent of crossline depths (2 sigma) laid within 0.20 meters of the mean, 0.00 meters. See figures, attached.

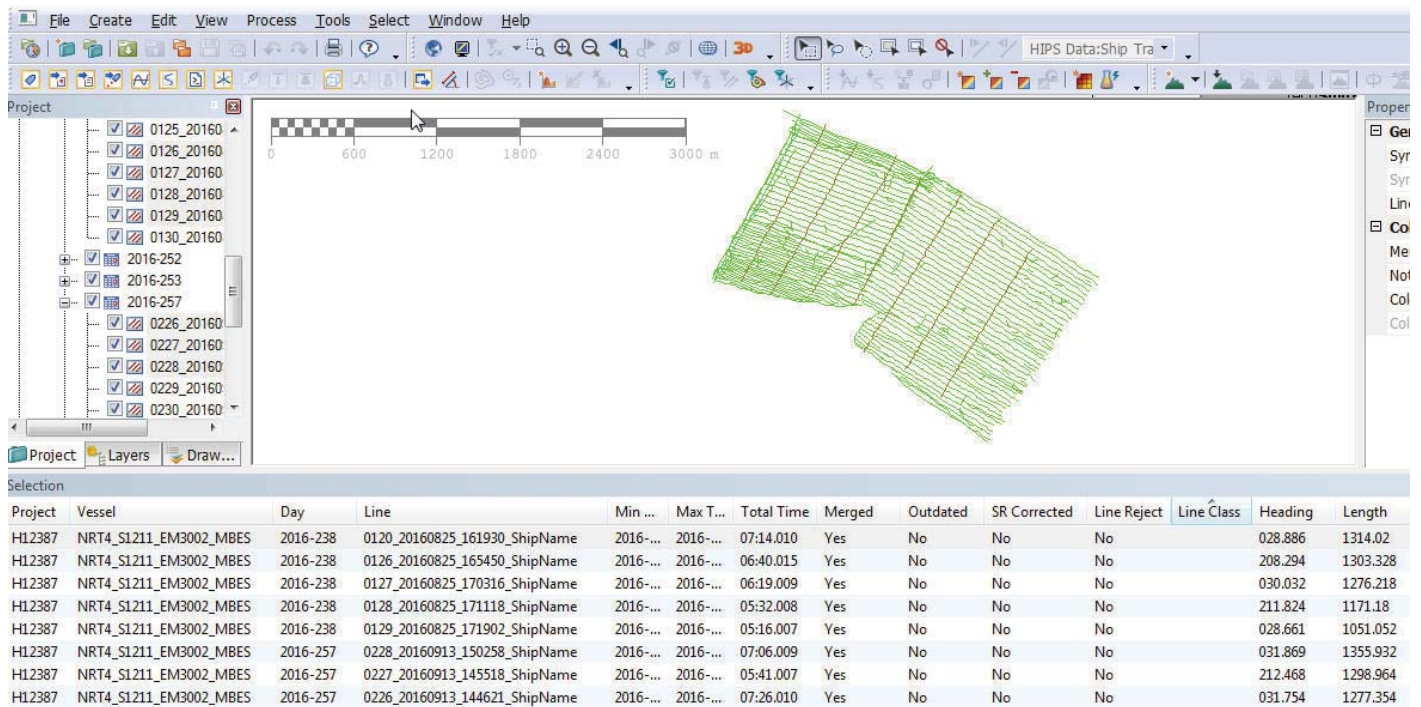


Figure 6: H12387 MBES Crosslines (brown) vs H12387 MBES Mainscheme Lines (green)

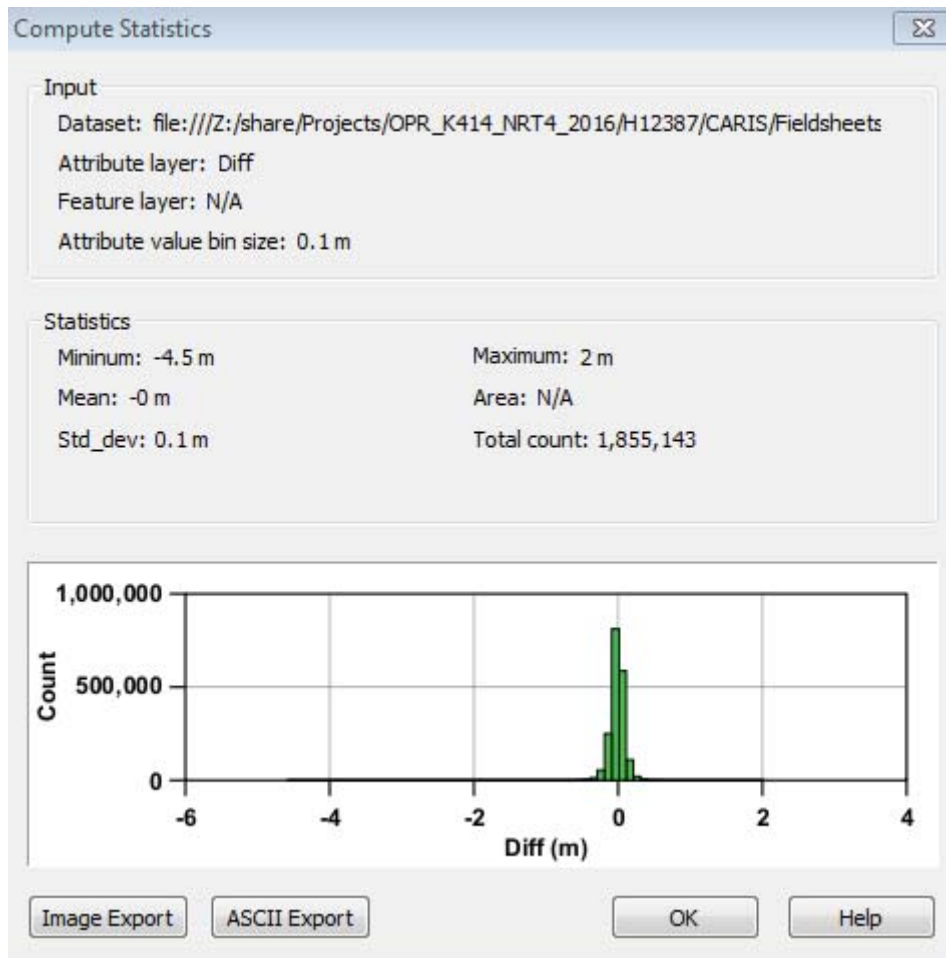


Figure 7: H12387 Crossline Depths vs Mainscheme Depths.

B.2.2 Uncertainty

The following survey specific parameters were used for this survey:

Measured	Zoning	Method
0.16 meters	0.00 meters	TCARI

Table 6: Survey Specific Tide TPU Values.

Tide uncertainty for the project area was 0.08 meters at one sigma (See graphic below). This value was doubled to 0.16 meters during TPU calculation as Caris expects a two sigma value. Total Vertical Uncertainty (TVU) was calculated implementing Pydro's QC tools. The finalized, 50cm grid passed with 99 percent of all grid nodes falling inside IHO Order 1a's error budget. Likewise, object detection

sounding density requirements were satisfied as 99 percent of finalized, 50cm grid nodes contained at least 5 soundings per node.



Figure 8: Tide Uncertainty, Galveston Bay, TX. Values scaled to one sigma.

Uncertainty Standards

Grid source: H12387_MBES_50cm_MLLW_Final.csar

99% pass (13,073,097 of all nodes), min=0.66, mode=0.70, max=5.02

Percentiles: 2.5%=0.68, Q1=0.69, median=0.70, Q3=0.71, 97.5%=0.74

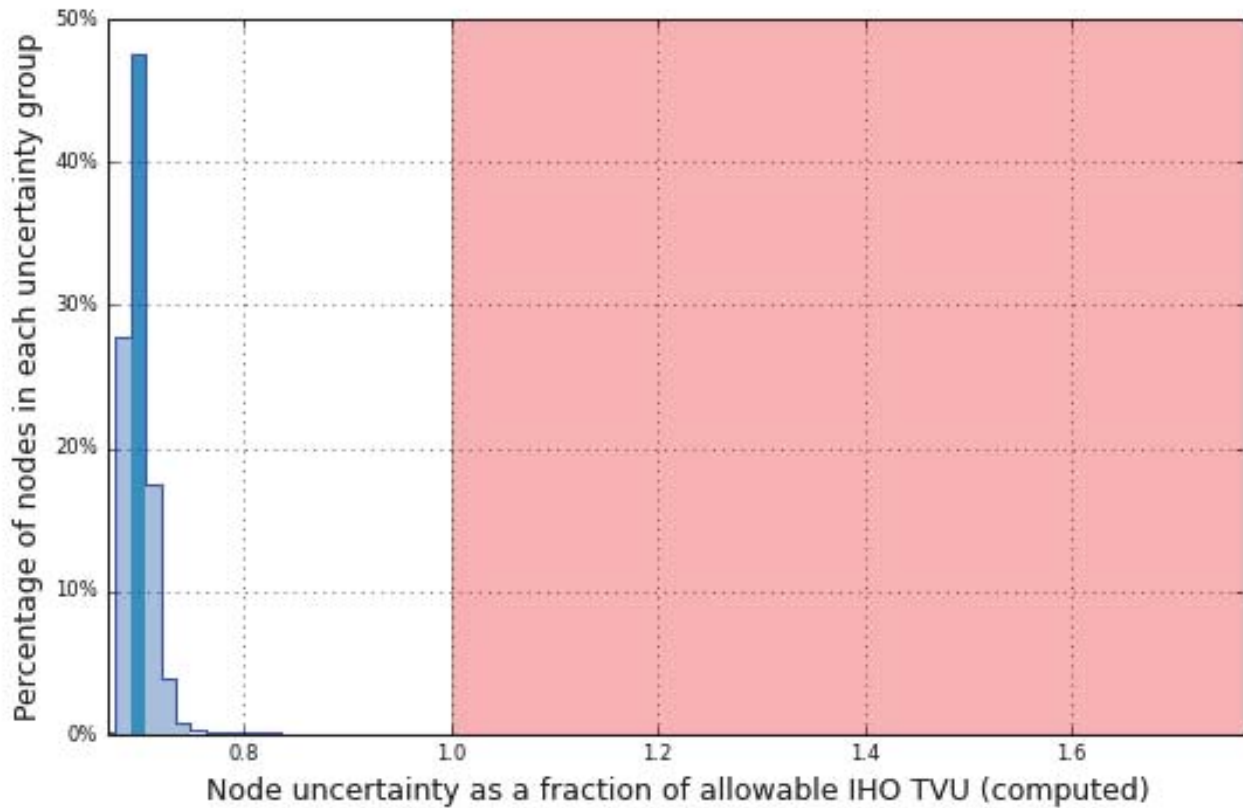


Figure 9: Total Vertical Uncertainty calculation for H12387 Finalized CUBE Surface.

Object Detection Coverage

Grid source: H12387_MBES_50cm_MLLW_Final.csar

99% pass (13,092,389 of all nodes), min=1.0, mode=9.0, max=729.0

Percentiles: 2.5%=6.0, Q1=10.0, median=16.0, Q3=25.0, 97.5%=63.0

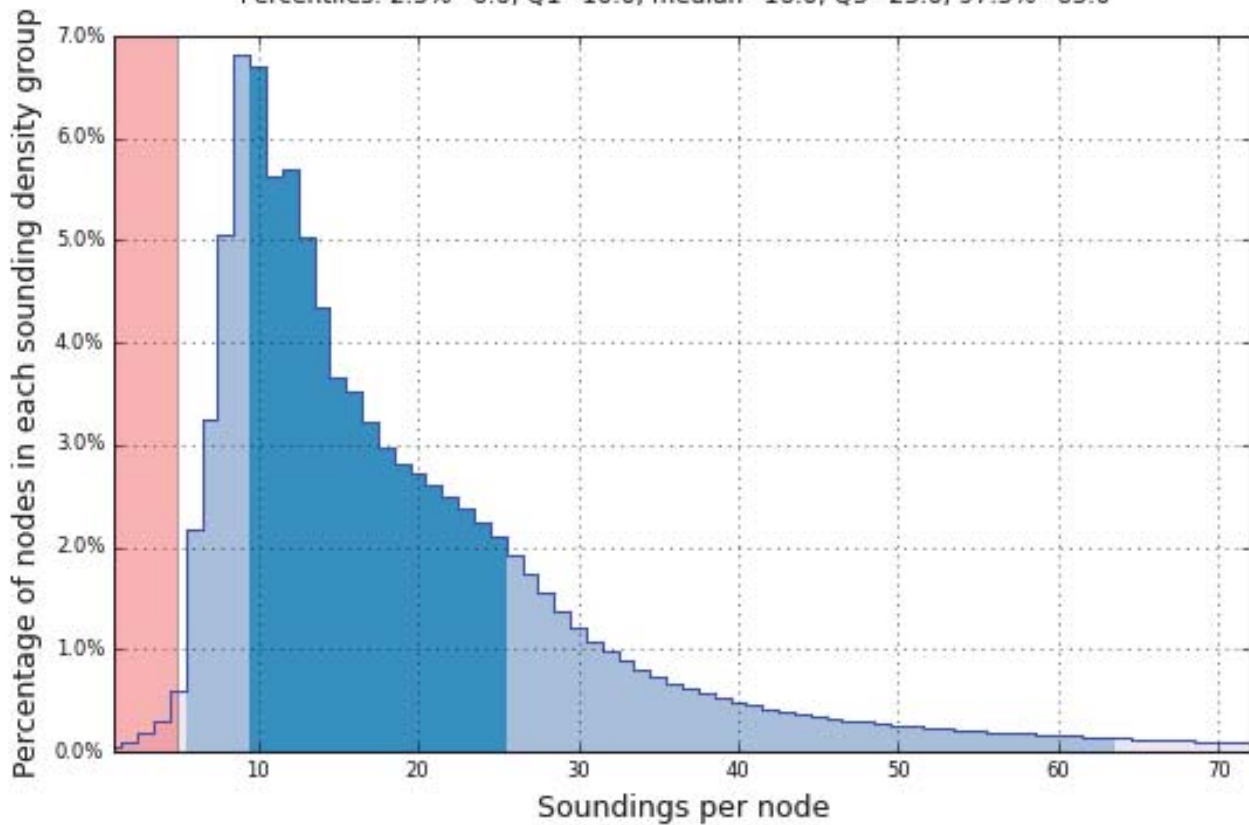


Figure 10: Sounding Density Statistics for H12387 Finalized CUBE Surface.

B.2.3 Junctions

H12387 50cm grid nodes were compared to historic (2013) H12388 50cm grid nodes invoking the CARIS "Surface Differencing" tool. A -0.6 meter trend was noted throughout the resultant surface at this junction area. See graphics below for specific CARIS statistics.

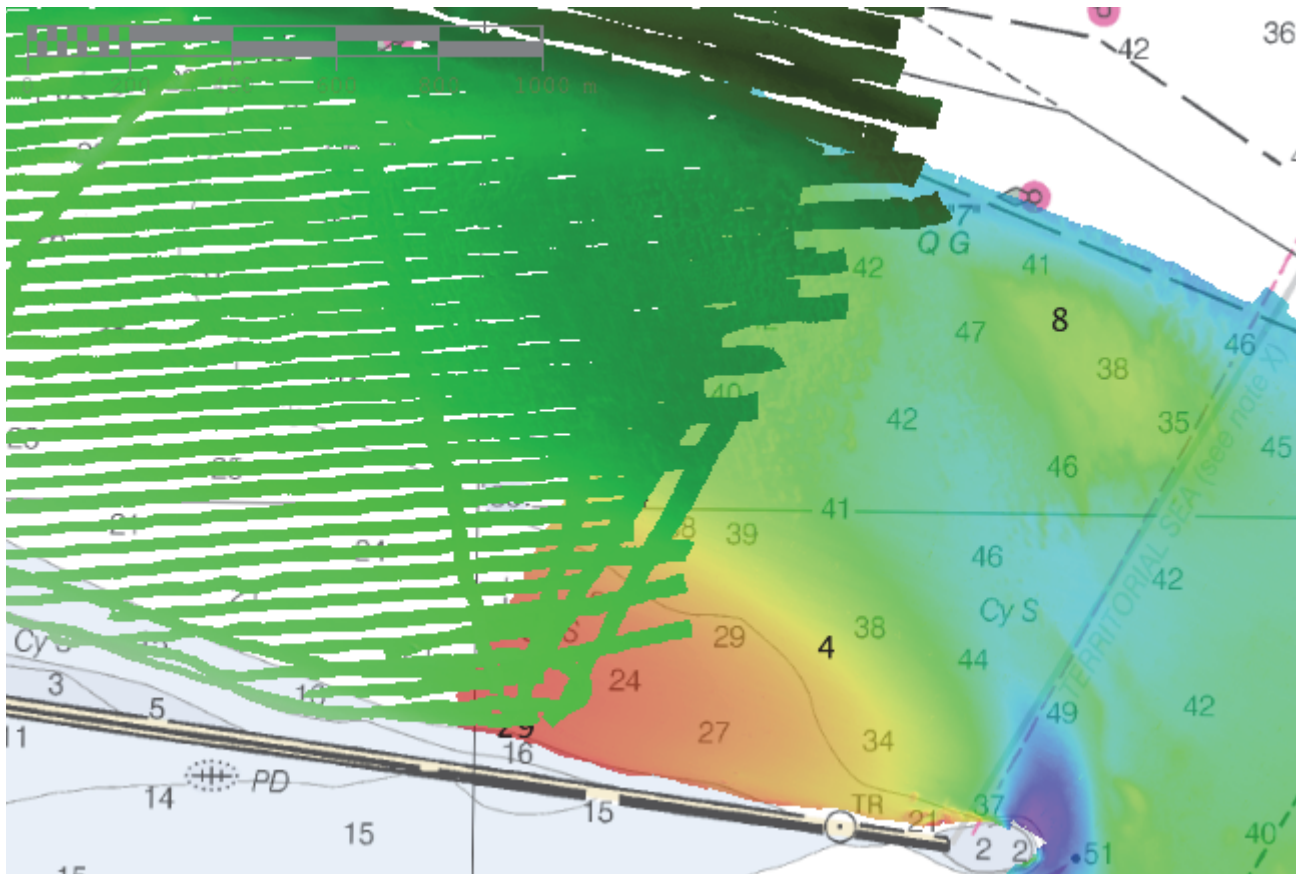


Figure 11: H12388 (green colored coverage) Junction to H12387 (rainbow colored coverage)

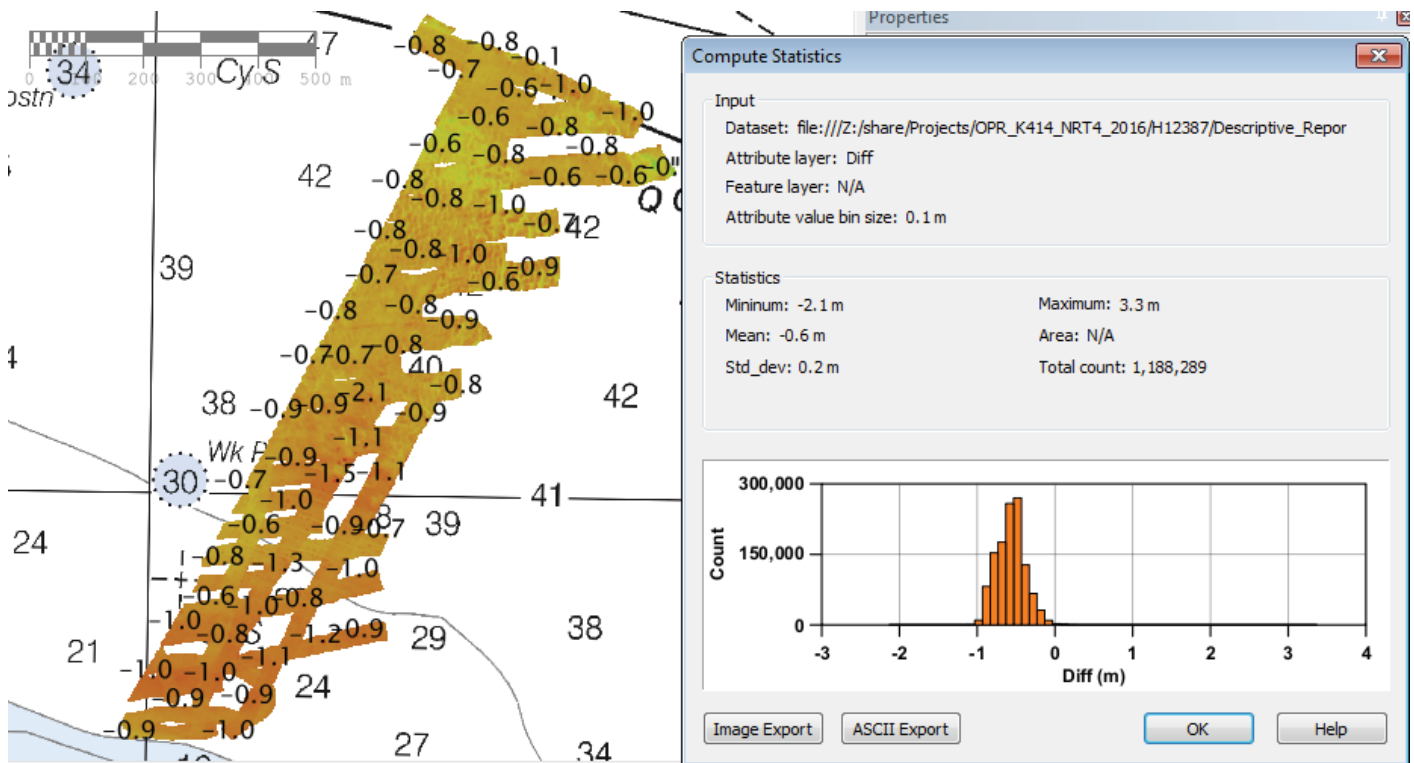


Figure 12: Junction to H12388, Surface Difference Statistics

There are no contemporary surveys that junction with this survey.

B.2.4 Sonar QC Checks

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

B.2.5 Equipment Effectiveness

Systematic artifact near nadir, EM3002

Overpowered beams near nadir were problematic throughout this survey. Please reference NRT4's 2016 DAPR for specific information regarding this well-known, MBES, systematic error which is unique to Kongsberg's EM3002 model, particularly over soft seabeds.

B.2.6 Factors Affecting Soundings

There were no other factors that affected corrections to soundings.

B.2.7 Sound Speed Methods

Sound Speed Cast Frequency: Sound speed casts were taken every 4 hours in accordance to the Field Procedures Manual.

Sound speed casts were taken at 4 hour intervals or less as sea characteristics (turbidity and thermal layering) dictated.

B.2.8 Coverage Equipment and Methods

H12387 is a MBES Object Detection survey, entirely. Ship traffic and restricted maneuverability deterred towed side scan operations.

B.3 Echo Sounding Corrections

B.3.1 Corrections to Echo Soundings

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

B.3.2 Calibrations

All sounding systems were calibrated as detailed in the DAPR.

B.4 Backscatter

Backscatter was not collected for this survey.

Backscatter was acquired in accordance with the PI's

B.5 Data Processing

B.5.1 Primary Data Processing Software

The following Feature Object Catalog was used: NOAA Profile Version 5.3.3. NOAA Profile Version 5.3.3 was installed to CARIS Bathy Database version 4.0.9. and implemented for H12387 feature management processing.

(CARIS_Support_Files_Ver_5_3_2.)

B.5.2 Surfaces

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

Surface Name	Surface Type	Resolution	Depth Range	Surface Parameter	Purpose
H12387_MBES_50cm_MLLW_Final	CUBE	0.5 meters	5.33 meters - 20.76 meters	NOAA_0.5m	Object Detection
H12387_MBES_1m_MLLW_Final	CUBE	1 meters	18.00 meters - 20.76 meters	NOAA_1m	Object Detection

Table 7: Submitted Surfaces

Two finalized CUBE surfaces were generated to account for H12387's maximum depth of 20.76 meters in accordance with 2014 Field Procedures Manual, Paragraph 4.2.1.1.1. The overlapping depth ranges induced 5 to 7 1meter X 1meter "orphaned" surfaces to materialize in the H12387_MBES_1m_MLLW_Final surface. Note that "H12387_MBES_50cm_MLLW_Final" met density and IHO requirements throughout the entire range of gridded depths. As such, no survey statistical analysis accompany the 1 meter finalized surface.

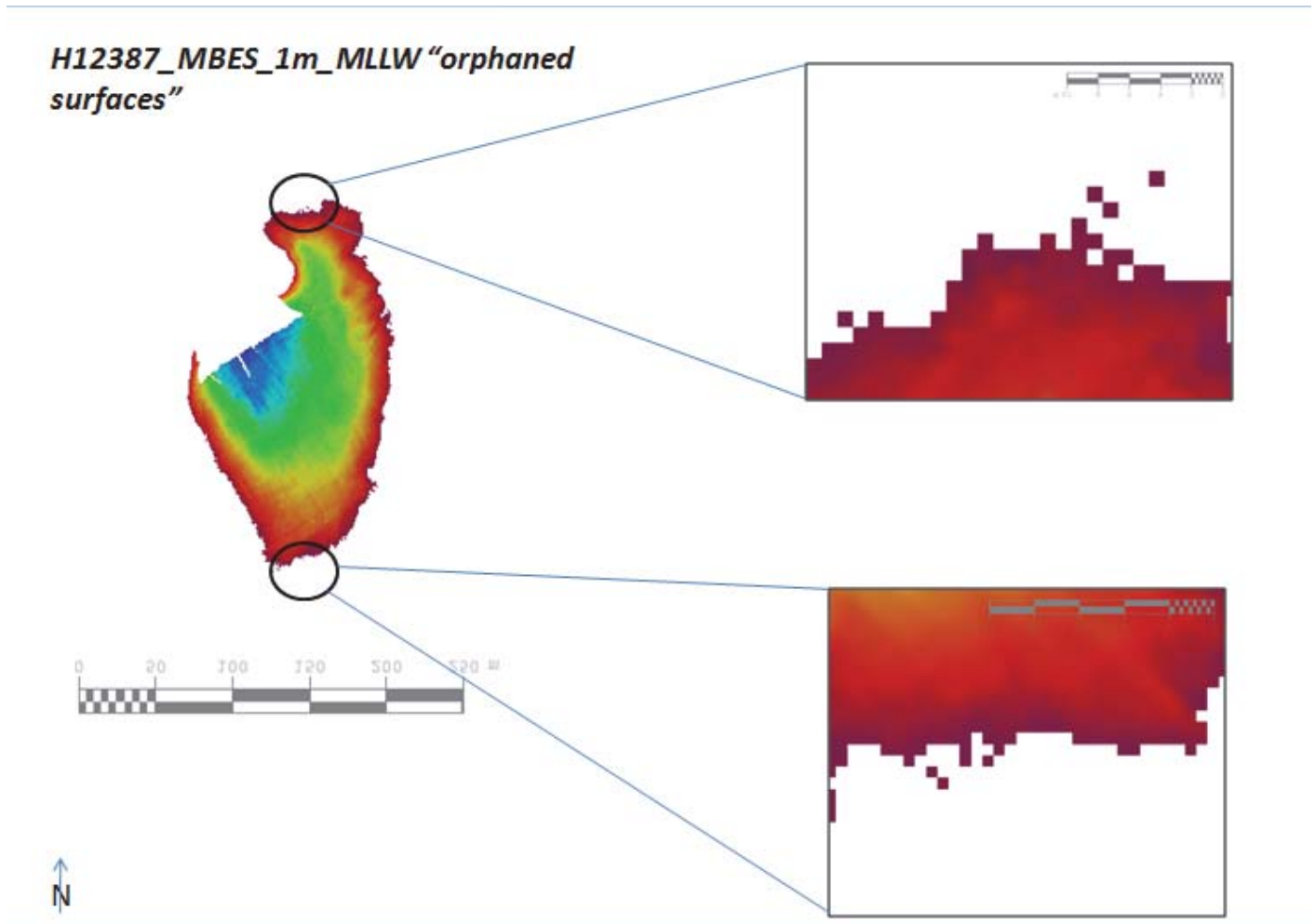


Figure 13: H12387 Orphaned Surfaces, 1 meter grid

C. Vertical and Horizontal Control

Additional information discussing the vertical or horizontal control for this survey can be found in the accompanying HVCR.

C.1 Vertical Control

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

Traditional Methods Used:

TCARI

File Name	Status
8770613.tid	Final Approved
8771013.tid	Final Approved
8771341.tid	Final Approved
8771450.tid	Final Approved

Table 8: Water Level Files (.tid)

File Name	Status
K414NRT42016.tc	Final

Table 9: Tide Correctors (.zdf or .tc)

A request for final approved tides was sent to N/OPS1 on 12/05/2016. The final tide note was received on 12/07/2016.

TCARI grid "K414NRT42016.tc" was used as the final grid for project OPR-K414-NRT4-16, H12387, during the time period between August 19 - September 20, 2016.

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 NAD83 Zone 15 North..

Angleton, TX DGPS, 301kHz was used for differential GPS corrections on all days of survey. No outages were reported for the duration of the survey.

The following DGPS Stations were used for horizontal control:

DGPS Stations
Angleton, Texas, DGPS, 301kHz

Table 10: USCG DGPS Stations

No HVCR was submitted as part of the H12387 package.

D. Results and Recommendations

D.1 Chart Comparison

In the figure below, survey soundings that were deeper by more than 2 feet as compared charted (11324) soundings were circled in blue. Survey soundings which ranged between +/- 2 feet of charted soundings were circled in green. Survey soundings that were shoaler by 2 feet or more were circled in red. Sheet H12387 exhibited some deepening trends near the end and seaward of the S. Jetty.

H12387 50cm Grid Nodes Compared to Chart 11324 Soundings

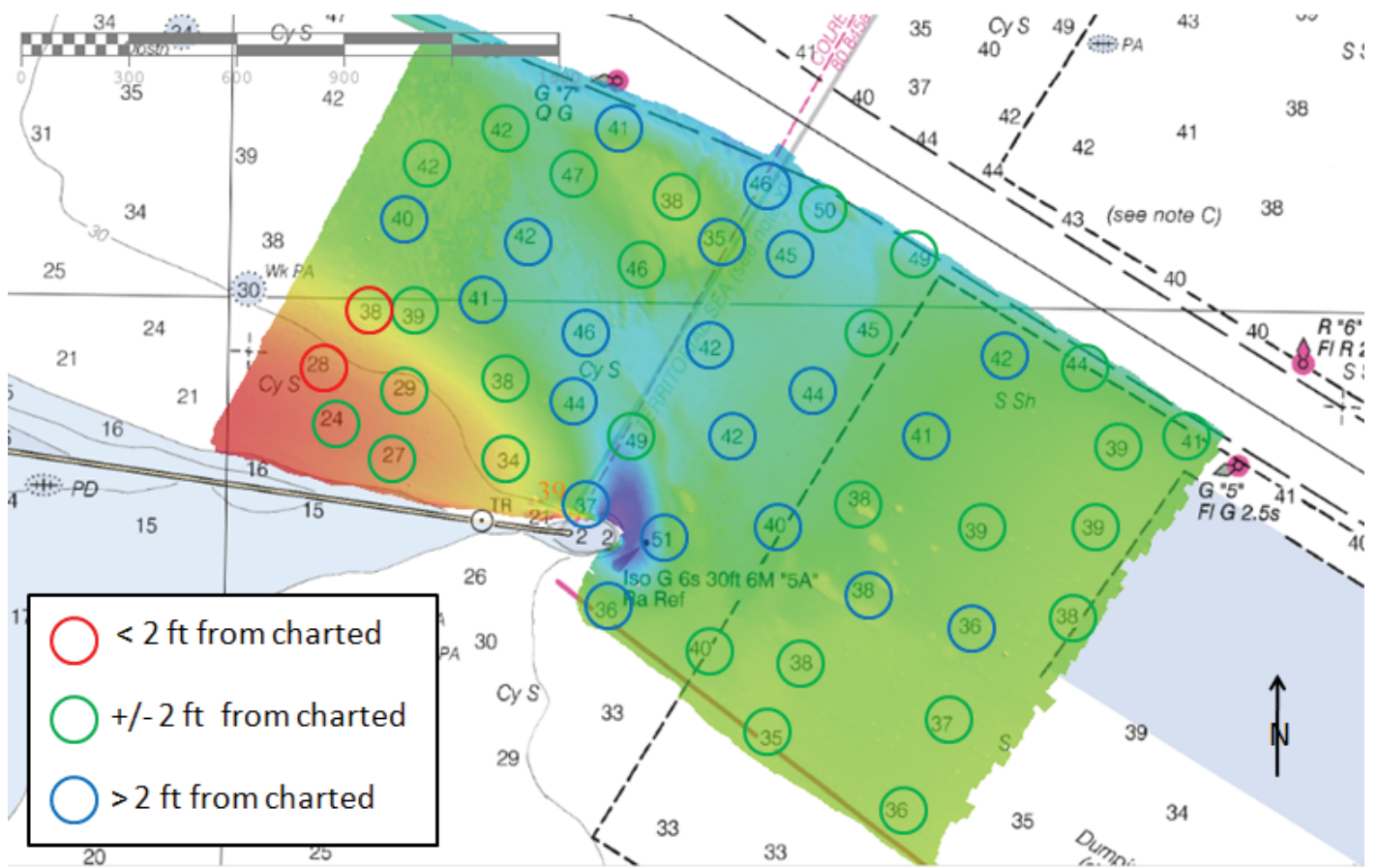


Figure 14: H12387 Survey Soundings vs Charted Soundings

D.1.1 Raster Charts

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

Chart	Scale	Edition	Edition Date	LNM Date	NM Date
11324	1:25000	39	05/2015	12/13/2016	11/26/2016

Table 11: Largest Scale Raster Charts

11324

Sheet H12387 exhibited some deepening trends near the end and seaward of the S. Jetty.

Applicable ENC not listed: US5TX53M, Scale: 1:25000, Edition: 52, Update Application Date: 12/26/2017, Issue Date: 12/26/2017

D.1.2 Maritime Boundary Points

No Maritime Boundary Points were assigned for this survey.

D.1.3 Charted Features

No charted features exist for this survey.

D.1.4 Uncharted Features

One sounding was designated over an obstruction situated at 29-19-43N 094-21-26W. Least depth is 39 feet below MLLW.

D.1.5 Dangers to Navigation

No Danger to Navigation Reports were submitted for this survey.

D.1.6 Shoal and Hazardous Features

No shoals or potentially hazardous features exist for this survey.

D.1.7 Channels

Channels, designated anchorages, precautionary areas, safety fairways, traffic separation schemes, pilot boarding areas, and/or channel and range lines exist within the survey limits, but were not investigated.

D.1.8 Bottom Samples

Bottom samples were assigned for this survey, but were not acquired.

D.2 Additional Results

D.2.1 Shoreline

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

D.2.2 Prior Surveys

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

D.2.3 Aids to Navigation

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

ATON's exist for the survey but were not investigated.

D.2.4 Overhead Features

No overhead features exist for this survey.

D.2.5 Submarine Features

No submarine features exist for this survey.

D.2.6 Ferry Routes and Terminals

No ferry routes or terminals exist for this survey.

D.2.7 Platforms

No platforms exist for this survey.

D.2.8 Significant Features

No Significant Features exist for this survey.

D.2.9 Construction and Dredging

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

D.2.10 New Survey Recommendation

H12387 project boundary was only 20 percent esonified with object detection MBES. A larger survey vessel or AUV is recommended for this turbulent area of Galveston Bay.

D.2.11 Inset Recommendation

No new insets are recommended for this area.

E. Approval Sheet

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

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

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

Report Name	Report Date Sent
Data Acquisition and Processing Report	2017-01-25

Approver Name	Approver Title	Approval Date	Signature
Dan Jacobs	Chief of Party	01/25/2017	<i>Dan Jacobs</i>

Dan Jacobs

Dan Jacobs, NRT4 Team Lead

Dan Jacobs

JACOBS.D
AN.L.1151
633478

Digitally signed by
JACOBS.DAN.L.115
1633478
Date: 2017.09.26
12:42:14 -05'00'

F. Table of Acronyms

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

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

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

**Preliminary TCARI grid for
K414-NRT4-2016
Galveston Bay and Vicinity, TX**

8770613 MORGANS POINT

8771013 EAGLE POINT

8771341 GALVESTON BAY ENTRANCE

8771450 GALVESTON PIER 21





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

TIDE NOTE FOR HYDROGRAPHIC SURVEY

DATE : December 7, 2016

HYDROGRAPHIC BRANCH: Atlantic
HYDROGRAPHIC PROJECT: OPR-K414-NRT4-16
HYDROGRAPHIC SHEET: H12387

LOCALITY: Galveston Bay Entrance, Galveston Bay, TX
TIME PERIOD: August 19 - September 20, 2016

TIDE STATION USED: 8770613 Morgans Point, TX
Lat. 29° 40.9' N Long. 94° 59.1' W

PLANE OF REFERENCE (MEAN LOWER LOW WATER): 0.000 meters
HEIGHT OF HIGH WATER ABOVE PLANE OF REFERENCE: 0.377 meters

TIDE STATION USED: 8771013 Eagle Point, TX
Lat. 29° 28.8' N Long. 94° 55.1' W

PLANE OF REFERENCE (MEAN LOWER LOW WATER): 0.000 meters
HEIGHT OF HIGH WATER ABOVE PLANE OF REFERENCE: 0.325 meters

TIDE STATION USED: 8771341 Galveston Bay Entrance, TX
Lat. 29° 21.4' N Long. 94° 43.5' W

PLANE OF REFERENCE (MEAN LOWER LOW WATER): 0.000 meters
HEIGHT OF HIGH WATER ABOVE PLANE OF REFERENCE: 0.473 meters

TIDE STATION USED: 8771450 Galveston Pier 21, TX
Lat. 29° 18.6' N Long. 94° 47.6' W

PLANE OF REFERENCE (MEAN LOWER LOW WATER): 0.000 meters
HEIGHT OF HIGH WATER ABOVE PLANE OF REFERENCE: 0.403 meters

REMARKS: RECOMMENDED Grid

Please use the TCARI grid "K414NRT42016.tc" as the final grid for project OPR-K414-NRT4-16, H12387, during the time period between August 19 - September 20, 2016.

Refer to attachments for grid information.

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

HOVIS.GERALD.THOMAS.JR.1365860250

Digitally signed by
HOVIS.GERALD.THOMAS.JR.1365860250
DN: c=US, o=U.S. Government, ou=DoD, ou=PKI,
ou=OTHER,
cn=HOVIS.GERALD.THOMAS.JR.1365860250
Date: 2016.12.09 09:21:17 -05'00'

CHIEF, PRODUCTS AND SERVICES BRANCH



APPROVAL PAGE

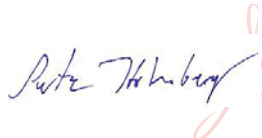
H12387

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

- H12387_DR.pdf
- Collection of depth varied resolution BAGS
- Processed survey data and records
- H12387_GeoImage.pdf

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

 Digitally signed by Peter Holmberg
Reason: Signing for Kurt Brown
Date: 2018.07.20 12:24:47 -07'00'

Approved: _____

Kurt Brown
Physical Scientist, Pacific Hydrographic Branch

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

 Digitally signed by Peter Holmberg
Date: 2018.07.20 12:17:45 -07'00'

Approved: _____

Peter Holmberg
Cartographic Team Lead, Pacific Hydrographic Branch