H13185

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

DESCRIPTIVE REPORT

Type of Survey:	Navigable Area
Registry Number:	H13185

LOCALITY

State(s):	Texas
General Locality:	Port Lavaca, TX
Sub-locality:	15 NM ESE of Cedar Bayou

2018

CHIEF OF PARTY
Andrew Orthmann

LIBRARY & ARCHIVES

Date:

U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION	REGISTRY NUMBER:
HYDROGRAPHIC TITLE SHEET	**H13185**

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:	**Port Lavaca, TX**
Sub-Locality:	**15 NM ESE of Cedar Bayou**
Scale:	**40000**
Dates of Survey:	**09/27/2018 to 12/15/2018**
Instructions Dated:	**07/18/2018**
Project Number:	**OPR-K376-KR-18**
Field Unit:	**Terrasond, Ltd.**
Chief of Party:	**Andrew Orthmann**
Soundings by:	**Multibeam Echo Sounder**
Imagery by:	**Side Scan Sonar**
Verification by:	**Atlantic Hydrographic Branch**
Soundings Acquired in:	**meters at Mean Lower Low Water**

Remarks:

Any revisions to the Descriptive Report (DR) applied during office processing are shown in red italic text. The DR is maintained as a field unit product, therefore all information and recommendations within this report are considered preliminary unless otherwise noted. The final disposition of survey data is represented in the NOAA nautical chart products. All pertinent records for this survey are archived at the National Centers for Environmental Information (NCEI) and can be retrieved via https://www.ncei.noaa.gov/.

Products created during office processing were generated in NAD83 UTM 14N, MLLW. All references to other horizontal or vertical datums in this report are applicable to the processed hydrographic data provided by the field unit.

Table of Contents

A. Area Surveyed 1
A.1 Survey Limits 1
A.2 Survey Purpose 2
A.3 Survey Quality 3
A.4 Survey Coverage 3
A.5 Survey Statistics 5
B. Data Acquisition and Processing 7
B.1 Equipment and Vessels 7
B.1.1 Vessels 7
B.1.2 Equipment 9
B.2 Quality Control 9
B.2.1 Crosslines 9
B.2.2 Uncertainty 10
B.2.3 Junctions 11
B.2.4 Sonar QC Checks 13
B.2.5 Equipment Effectiveness 13
B.2.6 Factors Affecting Soundings 14
B.2.7 Sound Speed Methods 16
B.2.8 Coverage Equipment and Methods 16
B.3 Echo Sounding Corrections 16
B.3.1 Corrections to Echo Soundings 16
B.3.2 Calibrations 19
B.4 Backscatter 19
B.5 Data Processing 19
B.5.1 Primary Data Processing Software 19
B.5.2 Surfaces 19
C. Vertical and Horizontal Control 20
C.1 Vertical Control 20
C.2 Horizontal Control 21
D. Results and Recommendations 21
D.1 Chart Comparison 21
D.1.1 Electronic Navigational Charts 22
D.1.2 Maritime Boundary Points 25
D.1.3 Charted Features 25
D.1.4 Uncharted Features 25
D.1.5 Shoal and Hazardous Features 25
D.1.6 Channels 26
D.1.7 Bottom Samples 26
D.2 Additional Results 26
D.2.1 Shoreline 26
D.2.2 Prior Surveys 26
D.2.3 Aids to Navigation 26
D.2.4 Overhead Features 26

D.2.5 Submarine Features....26
D.2.6 Platforms....26
D.2.7 Ferry Routes and Terminals....27
D.2.8 Abnormal Seafloor and/or Environmental Conditions....27
D.2.9 Construction and Dredging....27
D.2.10 New Survey Recommendation....27
D.2.11 Inset Recommendation....27
E. Approval Sheet....28
F. Table of Acronyms....29

List of Tables

Table 1: Survey Limits....1
Table 2: Survey Coverage....3
Table 3: Hydrographic Survey Statistics....6
Table 4: Dates of Hydrography....7
Table 5: Vessels Used....7
Table 6: Major Systems Used....9
Table 7: Survey Specific Tide TPU Values. 10
Table 8: Survey Specific Sound Speed TPU Values. 11
Table 9: Junctioning Surveys....12
Table 10: Submitted Surfaces....19
Table 11: Largest Scale ENCs....22

List of Figures

Figure 1: Graphic showing survey extents....2
Figure 3: Graphic showing survey coverage extents....5
Figure 2: Graphic showing areas surveyed using Option A (Complete Coverage MBES) only. Remaining areas were surveyed with Option B. Additional MBES-only lines (not shown) may have been run in Option B areas as holiday infills or developments. MBES-only crosslines are also not shown....4
Figure 4: Bunny Bordelon....8
Figure 5: Graphic showing junctions with this survey....12
Figure 6: Example of sound speed error from this survey. A collection of lines exhibit little to no sound speed error (left) while others show significant sound speed error, transitioning from an upward cupping (middle) to a downward cupping (right) in swath data. Gray soundings were considered to exceed IHO Order 1a and were rejected so as to be excluded from the final surfaces....15
Figure 7: Soundings from this survey (blue) overlaid on soundings from US4TX28M. South portion of survey area. Soundings in meters....23
Figure 8: Soundings from this survey (blue) overlaid on soundings from US4TX28M. North portion of survey area. Soundings in meters....24
Figure 9: Soundings from this survey (blue) overlaid on soundings from US4TX31M. Soundings in meters....25

Descriptive Report to Accompany Survey H13185

Project: OPR-K376-KR-18

Locality: Port Lavaca, TX

Sublocality: 15 NM ESE of Cedar Bayou

Scale: 1:40000

September 2018 - December 2018

Terrasond, Ltd.

Chief of Party: Andrew Orthmann

A. Area Surveyed

The survey area is located offshore SE Texas, centered on Port Lavaca. Water depths range from approximately 15 to 22 meters. Field work was carried out between September and December, 2018. Final processing and reporting was carried out between January and April, 2019. Eight other nearby sheets were surveyed concurrently. Work was done in accordance with the Hydrographic Survey Instructions (dated July 18th, 2018) and the NOS Hydrographic Surveys Specifications and Deliverables (HSSD), April 2018 edition.

A.1 Survey Limits

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
28° 12' 17.13" N 96° 41' 12.02" W	28° 0' 39" N 96° 27' 15.17" W

Table 1: Survey Limits

Survey limits were acquired in accordance with the Project Instructions and HSSD. Relative to the assigned extents, a small gap is apparent on the north-central part of this survey (approximately 28-07-49 N, 96-36-58 W) due to the layout of pre-plot line plans. This gap actually achieved coverage under junctioning Current survey H13184 to identical specifications.

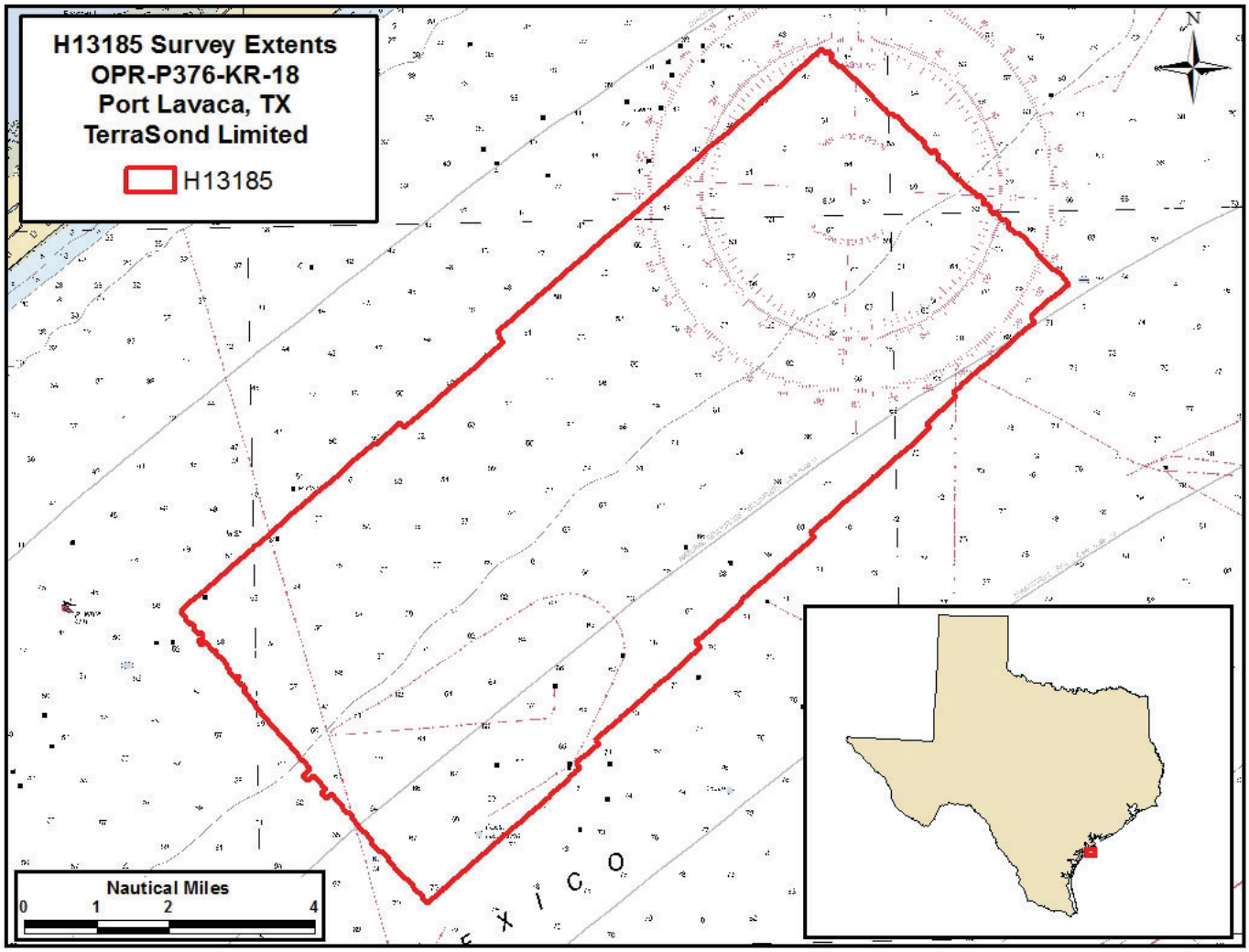

Figure 1: Graphic showing survey extents.

A.2 Survey Purpose

This project is located in the vicinity of Port Lavaca, which includes the Matagorda Bay Shipping Channel. Port Lavaca is a major sea port that allows shipping to support the fishing, manufacturing, agriculture, tourism, as well as the fishing industries in the state of Texas. As a leader in the shrimp processing industry, Port Lavaca allows million tons of seafood to be shipping through its port yearly. Port Lavaca also supports shipping for Matagorda Bay, which houses several large manufacturing plants and a nuclear station. The U.S. Army Corps of Engineers maintains the Matagorda Bay Shipping Channel which is dredged and there are future plans to expand this dredged channel to 44 ft. in depth and 400 ft. wide.4 The survey area covers the approaches to the shipping channel in an effort to cover all shipping traffic into the Matagorda Shipping Channel. Recent hurricane activity in 2017 has made previous bathymetry in the area unreliable. This survey will allow shipping activities to continue into the Port of Lavaca.

A.3 Survey Quality

The entire survey is adequate to supersede previous data.

A.4 Survey Coverage

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

Water Depth	Coverage Required
H13180-H13187, except H13181	Complete Coverage (Refer to HSSD Section 5.2.2.3)
All waters in survey area	LNM no less than 7869 LNM. Report significant shoaling via weekly progress report. COR may adjust survey prioritization based on observed shoaling.

Table 2: Survey Coverage

Approximately 9,103 LNM were collected project-wide, which exceeds the minimum of 7,869 required in the Project Instructions. The 13.5% overage was largely due to unplanned infill/rerun work in areas of marginal data.

Both "Option A: Complete Coverage Multibeam" and "Option B: 100% side scan sonar coverage with concurrent multibeam" were used to meet HSSD Section 5.2.2.3 "Complete Coverage" requirements during this survey. Option B was favored whenever possible and used for most of the area, but Option A was also frequently exercised when the SSS equipment was experiencing issues or SSS data quality had degraded to an unacceptable degree. Infills/reruns on holidays in Option B areas were also frequently MBES-only if MBES was capable of efficiently covering the holiday.

Some apparent minor holidays in the 100% SSS coverage exist, especially in the NE portion of the sheet. These were initially covered by the MBES swath, but opened after application of additional filters to remove outer beams to address sound speed refraction issues. Therefore, these SSS holidays did in fact receive coverage from the MBES system, but the associated soundings were subsequently rejected. The MBES data was examined in these areas for objects and left as rejected so as to not contribute erroneous depths to the final surfaces.

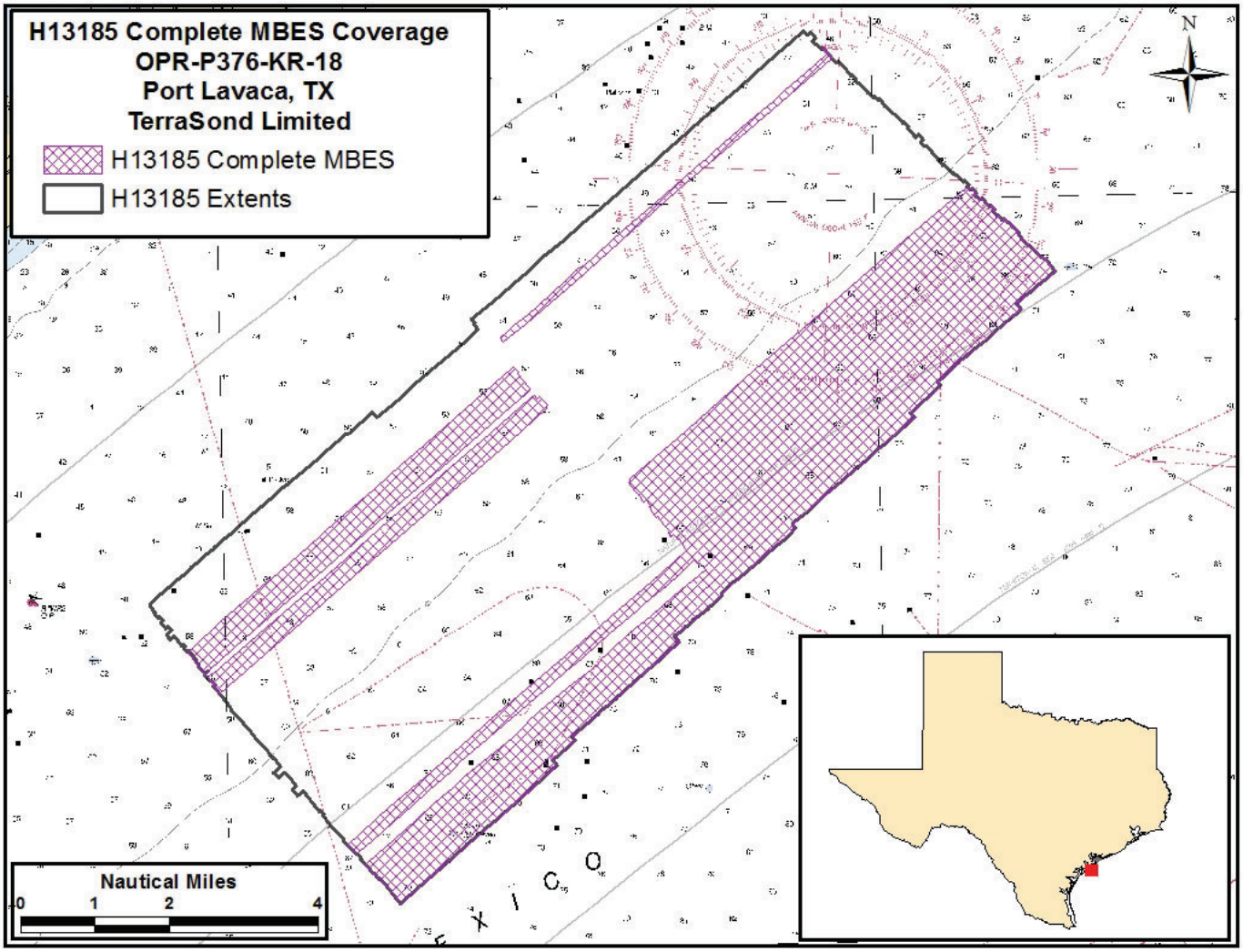

Figure 2: Graphic showing areas surveyed using Option A (Complete Coverage MBES) only. Remaining areas were surveyed with Option B. Additional MBES-only lines (not shown) may have been run in Option B areas as holiday infills or developments. MBES-only crosslines are also not shown.

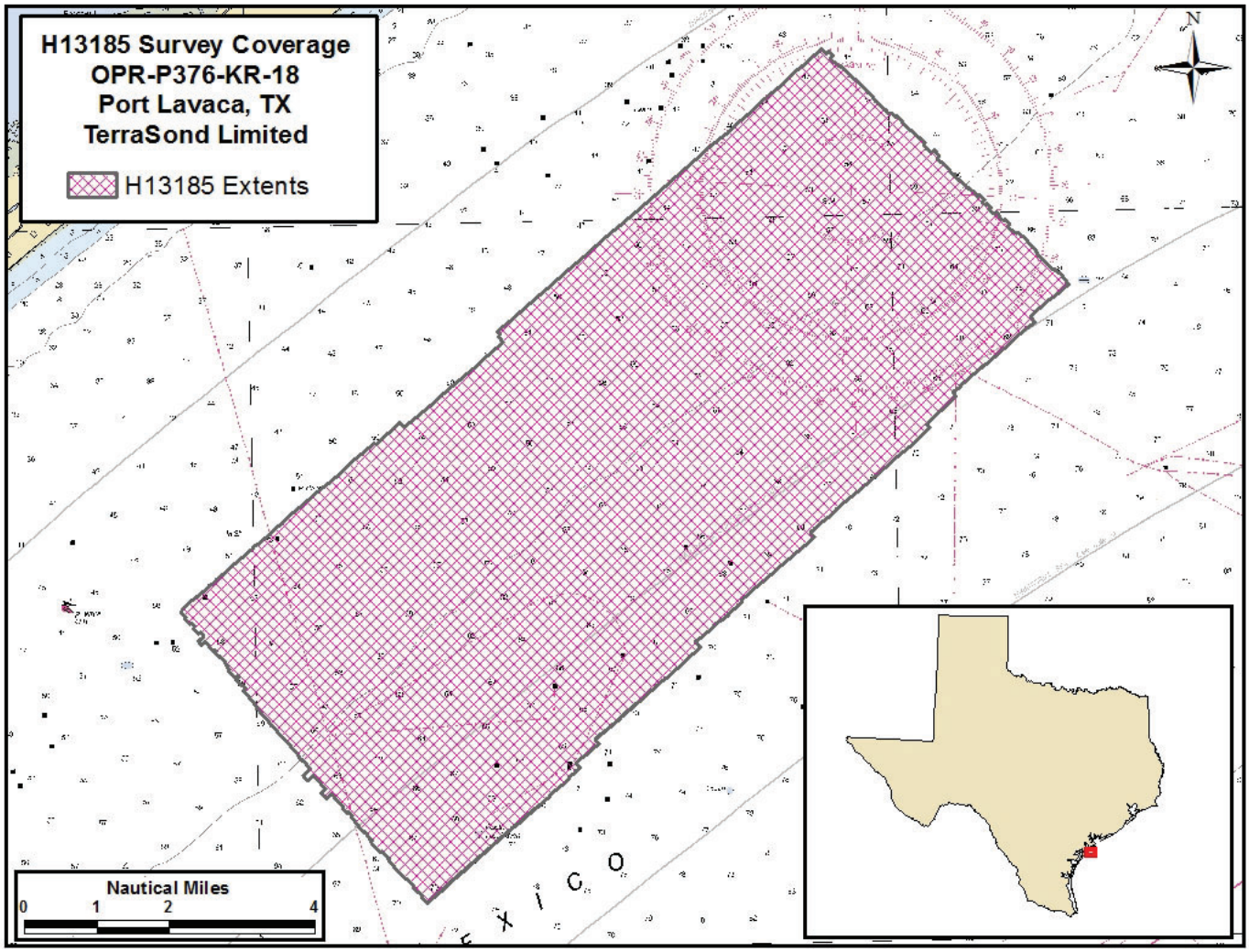

Figure 3: Graphic showing survey coverage extents.

A.5 Survey Statistics

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

	HULL ID	*Bunny Bordelon*	*Total*
LNM	**SBES Mainscheme**	0	0
	MBES Mainscheme	399	399
	Lidar Mainscheme	0	0
	SSS Mainscheme	0	0
	SBES/SSS Mainscheme	0	0
	MBES/SSS Mainscheme	465	465
	SBES/MBES Crosslines	42.7	42.7
	Lidar Crosslines	0	0
Number of Bottom Samples			4
Number Maritime Boundary Points Investigated			0
Number of DPs			0
Number of Items Investigated by Dive Ops			0
Total SNM			59.9

Table 3: Hydrographic Survey Statistics

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

Survey Dates	Day of the Year
09/27/2018	270

Survey Dates	Day of the Year
11/08/2018	312
11/09/2018	313
11/14/2018	318
11/17/2018	321
11/18/2018	322
11/19/2018	323
11/20/2018	324
11/21/2018	325
11/22/2018	326
11/23/2018	327
12/04/2018	338
12/05/2018	339
12/11/2018	345
12/15/2018	349

Table 4: Dates of Hydrography

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	***Bunny Bordelon***
LOA	45.7 meters
Draft	3.5 meters

Table 5: Vessels Used

Figure 4: Bunny Bordelon

The RV Bunny Bordelon is owned and operated by Bordelon Marine Services, LLC of Houma, Louisiana. It was outfit with a 20' conex on the back deck for working space, an A-frame and a winch for towed SSS operations, and a retractable MBES pole mid-ship on its port-side.

Note the other vessels detailed in the DAPR were not utilized on this survey sheet.

B.1.2 Equipment

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

Manufacturer	Model	Type
Teledyne RESON	Seabat T50 IDH	MBES
EdgeTech	4200	SSS
Applanix	POS MV 320 v5	Positioning and Attitude System
AML Oceanographic	Minos-X	Sound Speed System
AML Oceanographic	MicroX SVS	Sound Speed System
Valeport	RapidSV	Sound Speed System
Valeport	SWIFT SVP	Sound Speed System
Teledyne Oceanscience	RapidCast	Underway Sound Speed Deployment System

Table 6: Major Systems Used

B.2 Quality Control

B.2.1 Crosslines

Multibeam/single beam echo sounder/side scan sonar crosslines acquired for this survey totaled 4.94% of mainscheme acquisition.

Effort was made to ensure crosslines had good temporal and geographic distribution, were angled to enable nadir-to-nadir as well as nadir-to-outer beam comparisons, and that the required percent of mainscheme LNM was achieved.

The crossline analysis was conducted using CARIS HIPS “Line QC Report” process. Each crossline was selected individually and run through the process, which calculated the depth difference between each accepted crossline sounding and a "QC" BASE (CUBE-type, 2 m resolution) surface’s depth layer created from the mainscheme data. QC surfaces were created with the same parameters used for 2 m surfaces as the final surfaces, with the important distinction that the QC surfaces did not include crosslines so as to not bias the results. Differences in depth were grouped by beam number and statistics were computed, including the percentage of soundings with differences from the QC surface falling within IHO Order 1a.

When at least 95% of the sounding differences exceed IHO Order 1a, the crossline was considered to “pass,” but when less than 95% of the soundings compare within IHO Order 1, the crossline was considered to “fail.” A 5% (or less) failure rate was considered acceptable since this approach compares soundings to a

surface (instead of a surface to a surface), allowing for the possibility that noisy crossline soundings that don't adversely affect the final surface(s) could be counted as a QC failure under this process. Lines used as crosslines and their % of soundings passing IHO Order 1a, sorted from highest passing to lowest, are listed below.

0992-Bunny-326-558-XL -- 100.0% pass
1293-Bunny-338-SheetG_XL01 -- 100.0% pass
1296-Bunny-338-SheetG_XL_01 -- 100.0% pass
1298-Bunny-338-G_XL_02 -- 100.0% pass
1321-Bunny-338-G_XL_10 -- 100.0% pass
1305-Bunny-338-G_XL_03 -- 100.0% pass
1348-Bunny-339-G_XL_06 -- 100.0% pass
0986-Bunny-326-G1-963-XL -- 100.0% pass
1330-Bunny-338-G_XL_05 -- 99.8% pass
1329-Bunny-338-G_XL_04 -- 99.6% pass
1313-Bunny-338-G-XL_07 -- 98.4% pass

Note that individual crosslines often have two or more files (or segments) in CARIS due to the automatic file splitting feature in the acquisition software (QPS QINSy). For each individual crossline, all applicable segments were selected and ran together through the QC report process so that the QC report would reflect the crossline as a whole instead of its individual file segments.

Results:

Agreement between the mainscheme-only surface and crossline soundings is excellent. Compared to the mainscheme-only surface, 8 of 11 crosslines had 100% of soundings compare within IHO Order 1a. The remaining 3 had at least 98.4% of crossline soundings comparing to within IHO Order 1a and therefore pass QC as well.

Refer to Separate II: Digital Data for the detailed Crossline QC Reports.

B.2.2 Uncertainty

The following survey specific parameters were used for this survey:

Method	Measured	Zoning
ERS via VDATUM	0.104 meters	0 meters

Table 7: Survey Specific Tide TPU Values.

Hull ID	Measured - CTD	Measured - MVP	Surface
RV Bunny Bordelon	0 meters/second	2 meters/second	0.025 meters/second

Table 8: Survey Specific Sound Speed TPU Values.

The surfaces were finalized in CARIS HIPS so that the uncertainty value for each grid cell is the greater of either standard deviation or uncertainty. The surfaces were then ran through NOAA's QC Tools "QA" utility to compare uncertainty values to allowable TVU by depth.

Results: Over 99.5% of grid cells for all final surfaces have uncertainty within the allowable IHO Order 1a TVU.

Refer to the DAPR for more information on derivation of the values used for TPU estimates.

B.2.3 Junctions

This survey junctions with three Current surveys. All were surveyed concurrently with this survey.

NOAA's "Gridded Surface Comparison V18.4" utility was used to complete the junction comparisons. The utility differences the surfaces of the junctioning surveys and generates statistics, including the percentage of grid cells that compare to within allowable TVU. 1 m-resolution CUBE surfaces were used for all comparisons.

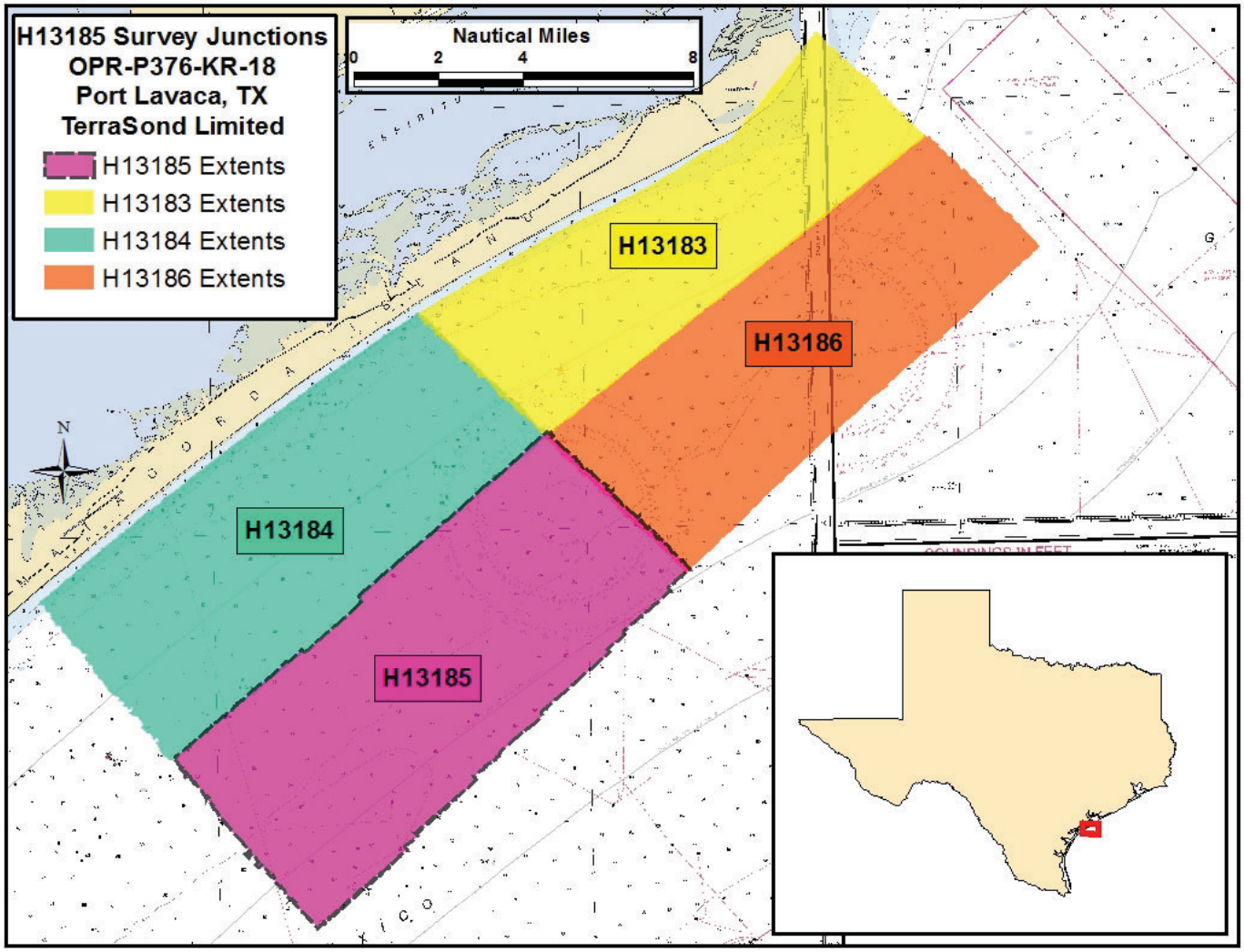

Figure 5: Graphic showing junctions with this survey.

The following junctions were made with this survey:

Registry Number	Scale	Year	Field Unit	Relative Location
H13184	1:40000	2019	Terrasond, Ltd.	NW
H13186	1:40000	2018	Terrasond, Ltd.	NE
H13183	1:40000	2019	Terrasond, Ltd.	N

Table 9: Junctioning Surveys

H13184

Agreement is excellent between the two Current surveys. The mean difference is 0.03 m, and greater than 99.5% of grid cells compare to within IHO Order 1a.

H13186

Agreement is excellent between the two Current surveys. The mean difference is 0.01 m, and greater than 99.5% of grid cells compare to within IHO Order 1a.

H13183

Overlap is incidental between these two Current surveys. However, agreement is excellent. The mean difference is 0.09 m and 100% of grid cells compare to within IHO Order 1a.

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

MBES pole vibration on Bunny Bordelon

During the initial patch test at the start of Bunny Bordelon operations, excessive vibration vibration or shaking became apparent in the MBES pole at speeds above about 4 knots. The effect on the data was minimized by adding additional support to the pole and minimizing survey speeds while a replacement MBES pole was fabricated. The new MBES pole was installed on JD2018-278, which resolved the issue for the remainder of the survey. Data quality collected with the shaky pole (up to and including JD2018-278) was found to be acceptable, largely due to the submersible IMU co-located with the MBES head which moved at the same frequency as the MBES head. However, this data exhibited above average noise, which was rejected in processing. The first data with the new pole, which did not exhibit similar issues and was used until the end of the project, was collected on JD2018-282. Data is within specifications.

B.2.6 Factors Affecting Soundings

Sound Speed Error

Sound speed error or refraction is common in this data set. This is observed as a general downward or upward cupping ("frowning" or "smiling") of the seafloor MBES profiles. The issue was exacerbated by use of a dual-head MBES system, which increased swath-width in order to cover more area per LNM collected but also resulted in outer beam data that was more susceptible to induced error from variations in sound speed profiles.

In processing, lines with excessive sound speed error were analyzed to determine if better results could be obtained from manually choosing a specific sound speed profile instead of using the project default "nearest in distance within time 4 hours". These are itemized later in this report.

Finally, swath filters as well as manual editing in subset mode was used to reject outer beam soundings that appeared to exceed IHO Order 1a specifications (considered conservatively to be greater than 0.5 m from estimated true seafloor based on nadir depth).

The entire NE portion of the sheet was most affected by sound speed error. This area received a 55 degree beam filter which removed the majority of the outer swath. Coverage requirements are met in the affected area with SSS, however, the process did expose some minor holidays in the SSS coverage due to layback corrections -- rejected MBES data was examined in these apparent gaps for significant objects and none were found.

Crossline analysis, which included crossings of good near-nadir crossline data over outerbeam mainscheme data exhibiting sound speed error, passes within IHO Order 1a indicating final surfaces are within specifications.

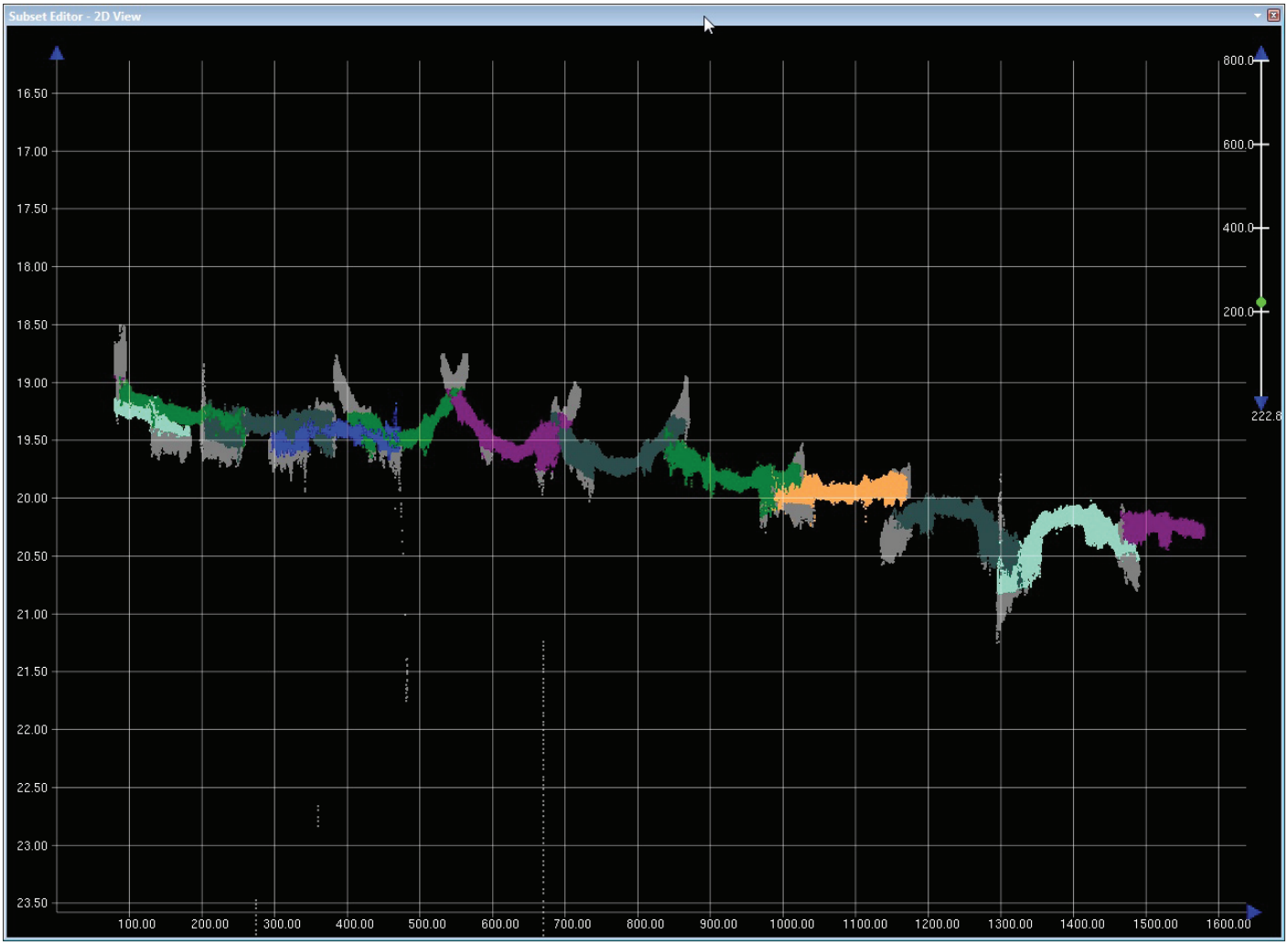

Figure 6: Example of sound speed error from this survey. A collection of lines exhibit little to no sound speed error (left) while others show significant sound speed error, transitioning from an upward cupping (middle) to a downward cupping (right) in swath data. Gray soundings were considered to exceed IHO Order 1a and were rejected so as to be excluded from the final surfaces.

SSS Refraction and Surface Noise

The SSS image quality is intermittently affected by thermocline refraction as well as water column noise due to waves at the surface, leading to variable artifacts in SSS data. SSS image quality was monitored continually during acquisition and SSS operations were stopped when it was determined that imagery quality had degraded to a point that significant objects were unlikely to be resolved. At this time either MBES-only operations were carried out with a tighter line spacing to obtain Complete Coverage, or vessel downtime due to weather was commenced.

B.2.7 Sound Speed Methods

Sound Speed Cast Frequency: 2 hours

Sound speed profiles ("casts") were collected while underway. A combination of AML Minos-X, Valeport RapidSV, and Valeport SWIFT SVP profilers were used over the course of the project. Changes in sound speed at the MBES sonar head were monitored and a sound speed profile was acquired when the sound speed at the head differed from the sound speed at the depth of the sonar head in the previous profile by greater than 2 m/s. This resulted in an interval of approximately 2 hours between subsequent casts. Casts were taken as deep as possible, usually extending to the seafloor. These were normally applied nearest in distance in time within 4 hours in CARIS HIPS to exclude profiles too outdated or distant from the applicable sounding data. Refer to the DAPR for more information on SVP profiling including specific instruments used, SVP confidence checks performed, and processing methodology.

B.2.8 Coverage Equipment and Methods

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

B.3 Echo Sounding Corrections

B.3.1 Corrections to Echo Soundings

SVP Profile Exceptions

As described earlier, in processing, lines with excessive sound speed error were analyzed to determine if better results could be obtained from manually choosing a specific sound speed profile instead of using the project default "nearest in distance within time 4 hours". To apply in CARIS, this necessitated placing individual casts in their own CARIS SVP file and applying using the custom file instead of the sheet-wide file which contained all casts. These were generally applied also using the setting "nearest in distance within time 4 hours", though the time interval needed to be changed on occasion to include the favored profile. These files are included with the CARIS SVP data and were applied as follows:

JD324
Used 0950-Bunny-324-G1-435_JD324_1522.svp to force the named line to use the JD324 15:22 SVP profile.

Used 0946-Bunny-324-G1-371_-_0002_JD324_1127.SVP and 0946-Bunny-324-G1-371_-_0003_JD324_0827.SVP to force the lines to use the aforementioned profiles.

JD325
Used profile JD325 09:15 (file 0972_0971_0969-Bunny-G1_-_0002_JD325_0915.svp) on lines:
0969-Bunny-325-G1-739_-_0002
0971-Bunny-325-G1-755_-_0002
0972-Bunny-325-G1-723_-_0002

Used profile JD325 06:47 (file 0972_0971_0969-Bunny-G1_-_0002_JD325_0647.svp) on lines:
0969-Bunny-325-G1-739_-_0001
0971-Bunny-325-G1-755_-_0001
0972-Bunny-325-G1-723_-_0001

Used Profile JD325 11:14 (file 0974-Bunny-325-G1-771_-_0001_JD325_1114.svp) with ndt 4 hours on line:
0974-Bunny-325-G1-771_-_0001

Used Profile JD325 20:08:57 (file Lines_0979-0985-Bunny-325-G1_JD325_2008.svp) with ndt 6 hours on lines:
0978-Bunny-325-G1-851_-_0001
0979-Bunny-325-G1-867_-_0003
0980-Bunny-325-G1-899_-_0001
0981-Bunny-325-G1-883_-_0003
0982-Bunny-325-G1-915_-_0001
0983-Bunny-325-G1-931_-_0002
0984-Bunny-325-G1-947_-_0001

JD326
Used profile JD326 0911 (file lines_0993-0994_0996-0997-Bunny-G2_JD326_0911.svp) with ndt 4 hours with lines:
0993-Bunny-326-G2-558_-_0001
0994-Bunny-326-G2-558_-_0001
0996-Bunny-326-G2-574_-_0002
0997-Bunny-326-G2-586_-_0001

Used profile JD326 17:51 (file Lines_1002_1003-Bunny-326-G2_JD326_1751.svp) with ndt 4 hours:
1002-Bunny-326-G2-774_-_0003
1003-Bunny-326-G2-746_-_0001
1003-Bunny-326-G2-746_-_0002

Used profile JD326 12:45 (file Line_1001-Bunny-326-G2-846_JD326_1245.svp) with ndt 4 hours:
1001-Bunny-326-G2-846_-_0002

Used profile JD326 13:50 (file Line_1000-Bunny-326-G2-760_JD326_1350.svp) with ndt 4 hours:
1000-Bunny-326-G2-760_-_0001

Used profile JD326 16:18 (file Line_1001-Bunny-326-G2-846_JD326_1618.svp) with ndt 4 hours:
1001-Bunny-G2-846_-_0003

Used profile JD326 19:54 (file Lines_1005-1007-Bunny-326-G2_JD326_1954.svp) with ndt 4 hours:
1005-Bunny-326-G2-802_-_0003
1006-Bunny-326-G2-816_-_0001
1007-Bunny-326-G2-831_-_0003

1007-Bunny-326-G2-831_-_0004

Used profiles JD327 00:35 and JD327 02:18 (file Line_1014-Bunny-G2-72_-_0002_JD327_0035_&_0218.svp) wit ndt 4 hours:
1014-Bunny-326-G2-729_-_0002

JD327
Used profile JD327 06:12 (file Line_1018-1019-Bunny-327-G2_JD327_0612.svp) with ndt 4 hours with lines:
1018-Bunny-327-G2-665_-_0003

Used profile JD327 02:18 (file Line_1016-1017-Bunny-327-G2_JD327_0218.svp) with ndt 4 hours with line:
1016-Bunny-327-G2-697_-_0003
1017-Bunny-327-G2-681_-_0001

Used profile JD327 04:34 (file Line_1017-1019-Bunny-327-G2_JD327_0434.svp) with ndt 4 hours with line:
1014-Bunny-326-G2-729_-_0001 (ndt 6hr)
1015-Bunny-327-G2-713_-_0002
1015-Bunny-327-G2-713_-_0003
1016-Bunny-327-G2-697_-_0001
1016-Bunny-327-G2-697_-_0002

1017-Bunny-327-G2-681_-_0002
1019-Bunny-327-G2-650_-_0002
1019-Bunny-327-G2-650_-_0003

Used profiles JD327 04:34 and 06:12 (file Lines__1018_1019-327-G2_JD327_0434_0612.svp) with ndt 4 hours:
1019-Bunny-327-G2-650_-_0001
1018-Bunny-327-G2-685_-_0002

SVP NDT 4 Hour Exceptions

The following lines used the sheet-wide SVP file but required use of "nearest in distance within time 6 hours" instead of the project-default 4 hours due to lack of sound speed profiles while troubleshooting profiler issues. These were:

0022-Bunny-270-G1-82_-_0006
0023-Bunny-270-G2-82_-_0001
0023-Bunny-270-G2-82_-_0002
0023-Bunny-270-G2-82_-_0003
0023-Bunny-270-G2-82_-_0004
0023-Bunny-270-G2-82_-_0005

0023-Bunny-270-G2-82_-_0006

B.3.2 Calibrations

All sounding systems were calibrated as detailed in the DAPR.

B.4 Backscatter

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

B.5 Data Processing

B.5.1 Primary Data Processing Software

The following Feature Object Catalog was used: NOAA Profile V_5_7.

NOAA Extended Attribute File V5.7 was used as the most current feature file version at the commencement of survey acquisition.

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
H13185_MB_1m_MLLW_Final	CARIS Raster Surface (CUBE)	1 meters	0 meters - 20 meters	NOAA_1m	Complete MBES
H13185_MB_2m_MLLW_Final	CARIS Raster Surface (CUBE)	2 meters	18 meters - 40 meters	NOAA_2m	Complete MBES
H13185_SSSAB_1m_400kHz	SSS Mosaic	1 meters	0 meters - 40 meters	N/A	100% SSS

Table 10: Submitted Surfaces

The final depth information for this survey was submitted as CARIS BASE surfaces (CSAR format) which best represented the seafloor at the time of the survey. The surfaces were created from fully processed data with all final corrections applied. Surfaces were created using NOAA CUBE parameters and resolutions by

depth range in conformance with the 2018 HSSD. Surfaces were finalized, and designated soundings were applied. Horizontal projection was selected as UTM Zone 14 North, NAD83. Non-finalized versions of the CSAR surfaces are also included which do not have a depth cutoff applied. These do not have the "_Final" designation in the filename.

A crossline QC surface is also included with the surface deliverables ("H13185_XLQC-MS-only_2m"). This is the 2 m resolution CUBE surface in CSAR format discussed previously in the crossline section used to create the crossline QC reports. This surface excludes crosslines. It is included for reference only and should not be used for charting.

SSS mosaics were exported from Chesapeake SonarWiz 7 software at 1 m resolution using a grayscale pallet per the 2018 HSSD. The grayscale coverages are not the SonarWiz default color pallet, which is a bronze color -- as a result the grayscale images appear rougher and less visually appealing than the bronze images. Therefore, bronze color versions are also included for reference and are recommended for use over the grayscale versions.

An S-57 (.000) Final Feature File (FFF) was submitted with the survey deliverables as well. The FFF contains meta-data and other data not readily represented by the final surfaces, including bottom samples and feature investigation results. An S-57 SSS contact file is also included. Each object is encoded with mandatory S-57 attributes and NOAA Extended Attributes (V#5.7).

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.

ERS Methods Used:

ERS via VDATUM

Ellipsoid to Chart Datum Separation File:

VDATUM_Outline_Shape_xyNAD83-MLLW_geoid12b.csar

Reduction to MLLW was accomplished using ERS methodology via VDATUM. The VDATUM model was provided by NOAA prior to operations and had an uncertainty specified as 10.4 cm. The VDATUM model was validated during this survey using comparisons with NWLON gauge data and found to be acceptable for tidal reduction. See the HVCR for validation reports.

C.2 Horizontal Control

The horizontal datum for this project is North American Datum 1983.

The projection used for this project is Projected UTM 14.

The following PPK methods were used for horizontal control:

Smart Base

Applanix Smart Base (ASB) was used as a comparison against Trimble PP-RTX results, and generally compared to 0.10 m or better.

All positions were post-processed in Applanix POSPac MMS software using Trimble PP-RTX as the correction source. RMS errors were generally at 0.10 m or better, both horizontally and vertically.

WAAS was used for real-time positioning only, and was replaced in post-processing with PP-RTX solutions for final MBES data. However SSS positions were not post-processed and are therefore based on WAAS positioning.

D. Results and Recommendations

D.1 Chart Comparison

The chart comparison was performed by examining the best-scale Electronic Navigational Charts (ENCs) that intersect the survey area. The latest edition(s) available at the time of the review were used. The chart comparison was accomplished by overlaying the finalized BASE surfaces with shoal-biased soundings, and final feature file on the charts in CARIS HIPS. The general agreement between charted soundings and survey soundings was then examined and a more detailed comparison was undertaken for any shoals or other dangerous features. In areas where a large scale chart overlapped with a small scale chart, only the larger scale chart was examined.

When comparing to survey data, chart scale was taken into account so that 1 mm at chart scale was considered to be the valid radius for charted soundings and features.

USCG LNM and NMs applicable to the survey area issued subsequent to the start of operations and prior to completion of operations were also examined.

It is recommended that in all cases of disagreement this survey should supersede charted data. Results are shown in the following sections.

D.1.1 Electronic Navigational Charts

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

ENC	Scale	Edition	Update Application Date	Issue Date	Preliminary?
US4TX28M	1:80000	18	11/16/2018	03/14/2019	NO
US4TX31M	1:80000	26	03/11/2019	03/19/2019	NO

Table 11: Largest Scale ENCs

US4TX28M

General agreement is excellent. Charted soundings agree with this survey to 0.5 m or better on average. No trends in deepening or shoaling were observed.

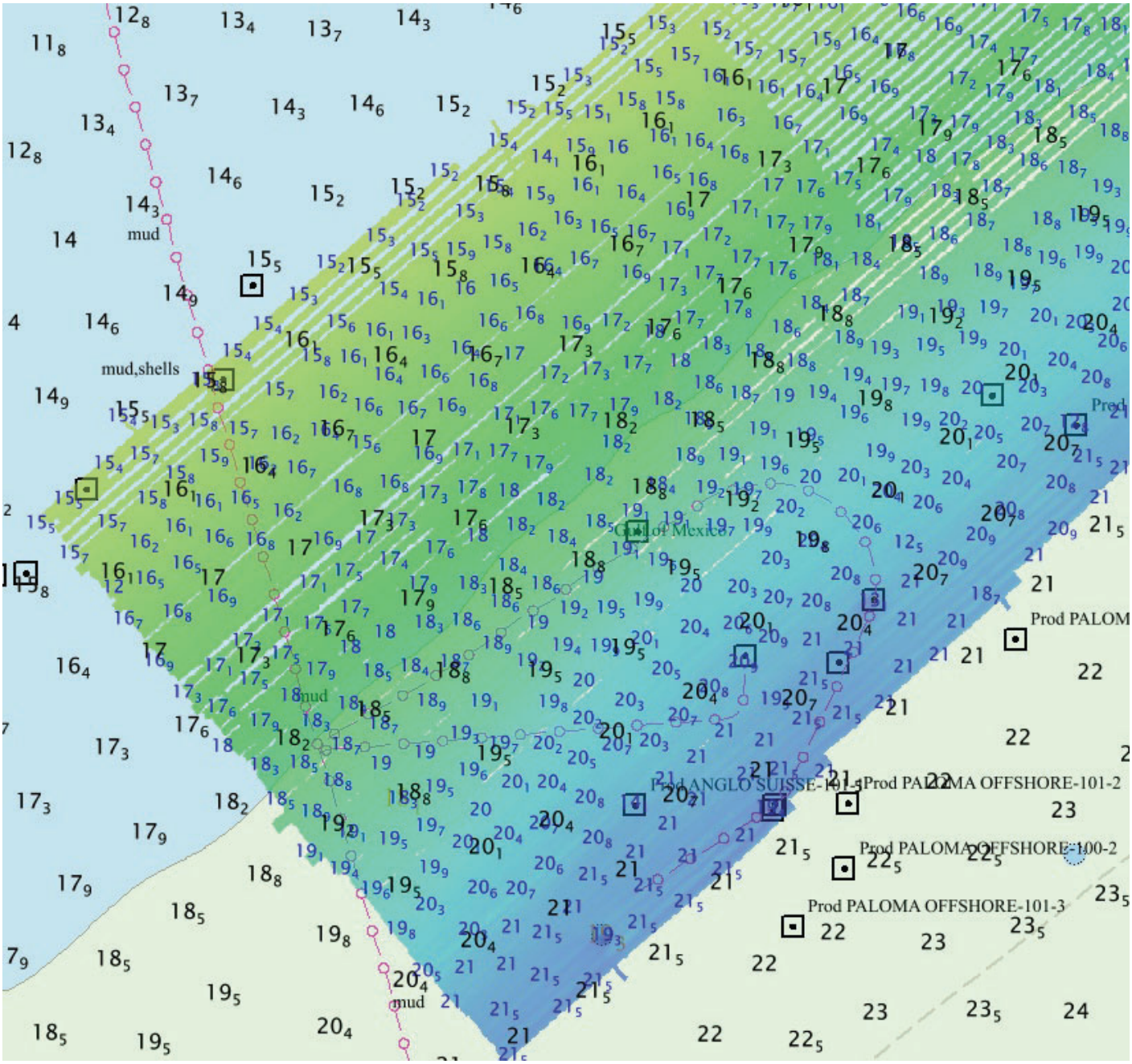

Figure 7: Soundings from this survey (blue) overlaid on soundings from US4TX28M. South portion of survey area. Soundings in meters.

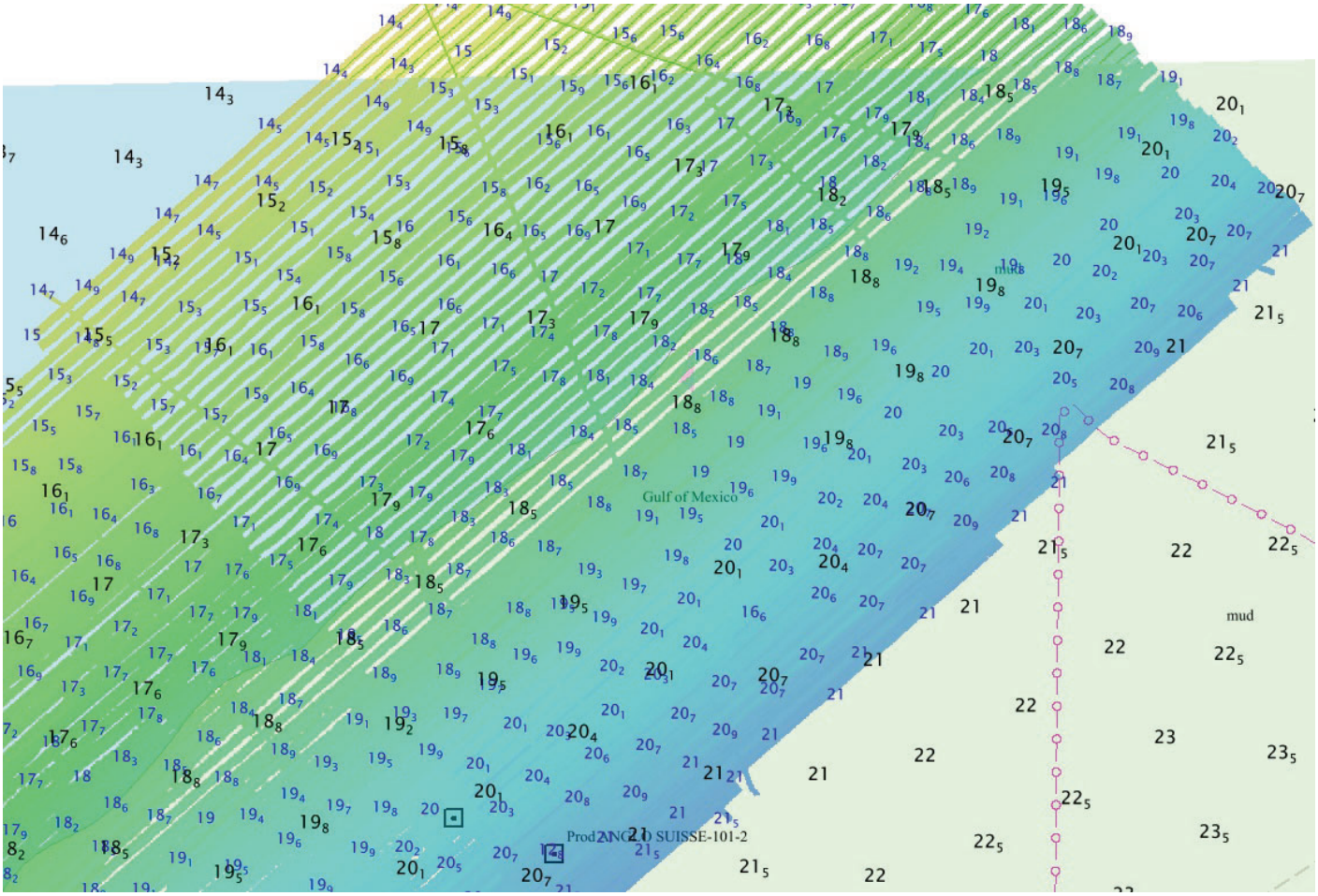

Figure 8: Soundings from this survey (blue) overlaid on soundings from US4TX28M. North portion of survey area. Soundings in meters.

US4TX31M

This survey has a small amount of overlap with US4TX31M on its north side. General sounding agreement is excellent, with soundings agreeing to 0.5 m or better. No trends in deepening or shoaling were observed.

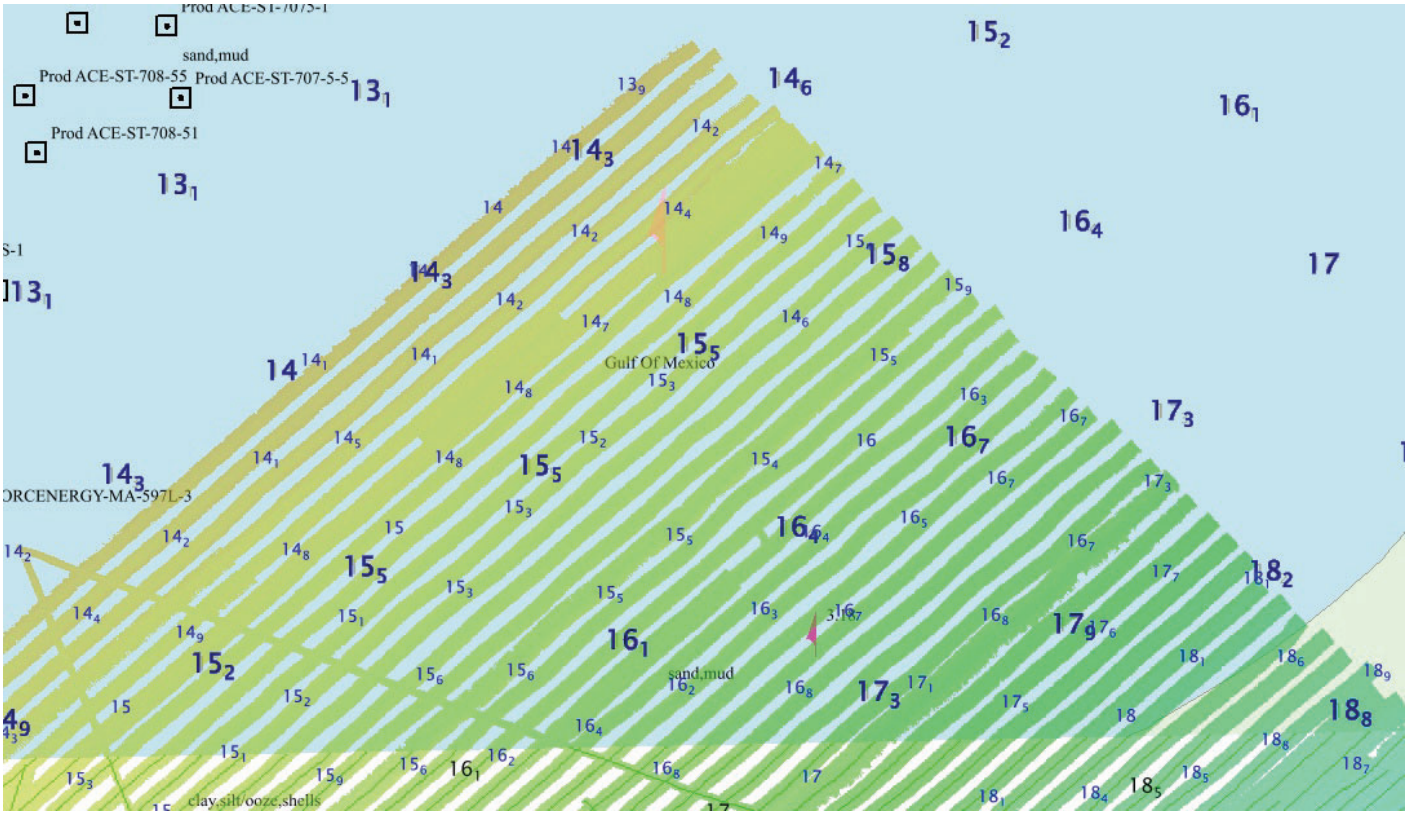

Figure 9: Soundings from this survey (blue) overlaid on soundings from US4TX31M. Soundings in meters.

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

New features are as described in the accompanying FFF.

D.1.5 Shoal and Hazardous Features

No shoals or potentially hazardous features exist for this survey.

D.1.6 Channels

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

D.1.7 Bottom Samples

Four samples were assigned in the project PRF. Samples were successfully obtained at all locations. Bottom sample results are provided in the accompanying FFF.

D.2 Additional Results

D.2.1 Shoreline

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

D.2.2 Prior Surveys

No prior survey comparisons were required for this survey.

D.2.3 Aids to Navigation

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

D.2.4 Overhead Features

No overhead features exist for this survey.

D.2.5 Submarine Features

Charted pipelines exist in the area but were generally not readily discernible in the survey data. None were found to be elevated or of navigational concern. All are recommended for retention in the FFF.

D.2.6 Platforms

Platforms were assigned in the CSF and investigated. Most were found to exist but at up to 70 m from charted/assigned position. Investigation results are available in the accompanying FFF.

D.2.7 Ferry Routes and Terminals

No ferry routes or terminals exist for this survey.

D.2.8 Abnormal Seafloor and/or Environmental Conditions

No abnormal seafloor and/or environmental conditions 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

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

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 Specifications and Deliverables document as well as the Hydrographic Survey Project Instructions and Statement of Work. This data is adequate to supersede charted data in their common areas. This survey is complete and no additional work is required with the exception of deficiencies--if any--noted in the Descriptive Report.

Report Name	Report Date Sent
Coast Pilot Report	2019-04-25
VDatum Validation Report for Port Lavaca	2019-04-24
NCEI Sound Speed Data Submission	2019-04-09
Marine Mammal Observers Training Logsheet and Observation Logs	2019-03-22
Port Lavaca Boat Float Tide Analysis	2018-09-18

Approver Name	Approver Title	Approval Date	Signature
Andrew Orthmann, C.H.	TerraSond Charting Program Manager	04/26/2019	Andrew Orthmann Digitally signed by Andrew Orthmann Date: 2019.04.26 14:18:41 -08'00'

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 Staiton
CTD	Conductivity Temperature Depth
CEF	Chart Evaluation File
CSF	Composite Source File
CST	Chief Survey Technician
CUBE	Combined Uncertainty and Bathymetry Estimator
DAPR	Data Acquisition and Processing Report
DGPS	Differential Global Positioning System
DP	Detached Position
DR	Descriptive Report
DTON	Danger to Navigation
ENC	Electronic Navigational Chart
ERS	Ellipsoidal Referenced Survey
ERZT	Ellipsoidally Referenced Zoned Tides
FFF	Final Feature File
FOO	Field Operations Officer
FPM	Field Procedures Manual
GAMS	GPS Azimuth Measurement Subsystem
GC	Geographic Cell
GPS	Global Positioning System
HIPS	Hydrographic Information Processing System
HSD	Hydrographic Surveys Division
HSSD	Hydrographic Survey Specifications and Deliverables

Acronym	Definition
HSTP	Hydrographic Systems Technology Programs
HSX	Hypack Hysweep File Format
HTD	Hydrographic Surveys Technical Directive
HVCR	Horizontal and Vertical Control Report
HVF	HIPS Vessel File
IHO	International Hydrographic Organization
IMU	Inertial Motion Unit
ITRF	International Terrestrial Reference Frame
LNM	Linear Nautical Miles
MBAB	Multibeam Echosounder Acoustic Backscatter
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
SSSAB	Side Scan Sonar Acoustic Backscatter
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 Stated Coast Guard
UTM	Universal Transverse Mercator
XO	Executive Officer
ZDA	Global Positiong System timing message
ZDF	Zone Definition File

APPENDIX I

Tides and Water Levels

Appendix I contains the following documentation.

1. Abstract of Times of Hydrography
2. Correspondence directly relating to tides and/or water levels

Data was reduced to MLLW using a VDATUM grid provided by NOAA. Therefore no Tide Notes, Transmittal Letters, or Request for Approved Tides letters exist.

The VDATUM model received a validation analysis; results are available with the project HVCR.

Abstract of Times of Hydrography

Project: OPR-K376-KR-18

Registry No.: H13185

Contractor: TerraSond Limited

Inclusive Dates: September 27, 2018 – December 15, 2018

Field work is complete.

All times UTC.

Year_DOY	Min Time	Max Time
2018_270	04:47:59	21:57:21
2018_312	23:20:42	23:50:30
2018_313	00:06:11	09:19:59
2018_318	17:56:33	23:42:46
2018_321	17:18:19	19:12:38
2018_322	05:06:54	23:51:55
2018_323	00:00:58	14:20:44
2018_324	03:53:02	23:59:50
2018_325	00:00:50	23:59:53
2018_326	00:00:53	23:59:12
2018_327	00:00:12	07:59:45
2018_338	03:47:42	22:56:34
2018_339	06:01:55	06:43:46
2018_345	01:29:48	01:31:48
2018_349	07:27:06	07:29:06

APPENDIX II

Supplemental Survey Records and Correspondence

Contents:

1. DTON recommendation(s) with NDB verification(s), if any

2. Other survey-related correspondence. See Appendix I for correspondence directly relating to tides and water levels.

Andrew Orthmann, CH

From: Brian Mohr - NOAA Federal <brian.mohr@noaa.gov>
Sent: Thursday, January 31, 2019 03:17
To: Andrew Orthmann, CH
Subject: Re: OPR-K376-KR-18 Port Lavaca survey outlines

Got it, thank you, I'll get H13181, H13185, H13186, H13187 updated in SURDEX shortly.

Brian Mohr
Physical Scientist - Data Manager
Hydrographic Surveys Division
brian.mohr@noaa.gov

On Fri, Jan 25, 2019 at 1:38 PM Andrew Orthmann, CH <aorthmann@terrasond.com> wrote:

> Hello,
>
> Please find attached survey outlines for project OPR-K376-KR-18, Port Lavaca, TX.
>
> Please note this is for 4 of 9 sheets in the project, the remaining sheets are in still being actively surveyed but should be finished soon.
>
> Thank you,
>
> Andy
>
> Andrew Orthmann, C.H.
> Charting Program Manager
>
> **TerraSond**
> **Precision Geospatial Solutions ®**
> 1617 South Industrial Way Suite 3, Palmer, Alaska 99645
> (907) 745-7215 Office (907) 745-7273 FAX (907) 982-5231 Cell
> aorthmann@terrasond.com www.terrasond.com
>

Andrew Orthmann, CH

From: Brian Mohr - NOAA Federal <brian.mohr@noaa.gov>
Sent: Monday, March 11, 2019 08:42
To: Andrew Orthmann, CH
Subject: Re: OPR-K376-KR-18 Port Lavaca survey outlines

Got it, thank you, I'll get H13180, H13182, H13183, H13184 and F00734 updated in SURDEX shortly.

Brian Mohr
Physical Scientist - Data Manager
Hydrographic Surveys Division
brian.mohr@noaa.gov

On Fri, Mar 8, 2019 at 9:56 PM Andrew Orthmann, CH <aorthmann@terrasond.com> wrote:

> Hello,
>
> Please find attached all remaining survey outlines for project OPR-K376-KR-18, Port Lavaca, TX.
>
> Thank you,
>
> Andy

From: Andrew Orthmann, CH
Sent: Friday, January 25, 2019 09:38
To: 'survey.outlines@noaa.gov' <survey.outlines@noaa.gov>
Cc: 'Kathryn Pridgen - NOAA Federal' <kathryn.pridgen@noaa.gov>
Subject: OPR-K376-KR-18 Port Lavaca survey outlines

Hello,

Please find attached survey outlines for project OPR-K376-KR-18, Port Lavaca, TX.

Please note this is for 4 of 9 sheets in the project, the remaining sheets are in still being actively surveyed but should be finished soon.

Thank you,

Andy

Andrew Orthmann, C.H.
Charting Program Manager

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(907) 745-7215 Office (907) 745-7273 FAX (907) 982-5231 Cell
aorthmann@terrasond.com www.terrasond.com

Andrew Orthmann, CH

From: Blair Delean - NOAA Federal <blair.j.delean@noaa.gov>
Sent: Friday, March 22, 2019 14:53
To: Andrew Orthmann, CH
Cc: pop.information@noaa.gov; ocs.ecc@noaa.gov; Kathryn Pridgen - NOAA Federal
Subject: Re: OPR-K376-KR-18 marine mammal observation logs

Excellent, thank you Andrew for your submission to the marine mammal POP.

Very Respectfully,

LTJG Blair Delean, NOAA
Marine Mammal Laboratory
206.526.4048

On Fri, Mar 22, 2019 at 1:32 PM Andrew Orthmann, CH <aorthmann@terrasond.com> wrote:

> Hello,
>
> Attached are the Marine Mammal Observation logs from OPR-K376-KR-18, Port Lavaca, TX.
>
> Andy
>
> Andrew Orthmann, C.H.
> Charting Program Manager
>
> **TerraSond**
> **Precision Geospatial Solutions** ®
> 1617 South Industrial Way Suite 3, Palmer, Alaska 99645
> (907) 745-7215 Office (907) 745-7273 FAX (907) 982-5231 Cell
> aorthmann@terrasond.com www.terrasond.com
>

Marine Mammal Training Video Logsheet
OPR-K376-KR-18 Port Lavaca, TX

List of those who have watched the Marine Species Awareness Training video:

Printed Name	Signature	Date
T. Marino		8/22/18
D. Maggio	David Maggio	9/21/18
P. Kelly		9/21/18
B. Hanson		9/26/18
S. Udy		10/1/18
H. Nikolis		10/1/18
LUCAS BLASS		11/15/2018
Whitney Martin	Whitney Martin	11/15/18
L. HOLLAHAN		~~1/17/19~~ LH 10/28/18

Andrew Orthmann, CH

From: Andrew Orthmann, CH
Sent: Friday, March 22, 2019 12:26
To: 'ocs.ecc@noaa.gov'
Cc: 'Kathryn Pridgen - NOAA Federal'
Subject: OPR-K376-KR-18 trained marine mammal observer logsheet
Attachments: OPR_K376_KR_18_MMO_TrainingVideoLogsheet.pdf

Hello, please find attached the marine mammal training logsheet for the OPR-K376-KR-18, Port Lavaca, TX project.

Thank you,

Andy

Andrew Orthmann, C.H.
Charting Program Manager

TerraSond
Precision Geospatial Solutions ®
1617 South Industrial Way Suite 3, Palmer, Alaska 99645
(907) 745-7215 Office (907) 745-7273 FAX (907) 982-5231 Cell
aorthmann@terrasond.com www.terrasond.com

Andrew Orthmann, CH

From: Andrew Orthmann, CH
Sent: Tuesday, April 09, 2019 13:36
To: 'NODC.submissions@noaa.gov'
Cc: 'kathryn.pridgen@noaa.gov'
Subject: sound speed profile data submission for OPR-K376-KR-18
Attachments: OPR-K376-KR-18_20190409.zip

Hello,

Please find attached the sound speed profile data for nautical charting project OPR-K376-KR-18. These were taken by TerraSond near Port Lavaca, TX, during the period August 2018 to February, 2019.

Please note the .nc files are organized in the zip file by the three vessels used on the project. These were the MV Sea Ark (hull id # SOM28799I506), RV Bella Marie (hull # IAR36CATK405), and RV Bunny Bordelon (USCG official number 1113614).

Please feel free to contact me with any questions.

Thank you,

Andy

Andrew Orthmann, C.H.
Charting Program Manager

TerraSond
Precision Geospatial Solutions ®
1617 South Industrial Way Suite 3, Palmer, Alaska 99645
(907) 745-7215 Office (907) 745-7273 FAX (907) 982-5231 Cell
aorthmann@terrasond.com www.terrasond.com

Andrew Orthmann, CH

From: Andrew Orthmann, CH
Sent: Thursday, April 25, 2019 09:50
To: 'ocs.ndb@noaa.gov'; 'Coast.Pilot@noaa.gov'
Cc: 'Kathryn Pridgen - NOAA Federal'
Subject: Coast Pilot Review for OPR-K376-KR-18
Attachments: OPR-K376-KR-18_Coast Pilot Review Report.pdf

Hello,

Please find attached the Coast Pilot Review for the hydrographic survey OPR-K376-KR-18, Port Lavaca, TX. This pertains to Coast Pilot 5, 46th edition.

Feel free to contact me with any questions.

Thank you,

Andy

Andrew Orthmann, C.H.
Charting Program Manager

TerraSond
Precision Geospatial Solutions ®
1617 South Industrial Way Suite 3, Palmer, Alaska 99645
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aorthmann@terrasond.com www.terrasond.com

APPROVAL PAGE

H13185

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

- Descriptive Report
- Data Acquisition and Processing Report
- Collection of Bathymetric Attributed Grids (BAGs)
- Processed survey data and records
- Geospatial PDF of survey products
- Collection of backscatter mosaics

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

Approved: MCGOVERN.MEGHAN.ELIZABETH.1284020495 Digitally signed by MCGOVERN.MEGHAN.ELIZABETH.1284020495 Date: 2020.06.15 10:56:07 -04'00'

Commander Meghan McGovern, NOAA
Chief, Atlantic Hydrographic Branch