

H13303

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

DESCRIPTIVE REPORT

Type of Survey: Basic Hydrographic Survey

Registry Number: H13303

LOCALITY

State(s): Virginia

General Locality: Areas of Mobjack Bay, VA and Choptank River, MD

Sub-locality: Wolf Trap

2021

CHIEF OF PARTY
Paul L. Donaldson

LIBRARY & ARCHIVES

Date:

HYDROGRAPHIC TITLE SHEET

H13303

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

State(s): **Virginia**

General Locality: **Areas of Mobjack Bay, VA and Choptank River, MD**

Sub-Locality: **Wolf Trap**

Scale: **20000**

Dates of Survey: **09/23/2020 to 05/18/2021**

Instructions Dated: **08/19/2020**

Project Number: **OPR-E350-KR-20**

Field Unit: **Leidos**

Chief of Party: **Paul L. Donaldson**

Soundings by: **Multibeam Echo Sounder**

Imagery by: **Multibeam Echo Sounder Backscatter Side Scan Sonar**

Verification by: **Atlantic Hydrographic Branch**

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

Remarks:

Contract: 1305M220DNCNJ0056/TO-0001. Contractor: Leidos, 221 Third Street, Newport, RI 02840 USA. Subcontractors: Divemasters, Inc., 15 Pumpshire Road, Toms River, NJ 08753; OARS, 8705 Shoal Creek Blvd, Suite 109, Austin, TX 78757. Leidos Doc. 21-TR-004. All times were recorded in UTC. Final data are corrected to North American Datum of 1983 (NAD83) 2011 realization 2010 (NAD83(2011)2010.0), UTM Zone 18N.

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

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Descriptive Report to Accompany Survey H13303

Project: OPR-E350-KR-20

Locality: Areas of Mobjack Bay, VA and Choptank River, MD

Sublocality: Wolf Trap

Scale: 1:20000

September 2020 - May 2021

Leidos

Chief of Party: Paul L. Donaldson

A. Area Surveyed

The area surveyed was a section of the Chesapeake Bay, with southern survey extents at the entrance of Mobjack Bay, continuing east and north of Wolf Trap to approximately the Milford Haven Spit (Figure 1).

A.1 Survey Limits

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
37° 27' 21.76" N 76° 18' 47.42" W	37° 15' 13.89" N 76° 9' 13.22" W

Table 1: Survey Limits

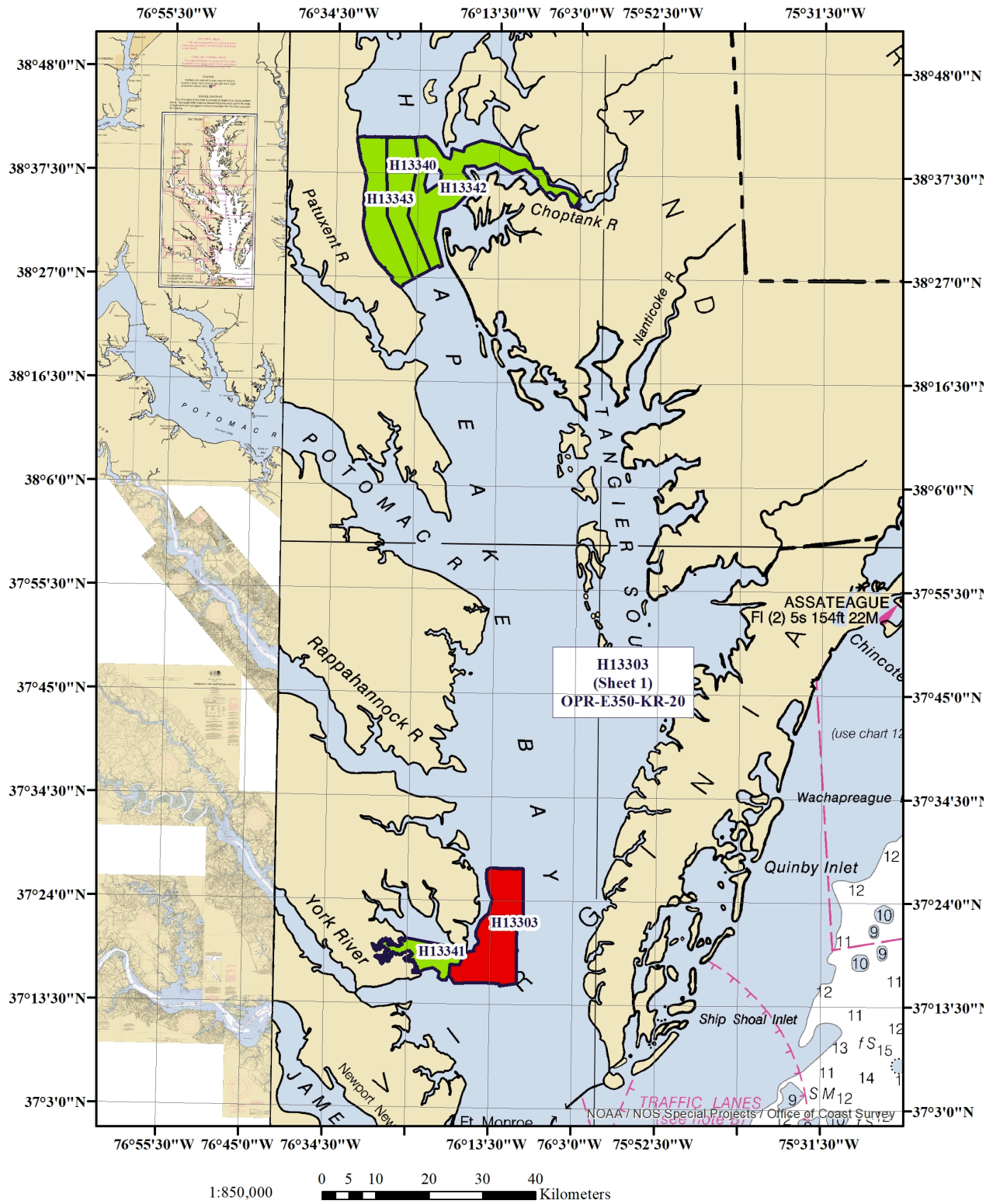


Figure 1: H13303 Survey Bounds

Survey limits were acquired in accordance with the requirements in the Project Instructions and the Hydrographic Surveys Specifications and Deliverables (HSSD), May 2020.

A.2 Survey Purpose

The central Chesapeake Bay is a critical shipping corridor for commerce transiting to and from the Port of Baltimore, as well the region supports an important commercial fishery, which includes menhaden, crabs and oysters. The purpose of this project is to provide contemporary surveys to update National Ocean Service nautical charts and products to support navigation safety and monitor the health of the environment.

Survey vintage predates the 1950s for the majority of the project area despite vessels transiting within close proximity to the seafloor. This project covers approximately 203 square nautical miles that will close a critical gap in existing modern hydrographic data for the stretch between the entrance to Chesapeake Bay up through Baltimore, MD. This project will provide critical data for the updating of National Ocean Service (NOS) nautical charting products to increase maritime safety in the region. Survey data from this project is intended to supersede all prior survey data in the common area.

A.3 Survey Quality

The entire survey is adequate to supersede previous data.

Leidos warrants only that the survey data acquired by Leidos and delivered to NOAA under Contract 1305M220DNCNJ0056 reflects the state of the sea floor in existence on the day and at the time the survey was conducted.

H13303 was surveyed in accordance with the following documents:

1. 1305M220DNCNJ0056/1305M220FNCNJ0278P21001 dated 19 August 2020
2. Hydrographic Surveys Specifications and Deliverables (HSSD), May 2020
3. OPR-E350-KR-20_PR.F.000, received 02 September 2020
4. OPR-E350-KR-20_CS.F.000, received 12 August 2020
5. OPR-E350-KR-20 Virtual Meeting with NOAA Responses.pdf, dated 23 March 2021

A.4 Survey Coverage

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

Water Depth	Coverage Required
H13303	Complete Coverage (Refer to HSSD Section 5.2.2.3)
8 meters water depth and shoaler	Sidescan may be acquired at an altitude of 6-20% of the range scale

Table 2: Survey Coverage

Leidos chose to achieve the coverage requirement using Complete Coverage, Option B (100% side scan sonar coverage with concurrent multibeam). Survey coverage achieved was in accordance with the requirements in the Project Instructions and the HSSD (Figure 2 through Figure 4).

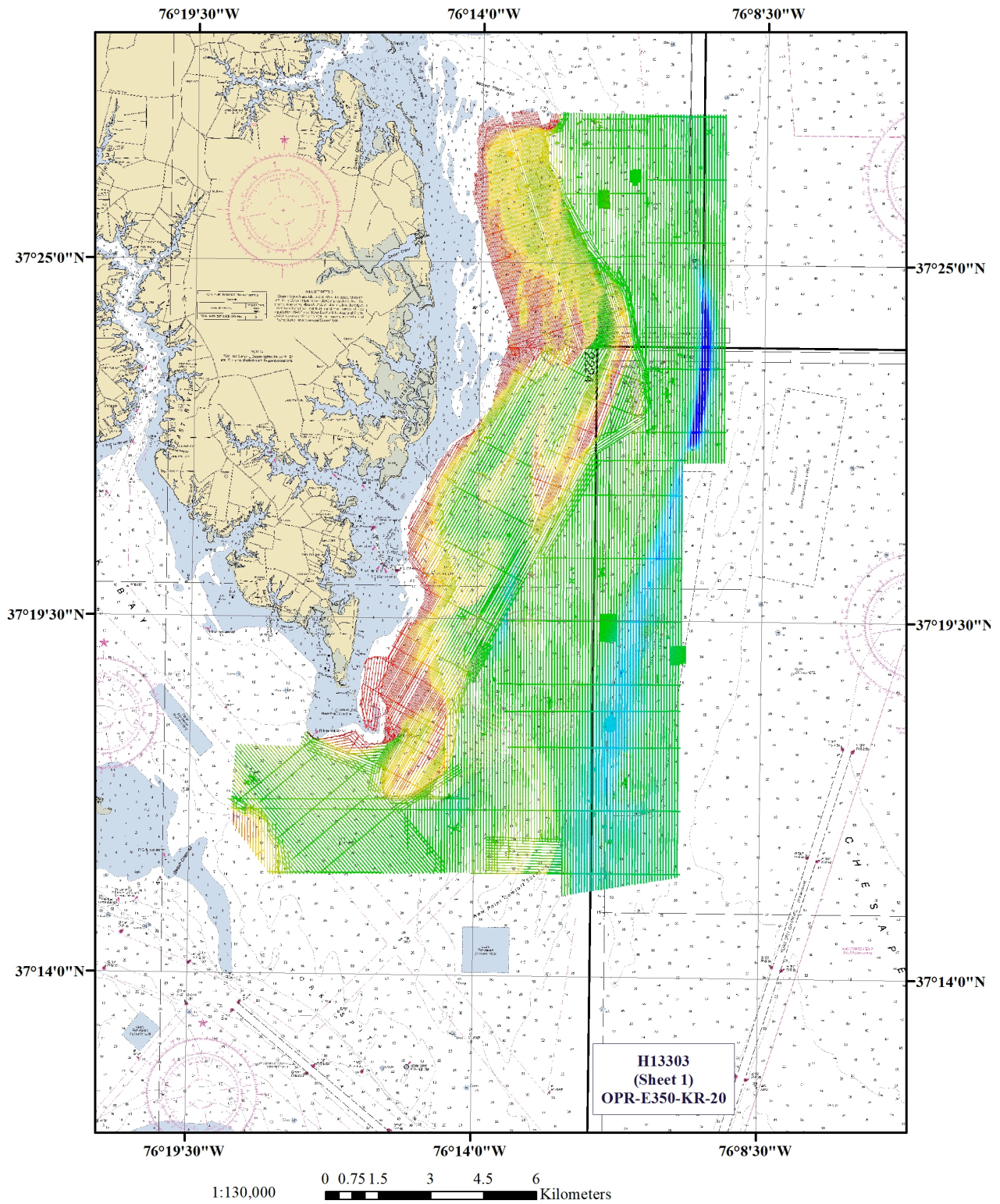


Figure 2: Final Bathymetry Coverage for H13303

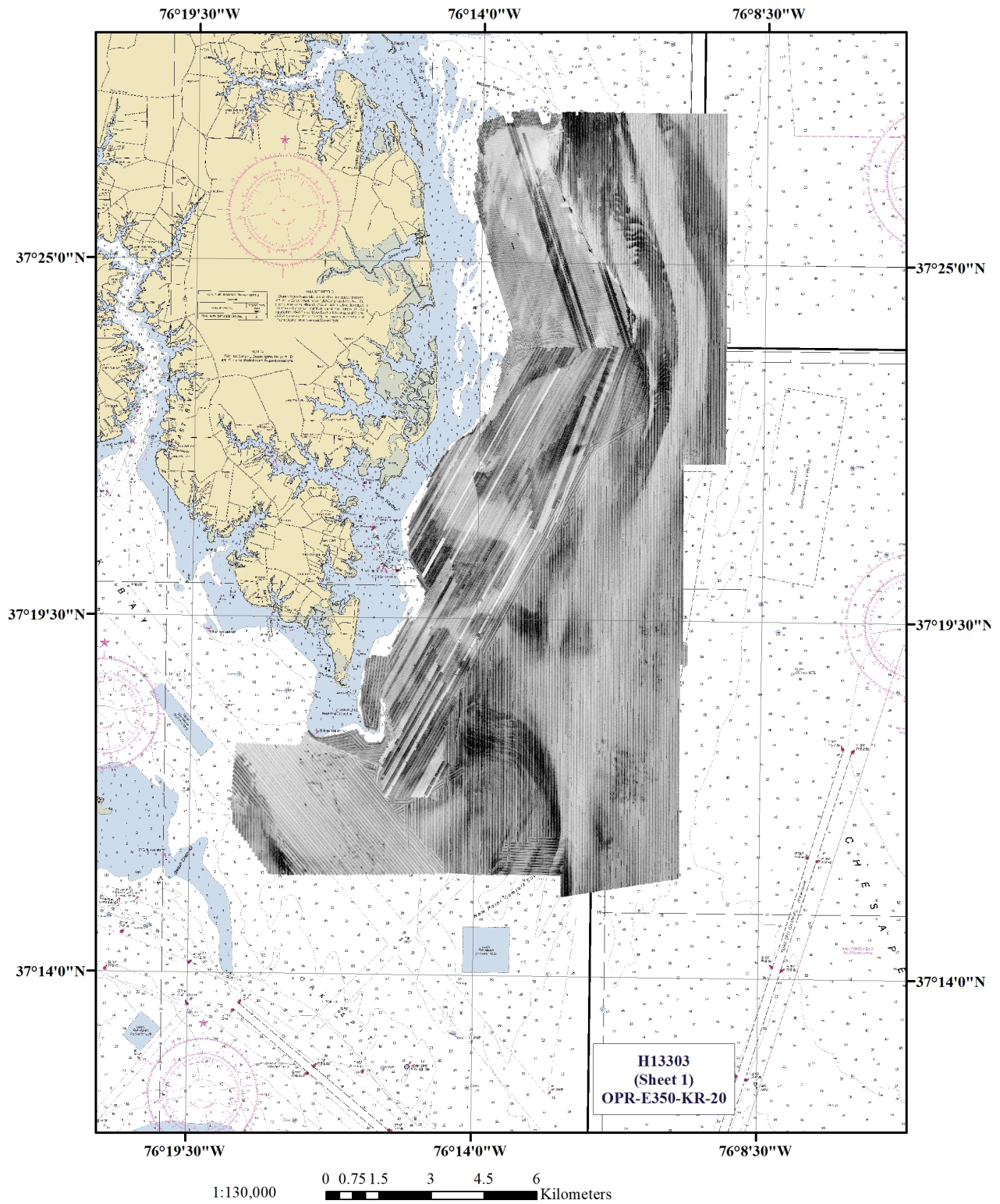


Figure 3: Final Side Scan Coverage for H13303 (First 100% coverage)

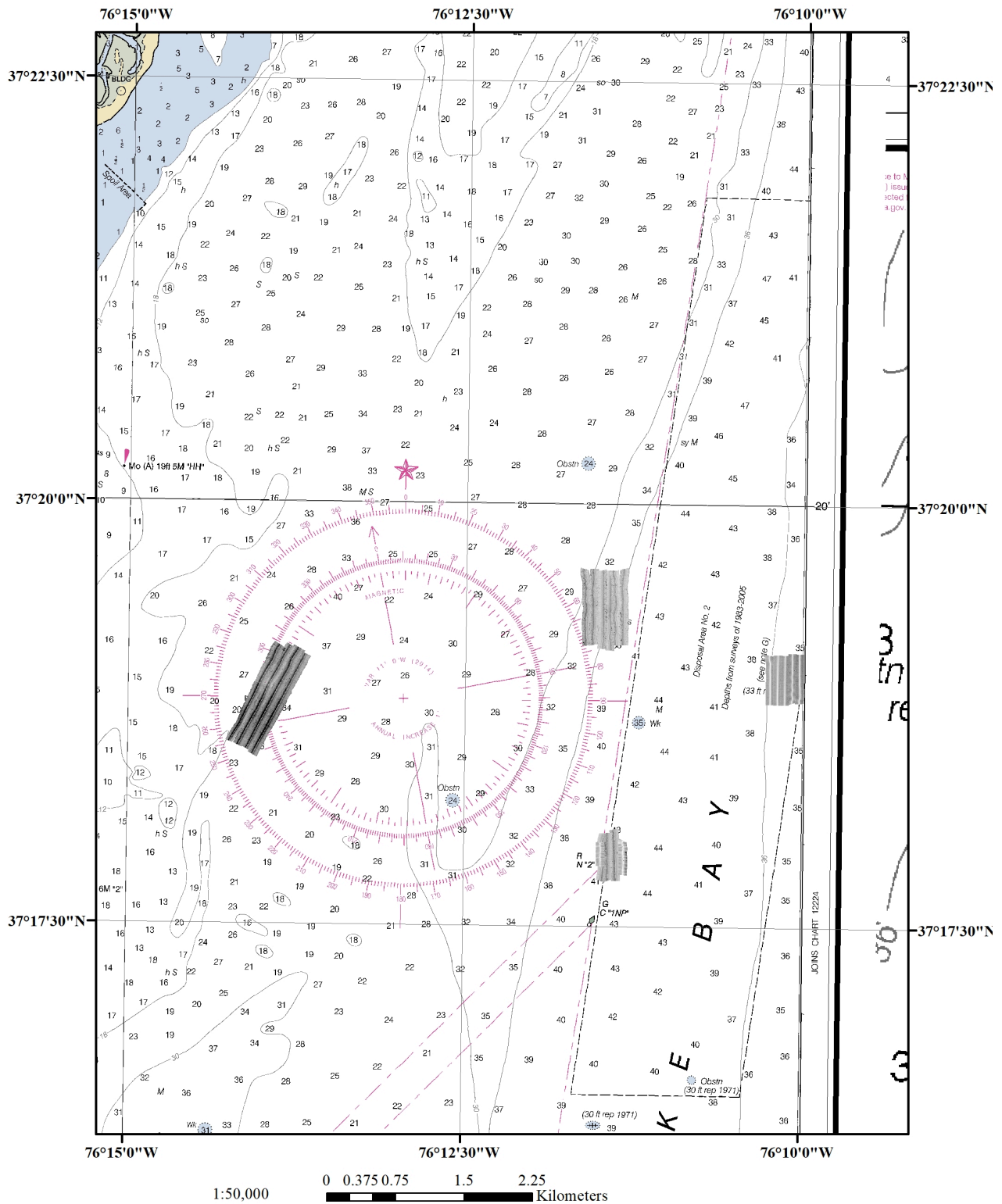


Figure 4: Final Side Scan Coverage for H13303 (Second 100% coverage)

A.6 Survey Statistics

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

	HULL ID	<i>M/V Atlantic Surveyor</i>	<i>R/V Oyster Bay II</i>	<i>Total</i>
LNM	SBES Mainscheme	0.0	0.0	0.0
	MBES Mainscheme	0.0	0.0	0.0
	Lidar Mainscheme	0.0	0.0	0.0
	SSS Mainscheme	0.0	0.0	0.0
	SBES/SSS Mainscheme	0.0	0.0	0.0
	MBES/SSS Mainscheme	942.15	695.63	1637.78
	SBES/MBES Crosslines	49.49	42.59	92.08
	Lidar Crosslines	0.0	0.0	0.0
Number of Bottom Samples				14
Number Maritime Boundary Points Investigated				0
Number of DPs				0
Number of Items Investigated by Dive Ops				0
Total SNM				53.05

Table 3: Hydrographic Survey Statistics

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

Survey Dates	Day of the Year
09/23/2020	267
09/24/2020	268
09/25/2020	269
09/26/2020	270
09/27/2020	271
09/28/2020	272
09/29/2020	273
09/30/2020	274
10/01/2020	275
10/13/2020	287
10/14/2020	288
10/15/2020	289
10/27/2020	301
10/28/2020	302
11/05/2020	310
11/07/2020	312
11/08/2020	313
11/09/2020	314
11/10/2020	315
11/11/2020	316
05/05/2021	125
05/06/2021	126
05/07/2021	127
05/09/2021	129
05/11/2021	131
05/12/2021	132
05/13/2021	133
05/14/2021	134
05/15/2021	135
05/16/2021	136
05/18/2021	138

Table 4: Dates of Hydrography

B. Data Acquisition and Processing

B.1 Equipment and Vessels

Leidos used their ISS-2000 software on a Windows platform to acquire these survey data. Survey planning and data analysis were conducted using the Leidos SABER software on Linux platforms. Side scan sonar (SSS) data were collected on a Windows platform using Klein's SonarPro software. Subsequent processing and review of the SSS data, including the generation of coverage mosaics, were accomplished using SABER.

A detailed description of the systems and vessels used to acquire and process these data is included in the Data Acquisition and Processing Report (DAPR) for OPR-E350-KR-20, delivered previously with H13341. There were no variations from the equipment configuration described in the DAPR except for Section A.5.4 Laser Rangefinders. A TruPulse 200X was utilized to determine elevations of assigned features.

B.1.1 Vessels

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

Hull ID	<i>M/V Atlantic Surveyor</i>	<i>R/V Oyster Bay II</i>
LOA	110.0 feet	30.0 feet
Draft	9.0 feet	3.0 feet

Table 5: Vessels Used



Figure 5: M/V Atlantic Surveyor



Figure 6: R/V Oyster Bay II

The M/V Atlantic Surveyor (Figure 5) was used to collect multibeam echo sounder (MBES) (RESON SeaBat T50), side scan sonar (SSS) (Klein 3000), and sound speed data during twenty-four hours per day survey operations. The R/V Oyster Bay II (Figure 6) was used to collect MBES (RESON SeaBat 7125 SV1 and RESON SeaBat T50), SSS (Klein 4900), and sound speed data during twelve hours per day survey operations.

A detailed description of the vessels used is included in the DAPR.

B.1.2 Equipment

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

Manufacturer	Model	Type
Teledyne RESON	SeaBat T50-R	MBES
Teledyne RESON	SeaBat 7125 SV	MBES
Klein Marine Systems	System 3000	SSS
Klein Marine Systems	System 4900	SSS
Applanix	POS MV 320 v5	Positioning and Attitude System
AML Oceanographic	MVP30	Sound Speed System
AML Oceanographic	BaseX2	Sound Speed System

Table 6: Major Systems Used

A detailed description of the equipment installed is included in the DAPR.

B.2 Quality Control

B.2.1 Crosslines

Multibeam echo sounder crosslines acquired for this survey totaled 5.62% of mainscheme acquisition.

Refer to Separates II for details about how the crossing analyses were performed and a complete discussion of each analysis and tabular results. Figure 7 summarizes the crossline comparison results. Additionally, repeatability analysis was conducted between the two vessels used during H13303 results are summarized in Figure 8.

Difference Grid	Minimum and Maximum CUBE Depth (meters) of Crossline Grid	IHO Order 1A Maximum Allowable Uncertainty (meters) for the Range of Depths	Percentage of Depth Differences Within IHO Order 1A Maximum Allowable Uncertainty
M/V Atlantic Surveyor and R/V Oyster Bay II Multibeam 1-meter Crossline (Class 1) to Atlantic Surveyor and R/V Oyster Bay II Multibeam 1-meter Mainscheme	1.958 – 16.266	0.501 – 0.543	100.00%
M/V Atlantic Surveyor Multibeam 1-meter Crossline (Class 1) to M/V Atlantic Surveyor Multibeam 1-meter Mainscheme	5.667 – 16.266	0.505 – 0.543	100.00%
R/V Oyster Bay II Multibeam 1-meter Crossline (Class 1) to R/V Oyster Bay II Multibeam 1-meter Mainscheme	1.958 – 11.911	0.501 – 0.523	100.00%

Figure 7: Summary of Crossing Analysis

Difference Grid	Minimum and Maximum CUBE Depth (meters) of Comparison	IHO Order 1A Maximum Allowable Uncertainty (meters) for the Range of Depths	Percentage of Depth Differences Within IHO Order 1A Maximum Allowable Uncertainty
M/V Atlantic Surveyor 1-meter Multibeam Data to R/V Oyster Bay II 1-meter Multibeam Data	2.765 – 13.411	0.501 – 0.530	99.70%

Figure 8: Summary of Vessel Comparison Repeatability Analysis

B.2.2 Uncertainty

The following survey specific parameters were used for this survey:

Method	Measured	Zoning
ERS via VDATUM	0.09 meters	0.2 meters

Table 7: Survey Specific Tide TPU Values.

Hull ID	Measured - CTD	Measured - MVP	Measured - XBT	Surface
M/V Atlantic Surveyor	1.0 meters/second	1.0 meters/second	1.0 meters/second	1.0 meters/second
R/V Oyster Bay II	1.0 meters/second	1.0 meters/second	1.0 meters/second	1.0 meters/second

Table 8: Survey Specific Sound Speed TPU Values.

For specific details on the use and application of the SABER Total Propagated Uncertainty (TPU) model, refer to the DAPR. Once the TPU model was applied to the GSF bathymetry data, each beam was attributed with the horizontal uncertainty and the vertical uncertainty at the 95% confidence level. The vertical and horizontal uncertainty values, estimated by the TPU model for individual multibeam soundings, varied little across the dataset, tending to be most affected by beam angle. Individual soundings that had vertical and horizontal uncertainty values above IHO S-44 5th Edition, Order 1a were flagged as invalid during the uncertainty attribution.

As discussed in the DAPR, SABER generates two vertical uncertainty surfaces; the Hypothesis Standard Deviation (Hyp. StdDev) and the Hypothesis Average Total Propagated Uncertainty (Hyp. AvgTPU). A third vertical uncertainty surface is generated from the larger value of these two uncertainties at each node and is referred to as the Hypothesis Final Uncertainty (Hyp. Final Uncertainty).

Per HSSD Section 5.2.2.3, H13303 depth data fell within a single grid resolution at 1-meter.

The final H13303 1-meter PFM CUBE surface contained final vertical uncertainties that ranged from 0.210 meters to 0.517 meters. The IHO Order 1a maximum allowable vertical uncertainty was calculated to range between 0.500 to 0.544 meters, based on the minimum CUBE depth (1.190 meters) and maximum CUBE depth (16.411 meters). Results from the SABER Check PFM Uncertainty function identified that there was one node in the final H13303 1-meter PFM CUBE surface with final vertical uncertainties that exceeded IHO Order 1a allowable vertical uncertainty. The single node was associated with a rock outcropping. The SABER Frequency Distribution Tool was also used to review the Hyp. Final Uncertainty surface within the final H13303 1-meter PFM grid. Results showed that 100.00% of all nodes had final uncertainties less than or equal to maximum allowable vertical uncertainty of 0.544 meters.

B.2.3 Junctions

Per the Project Instructions, junction analysis was performed between H13303 and the surveys listed in the table below. Figure 9 shows the general locality of H13303 as it relates to the sheets against which junctions were performed. Refer to Separates II for details about how junction analyses were performed and a complete discussion of each analysis and tabular results.

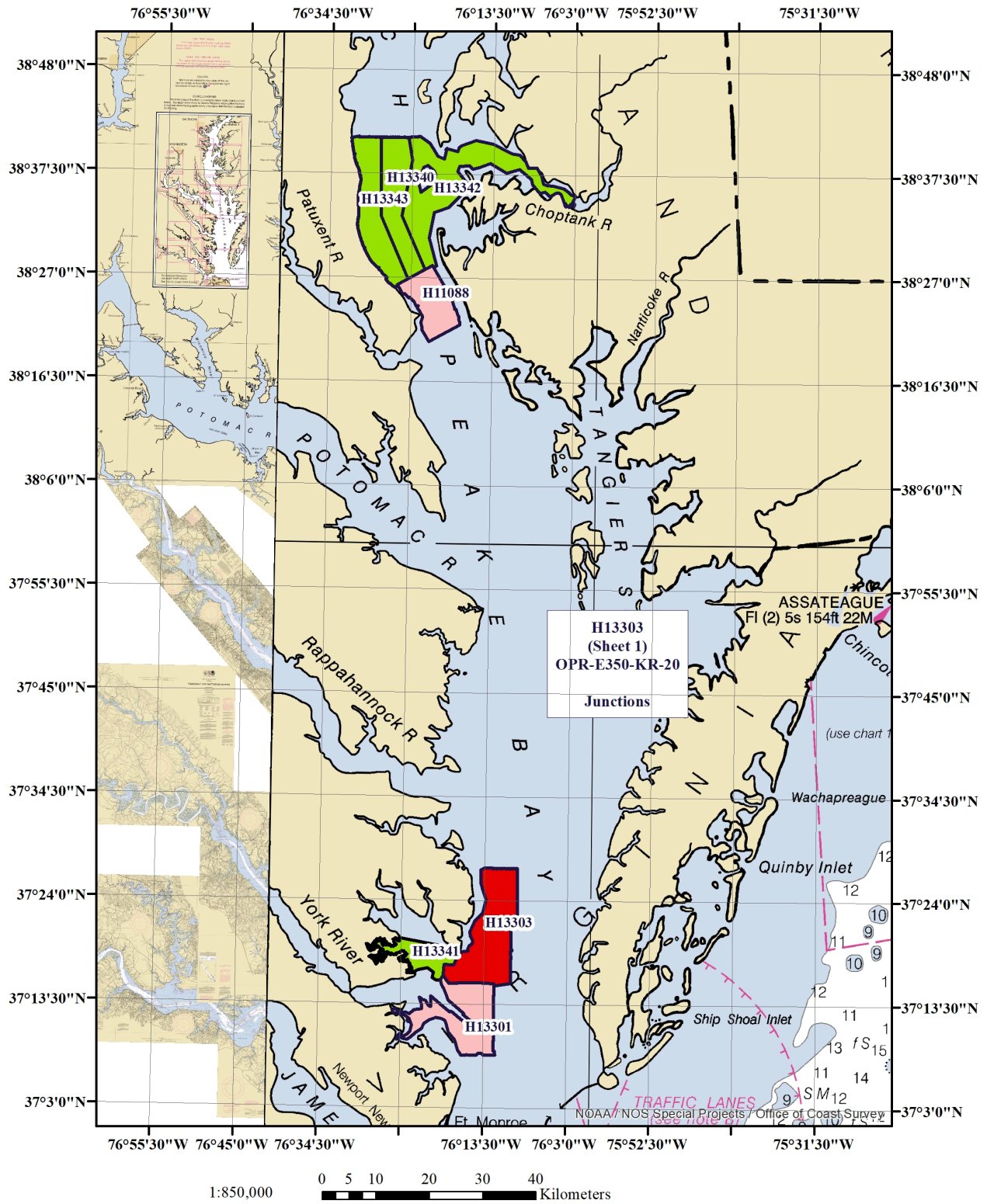


Figure 9: General Locality of H13303 with Junctioning Surveys

The following junctions were made with this survey:

Registry Number	Scale	Year	Field Unit	Relative Location
H13301	1:10000	2020	Leidos, Inc.	S
H13341	1:20000	2020	Leidos, Inc.	W

Table 9: Junctioning Surveys

H13301

H13301 junctions with H13303 to the south. Comparisons were made between a 1-meter resolution H13301 grid and the H13303 1-meter resolution grid. 100% of the values agreed within ± 0.213 meters, within the calculated maximum allowable TVU of 0.524 meters.

H13341

H13341 junctions with H13303 to the west. Comparisons were made between a 1-meter resolution H13341 grid and the H13303 1-meter resolution grid. 100% of the values agreed within ± 0.288 meters, within the calculated maximum allowable TVU of 0.512 meters.

B.2.4 Sonar QC Checks

Sonar system quality control checks were conducted as detailed in the DAPR; quality control checks conducted during H13303 are reported in Separates I.

B.2.5 Equipment Effectiveness

There were no conditions or deficiencies that affected equipment operational effectiveness.

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: On the M/V Atlantic Surveyor, the MVP30 was the primary system used to collect sound speed profile (SSP) data, and on the R/V Oyster Bay II, the AML BaseX2 was the primary system used to collect SSP data, refer to the DAPR for additional details. SSP data were obtained at intervals frequent enough to meet depth accuracy requirements. Section 5.2.3.3 of the HSSD requires that if the sound speed measured at the sonar head differs by more than two meters/second from the commensurate profile data, then another cast shall be acquired.

All sound speed profiles applied for online bathymetry data collection were acquired within 500 meters of the bounds of the survey area as specified in Section 5.2.3.3 of the HSSD.

Confidence checks of the sound speed profile casts were conducted by comparing at least two consecutive casts taken with different SSP sensors. Results for the sound speed confidence checks conducted during H13303 can be found in Separates II within the “Comparison Cast Log” section.

All individual SSP files are delivered with the H13303 data and are broken out into sub-folders, which correspond to the purpose of each cast. Also, all individual SSP files for H13303 have been concatenated into four separate files based on the purpose of the cast, provided in CARIS format files (.svp), and delivered under (H13303/Processed/SVP/CARIS_SSP) on the delivery drive. In accordance with HSSD Section 8.3.6, SSP files were also converted to NCEI format, as detailed in the DAPR, and provided as a separate delivery to NCEI. Refer to the DAPR and Separates II for additional details.

B.2.8 Coverage Equipment and Methods

All equipment and survey methods are detailed in the DAPR.

B.2.9 Multibeam Coverage Analysis

Leidos chose to achieve the complete coverage requirement using 100% side scan sonar coverage with concurrent multibeam bathymetry. To achieve this coverage, the SSS was set to 25-meter or 50-meter range scale, main scheme survey lines were spaced at 40-meter or 80-meter, respectfully, to ensure 100% SSS coverage. For safety, within an area of charted piles, the side scan range scale was set to 75-meters with survey lines spaced at 40-meters. Disproval areas were covered with either 100% multibeam coverage or 200% side scan coverage.

The SABER Gapchecker program was used to flag MBES data gaps within the CUBE surface. Additionally, the entire surface was visually scanned for holidays at various points during the data processing effort. Additional survey lines were run to fill any holidays that were detected. Bathymetric data and side scan

sonar imagery were reviewed and bathymetric splits were acquired if deemed necessary per Hydrographer's discretion, as noted in Section 5.2.2.1 of the HSSD.

A final review of the CUBE Depth surface of the H13301 1-meter PFM showed that there were no holidays as defined for complete coverage surveys in Section 5.2.2.3 of the HSSD.

The final H13303 CUBE PFM grid was examined for the number of soundings contributing to the chosen CUBE hypotheses for each node by running SABER's Frequency Distribution Tool on the Hypothesis Number of Soundings (Hyp. # Soundings) surface. The Hyp. # Soundings surface reports the number of soundings that were used to compute the chosen hypothesis. Analysis was conducted on the Hyp. # Soundings surface from the PFM grid to ensure that the requirements for complete coverage surveys, as specified in HSSD Section 5.2.2.3 were met. Within the final 1-meter PFM grid 99.47% of all nodes contained five or more soundings.

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. Multibeam files associated with calibration were previously delivered with the OPR-E350-KR-20 DAPR as part of the H13341 delivery.

B.4 Backscatter

Side Scan Sonar (SSS) Coverage Analysis: For all details regarding SSS data processing, see the DAPR. Leidos chose to adhere to the coverage requirements in the Project Instructions using Complete Coverage, Option B (100% side scan sonar coverage with concurrent multibeam). As referenced in Section A.4, the Project Instructions provided a waiver to HSSD Section 6.1.2.3 for towed side scan towfish height. In waters less than 8 meters the towfish height above the bottom could be 6% of the range scale. Mosaics were analyzed for coverage at both 8% and 6% of range based on water depths greater or less than 8 meters.

Leidos generated two separate coverage mosaics at 1-meter cell size resolution as specified in Section 8.2.1 of the HSSD (See section B.2.9 for additional information). The first 100% and second 100% coverage mosaics were independently reviewed using tools in SABER to verify data quality and swath coverage. The SABER Gapchecker routine was used to flag data gaps within each of the 100% SSS coverage mosaics.

Additionally, the entirety of each SSS surface was visually scanned for holidays at various points during the data processing effort. Additional survey lines were run to fill any holidays that were detected. Both coverage mosaics are determined to be complete and sufficient to meet the requirements contained within the Project Instructions and HSSD. Each 100 percent coverage mosaic is delivered as a single georeferenced raster file (datum of NAD83) in floating point GeoTIFF format, as specified in Sections 8.2.1 and 8.3.3 in the HSSD.

Multibeam Echo Sounder Seafloor Backscatter: Leidos collected MBES backscatter data with all GSF data acquired, in accordance with HSSD Section 6.2. The MBES settings used were checked to ensure acceptable quality standards were met and to mitigate acoustic saturation of the backscatter data. The MBES backscatter data acquired were written to the GSF in real-time by ISS-2000 and are delivered in the final GSF files for this sheet. Evaluation of backscatter data and processing were not required for OPR-E350-KR-20 and therefore no additional processing was performed by Leidos and no additional products were produced.

B.5 Data Processing

B.5.1 Primary Data Processing Software

The following software program was the primary program used for bathymetric data processing:

Manufacturer	Name	Version
Leidos	SABER	5.4.1.5.2

Table 10: Primary bathymetric data processing software

The following software program was the primary program used for imagery data processing:

Manufacturer	Name	Version
Leidos	SABER	5.4.1.5.2

Table 11: Primary imagery data processing software

The following Feature Object Catalog was used: NOAA Profile Version 2021.

The primary data processing software used for both bathymetry and imagery was SABER.

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
H13303_MB_1m_MLLW_Final	BAG	1 meters	1.19 meters - 16.411 meters	N/A	Complete coverage, Option B (100% side scan sonar coverage with concurrent multibeam)
H13303_SSSAB_1m_500kHz_900kHz_1of2	SSS Mosaic (.tif)	1 meters	0.0 meters - 0.0 meters	N/A	First 100% SSS
H13303_SSSAB_1m_500kHz_900kHz_2of2	SSS Mosaic (.tif)	1 meters	0.0 meters - 0.0 meters	N/A	Second 100% SSS (Disproval)

Table 12: Submitted Surfaces

Complete Coverage Section 5.2.2.3 of the HSSD requires 1-meter node resolution for depths ranging from 0 meters to 20 meters. Leidos generated a CUBE PFM grid for H13303 at 1-meter resolution.

SABER populates the CUBE depth with either the node's chosen hypothesis or the depth of a feature or designated sounding set by the hydrographer, which overrides the chosen hypothesis. The range of CUBE depths of the H13303 1-meter PFM grid were from 1.190 meters (3.904 feet; 0.210 meters Total Vertical Uncertainty [TVU]) to 16.411 meters (53.842 feet; 0.240 meters TVU).

The final gridded bathymetry data are delivered as a Bathymetric Attributed Grid (BAG). The BAG file was exported from the CUBE PFM grid as detailed in the DAPR.

C. Vertical and Horizontal Control

Additional information discussing the vertical and horizontal control for this survey can be found in the DAPR.

C.1 Vertical Control

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

ERS Datum Transformation

The following ellipsoid-to-chart vertical datum transformation was used:

Method	Ellipsoid to Chart Datum Separation File
ERS via VDATUM	OPR-E350-KR-20_NAD83_VDatum_MLLW.cov

Table 13: ERS method and SEP file

Refer to the DAPR for details regarding the application of VDatum to the MBES data files. No final tide note was provided nor was it required from NOAA Center for Operational Oceanographic Products and Services (CO-OPS).

C.2 Horizontal Control

The horizontal datum for this project is North American Datum of 1983 (NAD 83).

The projection used for this project is Universal Transverse Mercator (UTM) Zone 18.

PPP

The vessel kinematic data (POS/MV files) were post-processed in Applanix POSPac software using the Applanix PP-RTX solution to generate the Smoothed Best Estimate of Trajectory (SBET) solutions which were applied through SABER to the multibeam data. Refer to the DAPR for additional information and for details regarding all antenna and transducer offsets. Any soundings with total horizontal uncertainties exceeding the maximum allowable IHO S-44 5th Edition Order 1a specifications were flagged as invalid and therefore were not used in the CUBE depth calculations.

D. Results and Recommendations

D.1 Chart Comparison

Chart comparisons were conducted using a combination of SABER and CARIS' HIPS and SIPS. H13303 data met data accuracy standards and bottom coverage requirements. Leidos recommends updating the common areas of all charts using data from this survey. Review showed that the H13303 depth data were generally in good agreement (primarily within ± 0.5 meters) with the charted depths on ENC US5VA10M, US5VA14M, US5VA24M, and US5VA41M.

Charting recommendations for new features and updates to charted features, are documented in the H13303 S-57 FFF. Additional charted objects are discussed in later sections.

United States Coast Guard (USCG) District 5 Local Notice to Mariners (LNM) publications were reviewed for changes subsequent to the date of the Project Instructions and before the end of survey (as specified in Section 8.1.4 of the HSSD). The LNM reviewed were from week 35/20 (01 Sept 2020) until week 21/21 (25 May 2021).

D.1.1 Electronic Navigational Charts

The following are the largest scale ENC's, which cover the survey area:

ENC	Scale	Edition	Update Application Date	Issue Date
US5VA10M	1:40000	26	05/22/2020	03/31/2021
US5VA14M	1:40000	34	02/22/2021	04/29/2021
US5VA24M	1:40000	30	07/12/2021	07/12/2021
US5VA41M	1:40000	44	06/15/2021	06/15/2021

Table 14: Largest Scale ENC's

D.1.2 Shoal and Hazardous Features

Significant shoaling was observed associated with Milford Haven Spit. H13303 MBES data showed the charted shoal has migrated seaward and south. This shoaling was submitted as DTON 06 and was confirmed to be updated on ENC US5VA24M. All other hazardous features within the area covered by this survey are referenced in Section D.1.4.

Figure 10 details the Leidos submitted DTON reports for H13303. DTON reports were submitted per HSSD as S-57 format to the Atlantic Hydrographic Branch (AHB). Copies of the email correspondence for Leidos' submissions of DTON Reports, as well as the DTON recommendation files, are included within Appendix II of this Descriptive Report.

DTON Report Name	Date Submitted to AHB	AHB Submitted to NDB and MCD	NDB Registration	Feature Number(s)	S-57 Object Class in FFF
H13303_DTON_01.000	2020-12-15	2020-12-16	DD-33634	13	OBSTRN
H13303_DTON_02.000	2020-12-15	2020-12-16	DD-33634	03	WRECKS
H13303_DTON_03.000	2020-12-15	2020-12-16	DD-33634	08	OBSTRN
H13303_DTON_04.000	2020-12-15	2020-12-16	DD-33634	01	WRECKS
H13303_DTON_05.000	2021-01-08	2021-01-08	DD-33737	25	WRECKS
H13303_DTON_06.000	2021-01-14	2021-01-20	DD-33799	N/A	N/A
H13303_DTON_07.000	2021-03-02	2021-03-03	DD-34053	15	WRECKS
H13303_DTON_08.000	2021-03-08	2021-03-09	DD-34097	36	WRECKS
H13303_DTON_09.000	2021-05-07	2021-05-20	DD-34433	23	WRECKS
H13303_DTON_10.000	2021-06-01	2021-06-02	DD-34524	45	WRECKS
H13303_DTON_11.000	2021-06-02	2021-06-04	DD-34531	26	OBSTRN
H13303_DTON_12.000	2021-06-02	2021-06-04	DD-34531	30	OBSTRN
H13303_DTON_13.000	2021-06-02	2021-06-04	DD-34531	20	OBSTRN
H13303_DTON_14.000	2021-06-08	2021-06-08	DD-34493	34	OBSTRN

Figure 10: DTON Reports

D.1.3 Charted Features

There were 46 assigned charted features in the final CSF (OPR-E350-KR-20_CSF.000) within the SOW of H13303. Per HSSD Section 8.1.4, these charted features are not addressed in this section, refer to the H13303 S-57 FFF (H13303_FFF.000) for all the details and recommendations regarding these features. There was one land area assigned with the requirement to “visually confirm feature object existence and capture height to confirm or update LNDELV. Note that an islet may become a UWTRC based on WATLEV; reference Appendix F”. The land area is associated with New Point Comfort lighthouse, which while present was located 665-meters beyond the NALL survey limit. Numerous attempts to capture the land elevation height using a TruPulse 200X were conducted, but were unsuccessful due to the survey vessel's distance from the Lighthouse while remaining in navigable water depths.

D.1.4 Uncharted Features

See the H13303 S-57 FFF for all the details and recommendations regarding new uncharted features investigated. An exception are five features (5, 6, 18, 32 and 33) set within the data to retain the least depth of rock outcroppings. Per HSSD Section 7.3.2, these features were not included within the H13303 S-57 FFF. During the course of H13303 survey operations, various bamboo and PVC pipe markers were observed within the survey limits. These were determined to be temporary in nature as over the course of survey operations it was observed that several of the markers would no longer be present or were moved. Due to their temporary nature, there are no features associated with these markers within the H13303 S-57 FFF.

D.1.5 Channels

There were no assigned channels within the H13303 SOW from the final CSF.

D.2 Additional Results

D.2.1 Aids to Navigation

There were thirteen assigned features designated as aids to navigation (ATON) within the SOW of H13303 from the final CSF. All thirteen of these ATONs were observed on station and serving their intended purpose. Per the investigation requirements from the CSF, as they were on station and serving intended purpose, they are included in the H13303 FFF with description of retain (H13303 Features 46 to 55).

D.2.2 Maritime Boundary Points

No Maritime Boundary Points were assigned for this survey.

D.2.3 Bottom Samples

In accordance with both the Project Instructions and Section 7.2.3 of the HSSD, bottom characteristics were obtained for H13303. Bottom characteristics were acquired at the fourteen locations assigned in the final PRF (OPR-E350-KR-20_PRF.000). Leidos did not modify the bottom sample locations from the location proposed by NOAA in the PRF. Bottom characteristics are included in the S-57 FFF. In addition, images of the sediment obtained for each bottom sample are referenced in the S-57 FFF and are included on the delivery drive under the folder H13303/Processed/Multimedia.

D.2.4 Overhead Features

There were no overhead features within this survey area.

D.2.5 Submarine Features

Within the final CSF there were no assigned submarine features for investigation. There were several linear objects identified but were not considered submarine features. Non-significant side scan contacts were retained within the H13303 Side Scan Sonar Contact S-57 FFF (H13303_SSCon.000).

D.2.6 Platforms

No platforms exist within this survey area.

D.2.7 Ferry Routes and Terminals

No ferry routes or terminals exist within this survey area.

D.2.8 Abnormal Seafloor or Environmental Conditions

No abnormal seafloor or environmental conditions, as defined in Section 8.1.4 of the HSSD, exist within this survey area other than those discussed in Section B.2.6 and D.1.2.

D.2.9 Construction and Dredging

No construction or dredging exists for this survey area.

D.2.10 New Survey Recommendations

No new survey recommendations are made for the area surrounding this survey area.

D.2.11 ENC Scale Recommendations

No new ENC recommendations are made for the area surrounding this survey 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.

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 Hydrographic Surveys Specifications and Deliverables, Project Instructions, and Statement of Work. These data are adequate to supersede charted data in their common areas. This survey is complete and no additional work is required. Previously, or concurrently, submitted deliverables for OPR-E350-KR-20 are provided in the table below.

Report Name	Report Date Sent
OPR-E350-KR-20_Marine_Species_Awareness_Training_Record.pdf	2021-04-14
OPR-E350-KR-20_20210419.zip (NCEI Sound Speed Data 2020 data only)	2021-04-19
OPR-E350-KR-20_Coast Pilot Review Report.pdf	2021-04-19
OPR-E350-KR-20_DAPR.pdf	2021-04-27
H13341_DR.pdf	2021-04-27
H13340_DR.pdf	2021-04-29
OPR-E350-KR-20_Final_Project_Summary_Report_June_18.pdf	2021-06-18
OPR-E350-KR-20_Coast Pilot Review Report_Rev1.pdf	2021-08-11

Approver Name	Approver Title	Approval Date	Signature
Paul L. Donaldson	Chief Hydrographer	08/13/2021	 <small>Digitally signed by: Paul L. Donaldson DN: CN = Paul L. Donaldson C = US O = Leidos OU = A01410D00000171EA2490940000B ASB Date: 2021.08.12 14:28:48 -04'00'</small>

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	Continuously 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
ERTDM	Ellipsoidally Referenced Tidal Datum Model
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

Acronym	Definition
HSSD	Hydrographic Survey Specifications and Deliverables
HSTB	Hydrographic Systems Technology Branch
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
NALL	Navigable Area Limit Line
NTM	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
RNC	Raster Navigational Chart
RTK	Real Time Kinematic
RTX	Real Time Extended
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
TPU	Total Propagated Uncertainty
USACE	United States Army Corps of Engineers
USCG	United States Coast Guard
UTM	Universal Transverse Mercator
XO	Executive Officer
ZDF	Zone Definition File