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

Data Acquisition & Processing Report

Type of Survey:	Navigable Area
Project Number:	S-B920-NRTNL-21
Time Frame:	August - August 2021

LOCALITY

State(s):	New York
General Locality:	East River, NY

2021

CHIEF OF PARTY
LTJG Nicholas Azzopardi

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Date:

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Data Acquisition and Processing Report

MIST
Chief of Party: LTJG Nicholas Azzopardi
Year: 2021
Version: 1
Publish Date: 2021-08-26

A. System Equipment and Software

A.1 Survey Vessels

A.1.1 USCG TANB Sector NY

Vessel Name	USCG TANB Sector NY	
Hull Number	26144	
Description	Trailerable Aid to Navigation Boats, TANBs, are the small boats utilized by USCG Aid to Navigation Team. They are the most common option as a Vessel of Opportunity for the Navigation Response Branch's Mobile Integrated Survey Team in disaster response scenarios.	
Dimensions	*LOA*	29 feet 7 inches
	Beam	8 feet
	Max Draft	2 feet 4 inches
Most Recent Partial Static Survey	*Date*	2021-08-03
	Performed By	PS Michael Annis, LTJG Nicholas Azzopardi
Most Recent Partial Offset Verification	*Date*	2021-08-03
	Method	The MIST used a steel tape measure with units in feet and meters to verify the static offsets of: the Trimble Primary GPS antenna to the Secondary GPS antenna; the phase center of the POSMV IMU to the Primary GPS antenna; and the phase center of the Reson T20P to the Primary GPS antenna.

Figure 1: Photo of USCG TANB. Image from USCG website.

A.2 Echo Sounding Equipment

A.2.1 Multibeam Echosounders

A.2.1.1 Teledyne Reson T20P

Pole mounted Multibeam Echosounder with 165° equi-angle swath and 512 beams.

<table>
<tr><td>Manufacturer</td><td colspan="5">Teledyne</td></tr>
<tr><td>Model</td><td colspan="5">Reson T20P</td></tr>
<tr><td rowspan="6">Inventory</td><td rowspan="6">26144</td><td>Component</td><td>Transducer</td><td>Receiver</td><td>Topside Processing Unit</td></tr>
<tr><td>Model Number</td><td>T20P</td><td>T20P</td><td>T20P</td></tr>
<tr><td>Serial Number</td><td>2313068</td><td>2413031</td><td>84143413019</td></tr>
<tr><td>Frequency</td><td>400</td><td>N/A</td><td>N/A</td></tr>
<tr><td>Calibration</td><td>2021-08-03</td><td>2021-08-03</td><td>2021-08-03</td></tr>
<tr><td>Accuracy Check</td><td>2021-08-03</td><td>2021-08-03</td><td>2021-08-03</td></tr>
</table>

Figure 2: Reson T20P TPU and Tx/Rx heads.

A.2.2 Single Beam Echosounders

No single beam echosounders were utilized for data acquisition.

A.2.3 Side Scan Sonars

No side scan sonars were utilized for data acquisition.

A.2.4 Phase Measuring Bathymetric Sonars

No phase measuring bathymetric sonars were utilized for data acquisition.

A.2.5 Other Echosounders

No additional echosounders were utilized for data acquisition.

A.3 Manual Sounding Equipment

A.3.1 Diver Depth Gauges

No diver depth gauges were utilized for data acquisition.

A.3.2 Lead Lines

No lead lines were utilized for data acquisition.

A.3.3 Sounding Poles

No sounding poles were utilized for data acquisition.

A.3.4 Other Manual Sounding Equipment

No additional manual sounding equipment was utilized for data acquisition.

A.4 Horizontal and Vertical Control Equipment

A.4.1 Base Station Equipment

No base station equipment was utilized for data acquisition.

A.4.2 Rover Equipment

No rover equipment was utilized for data acquisition.

A.4.3 Water Level Gauges

No water level gauges were utilized for data acquisition.

A.4.4 Levels

No levels were utilized for data acquisition.

A.4.5 Other Horizontal and Vertical Control Equipment

No other equipment were utilized for data acquisition.

A.5 Positioning and Attitude Equipment

A.5.1 Positioning and Attitude Systems

A.5.1.1 Applanix POSMV Surfmaster

POS MV blends GNSS data with angular rate and acceleration data from an IMU and heading from GNSS Azimuth Measurement System (GAMS) to produce a robust and accurate full six degrees of freedom Position and Orientation solution.

<table>
<tr><td>Manufacturer</td><td colspan="4">Applanix</td></tr>
<tr><td>Model</td><td colspan="4">POSMV Surfmaster</td></tr>
<tr><td rowspan="4">Inventory</td><td rowspan="4">26144</td><td>Component</td><td>IMU</td><td>Topside Processing Unit</td></tr>
<tr><td>Model Number</td><td>82</td><td>POSMV V5-f1</td></tr>
<tr><td>Serial Number</td><td>4850</td><td>5872</td></tr>
<tr><td>Calibration</td><td>2021-08-03</td><td>2021-08-03</td></tr>
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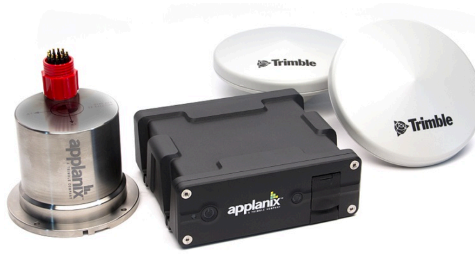

Figure 3: POSMV Surfmaster IMU, TPU & accompanying antennae.

A.5.2 DGPS

DGPS equipment was not utilized for data acquisition.

A.5.3 GPS

Additional GPS equipment was not utilized for data acquisition.

A.5.4 Laser Rangefinders

Laser rangefinders were not utilized for data acquisition.

A.5.5 Other Positioning and Attitude Equipment

No additional positioning and attitude equipment was utilized for data acquisition.

A.6 Sound Speed Equipment

A.6.1 Moving Vessel Profilers

No moving vessel profilers were utilized for data acquisition.

A.6.2 CTD Profilers

A.6.2.1 YSI Castaway

The YSI Castaway measures conductivity, temperature of seawater versus pressure, in depths up to 100 meters. GPS enabled for positioning, data is uploaded via Bluetooth to the acquisition computer.

<table>
<tr><td>Manufacturer</td><td>YSI</td></tr>
<tr><td>Model</td><td>Castaway</td></tr>
<tr><td>Inventory</td><td>
<table>
<tr><td>Component</td><td>CTD Sensor</td></tr>
<tr><td>Model Number</td><td>Castaway</td></tr>
<tr><td>Serial Number</td><td>CC1228004</td></tr>
<tr><td>Calibration</td><td>2021-06-07</td></tr>
</table>
</td></tr>
</table>

Figure 4: YSI Castawy CTD.

A.6.3 Sound Speed Sensors

A.6.3.1 AML Micro-X

The AML Micro-X SV sensor has a fixed mounting bracket configured with the instillation and set up of the MBES Universal Sonar Mount. This places the SV sensor as close to the receiver head as possible.

<table>
<tr><td>Manufacturer</td><td>AML</td></tr>
<tr><td>Model</td><td>Micro-X</td></tr>
<tr><td>Inventory</td><td>
<table>
<tr><td>26144</td><td>
<table>
<tr><td>Component</td><td>SV Sensor</td></tr>
<tr><td>Model Number</td><td>Micro-X</td></tr>
<tr><td>Serial Number</td><td>203513</td></tr>
<tr><td>Calibration</td><td>2021-03-18</td></tr>
</table>
</td></tr>
</table>
</td></tr>
</table>

Figure 5: AML Micro-X SV

Figure 6: Underside view of MBES mount. Note the SV sensor highlighted in red.

A.6.4 TSG Sensors

No TSG sensors were utilized for data acquisition.

A.6.5 Other Sound Speed Equipment

No other surface sound speed sensors were utilized for data acquisition.

A.7 Computer Software

Manufacturer	*Software Name*	*Version*	*Use*
Xylem	HYPACK 2020	20.0.5.0	Bathymetric Data Acquisition
Teledyne	CARIS HIPS & SIPS	11.3.18	Processing
NOAA	Pydro Explorer	19.4(r12288)	Processing
Teledyne	Seabat	5.0	Acquisition

A.8 Bottom Sampling Equipment

A.8.1 Bottom Samplers

No bottom sampling equipment was utilized for data acquisition.

B. System Alignment and Accuracy

B.1 Vessel Offsets and Layback

B.1.1 Vessel Offsets

The Multibeam Echosounder MIST set up places the system's the reference point at the POSMV IMU. Vessel offsets from IMU > Primary GPS and MBES Phase Center >Primary GPS were measured in the field with 0.001 meter accuracy using steel tape. The offsets were put in to the Caris HVF, along with the associated TPU values.

Figure 7: Close up of the USM pole kit with GPS mast and sonar Z-pole.

Figure 8: View from bottom side of MBES mount.

Figure 9: Topside view of MBES and IMU. Note the very small lever arm between the two sensors.

B.1.1.1 Vessel Offset Correctors

Vessel	MIST_Reson_T20P_MBES			
Echosounder	Teledyne Reson SeaBat T20P (400kHz 512 Beams)			
Date	2021-08-02			
Offsets			*Measurement*	*Uncertainty*
	MRU to Transducer	*x*	0.000 meters	0.020 meters
		y	0.232 meters	0.020 meters
		z	0.348 meters	0.020 meters
	Nav to Transducer	*x*	-0.510 meters	0.020 meters
		y	-1.050 meters	0.020 meters
		z	2.386 meters	0.020 meters
	Transducer Roll	*Roll*	0.000 degrees	

B.1.2 Layback

No layback correctors were applied to this survey.

Layback correctors were not applied.

B.2 Static and Dynamic Draft

B.2.1 Static Draft

Using a steel tape measure the field unit took a measurement along the fixed Z-pole of the Universal Sonar Mount from the phase center of Reson T20P Multibeam Echosounder to the waterline. Measurements taken from the vessel's partial static offset survey in the X and Y axis were applied to this waterline measurement, then added to the Caris Hips Vessel File.

B.2.1.1 Static Draft Correctors

Vessel		26144 MIST_Reson_T20P_MBES
Date		2021-08-03
Loading		0.010 meters
Static Draft	*Measurement*	-0.255 meters
	Uncertainty	0.030 meters

B.2.2 Dynamic Draft

Due to time constraints no dynamic draft measurements were collected.

B.2.2.1 Dynamic Draft Correctors

Dynamic draft correctors were not applied.

B.3 System Alignment

B.3.1 System Alignment Methods and Procedures

The MBES MIST system patch test was run in accordance with Field Procedure Manual section 1.5.5.1.2 and the Hydrographic Specifications & Deliverables documentation section 5.2.4.1.

B.3.1.1 System Alignment Correctors

<table>
<tr><td>Vessel</td><td>26144 MIST_Reson_T20P_MBES</td></tr>
<tr><td>Echosounder</td><td>Teledyne Reson SeaBat T20P (400kHz 512 Beams)</td></tr>
<tr><td>Date</td><td>2021-08-03</td></tr>
<tr><td>Patch Test Values</td><td>
<table>
<tr><td></td><td>Corrector</td><td>Uncertainty</td></tr>
<tr><td>Transducer Time Correction</td><td>0.000 seconds</td><td>0.010 seconds</td></tr>
<tr><td>Navigation Time Correction</td><td>0.000 seconds</td><td>0.010 seconds</td></tr>
<tr><td>Pitch</td><td>-0.050 degrees</td><td>0.020 degrees</td></tr>
<tr><td>Roll</td><td>0.400 degrees</td><td>0.020 degrees</td></tr>
<tr><td>Yaw</td><td>-0.170 degrees</td><td>0.020 degrees</td></tr>
<tr><td>Pitch Time Correction</td><td>0.000 seconds</td><td>0.010 seconds</td></tr>
<tr><td>Roll Time Correction</td><td>0.000 seconds</td><td>0.010 seconds</td></tr>
<tr><td>Yaw Time Correction</td><td>0.000 seconds</td><td>0.010 seconds</td></tr>
<tr><td>Heave Time Correction</td><td>0.000 seconds</td><td>0.001 seconds</td></tr>
</table>
</td></tr>
</table>

C. Data Acquisition and Processing

C.1 Bathymetry

C.1.1 Multibeam Echosounder

Data Acquisition Methods and Procedures

The MIST's acquisition of MB data was monitored in real time with the Seabat UI software and HYPACK acquisition software. Data were displayed using 2-D and 3-D data display windows. Traditional line planning using Hypack guides the MBES MIST acquisition of MBES data. Line planning for this project was based on object detection standards. An initial line plan was utilized at first but was completed by steering the vessel by coverage primarily to fill in holidays. Adjustable parameters common for the 2040C are range scale, power, gain and pulse width.

Data Processing Methods and Procedures

Following acquisition, MB sonar data were processed using NOAA's Office of Coast Survey automated processing tool Pydro-Charlene. The steps below are the standard procedure for MBES data processing as described

1. Create a Smartbase SBET in POSPac and copy it over to our new directory structure
2. Convert raw data in Caris
3. Load SBET for height/nav and Load our .000 files for delayed heave
4. Use the Caris Nearest in Distance in Time - 4 hours to apply sound velocity
5. Use our VDatum surface for Caris compute GPS tide to get to the ellipse
6. Merge with gps tide (since we computed it) and delayed heave (since we imported it)
7. Compute TPU with all the settings we have in Charlene (entered in those boxes labeled ‘TPU’)
8. Generate raster surface

Data cleaning is performed in Subset editor. Surfaces are examined for holidays and any additional line planning is done at this time.

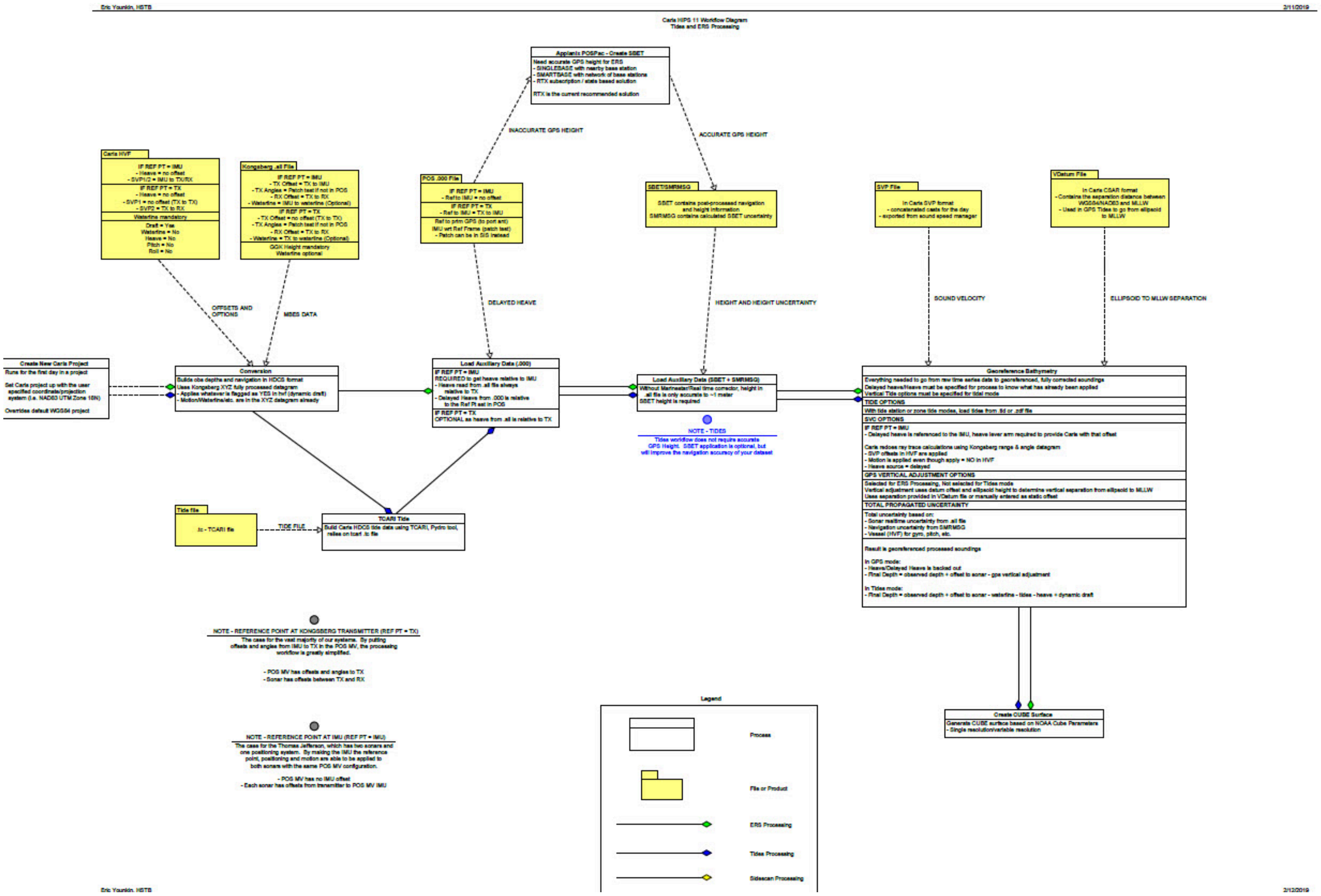

Figure 10: Charlene Automated Processing workflow for Multibeam Echosounder data.

C.1.2 Single Beam Echosounder

Single beam echosounder bathymetry was not acquired.

C.1.3 Phase Measuring Bathymetric Sonar

Phase measuring bathymetric sonar bathymetry was not acquired.

C.1.4 Gridding and Surface Generation

C.1.4.1 Surface Generation Overview

Surfaces are generated in CARIS using the CUBE gridding method. Resolution is determined by the Project Instructions and the HSSD.

C.1.4.2 Depth Derivation

Final depths are derived after data has undergone full cleaning and QC. Pydro QC Tools 2 is used to run programs such as Flier Finder and Surface QC.

C.1.4.3 Surface Computation Algorithm

Gridding parameters and surface computation algorithms used are consistent with HSSD specs and guidance from HSD.

C.2 Imagery

C.2.1 Multibeam Backscatter Data

Multibeam backscatter imagery was not acquired.

C.2.2 Side Scan Sonar

Side scan sonar imagery was not acquired.

C.2.3 Phase Measuring Bathymetric Sonar

Phase measuring bathymetric sonar imagery was not acquired.

C.3 Horizontal and Vertical Control

C.3.1 Horizontal Control

C.3.1.1 GNSS Base Station Data

GNSS base station data was not acquired.

C.3.1.2 DGPS Data

DGPS data was not acquired.

C.3.2 Vertical Control

C.3.2.1 Water Level Data

Water level data was not acquired.

C.3.2.2 Optical Level Data

Optical level data was not acquired.

C.4 Vessel Positioning

Data Acquisition Methods and Procedures

Attitude and Heave data were measured with the sensors described in Section A.5, and applied in post processing during SVP Correct and Merge in CARIS HIPS. The MIST utilizes a heave filter integration method known as "True Heave" as described in Section 3.4.1.2 of the 2014 Field Procedures Manual. This filter almost completely eliminates the need for steadying up on lines before logging can begin.

True Heave data were logged throughout the day via the POS MV's Ethernet Logging feature. Data was logged via an Ethernet connection to the PC in preset file size increments at 5 minute intervals. The multiple POS files that are created from logging are each distinguished by the numbering found in the file type (e.g, 000, 001, 002, etc.). After regular CARIS data conversion, the True Heave file was separately loaded into HIPS, replacing the unfiltered heave values recorded in the raw data. True Heave is actually applied to the data, if the check box is marked, during the sound velocity correction process.

It is standard procedure to begin logging the POS MV Applanix .000 file at least 5 minutes before starting bathymetric data acquisition and letting it run for at least 5 minutes afterward. Although the filter that produces the true heave values by looking at a long series of data to create a baseline needs only 3 minutes before and after the acquisition of bathymetric data, SBET processing which uses the same .000 file, requires logging for 5 minutes before and after bathymetric acquisition.

Data Processing Methods and Procedures

The MIST utilizes Charlene's Automated SBET creating tools, integrated as part of the MBES processing flow. Charlene uses specific POSBat files for each processing type (Smartbase, Marinestar, and RTX) and different export options for coordinate system (NAD83 vs WGS84). Charlene is able to create an SBET in the middle of Caris processing and load the generated SBET during processing, if the satellite data is available.

Following are the steps used in this processing procedure, based on which processing method chosen:

1. Set up the project.
2. Load the Applanix .000 file.
3. Select the "Find Base Stations" selecting either a SingleBase or SmatBase parameter search.
4. Run SmartBase QC.
5. Run GNSS Inertial Processor based on the method of base station solution chosen.
6. Export the post processed solution.

7. Copy the SBET and SMRSMG files to the SBET folder in you data directory.

C.5 Sound Speed

C.5.1 Sound Speed Profiles

Data Acquisition Methods and Procedures

Sound velocity profiles are acquired with the YSI Castaway CTD. Casts are taken approximately every 4 hours or when there is a noticeable change in environment or survey area. Realtime surface sound speed is also monitored and additional casts are taken if the value varies by more than 2 m/s.

Data Processing Methods and Procedures

Sound velocity cast data are processed using Pydro- Sound Speed Manager.

C.5.2 Surface Sound Speed

Data Acquisition Methods and Procedures

Surface sound speed is acquired by the AML Oceanographic Micro-X sensor. This is mounted in a fixed position as part of the Universal Sonar Mount configuration at the sonar head.

Data Processing Methods and Procedures

Surface sound speed data is not processed.

C.6 Uncertainty

C.6.1 Total Propagated Uncertainty Computation Methods

TPU values are based upon that recommended from Appendix IV (Uncertainty values for use in CARIS with vessels equipped WITH an attitude sensor) of the Field Procedures Manual, recommendations from a Vessel Offset Report created in Charlene, and the Project Instructions. The values used are the values detailed in the MIST_Reson_T20P_MBES.hvf by date applied.

C.6.2 Uncertainty Components

C.6.2.1 A Priori Uncertainty

Vessel		MIST_Reson_T20P_MBES
Motion Sensor	*Gyro*	0.02 degrees
	Heave	5.00% 0.05 meters
	Roll	0.02 degrees
	Pitch	0.02 degrees
Navigation Sensor		1.00 meters

C.6.2.2 Real-Time Uncertainty

Real-time uncertainty was not applied.

C.7 Shoreline and Feature Data

Shoreline and feature data was not acquired.

C.8 Bottom Sample Data

Bottom sample data was not acquired.

D. Data Quality Management

D.1 Bathymetric Data Integrity and Quality Management

D.1.1 Directed Editing

Depth, Standard Deviation, Hypothesis Strength and Hypothesis Count models derived from the surface are viewed with appropriate vertical exaggeration and a variety of sun illumination angles to highlight potential problem areas.

D.1.2 Designated Sounding Selection

In some instances, due to the nature of the weighting algorithm, a CUBE surface does not accurately represent the least depth of a navigationally significant feature (typically a fine item such as a tall, narrow coral head or a shipwreck's mast). In such cases, a sounding can be flagged as Designated to force the nearest CUBE surface grid node to honor the depth of the designated sounding.

Since the calculated depth at each grid node of a CUBE surface is influenced by multiple soundings, the least depth of a feature may not always be accurately represented in the gridded data. Prior to creating a finalized CUBE surface collection, the hydrographer must systematically review significant feature least depths to ensure they are accurately portrayed by the CUBE surface. If a specific least depth sounding is preferred over the weighted mean-depth calculation for the associated CUBE surface grid node, that sounding should be flagged Designated. The Designated flag can be applied in either HIPS or Pydro. If a sounding is made Designated in one software package, this flag will automatically carry through to the other application. Designated soundings shall be selected in accordance with section 5.2.1 and 5.2.2 of the HSSD.

A common area of confusion is the preferred spatial density of designated soundings. It is easy to lose ones sense of scale when viewing data in subset editor. Sand ripples can look like mountains and small rocks appear like house sized boulders. The hydrographer shall take a holistic view of the surrounding bathymetry to help determine the hydrographic significance of a feature before designating a sounding. When there are a group of features near each other (e.g. they would be shown as a single sounding or charted feature at the scale of the survey), only the shoalest sounding on the feature with the most representative shoal depth shall be selected.

As discussed in the Specifications and Deliverables section 5.2.1.2, the hydrographer should use discretion in designating soundings on features.

D.1.3 Holiday Identification

Holidays are defined as gaps in main scheme data or areas where accuracy requirements have not been met. Holidays may be caused by various events, such as vessel maneuvering, survey equipment problems, unexpected shoals, or rejection of poor quality data during post-processing. Holiday line plans are typically developed to address these data gaps as main scheme acquisition progresses, rather than at the end of main scheme operations. This practice will minimize transit time required to revisit each area of the survey with a holiday and the time required to acquire, process, and manage additional sound speed profiles. If the field unit uses a real- time coverage map during main scheme data acquisition, most holidays can be identified and addressed prior to ceasing operations that day, thus increasing survey efficiency. The MIST makes every effort to identify potential holidays during acquisition. Upon initial office review of the data holidays are identified visually by examining the surface or by using the Pydro QC tools "Holiday Finder".

D.1.4 Uncertainty Assessment

MIST primary bathymetric data review and quality control tools are the CARIS CUBE surfaces as implemented in CARIS HIPS. The CUBE algorithm generates a surface consisting of multiple hypotheses that represent the possible depths at any given position. The CUBE surface is a grid of estimation nodes where depth values are computed based on the horizontal and vertical uncertainty of each contributing sounding as follows:

Soundings with a low vertical uncertainty are given more influence than soundings with high vertical uncertainty
Soundings with a low horizontal uncertainty are given more influence than soundings with a high horizontal uncertainty.
Soundings close to the node are given a greater weight than soundings further away from the node.

As soundings are propagated to a node, a hypothesis representing a possible depth value is developed for the node. If a sounding's value is not significantly different from the previous sounding then the same or modified hypothesis is used. If the value does change significantly, a new hypothesis is created. A node can contain more than one hypothesis. As node-to-node hypotheses are combined into multiple surfaces through methodical processing, a final surface that is the best representation of the bathymetry is created.

Any individual sounding's uncertainty, or Total Propagated Uncertainty (TPU), is derived from the assumed uncertainty in the echosounder measurement itself, as well as the contributing correctors from sound speed, water levels, position, and attitude. TPU values for tide and sound velocity must be entered for each vessel during TPU computation, unless using TCARI, where uncertainty is added directly to survey lines by Pydro.

Tide values measured uncertainty value error ranges from 0.01m to 0.05 m dependent upon the accuracy of the tide gauges used and the duration of their deployment. The MIST is using a value of 0.0 since the Tide Component Error Estimation section of the Hydrographic Survey Project Instructions now includes the estimated gauge measurement error in addition to the tidal datum computation error and tidal zoning error.

Tide values zoning is unique for each project area and typically provided in Appendix II of the Hydrographic Survey Project Instructions, Water Level Instructions. In section 1.3.1.1 of the Water Level Instructions, Tide Component Error Estimation, the tidal error contribution to the total survey error budget is provided at the 95% confidence level, and includes the estimated gauge measurement error, tidal datum computation error, and tidal zoning error. Since this tidal error value is given for two sigma, the value must be divided by 1.96 before it can be entered into CARIS (which expects a one sigma value). If TCARI grids are assigned to the project area, this value is set at 0.0 since TCARI automatically calculates the error associated with water level interpolation and incorporates it into the residual/harmonic solutions.s

Measured sound speed value error ranges from 0.5 to 4 m/s, dependent on temporal/spatial variability. FPM recommends a value of 4 m/s when 1 cast is taken every 4-hours.

Surface sound speed value is dependent on the manufacturer specifications of the unit utilized to measure surface SV values for refraction corrections to flat-faced transducers.

All other error estimates are read from the Hydrographic Vessel File (HVF) and Device Model file. The HVF contains all offsets and system biases for the survey vessel and its systems, as well as error estimates for latency, sensor offset measurements, attitude and navigation measurements, and draft measurements. The HVF specifies which type of sonar system the vessel is using, referencing the appropriate entry from the Device Model file.

D.1.5 Surface Difference Review

D.1.5.1 Crossline to Mainscheme

Crossline data are used to identify any systematic data problems by comparing it to main scheme data acquired at different times, water levels, and line azimuths. Ideally, crosslines should be acquired prior to main scheme data, in areas of gently sloping bottom, and when water levels are as close to survey datum (MLLW) as practicable. Two separate surfaces are created for main scheme and crosslines. These surfaces are then differenced in Caris HIPS and SIPS. The resulting difference surface is examined for statistical variations.

D.1.5.2 Junctions

Junctioning surveys are evaluated by differencing the overlapping surfaces and examined for statistical variations.

D.1.5.3 Platform to Platform

MIST rarely has the opportunity to compare data across platforms.

D.2 Imagery data Integrity and Quality Management

Imagery data integrity and quality management were not conducted for this survey.

E. Approval Sheet

As acting Team Lead for this response to Hurricane Dorian I acknowledge that all the information contained in this report is complete and accurate to the best of my knowledge.

Please see the Descriptive Report for further information regarding survey completion.

Approver Name	Approver Title	Date	Signature
LTJG Nicholas Azzopardi	Chief of Party	08/27/2021	Digitally signed by AZZOPARDI.NICHOLAS.JAMES.1539165093 Date: 2021.08.27 10:25:31 -04'00'

List of Appendices:

Mandatory Report	***File***
Vessel Wiring Diagram	
Sound Speed Sensor Calibration	AML-Certificate-of-Calibration-Sound-Velocity.pdf MIST_Castaway_2021_Calibration_Certificate.jpg
Vessel Offset	
Position and Attitude Sensor Calibration	
Echosounder Confidence Check	
Echosounder Acceptance Trial Results	N/A