W00178

NOAA FORM 76-35A

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL OCEAN SURVEY

DESCRIPTIVE REPORT

Outside Source Data OPR-A922-UNH (OSD-AHB-06)
Type of Survey: Multibeam

Registry Number: **W00178**

LOCALITY

State: New Hampshire

General Locality: North Atlantic Ocean

Sub-locality: Coast of Gerrish Island

2006

CHIEF OF PARTY

Outside Source Data (CCOM-UNH)

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DATE

Center for Coastal and Ocean Mapping
Joint Hydrographic Center
University of New Hampshire

R/V Coastal Surveyor –Hydrographic Field Course

Descriptive Report

Abstract
This descriptive report provides a summary of the events as related to science and the systems that support science, for the R/V Coastal Surveyor 2006 Hydrographic Field Course Cruise.

Date
June, 2006

Contents *Filed with original field records.*

1 About This Document

This descriptive report pertains to hydrographic survey data acquired off Gerrish Island. The intent of this document is to give a detailed description regarding all the aspects involved in acquiring and processing this multibeam data as well as the findings and products which resulted from this survey.

1.1 Introduction

This survey data was part of the 2006 Summer Hydrographic Field Course at the University of New Hampshire (UNH) Center for Coastal and Ocean Mapping - Joint Hydrographic Center (CCOM-JHC) (see Participants list, Table 1.1). The survey area is approximately 4.2 km long and 1km wide (see Survey Area section 2.2 for graphic). The hydrographic survey data was acquired with a Simrad EM3002 multibeam echo-sounding (MBES) system which was bow mounted on the CCOM-JHC's R/V Coastal Surveyor. The purpose was to acquire multibeam data which could be compared to an existing Compact Hydrographic Airborne Rapid Total Survey (CHARTS) Light detection and Ranging (LIDAR) dataset acquired east of Gerrish Island, Maine. The supplementary objective was to obtain, as was reasonably possible, 100% coverage for the purposes of updating national Oceanic & Atmospheric Administration's (NOAA) nautical chart 13283 as bathymetric data for the area was previously acquired in the 1950's. Therefore, this data was acquired and processed as closely as was possible according to the specifications set forth in the International Hydrographic Organization (IHO) standards and the National Ocean Service (NOS) Hydrographic Survey Specifications and Deliverables (HSSD) (June 2006).

The multibeam data were acquired June 6th – June 15th, 2006 (Day Number (DN) 157-166). Real-Time Kinematic Global Positioning System (RTK) was used for positioning and for vertical control. The sounding data were reduced to chart datum-Mean Lower-Low Water (MLLW) with measurements from the NOAA Tide gauge station at Fort Point, New Castle, NH. The preliminary tidal data from this station was corrected with zoning provided by NOAA's Center for Operational Oceanographic Products and Services (CO-OPS).

The software CARIS HIPS was used to process all the multibeam data in this project and a Combined Uncertainty and Bathymetry Estimator (CUBE) surface was created with a resolution of 0.5 m. A Navigation Surface was also created to test its ability to preserve the highest bathymetric detail using the Open Navigation Surface (ONS) free source code. ***Concur.***

Table 1.1 Participants list

Muhammad Bashir
Djoko Hartoyo
Brian Heap
Jorge Heredia
Gretchen Imahori
Apolonio Lagonsin
Val Schmidt
Emma Sellén
Luis Soares Rosa
Ed Sweeney
Tsuyoshi Yoshida
Michelle Weirathmueller

2 Project

2.1 Project

Hydrographic survey S-A922-UNH-06 was conducted by the University of New Hampshire Hydrographic Field Course in June, 2006 using a Simrad EM3002 multibeam echo-sounding (MBES) system. The main purpose of the hydrographic survey was to compare the depth-measuring and bottom-characterization capabilities of acoustic seafloor-mapping using MBES to data collected using airborne LIDAR hydrography. The survey was designed to provide maximum overlap with a CHARTS LIDAR dataset collected in September, 2005 in the shallow water area east of Gerrish Island and Cutts Island, Maine, while attaining 100% coverage of the seafloor. The multibeam data were collected to attain NOAA and IHO Order 1 specifications for depth and position accuracy. Additionally, since hydrographic data in this area was previously acquired in the 1950's, the bathymetric survey provides more recent depth measurements for NOAA nautical chart 13283. The hydrographic survey was completed on Thursday, June 15th, 2006 (DN 166). ***Concur.***

2.2 Survey Area

The MBES survey area was located near Portsmouth Harbor on the eastern side of Gerrish Island and Cutts Island, Maine where LIDAR data had previously been collected (Figure 2.1). The survey area was located directly northeast of the harbor mouth where the bottom is less influenced by sediment transport, providing a more temporally consistent seafloor. This was necessary to compare the 2006 MBES bathymetry data to LIDAR data collected during the previous year. The hydrographic survey was conducted from June 6th – June 15th, 2006 (DN 157-166).

Depths ranged in the survey area from less than 1m to approximately 20 m with reference to the Mean Lower Low Water (MLLW) vertical datum. As shown on navigational chart 13283, this area is defined by a variable bottom with numerous rock outcrops and flatter regions of sediment. These seafloor features tend to follow the geological structure seen along the coastline.

Geographic Boundaries ***Concur.***

Latitude
43° 05' 34.66 N
43° 03' 21.56 N
Longitude
70° 38'51.71 W
70° 41' 01.05 W

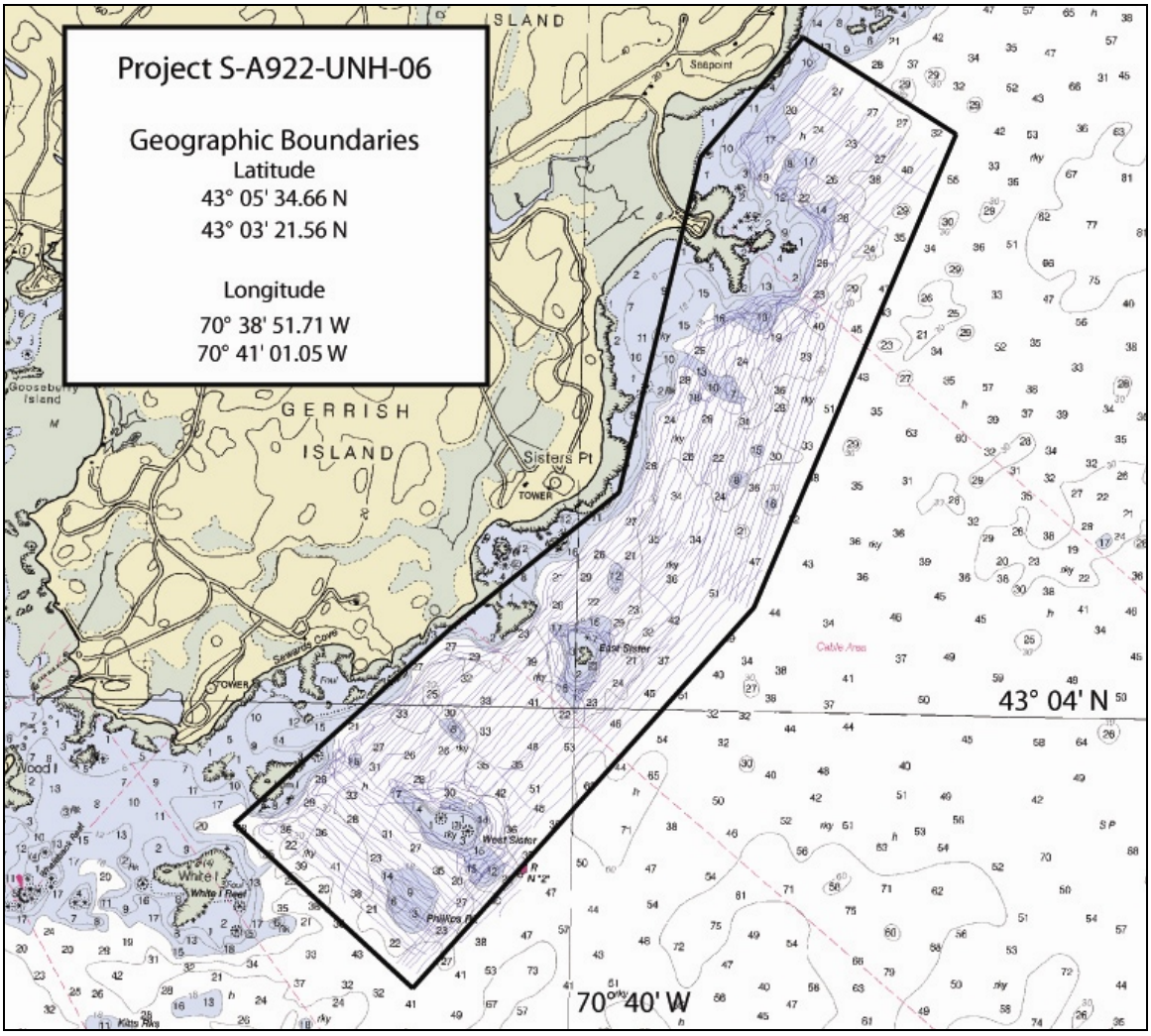


Figure 2.1 Chart of survey area and line plan.

3 Data Acquisition and Processing

3.1 Survey Vessel

The platform for the multibeam bathymetric data acquisition was the R/V Coastal Surveyor (Figure 3.1 and Table 3.1). The R/V Coastal Surveyor is a purpose built vessel, owned and operated by the University of New Hampshire, designed specifically for coastal multibeam hydrography. It is integrated with a robust, motor-driven ram system that provides an ideal mount for a range of multibeam and other sonar systems. The vessel incorporates an active roll stabilization feature to limit vessel motions detrimental to multibeam operations.

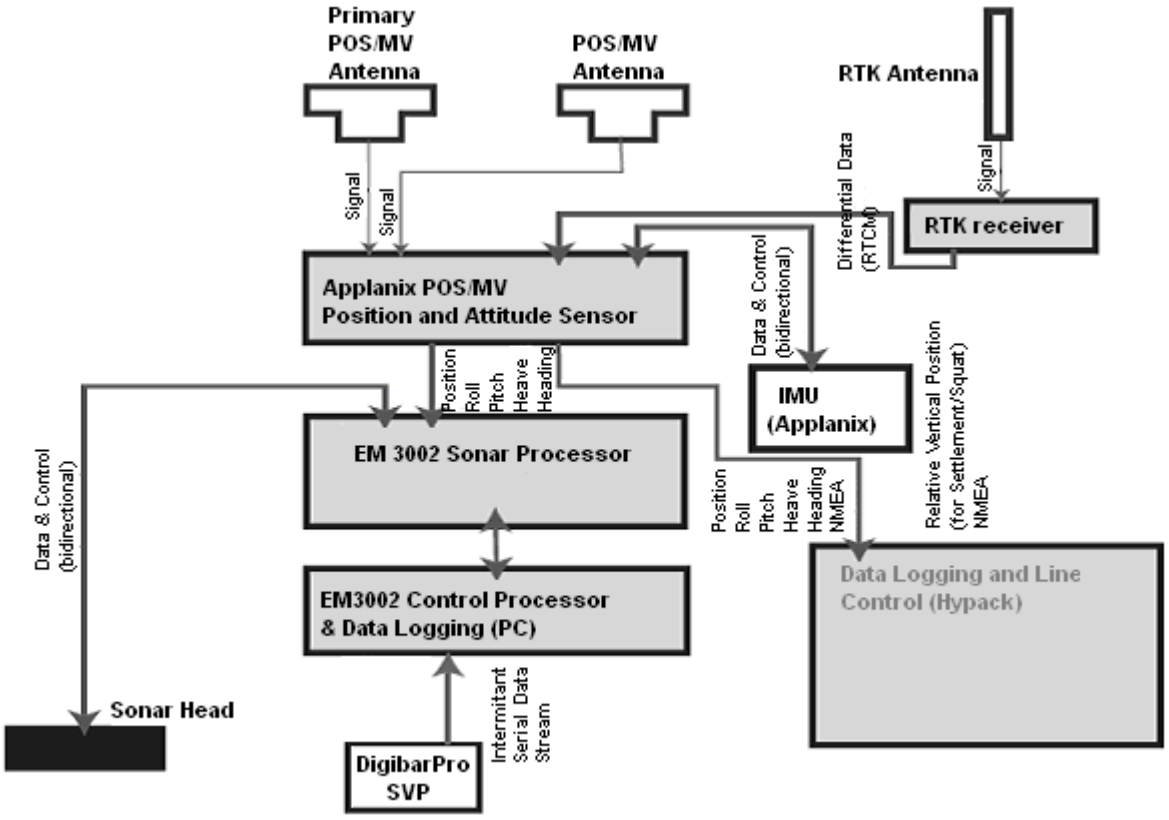


Figure 3.1 R/V Coastal Surveyor data flow

Table 3.1 Vessel Specifications

Dimensions:	40' x 12' x 3.7'
USCG:	Designated Research Vessel, subchapter "C"
Flag:	U.S.
Registry:	U.S. Coastwise and Registry
Official Number:	999206
Tonnage:	16 GRT 11 DWT
Lab space:	9' x 11' 6' x 10'
Speed:	10 knots
Minimum speed for full roll stabilization:	5 knots
Minimum survey speed:	2.5 knots
Propulsion:	1 x Cat 3116; 205 shp cont."A"; 2.57:1 reduction
Auxiliary:	1 x Isuzu/Lima 20 kw; 240/120 V; 60 Hz;
Power distribution:	38 ea. 115 volt receptacles 2 ea. 230 volt receptacles 1 ea. 12 volt receptacles 7 ea. 24 volt receptacles
Fuel capacity:	400 gallons
Potable water:	60 U.S. gallons
Roll stabilization:	Niad active fins
DGPS:	POS/MV model MV V4 sn. 2171 C-Nav firmware version 12.9 sn. 265211
Magnetic compass:	Ritchie 5"
Fluxgate compass:	Robertson RFC 300
Radar:	Furuno 1933CCBB NavNet
Autopilot:	Robertson AP 300DL
VHF:	Standard Omni 25 watt
Cellular phone:	Motorola 5 watt
Air conditioning:	3 x 1.25 tons
Heating:	3 x 16,000 BTU
Single Beam Echo Sounder	Odom Echotrac model CVX2 sn 23007 software version 3.08

3.2 Equipment

3.2.1 Positioning System

Horizontal positions were acquired using an Applanix POS/MV, model MVV4, Serial Number (S/N): 2171 (Table 3.2), combined with inertial navigation system, model IMU-200, S/N: 179. The differential correction for position was broadcasted by a Trimble Trimmark 3 radio modem from the base station (S/N: 4526152531) and received by another at the Coastal Surveyor (S/N: 4526152537) to attain centimeter horizontal position accuracy. The horizontal datum used for this project was World Geodetic System 84 (WGS 84). The final solution was made using the Seafloor Information System (SIS). The POS/MV National Marine Electronics Association (NMEA) string data were logged in POS/MV software.

Table 3.2 POS-MV (Position and Orientation Systems for Marine Vessels)

Position (m)	RTK: 0.02 - 0.10 DGPS: 0.5 - 4.0
Velocity (m/s)	RTK: 0.03 DGPS: 0.03
Roll & Pitch	RTK: < 0.01° DGPS: 0.02°
True Heading	4m baseline: 0.01°, 2m baseline: 0.02°
Heave	5% of heave amplitude or 5cm
Power	110/220 VAC, 60/50Hz, 60W
Operating Temperature	IMU & Antennas: -40° to +60° C PCS: 0° to +60° C
Humidity	IMU & Antennas: 0 to 100% PCs: 5 to 95% RH non-condensing
Ethernet Interface (10base-T)	Function: Operate POS MV™ & record data: Position, attitude, heading, velocity, track and speed, acceleration, status and performance, raw data. All data has time and distance tags UDP Ports: Display port - low rate (1Hz) data port - high rate (1-200Hz) data
RS232 Interface (DB9 male)	IP Ports: Control port - used by POS™ controller NMEA Port: GGA, HDT, VTG, GST, ZDA, PASHR, PRDID (1-50Hz), GGK. High rate attitude data port: Roll, pitch, true heading and heave in all multibeam proprietary formats (1-200Hz) Auxiliary GPS input: GGA, GST, GSA, GSV from Auxiliary DGPS, P-code or RTK receiver
Options	Internal RTK GPS receiver; analog interface (roll, pitch & heave); field support kit

Position and Attitude Sensors

Manufacturer: Applanix Corporation
Model no.: IMU-200 Part no.: 10001506
Serial no.: 179

Position Correction

Manufacturer: Trimble
Model: Trimmark 3 Serial no.: at base station - 4526152531
at Coastal Surveyor – 4526152537

3.2.2 Sounding System

Sounding was done using a single sonar head EM 3002 multibeam echosounder, loaned from Kongsberg Maritime. It is a high performance shallow water echosounder with very high resolution and dynamically focused beams, making it ideal for the depth range of the project area. The system's electronic pitch compensation and roll stabilized beams allow soundings even during rough seas. The EM 3002's improved processing power provides flexibility for manipulating complex acoustic signal processing, such as beam forming, beam stabilization, and bottom detection.

EM 3002, which is also capable of producing an acoustic image of the seabed, runs on the Seafloor Information System (SIS) software on Windows or Linux operating systems. The system provides 3D graphics and real time data cleaning.

The main components of the system are the sonar head, the processing unit and the operator station.

EM 3002

- Sonar Head (Part no.: 100-211464; Serial no.: 322)
- Processing Unit (Part no.: 125-218505; Serial no.: 1014)
- Hydrographic Work Station 10 (Part no.: 125-218784; Serial no.: 230)

Sound Velocity Profiler

Sound speed through water was measured continuously near the sonar head to obtain correction for the sound speed at the transmit point. For the patch test and the first day of survey, 06 June 2006 (DN157), the Smart SV&T velocimeter was used. However, it was lost in the afternoon and was replaced on the following day by the DigibarPro, which was used subsequently until the completion of the data acquisition.

The sound velocity corrections applied to soundings were determined using the sound velocity profiles obtained from casts of the SVPLUS velocimeter. Each resulting profile was entered on SIS, which in turn applied the corresponding sound velocity corrections to the soundings.

Surface sound speed: 1. Manufacturer: Applied Microsystem Ltd.
Model: Smart SV&T
Serial no.: 4543
2. Manufacturer: Odom Hydrographic Systems, Inc.
Model: DigibarPro DB1200
Serial no.: 98139

Sound Velocity Profile: Manufacturer: Applied Microsystems, Ltd.
Model: SVPLUS
Serial no.: 3319

3.2.3 Heading and Attitude Equipment

Course made good and heading data are calculated bye the POS/MV systems. The attitude equipment consists of the Applanix IMU, previously described. (See section 3.2.1).

3.2.4 Data Acquisition Software

Seafloor Information System:

The acquisition for the multibeam data for this survey was done using the Seafloor Information System (SIS), version 3.1. It is a real time software application designed to be the user interface and real time data processing system for hydrographic instruments produced by Kongsberg Maritime.

Hypack® Max:

Hypack Max (version 4.3) was used for survey planning as well as logging backup navigation data during the survey.

3.3 Settlement and Squat

3.3.1 Static Draft

At the beginning and end of each survey day, the static draft (taken while dead-in-the-water but not tied to the pier) was measured from the in-board draft tube to the top of the POS-MV IMU (the vessel reference). The value measured before surveying was entered into SIS as the waterline. The value measured at the end of the day served as a check to verify no significant changes in the ship's draft.

3.3.2 Dynamic Draft

Prior to surveying, dynamic draft measurements have been made for the Coastal Surveyor using RTK GPS. The general procedure was to conduct a total of 18 measurement runs each of 3 minutes in duration during which ship's speed over ground, ship's speed through water, vessel pitch and IMU ellipsoidal height were recorded at 1Hz. Of these 18 measurement runs, 8 were conducted with the current and 8 were taken against the current. Additional first and last measurement runs were taken while the vessel was stationary to the current (dead-in-the-water). A plot of the resulting measurements and error estimates is provided below (Figure 3.2) along with a summary table of the dynamic draft results (Table 3.3).

The GPS provided speed-over-ground which was corrected to the relative speed through water by taking the mean of two stationary measurements.

Ellipsoidal height measurements were corrected for tidal oscillations recorded at a tidal station less than 1 NM from the measurement location. Vertical translation resulting from vessel pitch was not considered in this analysis, as the sonar data acquisition system applies this translation in real-time.

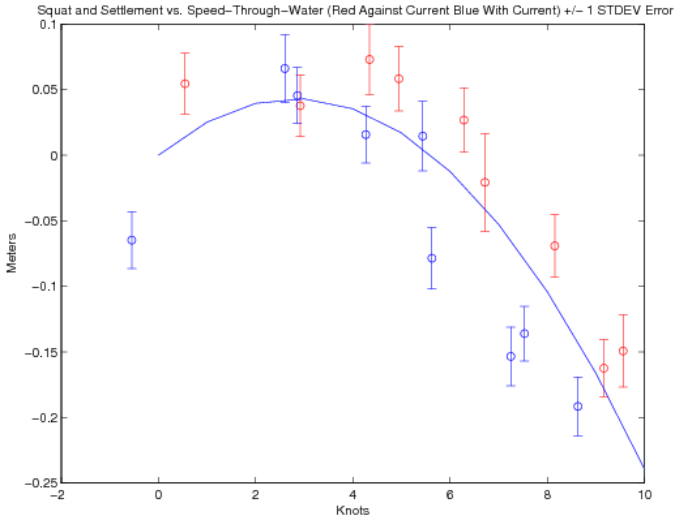


Figure 3.2 R/V Coastal Surveyor settlement and squat resulting measurements and errors.

Table 3.3 Dynamic draft measurements.

Speed (kts - (m/s))	Height (m)
0.000+/-0.790 (0.000+/-0.406)	0.000+/-0.0448
1.000+/-0.790 (0.514+/-0.406)	0.025+/-0.0448
2.000+/-0.790 (1.029+/-0.406)	0.040+/-0.0448
3.000+/-0.790 (1.543+/-0.406)	0.043+/-0.0448
4.000+/-0.790 (2.058+/-0.406)	0.035+/-0.0448
5.000+/-0.790 (2.572+/-0.406)	0.017+/-0.0448
6.000+/-0.790 (3.087+/-0.406)	-0.012+/-0.0448
7.000+/-0.790 (3.601+/-0.406)	-0.053+/-0.0448
8.000+/-0.790 (4.116+/-0.406)	-0.104+/-0.0448
9.000+/-0.790 (4.630+/-0.406)	-0.166+/-0.0448
10.000+/-0.790 (5.144+/-0.406)	-0.239+/-0.0448

*** NOTE: The convention in CARIS is for draft measurements to be positive down. Therefore the sign of these height measurements must be changed when entering values into the CARIS dynamic draft table.**

3.3.3 Heave

Heave was measured and compensated for in real-time by the ship's POS-MV GPS-aided inertial navigator. Care was taken to ensure operation of the POS-MV was within the accuracy limits (as shown in the POS-MV controller application) at all times.

3.4 Patch Test

The patch test carried out on June 6, 2006 (DN 157) for the EM3002 multibeam system using the guidelines found in the NOAA Field Procedures Manual 2005, Appendix 1.1, "Field Calibration Procedures for Multibeam Echo-sounding Systems" by Andre Godin and the calibration section in the Kongsberg Seafloor Information System (SIS) operation manual (rev. E). The data was processed and compared using the SIS data acquisition software utility. The offsets obtained during the patch test are shown in Table 3.4. These offsets were verified by using guidelines found in the CARIS HIPS & SIPS User's Guide Chapter 21 Calibration.

Table 3.4 Patch test offsets

Time delay: 0.0 s
Pitch: 2.4°
Roll: -1.6°
Heading: -1.1°

The biases were determined by running a series of lines at different speeds and headings over a patch of the seafloor and observing how the multibeam record was affected. The patch of seafloor used to determine the timing, pitch and heading biases consisted of an edge of a rock outcrop over a steep slope, and a flat bottom to the south was used to determine the roll bias (Figure 3.3). The NOAA Automated Wreck and Obstruction Information System (AWOIS) database and other resources were investigated to determine if wrecks existed in the area but none were found. Additionally, any significant individual targets nearby this survey area were surrounded by rapid currents which would have negatively affected the patch test results.

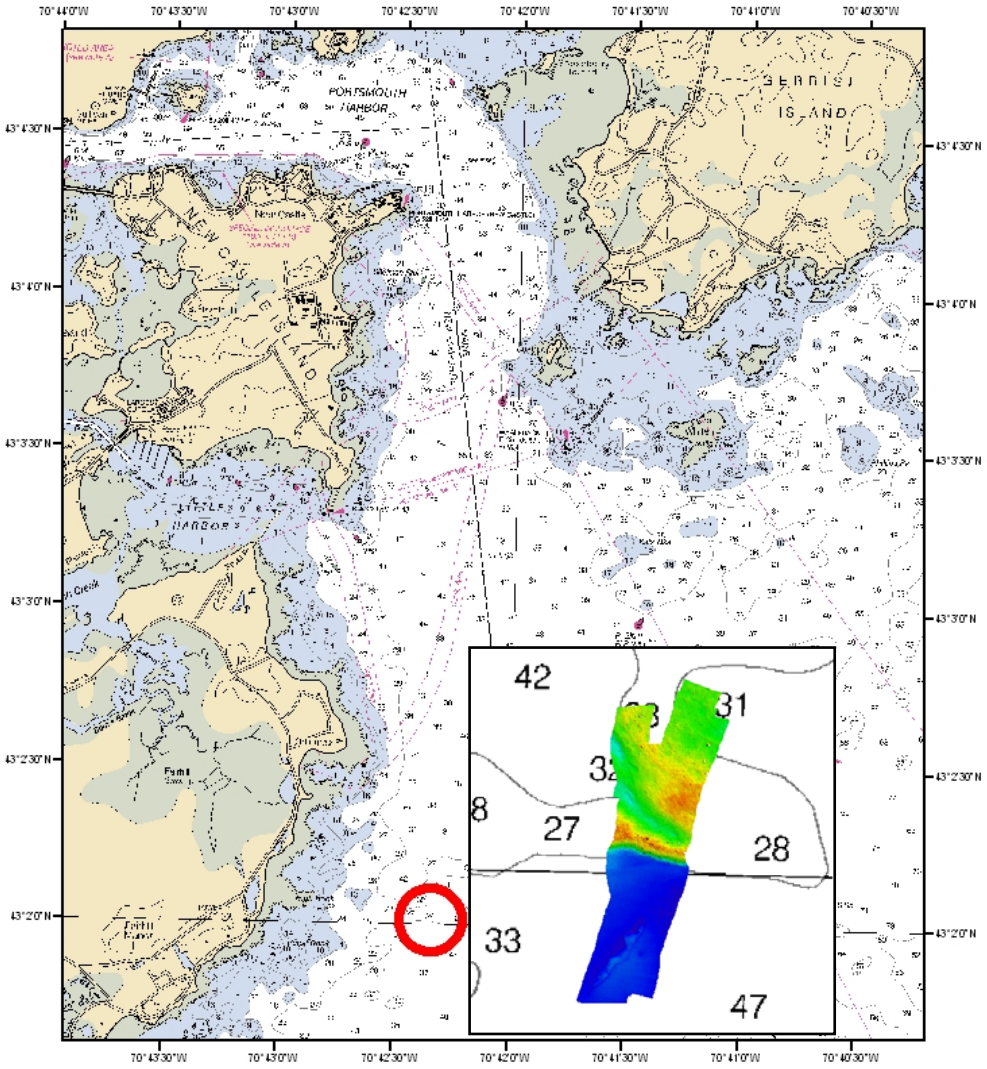


Figure 3.3 Patch test area over NOAA Nautical Chart 13283 centered on a reference point with position 43˚02’01.2’’N, 070˚42’20.0’’W (WGS84).

Survey lines were created using Hypack navigation software and the patch data were collected using SIS. The biases were determined in the following order: timing, pitch, roll and heading, with the results from each step calculated and put into the system before starting the next step. A Sound Velocity Profile (SVP) cast was taken once before the start of the patch test on June 6, 2006 (DN 157). Results from the patch test are shown in Table 3.5.

Table 3.5 Patch test results

Patch Test Data Table				
File	**Start Time**	**Stop Time**	**Heading**	**Speed (SOG – knots)**
002	15:03:18	15:06:30	030	4
004	15:18:46	15:21:37	030	4
006	15:32:55	15:34:15	210	9
007	15:46:00	15:48:52	210	4
008	16:14:11	16:17:38	030	4

Offsets	Lines used for calibration
Timing	006 & 007
Pitch	004 & 007
Roll	004 & 007 (south portion)
Heading	002 & 008

3.5 Horizontal and Vertical Control

This survey has been completed with respect to MLLW, WGS-84 and UTM Zone 19N. Horizontal and vertical field controls were established using a Trimble RTK base station/rover pair.

3.5.1 Horizontal Control *See also Evaluation Report*

Horizontal control for this project was established with fixed-integer, RTK navigation solution of the POS/MV Inertial Navitator. RTK corrections were provided by a Trimble GPS Real Time Kinematic (RTK) network over the survey area.

The RTK base station was established on Sisters Point, Gerrish Island, Maine. The site was mid-coast along the survey area and the approximate coordinates were φ = 43º 04’ 46” N, λ = 070º 39’ 55” W. The 10-meter instrument height enabled clear signal reception in a 6-nautical mile radius. The base station, consists of a Trimble 5700 receiver (S/N: 0220358293) and zephyr antenna (S/N: 60073787) connected to a Trimmark3 modem (S/N: 4526152531) transmitting CMR format at 19200 baud at 25 watts. For positional refinement, satellite data was logged for over two hours, and submitted to the NGS via OPUS. The final positional accuracy was established for the base station at 0.019 m rms in the horizontal and 0.073 m in the vertical, respectively. Refined positioning from Online Positioning User Service (OPUS) was entered into the base station and Radio Technical Commission for Maritime Services (RTCM) strings were enabled for RTK transmission to the rover unit.

A rover station consisting of a Trimble Trimmark3 modem (S/N: 4526152537) and antenna were located on the R/V Coastal Surveyor to receive the base station’s corrective transmissions. The Trimmark3’s output was channeled to the POS/MV for that unit’s positional update, which in turn provided navigation to the sonar system. The POS/MV was monitored throughout the survey to ensure a continuous fixed-integer RTK navigation solution. POS/MV reported accuracy remained less than 3cm. ***Concur.***

3.5.2 Vertical Control *See also Evaluation Report*

Mean Lower-Low Water (MLLW) was the vertical datum for the survey. The NOAA Tide gauge station at Fort Point, New Castle, NH in position of latitude of 43˚ 4.3'' N, and longitude of 70˚ 42.7' W was used to reduce sounding data to chart datum (MLLW). Preliminary tidal data from this station was corrected with zoning provided by NOAA. The preliminary tide zoning, time corrector is -6 minutes with range corrector of 1.01 from Fort Point Tide Station (ID: 8423898). The tidal station is leveled with respect to the benchmarks, located in close proximity. The benchmark stamping numbers are BM-2-1919 (primary), BM-1-1919, BM-4, respectively. ***Concur.***

Graphical representation of tidal data from June 3 to June 15, 2006 is shown in Figure 3.4.

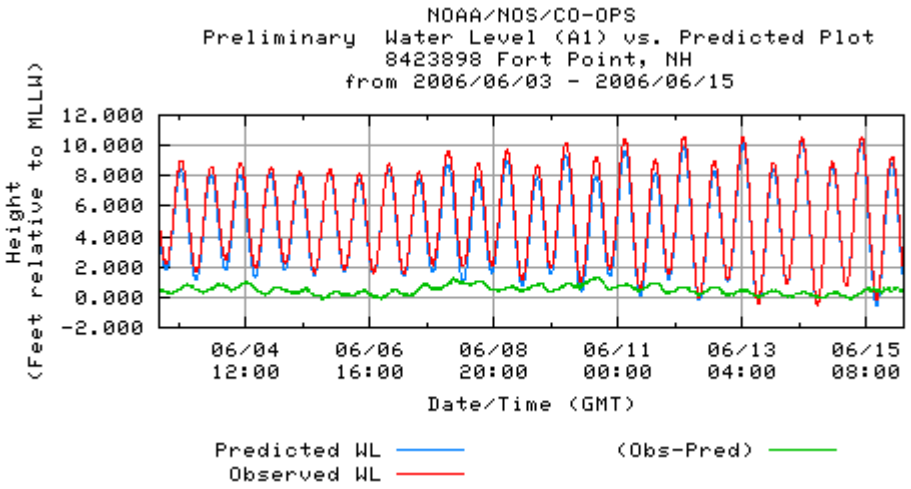
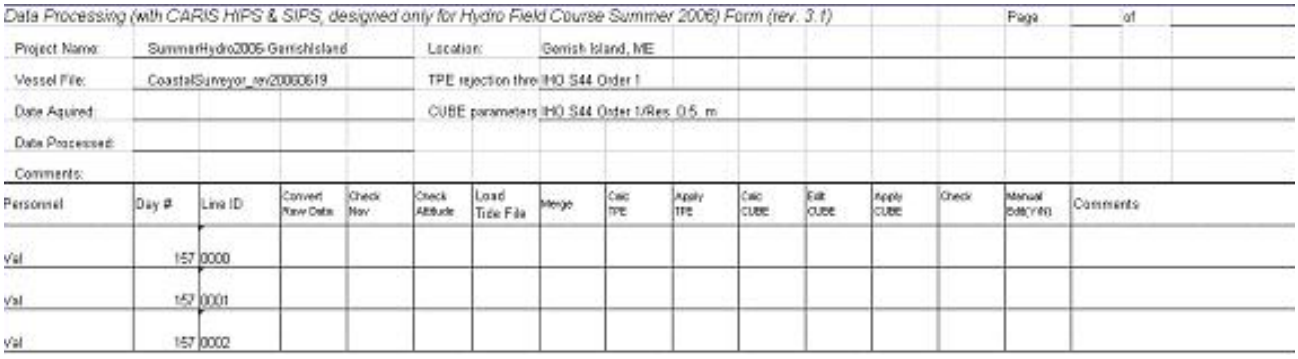


Figure 3.4 Plot of predicted and observed tides.

3.6 Final Processing

All multibeam data for this project were processed using CARIS HIPS software. The data was collected between June 6 and June 15, 2006 (DN 157-166). The results were examined informally each day, and preliminary plots were produced to avoid gross blunders and to assist in filling holidays. The final processing was carried out from June 20 to June 23, 2006. All the procedures shown in this section were controlled with the check sheet (Figure 3.5) to avoid processing ambiguity (quality control).


Data Processing (with CARIS HIPS & SIPS, designed only for Hydro Field Course Summer 2006) Form (rev. 3.1) Page of

Project Name:	SummerHydro2006-GarrishIsland	Location:	Gerrish Island, ME
Vessel File:	CoastalSurveyor_rev20060619	TPE rejection thre	IHO S44 Order 1
Date Aquired:		CUBE parameters	IHO S44 Order 1/Res. 0.5 m
Date Processed:			
Comments:			

Personnel	Day #	Line ID	Convert Raw Data	Check Nav	Check Attitude	Load Tide File	Merge	Calc TPE	Apply TPE	Calc CUBE	Edit CUBE	Apply CUBE	Check	Manual Edit(Y/N)	Comments
Val	157	0000													
Val	157	0001													
Val	157	0002													

Figure 3.5 Data processing checklist.

3.6.1 Calibration and Cleaning Procedures

The initial step taken in multibeam data processing was to create a CARIS HIPS vessel file. The vessel file normally contains information about the sensor offsets used in the multibeam survey. However, since these had already been corrected in the SIS data acquisition software, offsets in the Caris vessel file were set to zero. Information about model and manufacturer of each sensor was also included here.

Dynamic draft of the vessel was measured independently during the survey, as mentioned in section 3.3. These results are contained in the vessel file, and were applied during processing (Vessel file shown in Figure 3.6).

Along with vessel configuration information, the vessel file also contains information used for calculating Total Propagated Error (TPE) values in the multibeam data. Standard deviation values are based on both the manufacturer's specifications and estimates from field work. Sensor offsets were included in the section used for calculating TPE.

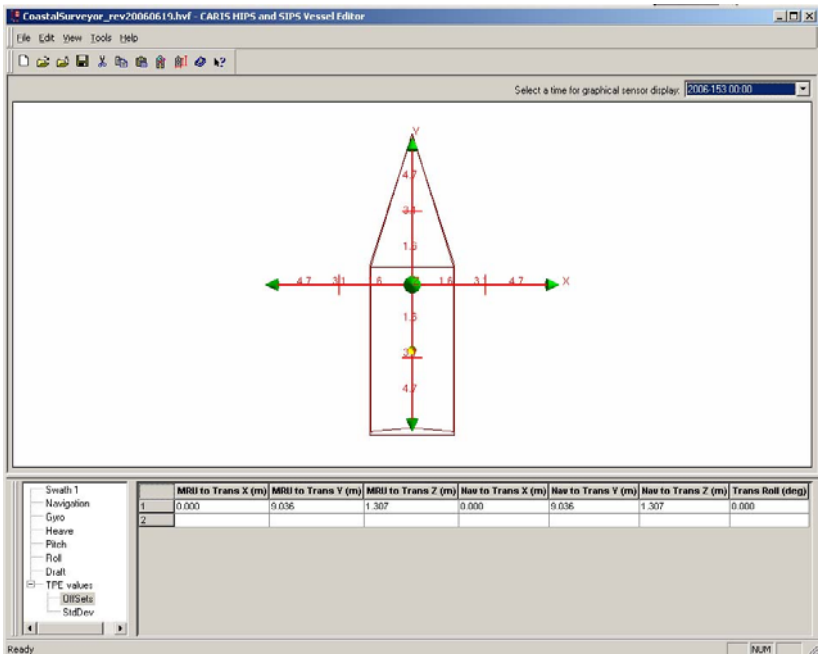


Figure 3.6 R/V Coastal Surveyor in CARIS HIPS Vessel Editor.

The next step in Caris data processing was to create a project file. This contains the vessel file, details about the projection and the boundaries of the project area. The project file was used to manage the raw data and all the information about data that was flagged during the editing process.

The multibeam data were imported into CARIS HIPS as raw Simrad .all files. After initially checking all lines for blunders in the navigation, as well as the attitude sensor data (pitch, roll, heave, and gyro), tidal corrections were applied using preliminary tide measurements from a tide station at Fort Point, New Hampshire. The tidal data was adjusted using a NOAA zoning chart. A time offset of -6 minutes and a range multiplier of 1.01 were applied to the preliminary tides (for more detailed information on the tidal reference please (see section 3.5.2). The tide was the only additional correction applied during processing. All other sensors were integrated during acquisition, including motion sensor data and sound velocity profiles.

Once tidal correctors were applied, the data were merged, and a temporary field sheet was created for use during the cleaning and editing. The TPE was then computed based on the sensor parameters in the vessel files and the EM3002 multibeam echosounder device model. The TPE filters were set up for IHO S-44 Order 1 requirements. The Swath/Sweep settings were not applied. Figure 3.7 shows the settings that were used and the file that was created to store the correct settings. The TPE filter was then applied to the selected files.

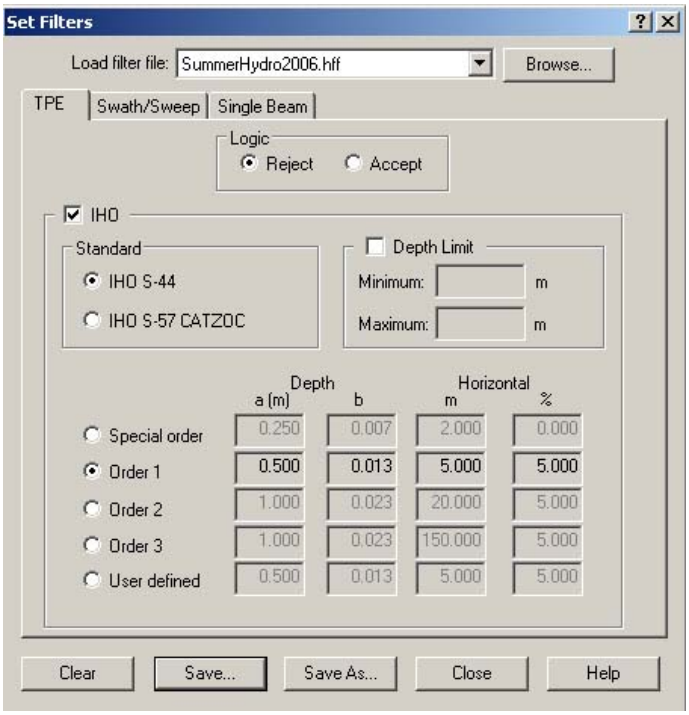


Figure 3.7 TPE filter settings.

A CUBE base surface was created with resolution set to 0.5 m, the IHO S-44 Order set to Order 1, and the Disambiguation method set to Density and Locale. The parameter menus are shown in Figure 3.8.

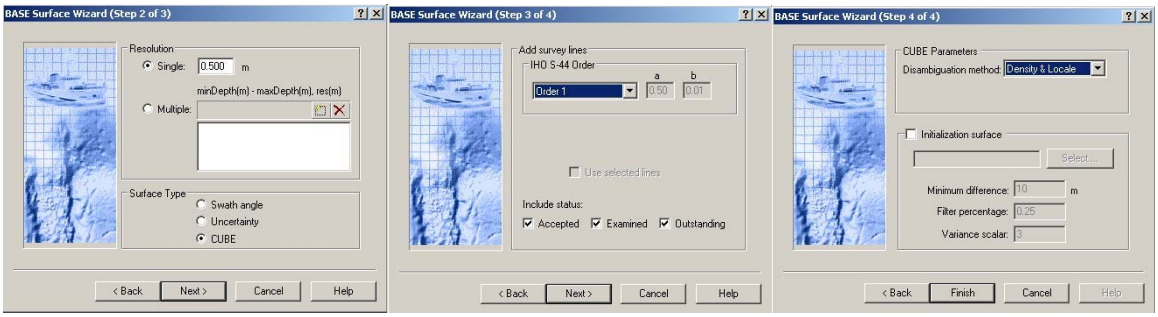


Figure 3.8 CUBE parameter setup.

Additional CUBE parameters contained in the cubeparams.xml system file were left at the default settings as follows:

```
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 <Distance_Exponent value="2.0" />
 <Queue_Length value="11" />
 <Quotient_Limit value="30.0" />
 <Discount_Factor value="1.0" />
 <Estimate_Offset value="4.0" />
 <Bayes_Factor_Threshold value="0.135" />
 <Run_Length_Threshold value="5" />
 <Capture_Distance_Scale value="5.00" />
 <Capture_Distance_Min value="0.5" />
 <Horiz_Error_Scalar value="2.95" />
 <Density_Strength_Cutoff value="2.00" />
 <Locale_Strengh_Max value="2.5" />
 <Locale_Radius value="1" />
 <Null_Hypothesis_Min_Neighbours value="3" />
 <Null_Hypothesis_Ratio value="3.0" />
 <Enable_Null_Hypothesis value="False" />
 </CARIS_CUBE_Parameters>
```

The CUBE surface was used to identify areas in the multibeam data with more than one hypothesis for the depth measurement. Using the subset editor tool, erroneous hypothesis choices made by CUBE could be rejected and data wrongly omitted could be nominated as a primary hypothesis. In most cases, the primary hypotheses generated by CUBE were acceptable to the data reviewers. However, there were some instances where the CUBE hypothesis was considered incorrect. An example of this is shown in Figure 3.9.

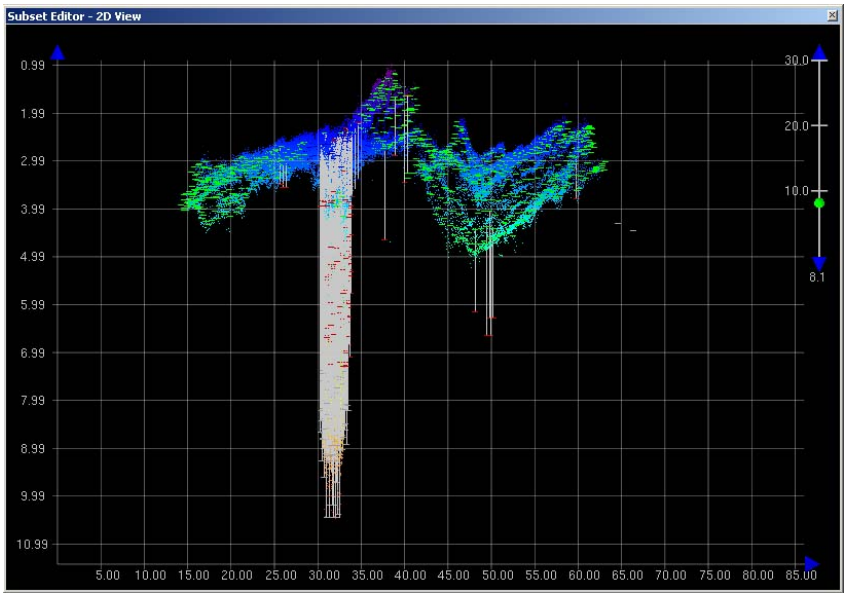


Figure 3.9 Editing the CUBE surface.

This example shows what would be done if there was a large blunder in the data. In this case CUBE designated some of the primary hypotheses in locations that were part of the blunder data. These hypotheses were rejected manually, and some secondary hypotheses were designated as primary if they were located in more reasonable places.

Once the lines were examined closely and the CUBE surface edited, the CUBE filter was applied. A base surface could then be created from the filtered data, using a 0.5m grid. The data was inspected using subset editor and swath editor. Any additional outliers not rejected by the CUBE filter were manually rejected.

At this point, all the individually processed lines were imported and merged, and one base surface was created. The base surface was created with a 0.5m grid cell size using swath data. The data was inspected to ensure that the lines were imported correctly and projected in the appropriate coordinate system. The entire dataset was checked for gross blunders and inconsistencies. The lines were queried to verify that the correct tide file was applied to each of them.

A chart comparison was carried out between the multibeam data and the NOAA chart for the area. This comparison is covered in more detail in section 4.1.

3.6.2 Accuracy Evaluation

Crossline surveys were carried out to check and clarify the accuracy of the measurements. After finalizing the initial processing as described above, the statistics of the difference in depth between the main surveys and the crossline surveys were examined, as well as junctions between days. The test areas are shown in Figure 3.10. The results of the difference in depth were summarized in Table 3.6. The differences in Table 3.6 are within the IHO Order 1 limits specified for the survey. It should be noted that these crossline calculations compared entire swaths as opposed to only the nadir overlap. Some lines used in this comparison were not perpendicular lines, but adjacent lines from different days. The results showed consistency between lines collected at different times during the day, and lines collected on different days.

Table 3.6 Summary of crossline analysis.

Area	Grid1						Grid2						Difference (Grid1 - Grid2)		
	DoY	Line ID	Time	Azimuth	Speed(m/s)	Av. Depth	DoY	Line ID	Time	Azimuth	Speed(m/s)	Av. Depth	Average	STD	# of pixs
		0002	16:59	SW→NE	3.3-3.4										
CL01	157	0003	17:04	NE→SW	3.3-3.5	11.3503	166	0074	17:50	NW→SE	2.7-3.4	11.3416	0.0087	0.0755	1979
		0004	17:10	SW→NE	3.3-3.5										
CL02	160	0022	15:50	NW→SE	3.4-3.8	8.7722	166	0049	16:20	NE→SW	3.5-3.9	8.7255	0.0468	0.0874	2277
		0023	15:58	SE→NW	3.0-3.5										
		0011	15:02	NW→SE	3.0-3.4										
CL03	162	0012	15:11	SE→NW	3.1-3.6	10.1253	166	0049	16:20	NE→SW	3.6-4.0	10.0995	0.0258	0.0641	2659
		0013	15:13	NW→SE	3.2-3.5										
	164	0014	16:42	SW→NE	3.6-3.7	10.8163	164	0017	17:07	NE→SW	3.3-3.5	10.8394	-0.0231	0.0366	1282
CL04	164	0014	16:42	SW→NE	3.6-3.7	10.8961	165	0017	16:25	SW→NE	3.3-3.4	10.9114	-0.0153	0.0594	567
	164	0017	17:07	NE→SW	3.3-3.5	10.9241	165	0017	16:25	SW→NE	3.3-3.4	10.9097	0.0144	0.0650	568
CL05	163	0000	15:05	S→N	3.2-3.3	2.3831	166	0064	17:22	N→S	3.1-3.4	2.3652	0.0178	0.1184	384
			15:13	N→S	3.2-3.3										
CL06	160	0029	16:47	SW→NE	3.0-3.4	4.8101	166	0058	16:51	S→N	2.1-2.5	4.7348	0.0754	0.0998	777
CL07	165	0029	18:04	SW→NE	3.6-3.7	5.4053	166	0055	16:43	SW→NE	2.1-2.4	5.3850	0.0203	0.0912	667
CL08	164	0019	17:20	NE→SW	3.6-3.7	5.7184	166	0054	16:38	SW→NE	2.4-2.6	5.6893	0.0291	0.1706	702
CL09	164	0015	16:48	S→N	2.5-2.8	4.3083	165	0006	15:30	S→N	2.0-2.7	4.2608	0.0475	0.1294	493
			16:52	S→N	2.5-2.8										
CL10	164	0012	15:37	NE→SW	3.6-3.8	3.7457	166	0071	17:40	N→S	3.1-3.4	3.7335	0.0122	0.2190	366
	160	0001	14:20	NW→SE	3.3-3.5	6.1313	160	0027	16:15	SE→NW	3.6-3.8	6.0766	0.0546	0.0850	571
CL11	160	0001	14:20	NW→SE	3.3-3.5	6.3037	166	0072	17:42	E→W	3.4-4.1	6.2615	0.0422	0.0723	639
	160	0027	16:15	SE→NW	3.6-3.8	5.8405	166	0072	17:42	E→W	3.4-4.1	5.8519	-0.0114	0.0851	660
CL12	160	0020	15:44	NW→SE	3.0-3.4	3.6841	166	0073	17:47	NW→SE	2.9-3.3	3.6745	0.0096	0.2079	619

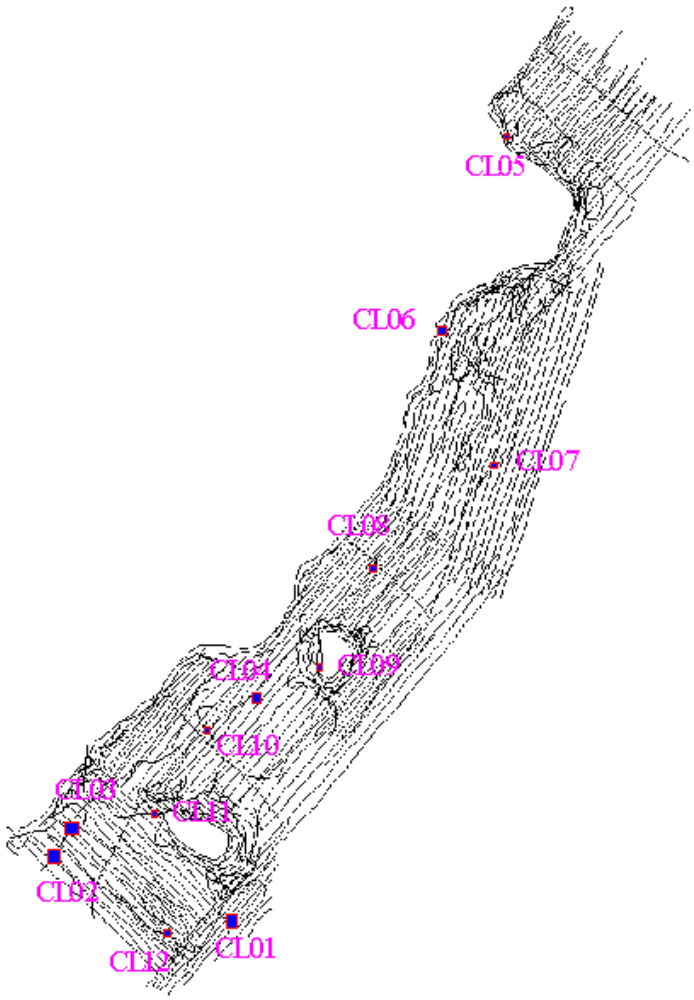


Figure 3.10 Locations of crossline and junction analyses.

3.6.3 Final Product

The final navigation surface products include the CARIS HIPS Bathymetry Associated with Statistical Error (BASE) surface computed at 0.5m resolution, as well as the Bathymetric Attributed Grid (BAG) or Open Navigation Surface (ONS). BAG uses the horizontal and vertical uncertainty for each sounding to create a gridded bathymetric model of the seafloor. The Navigation Surface is a gridded product that allows the highest amount of detail to be preserved and contains information regarding uncertainty, designated soundings, elevation and metadata. Software and more information regarding the BAG can be found at: http://www.opennavsurf.org/. A BAG and BASE surface was created in accordance with section 8.5.3 of the NOS's HSSD (June 2006) deliverables requirements.

While the BAG source code is free, due to time constraints, the final BASE surface was submitted to Bill Lamey of CARIS to implement the BAG source code in a beta CARIS executable which reformatted the surface to a common specification. The .bag file can be viewed in new beta versions of IVS Fledermaus, CARIS or in a free HDF Viewer (version 2.3). This current BAG does not include corresponding metadata or designated soundings however, it can be inserted at a later date.

4 Results and Deliverables

4.1 Chart Comparison

The final base surface was compared with the largest scale chart for this area: 13283, 19th edition, February 2005, scale 1:20 000, corrected through May 19, 2005. A cursory visual comparison was performed of shoal areas, named hazards and locations of potential discrepancy between the survey dataset and the chart, and are reported below.

4.1.1 Agreement with charted soundings

Considering the differing ages, sounding methods and positioning systems between the surveys used to construct the present edition of chart 13283 and this survey, overall agreement between the survey dataset and the chart appeared to be good. Considering the fact that some regions of the bottom within the survey area are mobile, and the area is swept by strong tidal currents, temporary artifacts such as sandwaves are expected, but certain areas where depth curves did not appear to fully represent the character of the seafloor were noted. Individual discrepancies discovered in rocky areas which were judged to require further investigation by competent authority were flagged, and are listed in Table 4.1. ***Concur.***

Table 4.1 Flagged discrepancies in need of further investigation.

N	Long (dms)	Lat (dms)	Day	Line	Profile	Beam	Depth (ft)	Charted Depth (ft.)
1	070-39-45.42W	43-04-11.05N	2006-157	0011_20060606_180521_Coastal_Surveyor	5,132	3	26.112	32
2	070-40-46.36W	43-03-50.69N	2006-166	0050_20060615_162250_Coastal_Surveyor	1,752	30	12.602	>18
3	070-40-54.92W	43-03-39.05N	2006-160	0024_20060609_160046_Coastal_Surveyor	915	143	18.392	22
4	070-39-23.72W	43-04-56.35N	2006-166	0058_20060615_165027_Coastal_Surveyor	5,579	144	6.276	10
5	070-39-38.10W	43-04-45.32N	2006-163	0036_20060612_183333_Coastal_Surveyor	3,779	61	12.516	18
6	070-39-33.58W	43-04-36.96N	2006-163	0040_20060612_185551_Coastal_Surveyor	2,084	160	16.204	22
7	070-39-17.47W	43-05-32.39N	2006-163	0000_20060612_150030_Coastal_Surveyor	14,942	160	2.277	10
8	070-40-21.25W	43-03-35.40N	2006-160	0003_20060609_142933_Coastal_Surveyor	5,291	1	15.364	20
9	070-39-21.95W	43-04-30.12N	2006-165	0037_20060614_191010_Coastal_Surveyor	1,040	145	14.019	16
10	070-39-24.13W	43-04-37.31N	2006-165	0031_20060614_181521_Coastal_Surveyor	2,825	35	12.986	15
11	070-39-07.64W	43-05-15.25N	2006-163	0054_20060661_172509_Coastal_Surveyor	1,267	35	21.775	Near 5fm curve

4.1.2 Wrecks and significant contacts

No wrecks or significant contacts were observed in the survey area. ***Do not concur. One DToN was submitted by AHB during office processing. See Appendix I DToN.***

4.1.3 Charting Recommendations

In isolated areas of this survey, significant differences between the charted depth curves and the character of the seafloor as captured by the final surface were noted. Such areas, which may warrant additional investigation, are: ***Concur***

NE side Horn Is. 43-03-58N., 70-41-00W.

Unnamed reef area, vicinity 43-05-03N,. 70-39-16W.

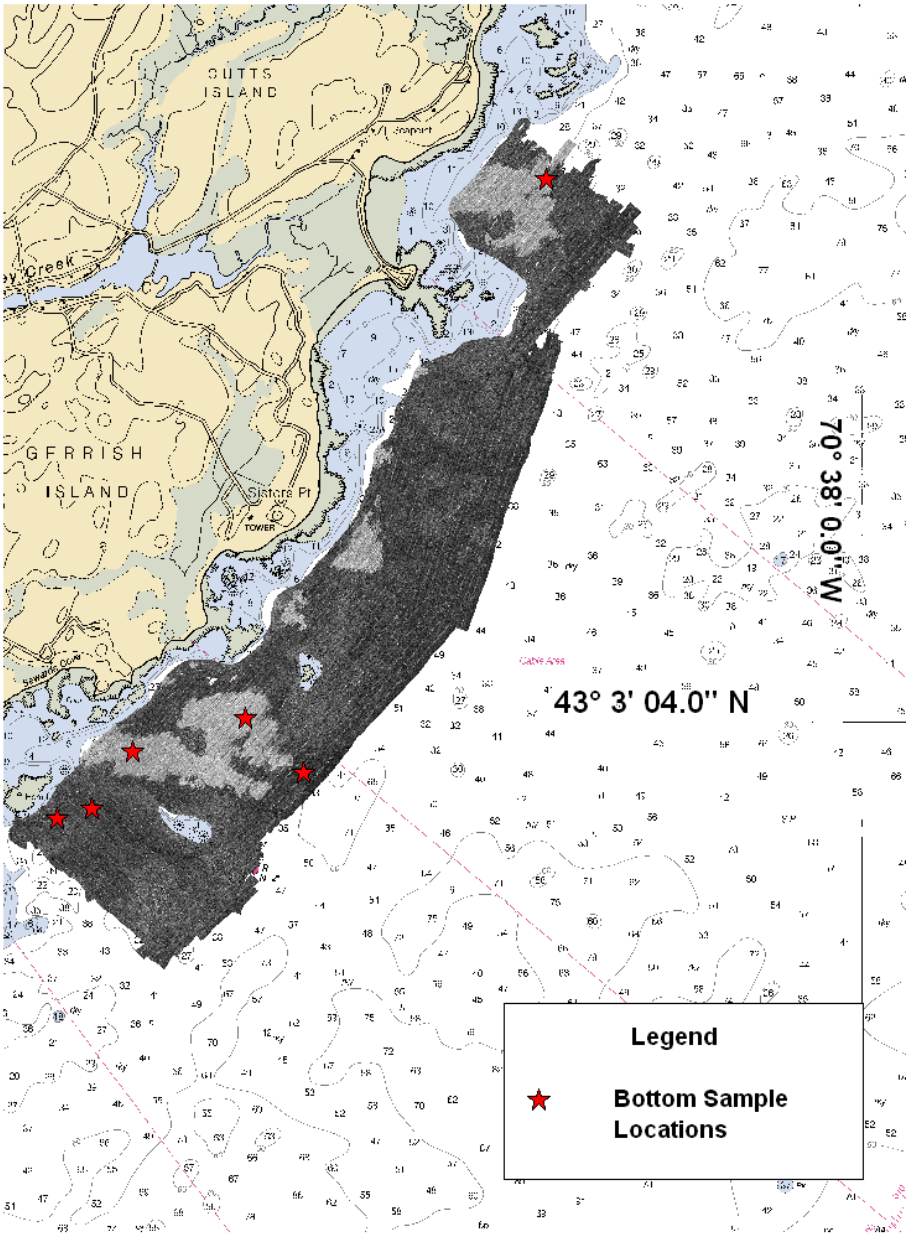
Phillips Rock, 43-03-33N., 70-40-33W.

East Sister, 43-04-08N., 70-39-59W.

4.2 Bottom Samples

Bottom samples were collected in accordance with section 7.1 of the NOS Specifications and Deliverables (2006 version) and section 2.5.3.6.1 and 3.4.5 of the NOAA Field Procedures Manual (2006 version 2.1). Positioning, depth and description of the samples are located in the Separates* section 6.4. Bottom samples locations were selected to examine backscattering strengths representative of different bottom types. The backscatter mosaic (figure 4.1) was assembled from the full time series acquired with the EM3002 June 6-June 15, 2006 (DN 157- DN 166). ***Concur with clarification. Only three bottom samples from W00178 were applied to the H-Cell. The additional bottom samples were not applied due to either the positional accuracy being in question or were more adequately addressed by the 13283 charted sea bed areas (SBDARE). Recommend that the three W00178 SBDARE's in the US500178_CS.000 H-Cell should be charted in addition to the charted 13283 SBDARE's which are also contained in the US500178_CS.000 H-Cell***

Filed with original field



records.

Figure 4.1 Acoustic backscatter from EM3002 mosaic and bottom sample locations

4.3 Conclusions

The survey was successful in providing good overlap with the LIDAR dataset for a comparison. The survey met the IHO Order 1 requirements and the NOS HSSD were followed as closely as possible. However, sections 5.2.3 on Gridded Data Specifications and 5.3.1 on Demonstration of Coverage were not clear to the hydrographers participating in this class. Therefore, the criteria for picking designating soundings were based on the previous Specifications and Deliverables and the minimum grid resolution was 0.5m instead of the minimum grid resolution of 2 meters as stated in the NOS HSSD (June 2006). Additionally, it should be noted there were no dangers to navigation could be found in the multibeam data. ***Concur.***

5 Appendices

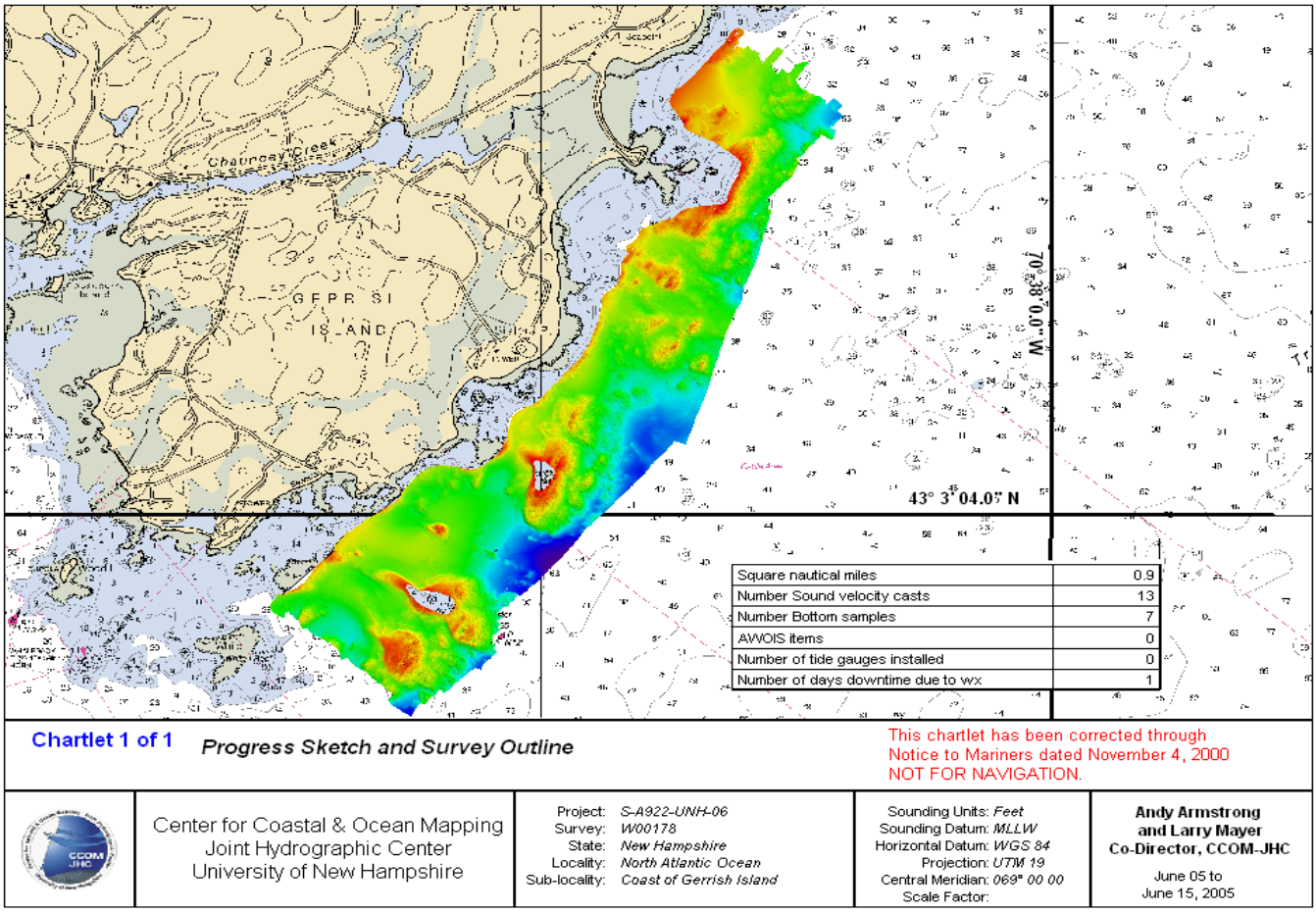
5.1 Dangers to Navigation

Considering the nature of the survey area, a shallow coastal area removed from main channels and shipping lanes, no items identified by this group is judged to be a charting discrepancy requiring immediate action. During survey operations, it was noted however, that there is intermittent fishing and pleasure boat traffic transiting the area. Soundings1, 2, 5, 6, 8 and 11 show enough variance from charted values that it is requested they receive further investigation as time permits. ***Do not concur. One DToN was submitted by AHB during office processing. See Appendix I DToN.***

5.2 Survey Feature Report

There were no AWOIS records in this survey area ***Concur.***

5.3 Final Progress Sketch and Survey Outline



5.4 Tides and Water Levels *See also Evaluation Report.*

See request for tides on next page.

APPENDIX I
DANGER TO NAVIGATION RECORDS

W00178 DToN Report

Registry Number: W00178
State: Maine
Locality: Portsmouth
Sub-locality: Garrish Isl.
Project Number: OPR-S-A992
Survey Date: 06/15/2006

Charts Affected

Number	Edition	Date	Scale (RNC)	RNC Correction(s)*
13283	20th	10/01/2007	1:20,000 (13283_1)	USCG LNM: 06/24/2008 (09/16/2008) CHS NTM: None (08/29/2008) NGA NTM: None (09/27/2008)
13274	27th	06/01/2007	1:40,000 (13274_2)	[L]NTM: ?
13286	30th	03/01/2004	1:80,000 (13286_1)	[L]NTM: ?
13278	26th	06/01/2005	1:80,000 (13278_1)	[L]NTM: ?
13260	40th	05/01/2007	1:378,838 (13260_1)	[L]NTM: ?
13009	33rd	05/01/2007	1:500,000 (13009_1)	[L]NTM: ?
13006	34th	05/01/2007	1:675,000 (13006_1)	[L]NTM: ?
13003	49th	04/01/2007	1:1,200,000 (13003_1)	[L]NTM: ?

* Correction(s) - *source: last correction applied (last correction reviewed--"cleared date")*

Features

No.	Name	Feature Type	Survey Depth	Survey Latitude	Survey Longitude	AWOIS Item
1.1	7 ft submerged rock	Rock	2.28 m	43° 05' 32.3" N	070° 39' 17.3" W	---

1 - Danger To Navigation

1.1) ~~7 ft~~ 2 ft submerged rock

DANGER TO NAVIGATION

Survey Summary

Survey Position:	43° 05' 32.384" N, 070° 39' 17.~~3~~477" W
Least Depth:	~~2.28~~ 0.694 m (= ~~7.47~~ 2.277 ft = ~~1.245 fm + 1 fm 1.47 ft~~)
TPU (±1.96σ):	**THU (TPEh)** [None] ; **TVU (TPEv)** [None]
Timestamp:	2006-166.00:00:00.000 (06/15/2006)
GP Dataset:	W00178.xls
GP No.:	1
Charts Affected:	13283_1, 13274_2, 13278_1, 13286_1, 13260_1, 13009_1, 13006_1, 13003_1

Remarks:

W00178 DToN: underwater rock located just off the coast of Seapoint Maine

Feature Correlation

Address	Feature	Range	Azimuth	Status
W00178.xls	1	0.00	000.0	Primary

Hydrographer Recommendations

AHB recommends append chart w/ ~~2.28m~~ 0.694 m ~~(7.47 ft)~~ (2.277 ft) rock.

Cartographically-Rounded Depth (Affected Charts):

~~7~~ 2 ft (13283_1, 13274_2, 13278_1, 13286_1)

~~1 ¼fm~~ (13260_1, 13009_1, 13006_1, 13003_1)

S-57 Data

Geo object 1:	Obstruction (OBSTRN)
Attributes:	QUASOU - 1:depth known
	SORDAT - 20070615
	SORIND - Us,Us,Nsurf,W00178
	TECSOU - 3:found by multi-beam
	VALSOU - ~~2.277 m~~ 0.694 m

VERDAT - 12:Mean lower low water

WATLEV - 3:always under water/submerged

Office Notes

Underwater rock located by AHB during the course of survey review. DToN sent to MCD 10/09/2008

Clarification required for Depth of W00178 DtoN-1. An oversight was made during office processing, the least depth should have been reported as a 2 feet not 7 feet. Revise sounding least depth at the survey position as 2 feet.

Feature Images

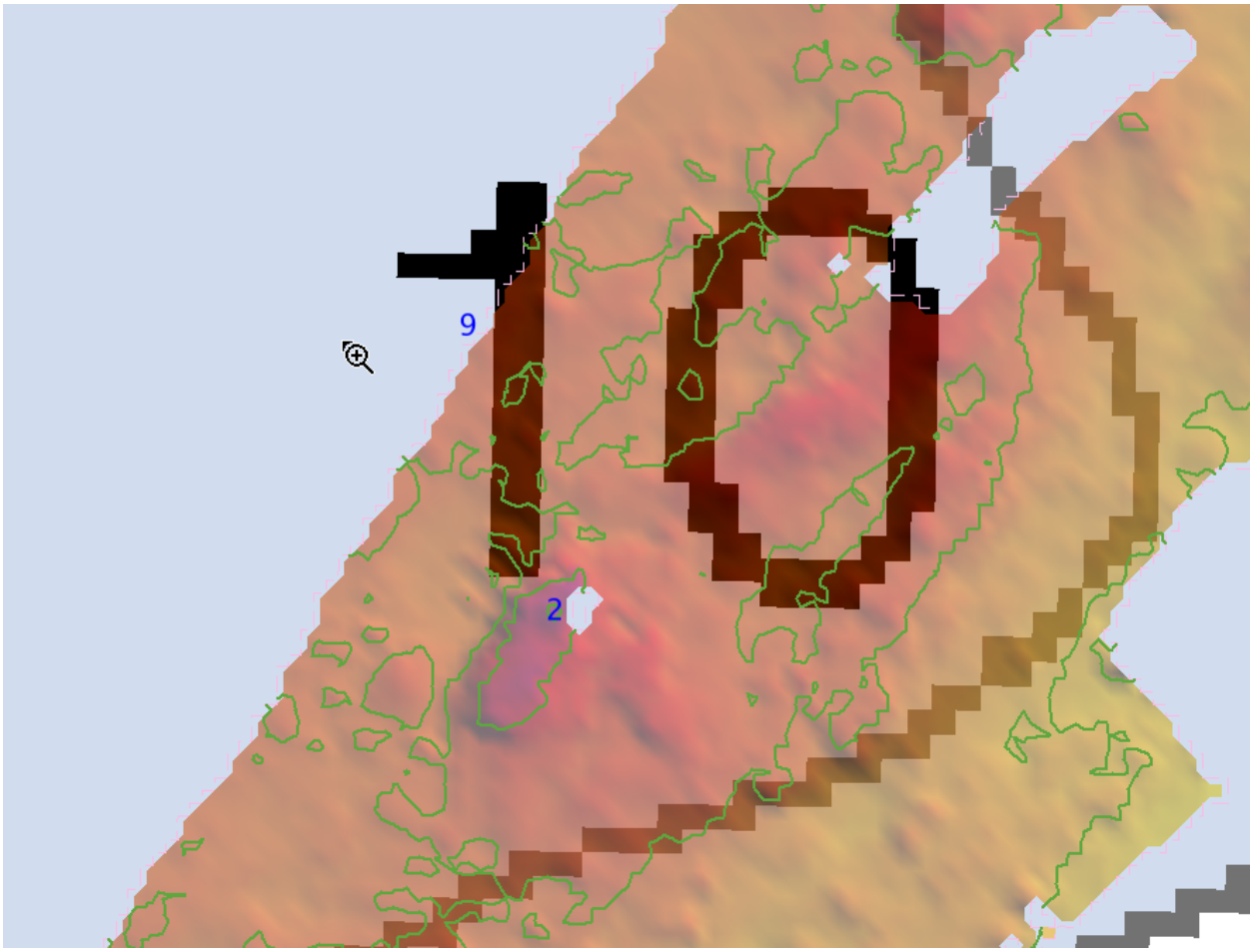


Figure 1.1.1

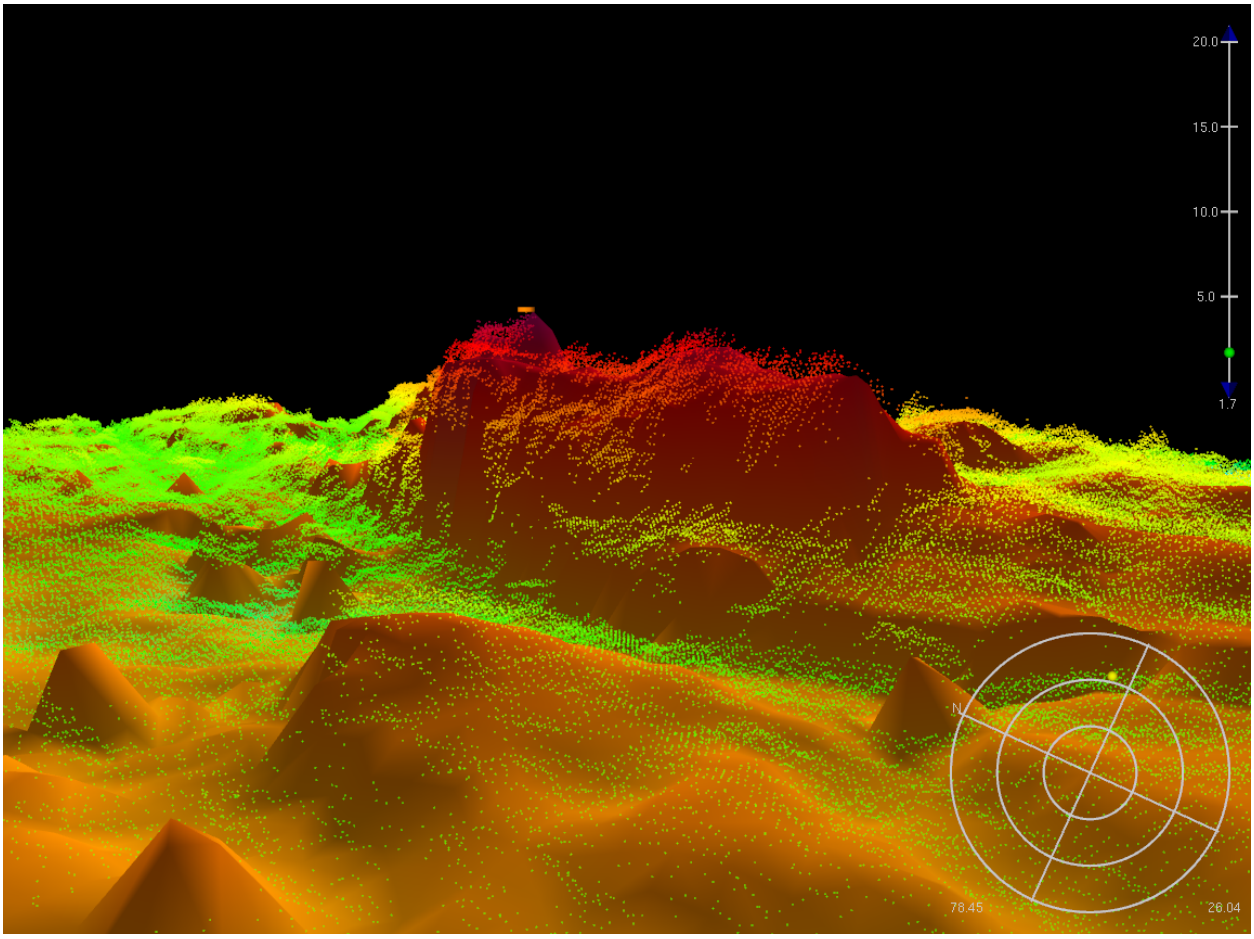


Figure 1.1.2

APPENDIX II
SURVEY FEATURE REPORT

Not applicable.

APPENDIX V
SUPPLEMENTAL SURVEY AND CORRESPONDENCE

Subject: Danger to Navigation
Date: Tue, 14 Oct 2008 14:12:30 -0400
From: Douglas Harpine <Douglas.Harpine@noaa.gov>
To: Castle Parker <Castle.E.Parker@noaa.gov>, Ed Martin <Ed.Martin@noaa.gov>,
Howard Danley <Howard.Danley@noaa.gov>,
James M Crocker <James.M.Crocker@noaa.gov>,
Joseph Robinson <Joseph.Robinson@noaa.gov>,
Mark Griffin <Mark.Griffin@noaa.gov>,
Richard Sillcox <Richard.Sillcox@noaa.gov>, Shep Smith
<Shep.Smith@noaa.gov>,
Stephen Hill <Stephen.Hill@noaa.gov>, Kevin Shaw <Kevin.Shaw@noaa.gov>,
Leonard Tyson <Leonard.Tyson@noaa.gov>

To whom it may concern:

Chart letter 1099/08 and DD12363 have been processed the Nautical Data Branch and put into Products Branch C's box. This involves a submerged rock located at 43°05'32.3"N 070°39'17.3"W.

This affects the following charts: 13283 (KAPP 2062)
13274 (KAPP 2077)
13286 (KAPP 2055)
13278 (KAPP 2069

This also affects ENC Cells: US5NH02M
US5MA18M
US5MA19M

This was reported by the Atlantic Hydrograph Branch.

REFERENCE: W00178
DD12363
OPR-S-A992

Douglas Harpine

Douglas Harpine <Douglas.Harpine@noaa.gov>
Senior Cartographer
NOAA/NOS
Marine Chart Division/Nautical Data Branch

Douglas Harpine
Senior Cartographer <Douglas.Harpine@noaa.gov>
NOAA/NOS
Marine Chart Division/Nautical Data Branch
1315 East-West Highway N/CS26 Station 7230 Work: (301) 713-2737 x126
Silver Spring Fax: (301) 713-4516
Maryland
20910-3282
USA
Additional Information:
Last Name Harpine
First Name Douglas
Version 2.1

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

TIDE NOTE FOR HYDROGRAPHIC SURVEY

DATE : March 12, 2007

HYDROGRAPHIC BRANCH: Atlantic
HYDROGRAPHIC PROJECT: S-A922-UNH-2006
HYDROGRAPHIC SHEET: W00178

LOCALITY: Coast of Gerrish Island, ME
TIME PERIOD: June 6 - June 15, 2006

TIDE STATION USED: 842-3898 Fort Point, NH
Lat. 43° 4.3'N Long. 70° 42.7' W
PLANE OF REFERENCE (MEAN LOWER LOW WATER): 0.000 meters
HEIGHT OF HIGH WATER ABOVE PLANE OF REFERENCE: 2.744 meters

REMARKS: RECOMMENDED ZONING

Preliminary zoning is accepted as the final zoning for project S-A922-UNH-2006, W00178, during the time period between June 6 to June 15, 2006.

Please use the zoning file "NH-CORP" submitted with the project instructions for S-A922-UNH-2006. Zones NA168 and NA169 are the applicable zones for W00178.

Refer to attachments for zoning information.

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

_____
CHIEF, PRODUCT AND SERVICES DIVISION

Version 1.0

This Document is for Office Process use only and is intended to supplement, not supersede or replace, information/recommendations in the Descriptive or Evaluation Reports

AHB PRE-COMPILATION PROCESS

REGISTRY No.	**W00178**
PROJECT No.	**OPR-A922-UNH**
FIELD UNIT	***R/V COASTAL SURVEYOR***
PRE-COMPILER	**LEONARD TYSON**
LARGEST SCALE CHART	**13283,20th Ed.,07/10-07/27-07/23**
CHART SCALE	**1:20,000**
SURVEY SCALE	**1:10,000**
DATE OF SURVEY	**2006/06/15**
CONTENT REVIEW DATE	**10/15/2008**

Components	File Names
Product Surface	**PS_W00178_10k_100mrad_5mres.hns**
Shifted Surface	**PS_W00178_10k_600mrad_20mres.hns**
Contour Layer	**W00178_Contours_eo.hob**
Survey Scale Soundings	**W00178_SS_SOUNDINGS.hob**
Chart Scale Soundings	**W00178_CS_Soundings_eo.hob**
ENC Retain Soundings	**W00178_ENC_Soundings.hob**
Feature Layer	**W00178_Features.hob / W00178_ENC_Features.hob**
Meta-Objects Layer	**W00178_MetaObjects_eo.hob**
Blue Notes	**W00178_BlueNotes.hob**

SPECIFICATIONS:

I. COMBINED SURFACE:
   a. File name: **W00178_Combined_1m.hns**
   b. Resolution: **1** m
   c. Final Grid Location: **W00178_AHB_Compile**

II. PRODUCT SURFACE (SOUNDINGS):
   a. Scale: **1:20,000**
   b. Radius: **200** m
   c. Resolution: **20** m

   d. Depth
      i. Minimum: **2.218m**
      ii. Maximum: **63.783m**

   PRODUCT SURFACE (CONTOURS):
   a. Scale: 1:10,000
   b. Radius: 600 m
   c. Resolution: 20 m

III. SHIFTED SURFACE:
   Single Shift Value: *-0.229m* *[-0.229m (feet), (≤ 10 fathoms)]*
   [-1.372m (fathoms), (> 10 fathoms)]

IV. CONTOUR LAYER:
   a. Use a Depth List: **W00178_NOAA_depth_curves_list.txt**
      Depth List: **0,1.829, 3.658, 5.486, 9.144, 18.288**

b. Output Options:
   i. Create contour lines:
      1. Line Object: DEPCNT
      2. Value Attribute: VALDCO

V. SOUNDING SELECTION:

a. Selection Criteria:
   i. Radius
   ii. Shoal biased
   iii. Use Single-Defined Radius: ____ distance on ground (m)
   iv. Filter: Generalized !=1

VI. FEATURES:

a. Brought in from Survey
   Total No. **3 SBDARE**

b. Brought in from ENC
   ENC: # **8 SBDARE, 1 UWTROC**
   Total No. **12**

VII. META-OBJECTS:

a. M_COVR attributes

Acronym	Value
SORDAT	**20060615**
CATCOV	**1**
SORIND	**Us,Us,Survy,W00178**

b. M_QUAL attributes

Acronym	Value
CATZOC	**zone of confidence U (data not assessed)**
INFORM	**W00178,OPR-S-A922-UNH-R/V Coastal Surveyor**
POSACC	**10**
SORDAT	**20060615**
SORIND	**Us,Us,Survy,W00178**
SUREND	**20060615**
SURSTA	**20060606**
TECSOU	**MB**

c. DEPARE attributes

Acronym	Value
DRVALV 1	**1.6**
DRVALV2	**64.0**
SORDAT	**20060615**
SORIND	**Us,Us,Nsurf,W00178**

d. M_CSCL attributes **N/A**

Acronym	Value
CSCALE	**N/A**
SORDAT	**N/A**
SORIND	**N/A**

VIII. NOTES: **1- DToN submitted to MCD 10/09/2008 by AHB**

ATLANTIC HYDROGRAPHIC BRANCH
EVALUATION REPORT

Project: OPR-A922-UNH / OSD-AHB-06 / Survey W00178
Center for Coastal and Ocean Mapping
Joint Hydrographic Center
University of New Hampshire R/V Coastal Surveyor –Hydrographic Field Course

This Evaluation Report has been written to supplement and/or clarify the original Survey Report, Outside Source Data Survey Acceptance Review (SAR), and Pre-Compile Processing Log.

A. AREA SURVEYED

The Atlantic Hydrographic Branch (AHB) has completed a survey acceptance review and evaluation of Outside Source Data (OSD) Survey W00178 of OSD-AHB-06. Multibeam Survey W00178 was conducted by the University of New Hampshire CCOM aboard the R/V Coastal Surveyor as part of the 2006 Summer Hydrographic Field Course.

The following survey description is taken from the Introduction section of the Descriptive Report: *The purpose was to acquire multibeam data which could be compared to an existing Compact Hydrographic Airborne Rapid Total Survey (CHARTS) Light detection and Ranging (LIDAR) dataset acquired east of Gerrish Island, Maine. The supplementary objective was to obtain, as was reasonably possible, 100% coverage for the purposes of updating national Oceanic & Atmospheric Administration's (NOAA) nautical chart 13283 as bathymetric data for the area was previously acquired in the 1950's. Therefore, this data was acquired and processed as closely as was possible according to the specifications set forth in the International Hydrographic Organization (IHO) standards and the National Ocean Service (NOS) Hydrographic Survey Specifications and Deliverables (HSSD) (June 2006).*

Office processing determined that W00178 survey data met the quality standards set forth for application to the Nautical Chart. Additionally, AHB determined that due to the close to ideal nature of W00178 deliverables the survey could be processed and incorporated into an H-Cell with minimum processing effort.

B. DATA ACQUISITION AND PROCESSING

B.1 DATA PROCESSING

The following software was used to process data at the Atlantic Hydrographic Branch:

CARIS HIPS/SIPS version 6.1 SP2 HF 1
CARIS Bathy Editor version 2.1 HF 1-9
DKART INSPECTOR, version 5.0 Build 732 SP1
CARIS HOM version 3.3
CARIS S57 Composer version 2.0 HF 1

B.2. QUALITY CONTROL

H-Cells W00178_CS.000 & W00178_SS.000 were created in CARIS Bathy Editor.

B.2.1. H-Cell

AHB created finalized depth grids for the survey's H-Cells at 50 centimeter and one meter resolutions. The finalized grids were combined at a one meter resolution, which was then used to create a product surface grid with a resolution of five meters. The survey scale selected soundings were extracted from the five meter product surface. The selected sounding set is approximately 16 to 32 times the number of charted depths at the largest scale chart available scale of 1:20,000. The chart scale selected soundings are a subset of the survey scale selected soundings and sounding spacing is representative the appropriate largest scale in the area. The surface model was referenced when selecting the chart scale soundings, to ensure that the selected soundings portrayed the bathymetry within the common area.

Depth curves were created from a 20 meter resolution product surface grid that was also created from the one meter combined grid. The 20m interpolated grid was shifted by a factor of -0.229 meters to allow for NOAA depth curve practices. The depth curves are forwarded to MCD for reference only. The curves were utilized during chart scale sounding selection and quality assurances efforts at AHB. The depth curves are incorporated into the S57 US500178_CS.000 H-Cell deliverable.

The pre-compilation products or components (Stand Alone HOB files (SAHOB)) are detailed in the Pre-Compile Process Log attached at the end of this document. The SAHOB files included sounding selections (SOUNDG), Rocks (UWTROC), Sea Bed Areas (SBDARE), Depth Area (DEPARE), Depth Contours (DEPCNT), Meta objects (M_COVR, M_QUAL), and Cartographic Blue Notes ($CSTMD). The individual SAHOB files were inserted into one BASE Manager feature layer and exported to S57 format in order to create the H-Cell deliverable.

The completed H-Cell was exported as an H-Cell File (ENC.000) in S-57 format with all values in metric units. The metric equivalent ENC.000 file was then converted to NOAA chart units (ENC_CU.000) with all values measured in feet following NOAA sounding rounding rules.

Chart compilation was performed by Atlantic Hydrographic Branch personnel in Norfolk, Virginia. Compilation data will be forwarded to Marine Chart Division, Silver Spring, Maryland.

The W00178 CARIS H-Cell final deliverables include the following products:

H-Cell	Scale	Description
US500178_CS.000	1:10,000	W00178 H-Cell with Chart Scale Selected Soundings & Cartographic Notes
US500178_SS.000	1:20,000	W00178 Selected Soundings (Survey Scale)

B.2.2. Junctions

No contemporary surveys exist for junctioning.

C. VERTICAL AND HORIZONTAL CONTROL

Final vertical correction processing was completed by the field unit/office personnel with no additional correction required by Atlantic Hydrographic Branch. The field unit personnel applied verified water levels in conjunction with the preliminary tidal zoning which was accepted and approved by N/OPSI CO-OPS as the final zoning for W00178. Sounding datum is Mean Lower Low Water (MLLW). Vertical datum is Mean High Water (MHW)

Horizontal control used for this survey during data acquisition is based upon the North American Datum of 1983 (NAD83), UTM projection zone 17. Office ENC processing of this survey required translating the datum to meet S-57 ENC requirements.

D. RESULTS AND RECOMMENDATIONS

D.1 CHART COMPARISON

13283, edition 20, 10/01/2007 Scale 1:20,000
Corrected through NM 09/16/2008
Corrected through LNM 09/27/2008

ENC Comparison

US4MA04M.000
Portsmouth Harbor –
Cape Neddick Harbor to Isles of Shoals
Edition 8
Update Application Date 2008-10-16
Issue Date 2008-10-16
References: Chart 13283

D.1.1 Hydrography

The charted hydrography originates with prior surveys and requires no further consideration.

D.2. ADDITIONAL RESULTS

D.2.1. Aids to Navigation

No aids were positioned by the field.

D.3. MISCELLANEOUS

Chart compilation was done by Atlantic Hydrographic Branch personnel, in Norfolk, Virginia. Compilation data will be forwarded to Marine Chart Division, Silver Spring, Maryland. See Section D.1. of this report for a list of the Raster Charts and Electronic Navigation Charts (ENC) used for compiling the present survey:

D.4. ADEQUACY OF SURVEY

The present OSD survey is adequate to supersede the charted bathymetry within the common area. Any features not specifically addressed either in the H-Cell BASE Cell File or the Blue Notes should be retained as charted. Refer to the Descriptive Report for further recommendations by the hydrographer.

APPROVAL SHEET
W00178

Initial Approvals:

The completed survey has been inspected with regard to survey coverage, delineation of depth curves, representation of critical depths, cartographic symbolization, and verification or disproval of charted data. All revisions and additions made to the H-Cell files during survey processing have been entered in the digital data for this survey. The survey records and digital data comply with National Ocean Service and Office of Coast Survey requirements except where noted in the Descriptive Report and the Evaluation Report.

All final products have undergone a comprehensive reviews per the Hydrographic surveys Division Office Processing Manual and are verified to be accurate and complete except where noted.

M.Leonard Tyson

Digitally signed by M.Leonard Tyson
DN: cn=M.Leonard Tyson, c=US, o=NOAA, ou=AHB/OCS, email=leonard.tyson@noaa.gov
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Leonard Tyson
Hydrographic Intern
Atlantic Hydrographic Branch

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Reason: I have reviewed this document
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Date: 2008.11.05 10:51:00 -05'00'

Edward Owens
I am the author of this document
2008.10.30 17:55:42 -04'00'

Edward A. Owens
Physical scientist
Atlantic Hydrographic Branch

I have reviewed the H-Cell files, accompanying data, and reports. This survey and accompanying Marine Chart Division deliverables meet National Ocean Service requirements and standards for products in support of nautical charting except where noted.

Approved: Shepard Smith
I am approving this document
2008.10.31 07:59:36 -04'00'

Shepard Smith
Lieutenant Commander, NOAA
Chief, Atlantic Hydrographic Branch