W00043

NOAA FORM 76-35A

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

DESCRIPTIVE REPORT

Type of Survey: **Navigable Area**

Registry Number: **W00043**

LOCALITY

State: Massachusetts

General Locality: Massachusetts Bay

Sub-locality: 22 NM North of Provincetown

2003

CHIEF OF PARTY
Donald W. Haines, LCDR, NOAA

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DATE

NOAA FORM 77-28U.S. DEPARTMENT OF COMMERCE
(11-72)NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

REGISTRY NUMBER:

HYDROGRAPHIC TITLE SHEET

W00043

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:	**Massachusetts**		
General Locality:	**Massachusetts Bay**		
Sub-Locality:	**22 NM North of Provincetown**		
Scale:	**1:20,000**	Date of Survey:	**04/1/95 to 04/21/95** **09/30/03 to 09/30/03**
Instructions Dated:	**07/17/03**	Project Number:	**OPR-A397-TJ-03**
Vessel:	**NOAA Ship THOMAS JEFFERSON, S-222**		
Chief of Party:	**LCDR Donald W. Haines, NOAA**		
Surveyed by:	**THOMAS JEFFERSON Personnel**		
Soundings by:	**KongsbergSimrad EM1002 multibeam echosounder**		
Graphic record scaled by:	**N/A**		
Graphic record checked by:	**N/A**		
Protracted by:	**N/A**	Automated Plot:	**N/A**
Verification by:	**Atlantic Hydrographic Branch Personnel**		
Soundings in:	~~**Meters**~~ ***Feet*** **at MLLW**		

Remarks: ***Bold, Italic, Red notes in Descriptive Report were made during office processing. Charted depths in feet at MLLW.***

1) All Times are UTC.

2) This is a Navigable Area Hydrographic Survey.

3) Projection is UTM Zone 19.

TABLE OF CONTENTS

DESCRIPTIVE REPORT

to accompany

HYDROGRAPHIC SURVEY W00043

Scale of Survey: 1:20,000
Year of Survey: 2003
NOAA Ship THOMAS JEFFERSON
LCDR Donald W. Haines, Commanding

A. AREA SURVEYED

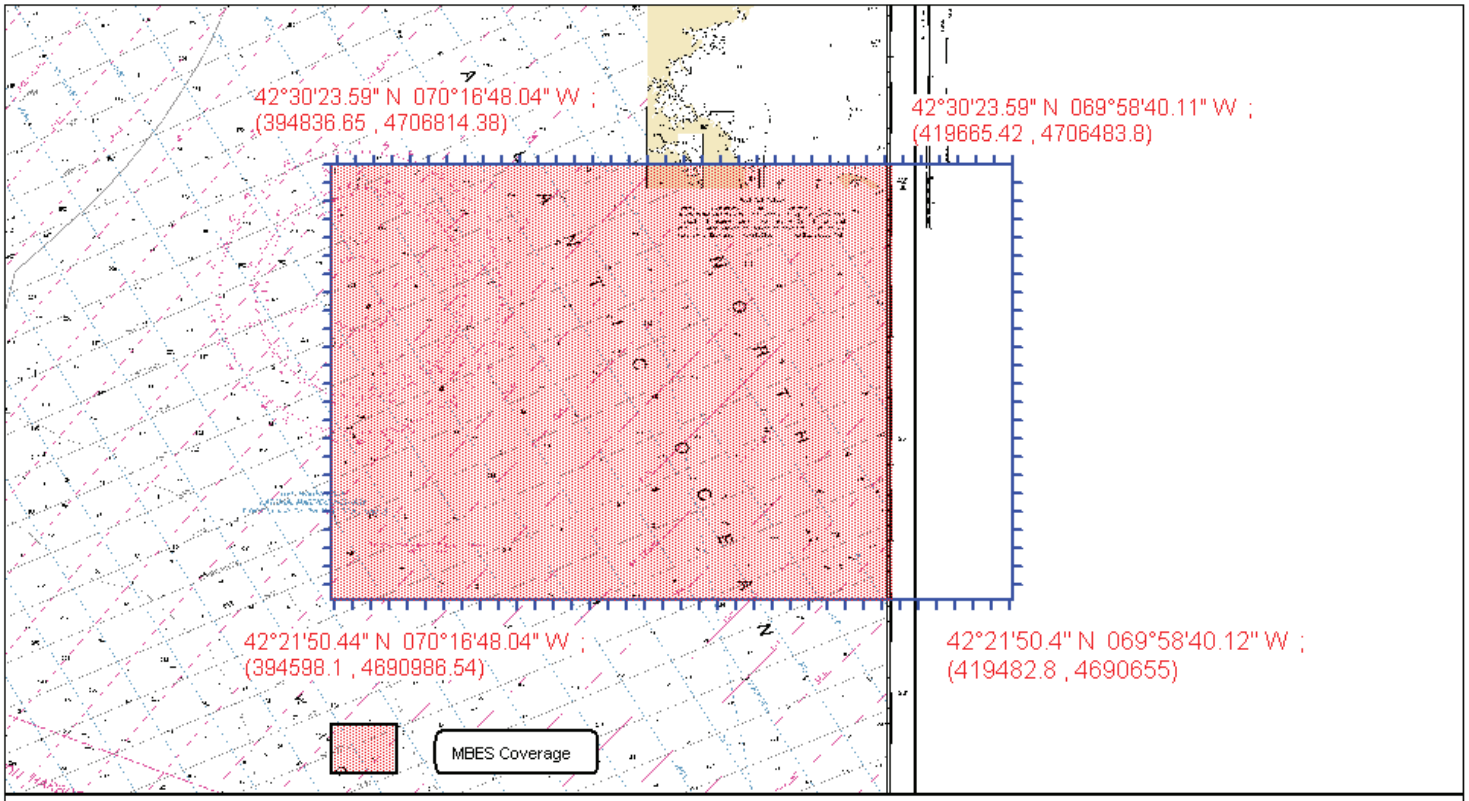
This hydrographic survey was conducted in accordance with Hydrographic Survey Letter Instructions* for project OPR-A397-TJ-03, Massachusetts Bay, Massachusetts. The original instructions* are dated July 17, 2003.

This Descriptive Report pertains to sheet "M" of project OPR-A397-TJ-03. The assigned registry number for this sheet is W00043, as prescribed in the Letter Instructions*.

This project is being conducted to provide contemporary hydrography with full bottom multibeam coverage in the approaches to Boston Harbor. This project responds to requests from the Massachusetts Port Authority (MASSPORT), Boston Pilots, the First U.S. Coast Guard District, Massachusetts Coastal Zone Management (Boston, MA), and the U.S. Geological Survey (Woods Hole, MA).

This project will also contribute valuable bathymetric data to the Stellwagen Bank Marine Sanctuary program in conjunction with the U.S. Geological Survey (USGS), Woods Hole Oceanographic Institution (WHOI), and the Canadian Hydrographic Service (CHS). Multibeam tracklines will be run in order to validate Outside Source Data (OSD) from the USGS and the University of New Hampshire (UNH). For complete survey limits, see the chartlet on the following page.

Data filed with original field records.



Chartlet 1 of 1 *Chart 13267, 31st Edition, October, 2003, Scale 1:80000, Massachusetts Bay*

This chartlet has been corrected through Notice to Mariners dated September 6, 2003
NOT FOR NAVIGATION.

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL OCEAN SERVICE

Project: *OPR-A397-TJ-03*
Survey: *W00043*
State: *Massachusetts*
Locality: *Approaches to Boston*
Sub-locality: *22 NM North of Provincetown*
Survey Scale: *1:20,000*

Sounding Units: *Meters*
Sounding Datum: *MLLW*
Horizontal Datum: *NAD 83*
Projection: *UTM 19*
Central Meridian: *069° 00 00*
Scale Factor: *0.9996*

NOAA Ship THOMAS JEFFERSON
LCDR Donald W. Haines, NOAA
Commanding Officer

September 30, 2003

B. DATA ACQUISITION AND PROCESSING *See Also Evaluation Report.*

EQUIPMENT

This survey took advantage of a vast data set acquired by U.S. Geological Survey (USGS). The USGS and their partnership with the Canadian Hydrographic Survey, acquired multibeam bathymetric data over a time span of ten years. The data for this project were acquired from March 29, 1995 to December 4, 1996. Data were delivered to NOAA in UNB swathed format. The data were assembled and converted to Caris HIPS format at University of New Hampshire's Joint Hydrographic Center as part of the preparation for the project. This OSD was integrated into our quality control pipeline (see Quality Control section). The majority of this OSD was located in waters greater than 20 meters and not located in high priority navigation areas as depicted in the national survey plan.

Data were also acquired by NOAA Ship THOMAS JEFFERSON on September 30, 2003 to help verify the OSD. The ship is 208' (63.41m) long with a mean draft of 14' (4.26m).

NOAA Ship THOMAS JEFFERSON acquired multibeam echosounder (MBES) data using a Simrad 1002 multibeam system. All positioning and attitude were determined with a TSS POS/MV 320 (version 3) GPS-aided inertial navigation system. Sound velocity casts were conducted with a Sea Bird 19 profiler.

No unusual vessel configurations or problems were encountered. Refer to the Data Acquisition and Processing Report (DAPR) * for detailed equipment and vessel configuration information.
Data filed with original field records.

QUALITY CONTROL

Multibeam Quality Control

Mainscheme MBES data is defined to be the Outside Source Data (OSD). There were no known faults with the MBES system which affected data integrity. ***Concur.***

All OSD were analyzed using Caris HIPS and SIPS 5.4, taking advantage of the new statistical analysis and error tracking capabilities. The data were used in the creation of HIPS BASE (Bathymetry Associated with Statistical Error) surfaces and analyzed using the standard deviation, density, and uncertainty layers. No systematic problems with the Outside Source Data were found. ***Concur.***

The OSD were acquired prior to the formation of NOAA standards for MBES coverage. As such, the data do not generally meet the sounding density and coverage requirements. The data are, however, sufficient to supersede the prior VBES surveys. ***Concur with clarification. See also Appendix V* and Evaluation Report.***

Crosslines

Crossline data were acquired by NOAA Ship THOMAS JEFFERSON. Due to a roll calibration error affecting outer beams at more than 50° off nadir, all data were filtered to 45° from nadir on each side. Refer to this projects associated DAPR* for detailed discussion of MBES system calibrations, data acquisition, and data processing.

On DN 273, data from four MBES crosslines were acquired by NOAA Ship THOMAS JEFFERSON. Mainscheme and crossline data were analyzed in a **HIPS** BASE surface (see project DAPR*) in addition to being analyzed in a **HIPS** Quality Control Report. On average, the crosslines were 0.8 meters deeper than the mainscheme data. Crossline data agreed within 95% to 100% of the mainscheme data, based on the International Hydrographic Organization (IHO) Order 2 statistical standards used in the **HIPS** Quality Control Report (see Separate V*). ***Concur. See Also Evaluation Report.***

Junctions

Hydrographic survey W00041, Sheet K, adjoins the southern edge of W00043. Survey W00042, Sheet L, adjoins the western edge of W00043. Survey W00046, Sheet P, adjoins the northern edge of W00043. All three surveys are part of project OPR-A397-TJ-03, and are validations of the same outside source data. As such, the data used for the survey overlaps were identical. ***Concur.***

CORRECTIONS TO ECHO SOUNDING

All methods or instruments used were as described in the project DAPR*. A table detailing all sound velocity casts is located in Separate III*. ***Concur.***
Data filed with original field records.

C. VERTICAL AND HORIZONTAL CONTROL

VERTICAL CONTROL

The tidal datum for this project is Mean Lower Low Water (MLLW). The operating tide stations at Boston, MA (844-3970) and Portland, ME (841-8150) served as control for datum determination. Tertiary gauges at Boston Light (844-4162) and Fort Point, NH (842-3898) provided ancillary tide data. ***Concur.***

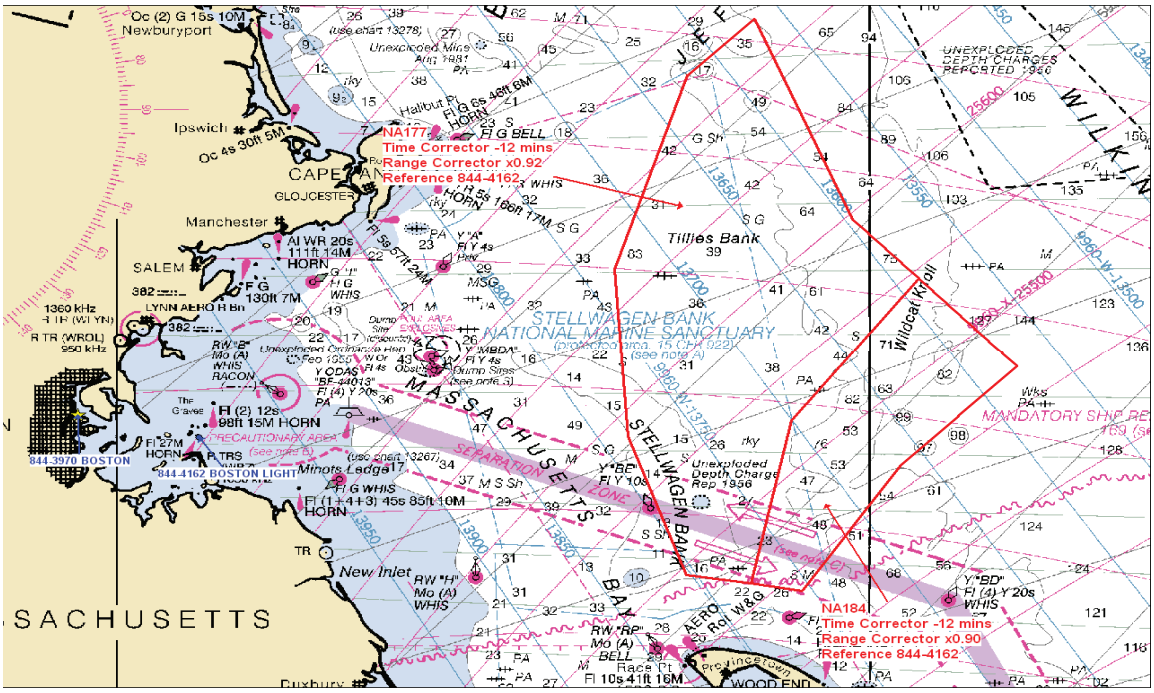
Tidal zoning for this survey is consistent with the Letter Instructions*. The zones used for this survey are as follows:

ZONE NAME	CORRECTOR (min)	RATIO	REFERENCE
NA177	-12	x0.87	844-3970
NA184	-12	x0.85	844-3970

A Request for Approved Tides letter was sent to N/OPS1 on October 15, 2003 (Appendix IV*). Verified tides from the N/OPS1 CO-OPS website were applied to THOMAS JEFFERSON data on February 20, 2004. Verified tides were applied to Creed data on September 10, 2003.

Preliminary zoning and verified water levels downloaded from the CO-OPS web site were used for the OSD data within the limits of this sheet. There were no differences in the preliminary and final zoning for this survey sheet. The controlling station at Boston Light (844-3970) was used for vertical water levels.

**** Data filed with original field records.***


NA177
Time Corrector -12 mins
Range Corrector x0.92
Reference 844-4162
NA184
Time Corrector -12 mins
Range Corrector x0.90
Reference 844-4162
Tillies Bank
STELLWAGEN BANK
NATIONAL MARINE SANCTUARY
MASSACHUSETTS
SEPARATION ZONE
STELLWAGEN BANK
Minots Ledge
New Inlet
Manchester
SALEM
Ipswich
Newburyport
Halibut
Wildcat Knoll
Unexploded Depth Charge Rep 1956
UNEXPLODED DEPTH CHARGES REPORTED 1956
MANDATORY SHIP RE
844-3970 BOSTON
844-4162 BOSTON LIGHT
LYNN AERO R Bn
1360 kHz
950 kHz
Oc (2) G 15s 10M
Oc 4s 30ft 5M
Al WR 20s 111ft 14M HORN
Fl (2) 12s 98ft 15M HORN
Fl (1+4+3) 45s 85ft 10M HORN
Fl G 6s 46ft 8M HORN
Fl G BELL
Fl 10s 41ft 16M
Race Pt
WOOD END
Duxbury
CAPE ANN
GLOUCESTER

HORIZONTAL CONTROL ***See also Evaluation Report.***

The horizontal datum used for this survey is the North American Datum of 1983 (NAD 83), projected using UTM zone 19.

Sounding positional control was determined using the Global Positioning System (GPS) corrected by U.S. Coast Guard differential GPS (DGPS) beacon stations. The primary and only DGPS beacon used for this survey was Portsmouth, New Hampshire (Beacon #771). No horizontal control stations were established for this survey.

Horizontal dilution of precision (HDOP) was monitored during data acquisition. That value did not exceeded 2.50, and the survey was conducted during times of adequate satellite coverage.

D. RESULTS AND RECOMMENDATIONS *See also Evaluation Report.*

CHART COMPARISON

There are seven charts affected by this survey:

13267, 31st edition, October 1, 2003, scale 1:80,000
13260, 39th edition, June 1, 2003, scale 1:378838
13200, 33rd edition, January 19, 2002, scale 1:400000
13009, 30th edition, August 1, 2002, scale 1:500000
13006, 31st edition, June, 2003, scale 1:675000
5161, 13th edition, October, 2003, scale 1:1058400
13003, 47th edition, June, 2003, scale 1:1200000

General Agreement with Charted soundings

Most sounding data acquired during this survey were 1 to 4% shoaler than charted depths. The charted depths are from partial bottom NOS surveys before 1970. The MBES data acquired for this survey are adequate to supercede the charted soundings. This sheet is in offshore waters in depths of approximately 60 meters or greater. As such, the shoaler soundings do not represent a hazard to marine traffic in the area. ***Concur. See also Evaluation Report.***

AWOIS Items and Significant Contacts

There were no AWOIS items within the survey limits. ***Concur.***

Dangers to Navigation

There were no Dangers to Navigation (DtoN) reported by the Hydrographer for this project. ***Concur.***

Charted Features

There are two charted features within the survey limits. Both are charted as position approximate wrecks. ***Concur.***

Charting Recommendations

Select survey soundings and redraw contour lines to represent the soundings acquired. ***Concur.***

ADDITIONAL RESULTS

Aids to Navigation and Other Detached Positions

There are no Aids to Navigation in the survey limits. ***Concur.***

Bridges and Overhead Cables

There are no bridges or overhead cables within the survey limits. ***Concur.***

Ferry Routes

There are no ferry routes that pass through the survey limits. ***Concur.***

Submarine Cables and Pipelines

There are no charted submarine cables or pipelines within the survey limits, nor were any found during the survey. ***Concur.***

E. APPROVAL SHEET

OPR-A397-TJ
Massachusetts
Approaches to Boston Harbor

22 NM North of Provincetown
Survey Registry No. W00043

Field operations for this basic hydrographic survey were conducted under my daily supervision with frequent checks of progress and adequacy. All field sheets, this Descriptive Report, and all accompanying records and data are approved.

I have ensured that standard field surveying and processing procedures were adhered to during this project in accordance with the Hydrographic Manual, Fourth Edition; Hydrographic Survey Guidelines; Field Procedures Manual, and the NOS Hydrographic Surveys Specifications and Deliverables, as updated for March, 2003. This survey was conducted as outlined in the Data Acquisition and Processing Report (August - November, 2003) submitted March 30, 2004, as well as the DAPR Change No. 1 sumbmitted April 11, 2004. Refer to the Horizontal and Vertical Control Report (20 January, 2004) submitted March 4, 2004 for further information not included with this Descriptive Report.

This survey is adequate to supersede all prior surveys in common areas, and for application to the relevant NOS nautical charts.

Respectfully Submitted:

ENS Matthew Ringel, NOAA
Junior Officer

Approved and Forwarded:

LT Shepard Smith, NOAA
Field Operations Officer

LCDR Donald W. Haines, NOAA
Commanding Officer

APPENDIX V

SUPPLEMENTAL SURVEY RECORDS AND CORRESPONDENCES

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NOAA Marine and Aviation Operations
NOAA Ship Thomas Jefferson S-222
439 W. York Street
Norfolk, VA 23510-1114

October 5, 2004

MEMORANDUM FOR: LCDR Tod Schattgen, NOAA
Chief, Atlantic Hydrographic Branch

THROUGH: CDR Emily B. Christman, NOAA
Commanding Officer, NOAA Ship THOMAS JEFFERSON

FROM: LT Shepard M. Smith, NOAA
Executive Officer, NOAA Ship THOMAS JEFFERSON

SUBJECT: USGS Stellwagen Bank Data

This memorandum serves to document the background, approach, and processing steps employed to incorporate the USGS Stellwagen Bank and Massachussets Bay multibeam data into the NOAA charting system.

Background

During the planning of OPR A397, I became aware that the survey areas assigned to WHITING, then LITTLEHALES, then THOMAS JEFFERSON overlapped significantly with the multibeam data acquired by USGS during the mid 1990s. This project was funded by USGS, with technical assistance from the Ocean Mapping Group at the University of New Brunswick and surveyed using the Canadian Hydrographic Service vessel *Frederick Creed*. It was also a cooperative project with NOAA, and several NOAA Corps hydrographers sailed aboard for portions of the project.

The data was collected under the guidance of some of the worldwide experts in multibeam surveying at the time. While it was NOAA's intention at the time to chart this data, we did not have the capability to process this large a dataset, and the data that NOAA did get languished in a collection of shoeboxes in Silver Spring.

In March 2003, after discussing the possibility with LT Jon Swallow at HSD operations, I contacted USGS in Woods Hole through Dr. Larry Mayer to inquire about the status of the data. I told them that we would be surveying the area on the NOAA Ship THOMAS JEFFERSON, and that we wanted to reduce duplication of effort. Dr. Bill Danforth replied enthusiastically that they would make the data available to us in whatever form we needed.

In addition, UNH's Center for Coastal and Ocean Mapping (CCOM) had contracted with SAIC to conduct a multibeam survey of Jeffrey's Ledge, an area just to the north of the

USGS Stellwagen Bank data set. During a break in their hydrographic survey work for NOAA, the SAIC team went up to Jeffreys Ledge and conducted the survey in the winter of 2002-2003. The data was sent to UNH in lightly edited form and turned over to graduate student Mashkoor Malik to work on. The CCOM leadership team offered the data to NOAA for charting. Because of the plans to incorporate the USGS data into NOAA's pipeline aboard the THOMAS JEFFERSON, I offered to add this SAIC data to the USGS data and work with it all together.

I then contacted HSD operations again to plan our approach to the project.

The Approach

This was an unusual opportunity to incorporate a large amount of Outside Source Data into the charting process. The most unusual aspect was that we had a ship available to junction and check the data. We came up with the following premises:

1) We would convert the data to a form where it could be manipulated as if it were our own data. This necessitated a new convertor to get the data into Caris HIPS format.
2) The tides applied to the data were inconsistent. We would plan to reapply all tides using historic NOAA station data and modern zoning.
3) We would use a Navigation Surface approach to process the data for charting. We would estimate the sensor errors for the Creed data and compute TPE as appropriate.
4) The data was edited to some extent by the Creed in the one case and CCOM in the other. We would further clean data only as necessary to produce a clean Navigation Surface.
5) The grids provided by the USGS were at a coarse resolution of 10m. For parts of the survey area, this is insufficient to capture all the seafloor detail in the data.
6) Various techniques were used by the CHS and USGS hydrographers to correct for sound velocity. The Simrad 1000 multibeam sonar system was corrected for sound velocity at the head and in the water column in real time. In order to compensate for head velocity errors and the difference between the last cast and the water column at their location, the hydrographers made extensive use of head velocity offsets and the interactive refraction editor. We would not second-guess the hydrographer's judgement on this, but merely reapply the values as they intended.
7) In general, we would compare *their results* to *our results*. We would not compare their *processes* to our *processes*. Because of the difference in the purpose of the survey and the changes in technology, it would not be useful to spend a lot of time worrying about processing techniques.
8) We would run crosslines with the TJ or her launches to check the accuracy of the data. We could also fill holidays or develop shoals at our discretion.
9) The TJ data would be combined with the OSD data to create a single survey with a "W" designation. TJ would write DRs and submit the surveys to AHB in a form

similar to that used for our own surveys. This should ease its inclusion in our workflow.

This approach was discussed with LT Jon Swallow Mike Riddle and Steve Verry, HSD Operations, and CDR Emily B. Christman at AHB, and is consistent with the project instructions issued for the project.

Preliminary Processing

Because I would be going out to the THOMAS JEFFERSON as Operations Officer and would oversee the project, I volunteered to be the focal point for data conversion and preliminary troubleshooting.

The data from USGS had all arrived by May 2003, and I was able to restore it all from CDs. The Swathed files were converted using a Swathed→Caris HIPS convertor written by Caris for this purpose. The first draft of the convertor assumed that the data had been fully merged with all refraction editing applied. This was not the case and a second version of the convertor was written which converted Swathed's three-parameter refraction editor files and converted them to a new HIPS format. In addition, the merge function in HIPS was modified to be able to perform a head velocity change in addition to changes at depth, to be consistent with the Swathed technology. After those changes, the data looked pretty good.

I contacted Cary Wong through HSD Operations and explained the project. Cary was able to find tide files going back to 1994. However, the files for 1994 were archived on a type of media that is no longer readable, so that year is only hourly data, which was interpolated by HIPS.

The Survey

THOMAS JEFFERSON arrived on scene in Massachusetts Bay in August 2003. In making up the cross line files for the survey, we estimated the total level of effort we wanted to spend on the project, then determined the number of crosslines that would be possible to run in that time frame. It came out to about three lines per sheet, run lengthwise east-west. In addition, in some areas, we ran some holiday lines and a few item investigations. On sheets D and F, we junctioned NOAA launch and ship data with the USGS data to form a complete survey.

Comparison of Data

In general, we found that the USGS data was consistently shoaler than the TJ ship multibeam data by 0.5m to 0.8m. In order to try to determine which was right, we tested several hypotheses.

1) Tidal Epoch-the tidal epoch changed in April 2003. The change is in the "right" direction to explain the difference, but the maximum magnitude in the survey area is 0.05m, not enough to explain the difference on its own.

2) Changing seafloor-The difference is too consistent
3) USGS use of the refraction editor-This could explain some differences in the outer beams, but the difference is consistent across the swath.
4) TJ draft error-We sought to test this hypothesis by doublechecking our draft and by conducting a leadline check. We conducted numerous tests and checked as many static measurements as possible. In addition, we installed a tube in the sonar void to be able to measure the waterline-reference mark directly. We were able to correct the difference by about 15 cm after adjusting our draft based on the new measurements. However, even after all the checking, we were unable to make the leadline test close with the Simrad processed soundings. The difference was about 0.4m, and the leadline measurements would be in general agreement with the USGS data.
5) The launches data was also compared to the USGS data and the TJ ship data. In general, the launch data was also shoaler than the ship data by 0.2-0.3m, placing it between the ship data and the USGS data.
6) Creed draft/loading error-*Creed* is a SWATH vessel with active stablization and controllable draft to optimize seakeeping abilities. It is possible that the draft was poorly measured or controlled. If it were poorly controlled, however, we would expect that there would be considerable inconsistency within the USGS data set. A draft measurement error would be consistent with a constant offset.

Conclusions

1) We were not able to find a single cause for the difference between the USGS data and TJ data, but believe it to be a combination of TJ draft measurement, Creed draft measurement, and tidal epoch change.
2) The data collected for these surveys by USGS and TJ were collected under circumstances other than an NOS-specified hydrographic survey for charting, and need to be treated differently than other surveys.
    a. The current version of NOS Specifications and Deliverables is inapplicable to these surveys.
    b. The results of the surveys should be examined, with far less emphasis on the processes employed during acquisition and processing.
    c. These surveys were not intended to find and characterize small features such as rocks, wrecks, and obstructions. In the few cases where these features were in fact visible in the data, they will be noted in the DR. In other cases, the items should remain as charted.
    d. Most of the survey area was in deep water (>30m) and there was continuous coverage in these areas. In shoaler areas, the line spacing was frequently too wide to achieve continuous coverage. As a result, there are a few shoals on some sheets that TJ has recommended be retained as charted because the least depth was not determined by these surveys. It was beyond the scope of this project to investigate every shoal and fill every holiday.

3) This procedure of running a few crosslines over OSD data was very successful and has resulted in a set of surveys that NOAA can stand behind for charting purposes. However, I do not think it should generally be necessary for ship's personnel take the lead on the project. I recommend that future similar efforts should be encouraged, with shoreside processing personnel taking the lead on the project from start to finish. This includes:

   a. Discussing the form of data transfer from the supplying organization to NOAA in manner conducive to continued cooperation and collaboration.
   b. Ensuring that the data is rigorously converted to our processing software (HIPS), paying special attention to the application of ancillary data such as tides, sound velocity, and draft. Conversion should also be made in such a way as to preserve any edits that the original hydrographers made to the data.
   c. Well before any planned field work, the data should be analyzed for holidays, searched for rocks, wrecks, obstructions and compared to the chart. With this information, the hydrographers can develop a survey plan that optimizes the use of the ship.
   d. Survey work should include regularly spaced crosslines sufficient to check most of the OSD survey lines. It should include holiday lines and item investigation lines as necessary to minimize unresolved items and unaddressed charted features.
   e. Preliminary processing can occur on the ship, but a shoreside team should write up the DR and do the final analysis and processing.

Subject: [Fwd: status of stellwagen data]
Date: Mon, 10 Apr 2006 15:17:54 -0400
From: Shepard Smith <Shep.Smith@noaa.gov>
To: Daniel Wright <Daniel.Wright@noaa.gov>

-------- Original Message --------
Subject: status of stellwagen data
Date: Wed, 10 Sep 2003 17:41:25 GMT
From: Kim Sampadian <kim.sampadian.atsea@noaa.gov>
To: shep.smith@noaa.gov
CC: matthew.ringel@noaa.gov,peter.lewit@noaa.gov

Status of applying zoned verified tides to the Stellwagen Data as of 9/10/03

Contents of Tide file (8443970.tid)-
1994 verified tide is hourly with coverage from 10/01/1994 to 2/31/1994; Dates of acquisition are 11/11/1994 to 12/04/1994

1995 verified tide is hourly with coverage from 3/01/1995 to 5/31/1995; Dates of acquisition are 3/29/1995 to 4/26/1995

1996 verified tide is six-minute with coverage from 3/01/1996 to 5/31/1996 and 11/01/1996 to 12/31/1996; Dates of acquisition are 4/2/1996 to 4/26/1996 and 12/4/1996 to 12/13/1996

1997 verified tide is six-minute with coverage from 11/01/1997 to 12/31/1997; Dates of acquistion are 11/20/1997 to 12/01/1997

1998 verified tide is six-minute with coverage from 01/01/1998 to 01/31/1998 (not needed for the data but left them in anyway) and hourly from 11/10/1998 to 11/30/1998; Dates of acquisition are 11/22/1998 to 11/23/1998

All data has preliminary zoned verified tides applied off the primary Boston gauge(H:\tide\2003\Boston\844-3970\AppBostonCORP.zdf) with the exception of the following lines that only have the verified tide applied directly(H:\tide\2003\Boston\844-3970\8443970.tid-- 7 out of 1748 lines isn't bad):

1996_116
stell_116_0732 (cross zones from NA156 to NA176 and back to NA156)

1996_342
stell_342_0892 (cross zones from NA169 to NA156 and back to NA169)

1996_344
stell_344_0919 (cross zones from NA156 to NA176 and back to NA156)

stell_344_0943 (cross zones from NA169 to NA156 and back to NA169)
stell_344_0950 " "
stell_344_0962 " "

1996_345
stell_345_1034 (cross zones from NA156 to NA176 back to NA156 and then back to NA176)

These lines crash Caris when trying to apply zoned tides but work fine when applying the tide file directly. I verified that there isn't any gaps or overlaps in these zones and tried rejecting the parts of the

lines that cross between zones (reaccepted the data once I tested this theory). I also tried deleting the ProcessedDepths.lsf file for a couple of the lines and then trying to reapply and still no luck. Hopefully the Caris Hotfix will take care of these remaining lines. I've created a session "stellwagen_tide.hsf" for these lines.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SERVICE
Silver Spring, Maryland 20910

TIDE NOTE FOR HYDROGRAPHIC SURVEY

DATE: January 7, 2004

HYDROGRAPHIC BRANCH: Atlantic
HYDROGRAPHIC PROJECT: OPR-A397-TJ-2003
HYDROGRAPHIC SHEET: W00043

LOCALITY: Approaches to Boston, MA
TIME PERIOD: September 30, 2003

TIDE STATION USED: 844-4162 Boston Light, MA
Lat. 42° 19.7'N Lon. 70° 53.5'W
PLANE OF REFERENCE (MEAN LOWER LOW WATER): 0.000 meters
HEIGHT OF HIGH WATER ABOVE PLANE OF REFERENCE: 2.858 meters

REMARKS: RECOMMENDED ZONING
Use zone(s) identified as: NA177, NA184

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 **new 1983-2001 National Tidal Datum Epoch (NTDE).**

Thomas V. Mero 1/9/04

CHIEF, REQUIREMENTS AND DEVELOPMENT DIVISION

ATLANTIC HYDROGRAPHIC BRANCH
EVALUATION REPORT FOR W00043 (1995,2003)

This Evaluation Report has been written to supplement and/or clarify the original Descriptive Report. Sections in this report refer to the corresponding sections of the Descriptive Report.

B. DATA ACQUISITION AND PROCESSING

B.1 EQUIPMENT

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

MapInfo, version 6.5, Release Build 19
PYDRO, version 6.4.9-HF4
CARIS HIPS/SIPS version 6.0 SP2
CARIS BASE Editor 1.0
CARIS HOM ENC Version 3.3 SP3
DKART INSPECTOR, version 5.0

B.2 PROCESSING

H-CELL

H-Cell W00043_01.des was created in HOM to produce the Base Cell final product W00043_CU.000 at 1:80,000 scale as per Chart 13267. H-Cell W00043_02.des was created in HOM to produce the Base Cell final product W00043_SS.000 at 1:20,000 survey Scale.

H-cell layers in CARIS HOM are organized as follows:

Layer 20 Soundings
Layer 200 Skin of the Earth (SOTE)
Layer 500 Line & Meta data
Layer 801&802 Wrecks & Obstructions

Office processing entailed the use of CARIS BASE Editor to generate a Bathymetry Associated with Statistical Error (BASE) navigation surface model. The BASE Surface model serves as the bathymetric and feature presentation source for all cartographic components incorporated within the submitted Electronic Navigational Chart Base Cell file.

The field unit submitted a single surface model at 5m resolution. During office processing, new finalized surfaces

were generated at 5m and 10m resolution with depth thresholds of 0m-30m and 29m-200m respectively.

Final BASE surfaces were used as the source data for the nautical chart update products. During office processing, it was determined to exclude the Thomas Jefferson crossline data due to an undetermined inconsistency between the two data sources. Creed data was selected as the source for BASE surfaces and nautical chart products.

BASE Editor processing included the generation of product Surfaces at 10m and 100m resolution, creation of contours, and extraction of sounding data sets at survey scale. Survey scale (1:20,000) soundings were extracted from the 10m resolution Product Surface. The contour set was generated from the 100m resolution product surface.

Chart scale soundings were extracted from survey scale soundings at a radius of 5mm at 1:80,000 using Caris HOM sounding suppression. Soundings were selected during HOM processing with the CARIS GIS Environmental Variable set to a metric scale (-1,-1,T) in order to accommodate millimeter precision of the sounding value (CARIS default rounding regime with truncation) during H-Cell processing and export of Base Cell file. This environmental variable was reset to NOAA standard values (0,0,N) when converting the metric exchange file to chart depth units after the Base Cell File export.

BASE CELL TESTING

The base cell file W00043_CU.000 was examined using dKart Inspector. Warnings received were all inconsequential. The DSPM.HUNI and DSPM.DUNI were reported to have illegal values, but these errors were expected as originating during ENC conversion to NOAA chart values, so they also can be ignored. All other errors refer to ENC features being retained where QUASOU and TECSOU are attributed as unknown.

CROSS LINES

Office processing determined the field unit acquired more than the required 5% (approximately 9.70%)of cross line data for quality assurances and system assessment as specified in the *NOS Hydrographic Surveys Specifications and Deliverables* (*NOS HHSSD*), 2003 Edition. The cross line analyses conducted at AHB were consistent with the field analysis. W00043 has been deemed as acceptable for charting purposes.

The vertical depth variance at crossline junctions were on the average 0.8m. This discrepancy is within the IHO Order 1 depth accuracy vertical error budget which ranges between 0.69m to 4.35m for the survey's depth range. This method does not technically meet the conventional standards set forth in the *NOS HHSSD*. However, Hydrographic Surveys Technical Directive 2004-03, dated 01/08/05, has given approval that NOAA field units may vary from the established procedures and documentation with respect to CARIS HIPS BASE Surface processing methods.

C. HORIZONTAL CONTROL

Office ENC processing of this survey required translating the datum to meet S-57 ENC requirements. During CARIS HOM processing the horizontal geodetic datum was translated to Latitude and Longitude (LLDG) World Geodetic System-84 (WGS-84). The S-57 ENC format serves as the exchange file submitted to Marine Chart Division.

D.1 CHART COMPARISON

13267 (32nd Edition, December,2004)
Corrected through NM Dec 25/04
Corrected through LNM Dec 7/04

13260 (39th Edition, June,2003)
Corrected through NM Jun 7/03
Corrected through LNM May 20/03

13200 (34th Edition, December,2005)
Corrected through NM Dec 3/05
Corrected through LNM Nov 22/05

13009 (31st Edition, October,2004)
Corrected through NM Oct 23/04
Corrected through LNM Nov 12/04

13006 (32nd Edition, February,2005)
Corrected through NM Feb 5/05

Corrected through LNM Jan 25/05

5161 (13th Edition, October,2003)

Corrected through NM Sep 20/03

Corrected through LNM Sep 2/03

13003 (48th Edition, October,2004)

Corrected through NM Oct 9/04

Corrected through LNM Sep 21/04

ENC Comparison **US4MA13M (Edition 2 2005-12-15)**

The charted hydrography originates with prior surveys and requires no further consideration. The hydrographer makes adequate chart comparisons in the Descriptive Report. The MBES data acquired for this survey are adequate to supersede the charted hydrography.

ADDITIONAL RESULTS

General Agreement with Charted soundings

The charted depths are from partial bottom NOS surveys before 1970. The MBES data acquired for this survey are adequate to supercede the charted soundings. This sheet is in offshore waters in depths of approximately 30 meters or greater. As such, the shoaler soundings do not represent a hazard to marine traffic in the area.

Charted Bottom Characteristics

The field unit did not acquire bottom samples during survey operations. It is therefore recommended to retain the present charted bottom characteristics.

COMPARISON WITH PRIOR SURVEYS

A comparison with prior surveys was not done during office processing in accordance with section 4. of the memorandum titled "Changes to Hydrographic Survey Processing", dated May 24, 1995.

ADEQUACY OF SURVEY

The OSD were acquired prior to the formulation of NOAA standards for MBES coverage. As such, the data do not generally meet the sounding density and coverage requirements. The data are, however, sufficient to supercede the charted hydrography where survey depths are shoaler than charted

depths. Full seafloor coverage was not achieved and uncharted features hazardous to surface navigation are not expected but may exist.

MISCELLANEOUS

ENC products were created by Atlantic Hydrographic Branch personnel, Norfolk, Virginia, using CARIS HOM v3.3. ENC products and electronic data will be forwarded to Marine Chart Division, Silver Spring, Maryland.

For charted features the field unit used positions sourced from the raster chart. These positions appear in the item investigation forms and vary slightly form the positions of corresponding features in the H-Cell. The positions of the charted features in the H-Cell are from the last version of the ENC at the time of processing.

Daniel B. Wright
Physical Scientist
Verification of Field Data
Evaluation and Analysis

APPROVAL SHEET
W00043

The completed surveys have been inspected with regard to survey coverage, delineation of depth curves, development 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 these surveys. The survey records and digital data comply with NOS requirements except where noted in the Evaluation Report.

Date: 3/15/07

Daniel Wright
Physical Scientist,
Atlantic Hydrographic Branch

All final products have undergone a comprehensive review as per the Atlantic Hydrographic Branch Processing Manual and are verified to be accurate and complete except where noted in the Evaluation Report.

Date: 3/15/04

Marilyn L. Schluter,
Cartographer,
Atlantic Hydrographic Branch

I have reviewed the Base Cell files, accompanying data, and reports. This survey and accompanying Marine Chart Division deliverables meet or exceed NOS requirements and standards for products in support of nautical charting except where noted in the Evaluation Report.

Digitally signed by CDR P. Tod Schattgen
DN: cn=CDR P. Tod Schattgen, c=US, o=NOAA
Office of Coast Survey, ou=Atlantic Hydrographic
Branch, email=tod.schattgen@noaa.gov
Date: 2007.06.04 15:34:36 -04'00'

Approved: _____ Date: _____
Commander P. Tod Schattgen, NOAA
Chief, Atlantic Hydrographic Branch