W00004

NOAA FORM 76-35A

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

DESCRIPTIVE REPORT

Type of Survey **Bathymetric**

Outside Source Data

Registry No. **W00004**

LOCALITY

State **Puerto Rico**

General Locality **North Atlantic Ocean**

Sub-locality **Puerto Rico Trench**

2002-2003

NOAA Office of Ocean Exploration
NOAA Ship *Ron H. Brown*
Lead Hydrographer Castle Eugene Parker

LIBRARY & ARCHIVES

DATE:

NOAA FORM 77-28
(11-72)

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

REGISTRY No W00004

HYDROGRAPHIC TITLE SHEET

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

FIELD No.

State Puerto Rico

General Locality North Atlantic Ocean

Sub-Locality Puerto Rico Trench

Scale 1:500,000 **Date of Survey** 09/24-30/2002; 02/22/2003 - 03/07/2003

Instructions dated _____ **Project No.** _____

Vessel NOAA Ship Ron H. Brown

Chief of party Chief Scientist: Uri ten Brink, USGS Lead Hydrographer: Castle Eugene Parker

Surveyed by Ocean Exploration PROBE II Scientific Crew; Castle Parker; Toshi Uozumi;

Soundings by echo sounder, hand lead, pole Multibeam Seabeam 2012

Graphic record scaled by N/A

Graphic record checked by N/A **Automated Plot** HP Design Jet 2500CP

Verification by Atlantic Hydrographic Branch Personnel

Soundings in **fathoms** **feet** **at** **MLW** **MLLW** _____

REMARKS: Data collection in meters, referenced to MLLW.

UTC time was used exclusively.

UTM WGS-84 Projection; Zone19

NOAA FORM 77-28 SUPERSEDES FORM C&GS-537

U.S GOVERNMENT PRINTING OFFICE: 1976-665-661/1222 REGION NO.6

Outside Source Data Evaluation
Survey W00004

NOAA Ocean Exploration
Puerto Rico Oceanographic Bathymetric Exploration II
NOAA Ship *Ron H. Brown*
Scale 1:500,000
September 24 - 30, 2002
February 22 - March 7, 2003

A. GENERAL INFORMATION

A.1 Background

This survey was a joint project that included NOAA's Office of Ocean Exploration, U.S. Geological Survey (USGS), NOAA Ship Ro*n H. Brown*, NOAA/University of New Hampshire Center for Coastal and Ocean Mapping, and the National Ocean Service's Office of Coast Survey. Office of Ocean Exploration identified the Puerto Rico Trench as a prime target for exploration and funded two expeditions to survey the trench. The survey consisted of 100 percent multibeam coverage producing bathymetric and backscatter data.

The expedition was the combined efforts of different government agencies, arranged through NOAA's Office of Ocean Exploration. PROBE II's scientific crew members included a geologist and two computer specialists from U.S. Geological Survey, Woods Hole Field Center, Woods Hole, MA; two hydrographers from NOS Office of Coast Survey (OCS), Atlantic Hydrographic Branch, Norfolk, VA; two expedition coordinators from NOAA Office of Ocean Exploration, Washington, D.C.; two marine mammal observers from an independent contractor and Coastal Sciences Center, Provincetown, MA; one 'Teacher at Sea' from Ramey High School, Aguadilla, Puerto Rico; NOAA Ship *Ronald H. Brown* command and crew.

The Puerto Rico Trench is known as the deepest site in the Atlantic Ocean, with maximum depths of approximately 8, 672 meters (28,451.4-feet). This seafloor area is considered geologically active; the combined effects of the earth's crustal movement, via seawater and carbonate rock, and anomalous negative gravity within the trench area create a unique region for study. These active physical elements often produce earthquakes and increase tsunami hazards for the people of Puerto Rico. Prime mission directive was acquiring and processing 100% multibeam bathymetry and backscatter data. PROBE II 2003 data was combined with data obtained in 2002 to provide USGS complete bottom coverage of the Puerto Rico Trench. The processed bathymetric data allowed geologists to visually identify and analyze new and known features of the Puerto Rico Trench seafloor.

A.2 Area Surveyed

The actual extents of the survey W00004 can be seen in Figure 1 provided by Atlantic Hydrographic Branch.

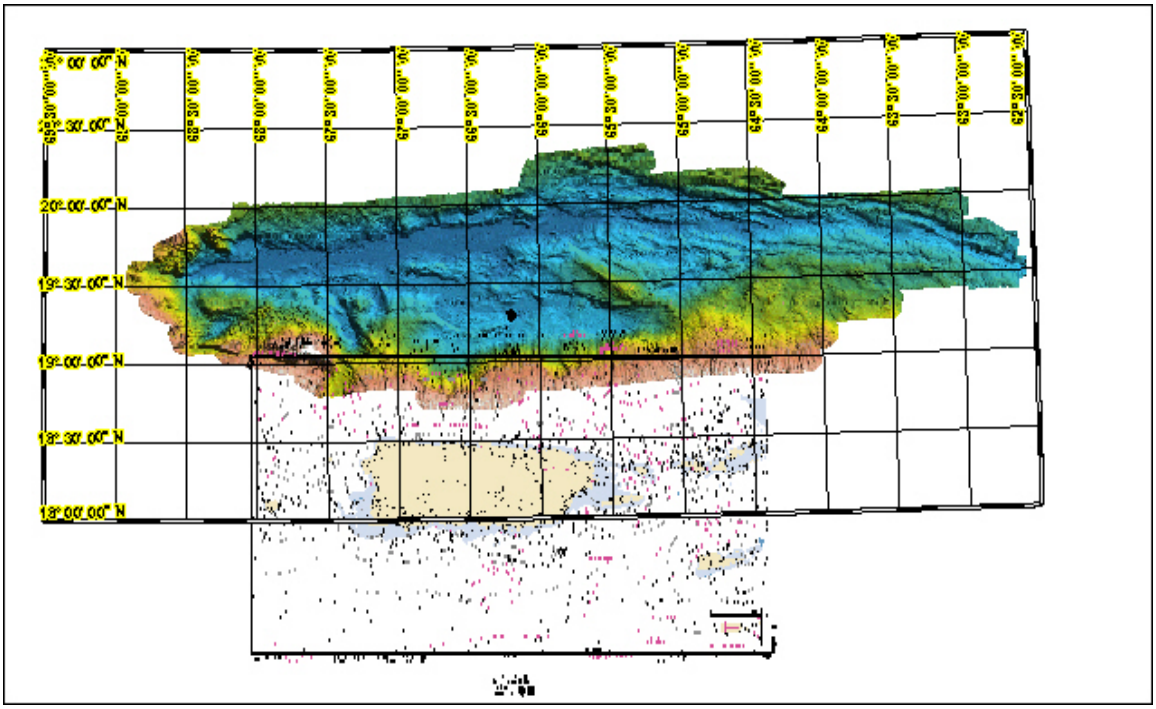

Figure 1: Survey limits of W00004

The approximate extents of the survey were scaled off in MapInfo:

Northern Latitude:	20°22'00.0"N
Southern Latitude:	18°42'18.6"N
Eastern Longitude:	062°32'52.0"W
Western Longitude:	068°54'36.0"W

A.3 Data and Reports

The following data were submitted to Atlantic Hydrographic Branch:

- Raw SeaBeam 2112 data files (MB41 format)
- XBT/CTD Sound Velocity data files
- Pcode Navigation Files (.XLS format)
- Meta Data
- Processed CARIS HDCS_DATA
- MapInfo tables generated during the survey : Digital Terrain Model, Backscatter Mosaics, Depth Plots, and Contours
- ACSII XYZ data set binned at 150 meters
- Web page generated by USGS containing supporting documentation

B. DATA ACQUISTION AND PROCESSING *See the Evaluation Report.*

B1. Data Acquisition

The sounding data for this survey was collected with a SeaBeam 2112 (12 Khz) swath bathymetric sonar system. The system is capable of hydrographic charting and seafloor acoustic backscatter imaging in water depths of 50 to 11,000 meters using up to 151 beams. Swath coverage varies as a function of depth, from 150 degrees at 1,000 meters, to 120 degrees at 5,000 meters, and 90 degrees at 11,000 meters; the beam width resolution is 2° X 2°. The system regularly operates in 4000+ meters of water, but is effective in shallower water less than 500m. The swath coverage on the ocean floor is approximately 75% of the water depth. The system operates at an acoustic frequency of 12 KHz and uses transducer arrays that are flush-mounted on the hull in a T-shaped configuration centered on the ship's keel.

The operation of the SeaBeam system is dependent upon the depth of water; the deeper the water, the longer the pulse width, the slower the ping rate, and narrower the swath width. The multibeam swath width in the deeper regions of the survey was between 10,000 m and 12,000 m wide (approximately 5.3 miles to 6.5 miles). This multibeam swath coverage allowed for survey line spacing to be established at 6 minute (00°06'00") intervals with an east - west azimuth. The pulse width ranged between 7 ms and 20 ms, with ping intervals varying between 8 seconds to 20 seconds. The SeaBeam system recorded the raw data files to a Silicon Graphics Incorporated (SGI) IRIX Origin 2 computer (175 MHz / 256 mg memory). The data files were automatically opened and closed with a 6 Mb limit, enabling efficient data management procedures. The total file size for the converted 2003 SeaBeam bathymetric data was approximately 557 Mb. Real time track line information was displayed on the SGI acquisition computer during data acquisition. Sea View plotting package was used to create and display real time contour plots.

B2. Corrections to Echo Soundings

B2.1 Sound Velocity

Sound velocity corrections were required by the SeaBeam acquisition system. The cast data was derived from three separate sources. A deep water Conductivity Temperature and Density (CTD) cast was obtained prior to the start of data collection. A Seabird Electronic Model 9/11 Conductivity Temperature and Density probe was used for obtaining CTD cast data. The maximum depth obtained with this instrument was 3,000 meters. The Levitus Database was used to supplement the cast data with velocity values for water depths between 3,000 meters and 9,000 meters. Additional speed of sound data was recorded using Expendable Bathythermographs (XBT). Cast data was limited to range of 760 meters to 1365 meters depth. A Seabird Electronic Model SPE-21 Thermosalinograph (TSG) was constantly monitored for surface sound velocity values. Monitoring the TSG values allowed the scientific crew to determine when additional sound velocity data was required for upper layers of the water column. Sound velocity values were entered in the acquisition system for real time application for beam forming and beam steering capabilities. No evidence of multibeam swath cupping or frowning was evident during data acquisition and processing.

Surface sound velocity was monitored using the Seabird Electronics SBE-21 Thermosalinograph. The water intake is locate at the bow of the survey vessel and is capable of measuring the conductivity and temperature of the water from either 2 meters below the ship's waterline or from 5.6 meters below the water line. This data was recorded on shipboard sensor network. Cast data was also monitored and

evaluated by means of using ExpendableBathythermographs (XBT). A total of five XBT casts were collected during the survey. Reference Figure 2 below.

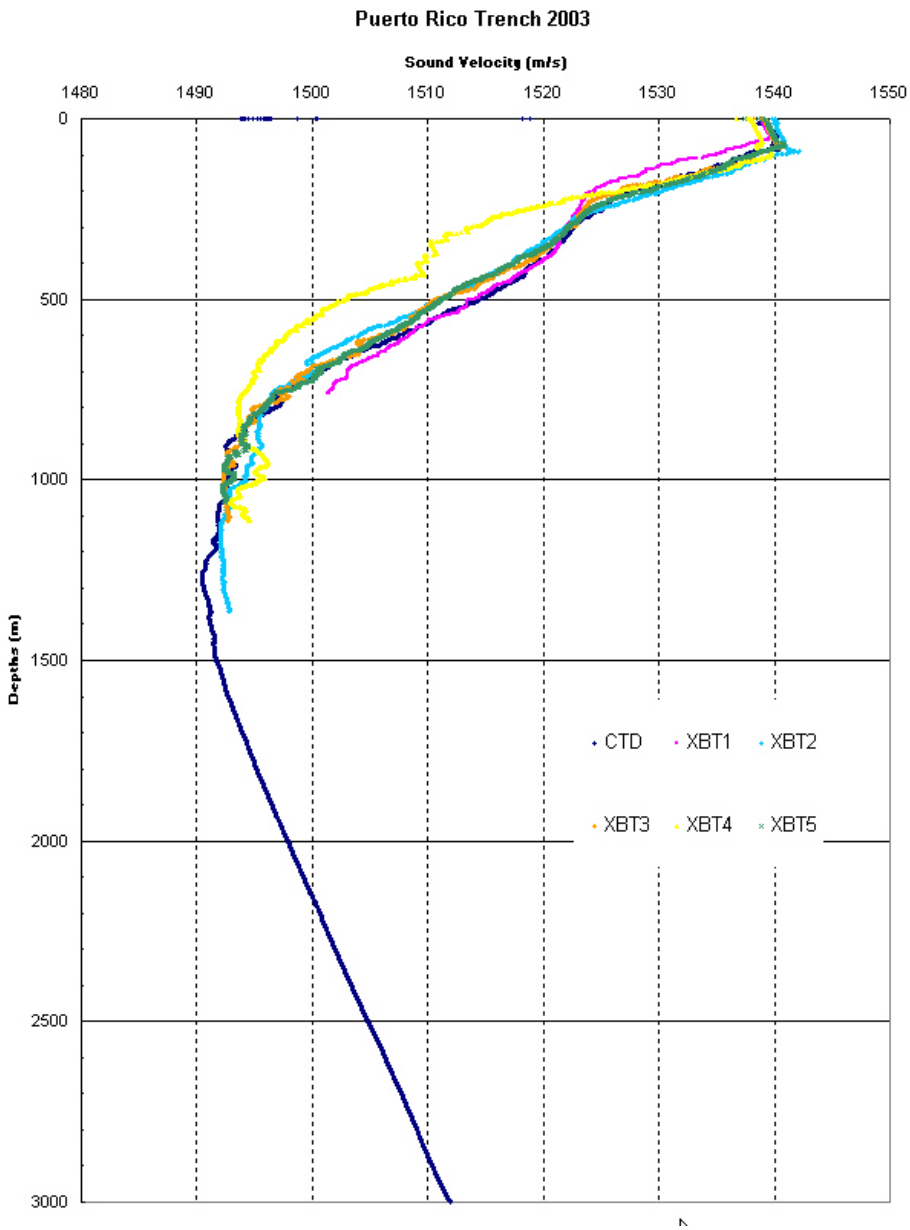

Figure 2: Sound Velocity Data: CTD and XBT

The XBT cast data was combined with the CTD cast data for sound velocity correction down to 3000 meters. The Levitus Database was used to extract velocity values past the CTD depth of 3,000 meters, extending the velocity values down to a depth of 12,000 meters. The profile was created by the program MBLEVITUS (version $1d; mblevitus c.v 4.8). Water velocity values derived from the Levitus program uses a temperature and salinity database. The profile represents the annual average water velocity structure for a 1° X 1° area centered at 20.5° N Latitude, 68° W Longitude. The water

velocity profile is in the form of discrete (depth, velocity) data points where the depth is in meters, the velocity in meters per second (m/s). The first 31 velocity values are defined using the salinity and temperature values available in the Levitus Database. The remaining 15 velocity values are calculated using the deepest temperature and salinity value available.

B2.2 System Bias

All system bias were applied to the acquisition system. According to the Chief Survey Technician aboard the NOAA Ship *Ron H. Brown*, a SeaBeam company representatives conducted a system acceptance test; none of the system bias values were provided to OCS hydrographers.

At one point during the survey, the acquisition system crashed and required the survey vessel to change heading. The adjacent data line allowed hydrographers to review the adjacent coverage data and determine that at roll bias remained within the system. Preliminary evaluation led to a correction of +0.60° during field data processing. Post survey analysis applied a mean corrector of + 0.51° to all data obtained during the 2003 survey. This roll artifact was most evident in regions of relatively little slope change or smooth seafloor. The roll artifact was hardly noticeable in areas or regions with rapid slope changes or with irregular benthic profile.

B2.3 Water Level Correction

No water level correctors were applied during field acquisitions. The tide range within the common area was considered negligible; observed tide range was between -0.02 meter and 0.58 meters above MLLW. Considering this survey is an IHO Order 3 and the water depth, the corrector value is insignificant.

Verified water levels were applied to the data during post processing at Atlantic Hydrographic Branch. See Vertical Control Section on page 8.

B2.4 Attitude Data Correction

The motion or attitude data was recorded during survey operations. The ship's sensors (Heave, Pitch, and Roll) known as the "HIPPY" was integrated with the Scientific Computing System (SCS). SCS is centralized for data collection and parsing for specific data logging purposes. The exact model and make of the attitude data sensor is unknown. All data were time stamped from the ship's precise Universal Time Coordinate clock. The attitude data originating from the "HIPPY" was networked to the SeaBeam acquisition system and recorded in the raw MB41 files. The attitude data was reviewed using Caris version 5.3 during normal hydrographic data processing. Attitude data editing was minimal and if necessary, included smoothing or rejecting with interpolation.

B3. Data Processing and Quality Control

Hydrographer

Data processing was the responsibility of NOAA hydrographers. The data pipeline included transferring the SeaBeam MB41 raw data files from the SGI computer to a processing laptop via file transfer protocol (ftp). Once the transfer was complete, the raw file was converted using Caris 5.3 Hips Sips software. The processing crew (NOAA hydrographers) maintained the same processing procedures as employed by NOAA hydrographic field units. Once the data was converted, a Digital

Terrain Model or "dirty DTM" was generated for visual detection of artifacts and missed depths. Caris Weighted Grids and multibeam backscatter mosaics were created for proof of coverage

The next step entailed reviewing and editing the data with Caris Swath Edit, followed with Caris Sub Set mode editing. Both editing processes allowed the hydrographer to eliminate data points that were considered artifacts or out of context with the immediate benthic area. Swath filtering was performed on all survey data; all data points or beams outside of 60° from the nadir beams were rejected.

After data editing, correction for sound velocity, followed by merging the data yields processed depth data. A Digital Terrain Model (DTM) or weighted mean grid was generated; grid resolutions included 150 and 200 meter grid DTM. A colorized by depth and grey toned surface model was exported as a .tif image and submitted to USGS team members. The 150 meter weighted grid was also exported as an ASCII XYZ data set that was converted to a .gutm file read by GeoZui3D. GeoZui3D, Caris 3D Viewer, and Fledermaus were used for visual data interpretation by USGS geologists. The exported ASCII XYZ data set was also converted into a Vertical Mapper Grid that was used to generate a MapInfo contours.

Final data products submitted to USGS team members included the 150 meter resolution weighted grid image files, both colorized by depth with sun illumination and gray tone surface model; 500 meter interval contour file; backscatter mosaics with 25 and 75 meter resolution; GeoZui ASCII gutm grid file with 150 meter grid interval. The image files were used in a project poster that described the results and interpretations of the geologic / bathymetric survey.

During field processing no water level corrections were applied to the data. Post processing produced contour plots and sounding plots of the area charted. Additional plotting capabilities utilized an HP-750 printer.

Atlantic Hydrographic Branch data processing included normal Office of Coast Survey processing routines. These routines include application of water levels and creating a Pydro Preliminary Smooth Sheet. Pydro version 4.4.3 was used for data binning and excessing. The data was originally binned at 150 meter interval, then excessed at 1250 meter interval for final xyz data export. The XYZ data set was then used to populate a Microstation Design file for the smooth sheet. Contours, projection grid, and title block were added to the final AHB smooth sheet.

Evaluator

There are three methods of quality assessment with W00004 survey data. One entails comparing the common areas of the 2002 data to the data collected in 2003. The hydrographer did not notice any disagreements indicating systematic problems between the two data sets.

The second method entails comparing the outer beam swath regions to adjacent lines. Generally speaking, this comparison led the hydrographers to realize the roll artifact that remained with the system. Caris calibration allowed hydrographers to determine the extent of the roll bias and the method from which to correct the bias.

The third method entails comparing the survey data to the charted data; the chart comparison is good taking in consideration the depth of the water within the common areas. The areas that were highlighted with significant difference were located in regions of steep bathymetric relief. These areas include the southern survey area where the carbonate platform is located. The source of the charted data within these common areas is from partial bottom coverage surveys that were conducted during

time period of 1970 to 1989. Some of the charted soundings that do not compare well are located near the down sloping carbonate platform. The chief scientist and hydrographer believe the sounding difference is related to the erosion of the carbonate platform; basically, the edge of the platform slumps down and sediment fills the down sloping canyons.

Internal Data Consistency

This survey contained no cross line data. Due to time constraints, the Chief Scientist chose not to collect any bathy data that crossed the main scheme lines. The only internal data quality assessment that can be made is with the multibeam data; comparisons should be made in the outer swath regions of the over lapping multibeam sounding lines. This method is not preferred, but the only method of quality assessment available.

Data Quality Factors

Depth accuracy standards fall within the International Hydrographic Organization (IHO) standards as specified in Special Publication 44 (S-44). IHO Order 3 requirements with water depths greater than 200 meters apply to this survey. For instance, a water depth of 2000 meters, the error accuracy should be within 20 meters; depths of 5000 meters the accuracy tolerance is 115 meters; depths of 8000 meters the accuracy tolerance is 184 meters. Due to time constraints, no crossline data was acquired. There was no other method of determining accuracy of the multibeam system considering the water depths.

The first several days of data collection experienced easterly wind speeds between 20 kts and 30 kts. The wind and sea state affected data quality. Easterly line azimuths encountered an increase of surface noise within the water column. Noise introduced under the ships hull stemmed from seas on the bow along with vessel pitch and roll motion. This caused the acquisition system or the data processors to reject anomalous data points or data “blow outs.” The vessel motion (pitch, roll, and yaw) was more pronounced in the data with wind and seas on the bow of the vessel as compared to the roll influences revealed with seas and wind on the stern of the survey vessel. Vessel speed during the windy period was limited to 5 - 6 kts in order to acquire quality data and limit the amount of rejected data points. The slower the vessel speed, the better the data quality. Once the wind and seas became calmer, vessel speed increased between 10 kts to 12 kts. Toward the end of the survey, the survey speed remained between 11 kts and 13 kts in order to maximize survey production and complete the survey as planned by the Chief Scientist.

The most arduous task confronting the survey personnel was that of becoming familiar with the multibeam acquisition system. Facts such as data inputs for positioning devices, transducer location, multibeam system setup parameters, sound velocity corrections, and vessel spatial horizontal and vertical offsets were not easily identified. No such documentation was available on the survey vessel.

Flat, smooth seafloor areas included artifacts exhibited as pock marks. These artifacts occur in areas that contained softer sediments. No bottom samples were obtained in these regions for sediment verification. The geologist inferred that the flat regions were composed of soft sediments such as fluid mud and silt. These types of sediments are not very reflective of the acoustic signal generated by the multibeam system. Along with the angle of incidence, the signal was absorbed or attenuated. The acoustic signal could penetrate the soft fluid sediment and ensonify on harder material below the softer sediment. The softer sediments created more variance between data points as opposed to the carbonate material that was more dense and reflective. This phenomenon was also evident in the

backscatter mosaic. The carbonate material and high vertical relief areas were much more reflective as compared to the deeper trench area. The data points within the regions of softer sediments varied in depths, yielding between 50 meters to 100 meters or more depth variance; thus the weighted grid portrays rough or bumpy texture (pock marks) of the seafloor.

B4. Data Reduction

AHB processing used PYDRO for data binning and sounding excessing. Preliminary Smooth Sheet was binned at 150 meters resolution with a scale of 1:500,000, then excessed at 1250 meter resolution. The XYZ data set was exported out of PYDRO and imported to a Microstation Design file. An additional limited data set excessed at a resolution of 1000 meters was added to layer 63 for depth definition during contour generation.

C. VERTICAL AND HORIZONTAL CONTROL *See the Evaluation Report.*

The earth's fixed global reference frame used during data collection was World Geodetic System 1984 (WGS 84), Universal Transverse Mercator (UTM) zone 19, northern hemisphere.

Horizontal Control

Horizontal datum for survey was collected using WGS 84, UTM zone 19. Data presentation is referenced to North American Datum of 1983 (NAD 83).

All horizontal positions were acquired with Trimble Centurion Precision (P) code GPS. Data output from networked time code receiver, time synched the shipboard data acquisition system and the computer dynamic positioning system.

Vertical Control

The Vertical Datum for survey W00004 was Mean Lower Low Water (MLLW). Water levels were obtained from NOAA Tide Station 9755371, San Juan, La Putilla, San Juan Bay, Puerto Rico. No Final Tide Note was generated or submitted.

AHB had contacted the NOS Center for Operational Oceanographic Products and Services (COOPS) for tidal zoning and reference station information. Final water level corrections entailed using the preliminary zoning for station 9755371 and the verified water level data downloaded from the COOPS web site. Final water levels were zone corrected using Caris version 5.3. See Figure 3, page 9 of this report.

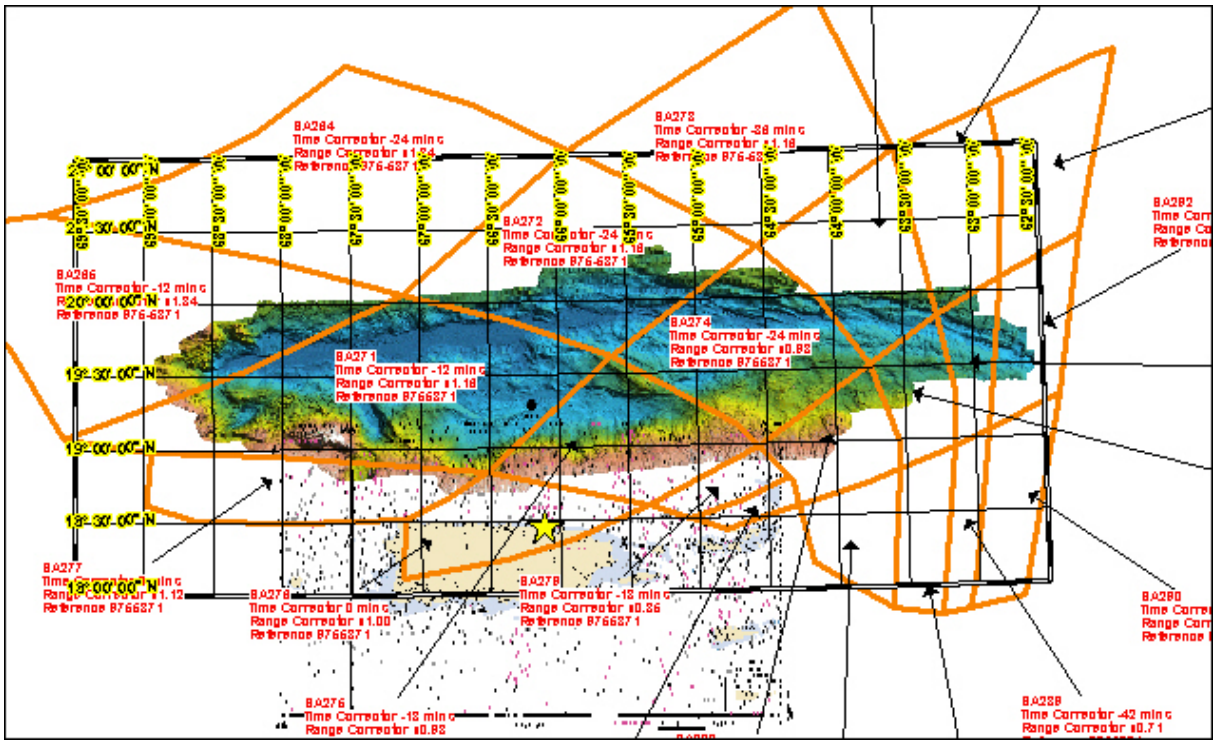

Figure 3: Tidal Zoning

D. ANALYSIS AND RECOMMENDATIONS *See the Evaluation Report.*

D.1 Error Analysis

Source of Error	IHO Special Order	IHO Order 3
Sounding Measurement	No	Yes
Static Draft	Unknown	Yes*
Dynamic Draft	Unknown	Unknown
Vessel offsets and biases	Unknown	Yes*
Sound Velocity / Refraction	No	Yes
Heave	No	Yes
Attitude	No	Yes
Water Level	No	Yes
Object detection	No	Unknown
Standard Met?	No	Yes**

* Applied in the SeaBeam Acquisition System
** With exceptions

D.2 Discussion of Data Quality and Suitability for Charting

An evaluation of the data, including an analysis of the factors described in this report, has determined that it meets minimum IHO specifications for an Order 3 survey. The data has been evaluated and has been determined suitable for nautical chart update. Without exception these data are considered to be acceptable to supersede the charted information within the common area.

D.3 Automated Wreck and Obstruction Information System (AWOIS) Items

No AWOIS were located within the survey limits.

D.4 Chart Comparison

D.4.1 Chart 25668

Survey W00004 was compared with Chart #25668_1, 19th Edition, June, 2004, Scale 1:100,000. The survey depths compare well considering the geology and bathymetric profile within the common area located in the southern survey area of W00004. The areas that were highlighted with significant differences were located in regions of steep bathymetric relief.

Some of the charted soundings that do not compare well are located in the area of the down sloping carbonate platform. The hydrographer believes the sounding difference is related to the erosion of the carbonate platform; basically, the edge of the platform slumps down and sediment fills the down sloping canyons.

Differences can be attributed to the age of the survey soundings and evolution of horizontal control. The charted sounding stem from surveys conducted between 1970 and 1989; GPS positioning during time frame of prior surveys was not as accurate as the horizontal positioning at the time of survey W00004.

D.4.2 Chart 25640

Survey W00004 was compared with Chart #25640, 41st Edition, March, 2004, Scale 1:326,856. Chart 25640 has 196 charted depths within the common area. Out of 196 charted depths, only 9 survey soundings did not beat the charted depths. This equates to 4.5% disagreement of survey sounding to charted depths. Similar chart comparison differences are related to the existing situation as describe in the comparison for Chart 25668.

D.5 Shoreline

Shoreline Source

W00004 has no associated shoreline.

Charted Shoreline Changes

Not applicable.

D.6 Dangers to Navigation

No dangers to navigation were found during the evaluation of survey W00004

D.7 Aids to Navigation

No navigational aids were positioned during W00004.

D.8 Cartography

See AHB Evaluation Report.

D.9 Miscellaneous

No additional recommendations or fieldwork is warranted.

E. APPROVAL

Hydrography

All obtained records, reports, and data have been evaluated with regard to survey coverage, survey accuracy, and suitability for nautical charting.

Evaluated by:

Castle Eugene Parker
Physical Scientist
Atlantic Hydrographic Branch

Cartography

The evaluated survey has been inspected with regard to delineation of the depth curves, development of critical depths, cartographic symbolization, and verification or disproval of charted data.

Compiled by:

Castle Eugene Parker
Physical Scientist
Atlantic Hydrographic Branch

Reviewed by:

Richard H. Whitfield
Cartographer
Atlantic Hydrographic Branch

Approval

I have reviewed the smooth sheet, W-Drawing, accompanying data, and reports. Data are suitable for nautical charting where specifically recommended in this report.

Approved by:

CDR Tod. Schattgen, NOAA
Chief
Atlantic Hydrographic Branch

Digitally signed by Jeremy McHugh
Reason: AWOIS / SURF check complete
Date: 2005.12.16 16:34:29 -05'00'

July 22, 2005

MEMORANDUM FOR: Chief, Requirements and Development Division, N/OPS1

FROM: Castle Eugene Parker

Atlantic Hydrographic Branch N/CS 33

SUBJECT: Request for Approved Tides/Water Levels

Please provide the following data:

1. Tide Note
2. Final zoning in MapInfo and .MIX format
3. Six Minute Water Level data (Co-ops web site)

Transmit data to:

NOAA/NOS/Atlantic Hydrographic Branch
N/CS33, Building #2
439 West York Street
Norfolk, VA 23510
ATTN: Chief AHB

These data are required for the processing of the following hydrographic survey:

Project No.:

Registry No.: W00004

State: Puerto Rico

Locality: North Atlantic Ocean

Sublocality: Puerto Rico Trench

Attachments containing:
1) an Abstract of Times of Hydrography,
2) digital MID MIF files of the track lines from pydro on CD/diskette

cc: N/CS33

Year_DOY	Min Time	Max Time
2002_267	23:28:27	23:58:31
2002_268	00:01:21	23:58:40
2002_269	00:01:33	23:58:39
2002_270	00:01:29	23:39:15
2002_271	00:27:04	23:59:02
2002_272	00:02:02	23:59:19
2002_273	00:02:14	08:00:00
2003_053	00:48:21	23:59:54
2003_054	00:03:24	23:59:41
2003_055	00:03:18	23:57:38
2003_056	00:00:13	23:58:25
2003_057	00:00:02	23:57:49
2003_058	00:00:01	23:25:53
2003_059	00:12:12	23:03:46
2003_060	00:03:17	23:58:25
2003_061	00:01:28	23:59:13
2003_062	00:02:29	23:59:46
2003_063	00:02:47	23:57:53
2003_064	00:01:27	23:57:11
2003_065	00:00:17	23:59:07
2003_066	00:02:07	10:33:52

Survey W00004 Metadata

Identification Information:
Originator: Castle Eugene Parker
Atlantic Hydrographic Branch
National Ocean Service
Office of Coast Survey

Registry Number: W00004
Project Number: N/A; Outside Source Data
Dates of Survey: September 24-30, 2002
February 22 – March 7, 2003
Received Date at Processing Branch: March 2003
Central Latitude and Longitude (DMS): Lat: 19°30'N Long: 066°00'W
Scale: 1:5000,000
State: Puerto Rico
General Locality: North Atlantic Ocean
Sub-Locality: Puerto Rico Trench
Corresponding Charts: #25640 Scale 1:326,856 ; #25668 Scale 1:100,000
All attached Items: Smooth Sheet, H-Drawing, Drawing History, Record of Application Charts, Outside Source Data Evaluation Report, Atlantic Hydrographic Branch W00004 Evaluation Report, Survey W00004 Metadata
Originating Source: NOAA MAO: NOAA Ship *Ron H. Brown*
NOAA Office of Ocean Exploration
Country: USA
Chief Scientist: Uri ten Brink (US Geological Survey)
Chief Hydrographer: Physical Scientist Castle Eugene Parker (NOAA)
Horizontal Datum: North American Datum 1983
Ellipsoid: WGS-84 UTM-19
Cartographic Products: NAD83
Vertical Datum: MLLW
Sounding Method: Multibeam Echosounder Seabeam 2012
Sound Velocity Correction: Seabird Model 9/11 CTD Probe; Seabird Model SPE-21 Thermosalinograph (TSG); Expendable Bathythermographs (XBT); Levitus Database; corrected using CARIS HIPS version 5.3
Data Processing Methodology: Standard Office of Coast Survey Hydrographic Surveys Division processing routines using Caris HIPS/SIPS version 5.3 and 5.4. Cartographic products created using Bentley's Microstation J and IRASB
Tide Origin: NOAA OCS COOPS; Tide Station 9755371, San Juan, La Putilla, San Juan Bay, Puerto Rico
Sounding Units: Acquisition: Meters; Cartographic Product: Fathoms
Type of Survey: Multibeam 100% Coverage
Data Format: Full Density Seabeam MB41 converted and processed with Caris Format
Meets Standards for Nautical Charting: Meets IHO Order 3

ATLANTIC HYDROGRAPHIC BRANCH
EVALUATION REPORT FOR W00004 (2002-2003)

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

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

MicroStation J, version 7.01.04.16
I/RAS B, version 7.01.000.18
MapInfo, version 6.5
CARIS HIPS/SIPS version 5.8 Hot Fix 1-28
PYDRO, version 4.4.3

The smooth sheet was plotted using a Hewlett Packard DesignJet 1050C plotter.

Junctions

There are no junctional surveys to the north, south, east, or to the west. Present survey depths are in harmony with the charted hydrography within the common area.

C. VERTICAL AND HORIZONTAL CONTROL

Horizontal Control

Horizontal control used for this survey during data acquisition is based upon World Geodetic System (WGS) 1984 geodetic datum, using Universal Transverse Mercator (UTM) Zone 19 projection. Office processing of this survey is referenced to North American Datum 1983 (NAD 83) values.

Vertical Control

The Vertical Datum for survey W00004 was Mean Lower Low Water (MLLW). Water levels were obtained from NOAA Tide Station 9755371, San Juan, La Putilla, San Juan Bay, Puerto Rico. Verified water levels and preliminary zoning provided by NOS Center for Operational Oceanographic Products and Services (COOPS) was applied.

D. RESULTS AND RECOMMENDATIONS

D.4.1 COMPARISON WITH CHART 25668 (19th Edition, Jun. /04)

Corrected through NM Jun. 26/04
Corrected through LNM Jun. 08/04

The charted hydrography originates with prior surveys and requires no further consideration. The hydrographer makes adequate chart comparisons in Section D.4.1 Chart Comparison of the Descriptive Report. Continual maintenance raster updated to June 26, 2004 was used for chart comparison during office processing.

The present survey is adequate to supersede the charted hydrography within the common area.

D.4.2 COMPARISON WITH CHART 25640 (41st Edition, MAR. /04)

The charted hydrography originates with prior surveys and requires no further consideration. The hydrographer makes adequate chart comparisons in Section D.4.2 Chart Comparison of the Descriptive Report. Continual maintenance raster updated to March 20, 2004 was used for chart comparison during office processing.

The present survey is adequate to supersede the charted hydrography within the common area.

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

This is an adequate hydrographic multibeam survey. No additional field work is recommended.

D.8 Cartography

Chart compilation was done by Atlantic Hydrographic Branch personnel, in Norfolk, Virginia. Compilation data will be forwarded to Marine Chart Division, Silver Spring, Maryland. The continuous maintenance raster updated through March 20, 2004 was used for the following NOS Chart for compilation of the present survey: 25640 (41st Edition, March, 2004)
25668 (19th Edition, June, 2004)

Castle Eugene Parker
Physical Scientist
Project Lead Hydrographer
Verification of Field Data,
Evaluation and Analysis

APPROVAL SHEET
W00004

The completed survey has been inspected with regard to survey coverage, delineation of depth curves, development of critical depths, cartographic symbolization, and verification or disproval of charted data. The survey records and digital data comply with NOS requirements except where noted in the Evaluation Report.

Date: 12/2/05

Richard H. Whitfield
Cartographer
Atlantic Hydrographic Branch

I have reviewed the compiled H-Drawing, accompanying data, and reports. This survey and accompanying digital data meet or exceed NOS requirements and standards for products in support of nautical charting except where noted in the Evaluation Report.

Approved: Date: 12/14/05

P. Tod Schattgen
Lieutenant Commander, NOAA
Chief, Atlantic Hydrographic Branch

NOAA FORM 75-96
(10-83)

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

MARINE CHART BRANCH

RECORD OF APPLICATION TO CHARTS

FILE WITH DESCRIPTIVE REPORT OF SURVEY NO. W00004

INSTRUCTIONS

A basic hydrographic or topographic survey supersedes all information of like nature on the uncorrected chart.

1. Letter all information.
2. In "Remarks" column cross out words that do not apply.
3. Give reasons for deviations, if any, from recommendations made under "Comparison with Charts" in the Review.

CHART	DATE	CARTOGRAPHER	REMARKS
25668	12/2/05	C.E. PARKER	Full ~~Part Before~~ After Marine Center Approval Signed Via
			Drawing No.
25640	12/2/05	C.E. PARKER	Full ~~Part Before~~ After Marine Center Approval Signed Via
			Drawing No.
			Full Part Before After Marine Center Approval Signed Via
			Drawing No.
			Full Part Before After Marine Center Approval Signed Via
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			Full Part Before After Marine Center Approval Signed Via
			Drawing No.

SUPERSEDES C&GS FORM 8352 WHICH MAY BE USED

NOAA FORM 61-29
(12-71)

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

REFERENCE NO.
N/CS33-35-05

LETTER TRANSMITTING DATA

DATA AS LISTED BELOW WERE FORWARDED TO YOU BY (Check)

- [ ] ORDINARY MAIL
- [ ] AIR MAIL
- [ ] REGISTERED MAIL
- [X] EXPRESS
- [ ] GBL (Give number)_____

TO:

NOAA / National Ocean Service
Chief, Data Control Group, N/CS 35
SSMC3, Station 6704
1315 East West Hwy.
Silver Spring, MD 20910-3282

DATE FORWARDED
12/15/05

NUMBER OF PACKAGES
1

NOTE: A separate transmittal letter is to be used for each type of data, as tidal data, seismology, geomagnetism, etc. State the number of packages and include an executed copy of the transmittal letter in each package. In addition the original and one copy of the letter should be sent under separate cover. The copy will be returned as a receipt. This form should not be used for correspondence or transmitting accounting documents.

W00004
Puerto Rico
North Atlantic Ocean
Puerto Rico Trench

One chart tube containing the following deliverables:

1 Smooth Sheet Mylar Plot for Outside Source Data survey W00004.
1 Mylar H-Drawing for NOS Chart #25668.
1 Mylar H-Drawing for NOS Chart #25640.

FROM: (Signature)

RECEIVED THE ABOVE
(Name, Division, Date)

Return receipted copy to:

NOAA / National Ocean Service
Atlantic Hydrographic Branch
439 West York Street
Norfolk, VA 23510-1114