H10646

NOAA FORM 76-35A

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

DESCRIPTIVE REPORT

Type of Survey Multibeam

Field No. A

Registry No. H10646

LOCALITY

State Maine

General Locality Casco Bay

Sublocality 5 NM Southeast of Peaks Island

2000

CHIEF OF PARTY

Steven A. Lemke

LIBRARY & ARCHIVES

DATE

NOAA FORM 77-28
(11-72)

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

REGISTRY NO.

H10646

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. A

State MAINE

General locality CASCO BAY

Locality 5 Miles SE of Peaks Island

Scale 1:10,000 Date of survey 6 July – 11 August 2000

Instructions Dated 01 November 1999 as amended Project No. OPR-A318-KR-00

Vessel R/V OceanExplorer US905425

Chief of Party *STEVEN A. LEMKE*

Surveyed by Steven Lemke, George Ghiorse, Rick Nadeau, Paul Donaldson

Soundings taken by (**echo sounder**), hand lead, pole MULTIBEAM RESON SEABAT 8101

Graphic record scaled by survey personnel

Graphic record checked by survey personnel

Protracted by Automated plot by HP1055CM (Field)

Verification by

Soundings in fathoms, (**feet,**) meters at MLW, (**MLLW**)

REMARKS: Contract # 50-DGNC-0-90015
Contractor Name: Science Applications International Corp.
221 Third Street; Newport, RI 02840
HANDWRITTEN NOTES IN THE DESCRIPTIVE REPORT WERE MADE DURING OFFICE PROCESSING

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

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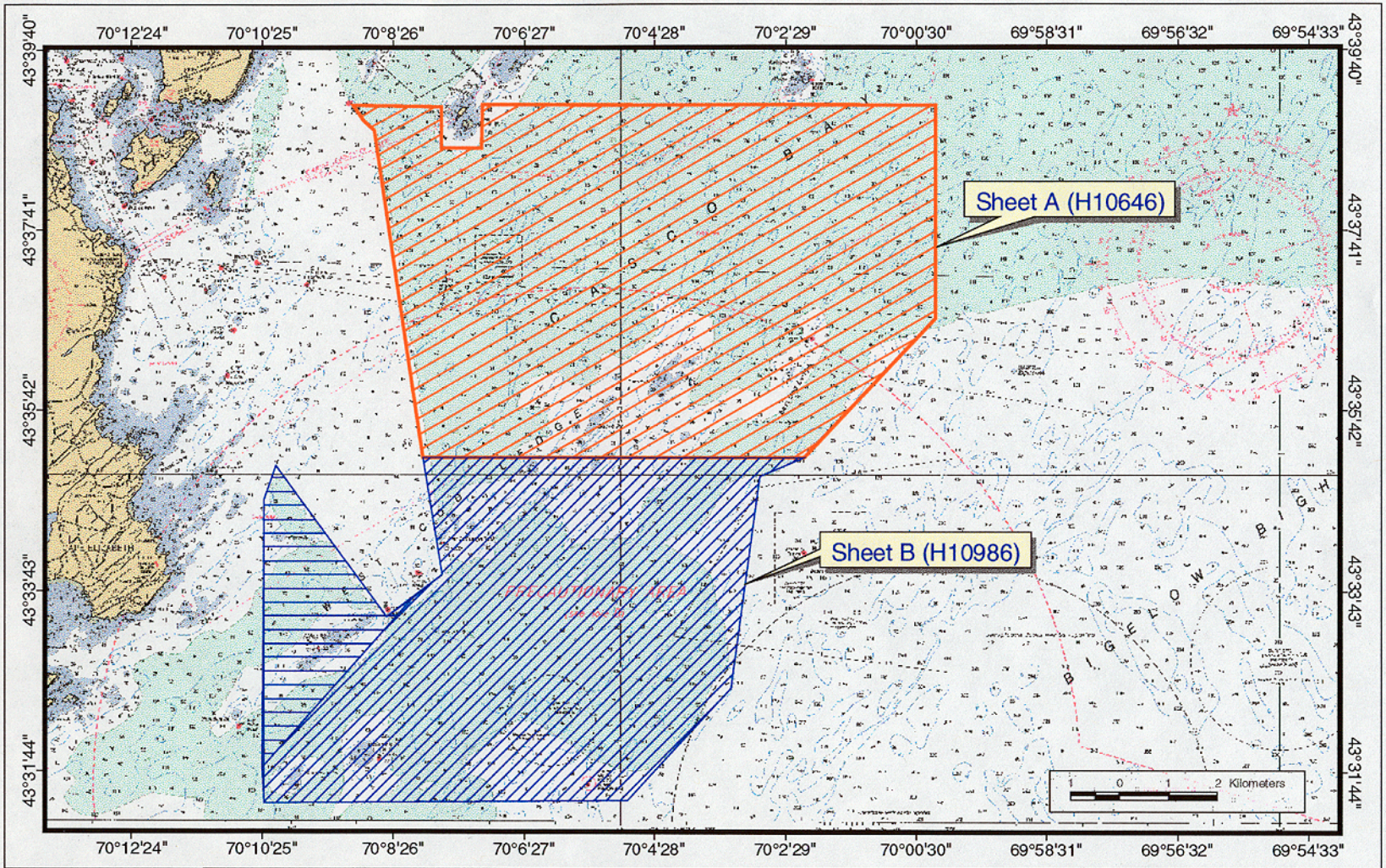
1. Survey Outlines
2. Field Survey Letters and Survey Registry Numbers
3. Work Accomplished by Month



REGISTRY #	STARTED	COMPLETED	SUBMITTED
H10646	7/06/2000	8/11/2000	
H10986	7/21/2000	8/11/2000	

DAYS LOST BY:	JULY	AUGUST
WEATHER	2.0	0.0
BOAT	2.0	0.0
EQUIPMENT	0.0	0.0

PROGRESS SKETCH

PROJECT OPR-A318-KR
H10646, H10986 CASCO BAY, ME
MULTBEAM SONAR

R/V OCEANEXPLORER
SCIENCE APPLICATIONS INTERNATIONAL CORPORATION
STEVEN A. LEMKE
HYDROGRAPHER

STATISTICS

	SHEET A		SHEET B	
	JULY	AUG	JULY	AUG
LNM	809	96	451	248
SQ NM	21.6	0	14.8	2.4
ITEMS INVESTIGATED	0	0	0	0
SVP CASTS	71	0	26	52
MULTIBEAM COVERAGE				

Science Applications International Corporation (SAIC) warrants only that the survey data acquired by SAIC and delivered to NOAA under Contract 50-DGNC-0-90015 reflects the state of the sea floor in existence on the day and at the time the survey was conducted.

* FILED WITH THE ORIGINAL FIELD RECORDS

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* FILED WITH THE ORIGINAL FIELD RECORDS

Descriptive Report to Accompany
Hydrographic Survey H10646
Scale 1:10,000, Surveyed 2000
R/V OceanExplorer
Science Applications International Corporation (SAIC)
Steven A. Lemke, Hydrographer

A. PROJECT

Project Number: OPR-A318-KR-00
Dates of Instructions: 1 November 1999
27 June 2000

Original: 50-DGNC-0-90015
Task Order #3: 56-DGNC-0-33003

Dates of Supplemental Instructions: none
Sheet Letters: A
Registry Number: H10646
Purpose: To provide NOAA with modern, accurate hydrographic survey data with which to update the nautical charts of the assigned area.

B. AREA SURVEYED

Description:

The area surveyed covered a section of the approach to Portland, Maine, in Casco Bay, 5 Miles SE of Peaks Island.

Dates of multibeam data acquisition (UTC):

7/06/2000 – 7/21/2000	188 – 203
8/04/2000–8/05/2000	217 - 218
8/11/2000	224

C. SURVEY VESSEL

The R/V OceanExplorer was the platform for multibeam sonar and sound velocity data collection. The main cabin of the vessel was used as the data collection center. All data were shipped to the Data Processing Center in the Newport office for post-processing. The POS/MV IMU was mounted on the vessel centerline just forward and above the RESON 8101 transducer, below the main deck. The multibeam sounder transducer was mounted on the keel. Multibeam data were collected by the 8101. Table C-1 is a list of vessel characteristics for the R/V OceanExplorer.

Table C-1. Survey Vessel Characteristics

Vessel Name	LOA (Ft)	Beam (Ft)	Draft (Ft)	Gross Tonnage	Power (Hp)	Registration Number
R/V OceanExplorer	61'	16'4"	3'3"	56	1100	US905425

The R/V OceanExplorer sensor configuration is depicted in Figure C-1 and the vessel offsets are shown in Table C-2. For these surveys, the R8101 transducer was installed on the hull mount. Figure C-2 shows the draft calculations for the R/V OceanExplorer. All measurements are in meters. The Reference Point for the entire multibeam system is located at the top centerline of the POS/MV IMU. The transducer depth was recorded as 3.07 meters below the boat's main deck. The distance below the boat deck to the water surface was measured and subtracted from the transducer hull depth to determine the draft of the electronic center of the transducer. Measurements were made on each side of the vessel before departure from port and upon return to port in order to prorate the daily draft for fuel and water consumption.

Figure C-1. Configuration of R/V OceanExplorer during Survey Operations, measurements in meters

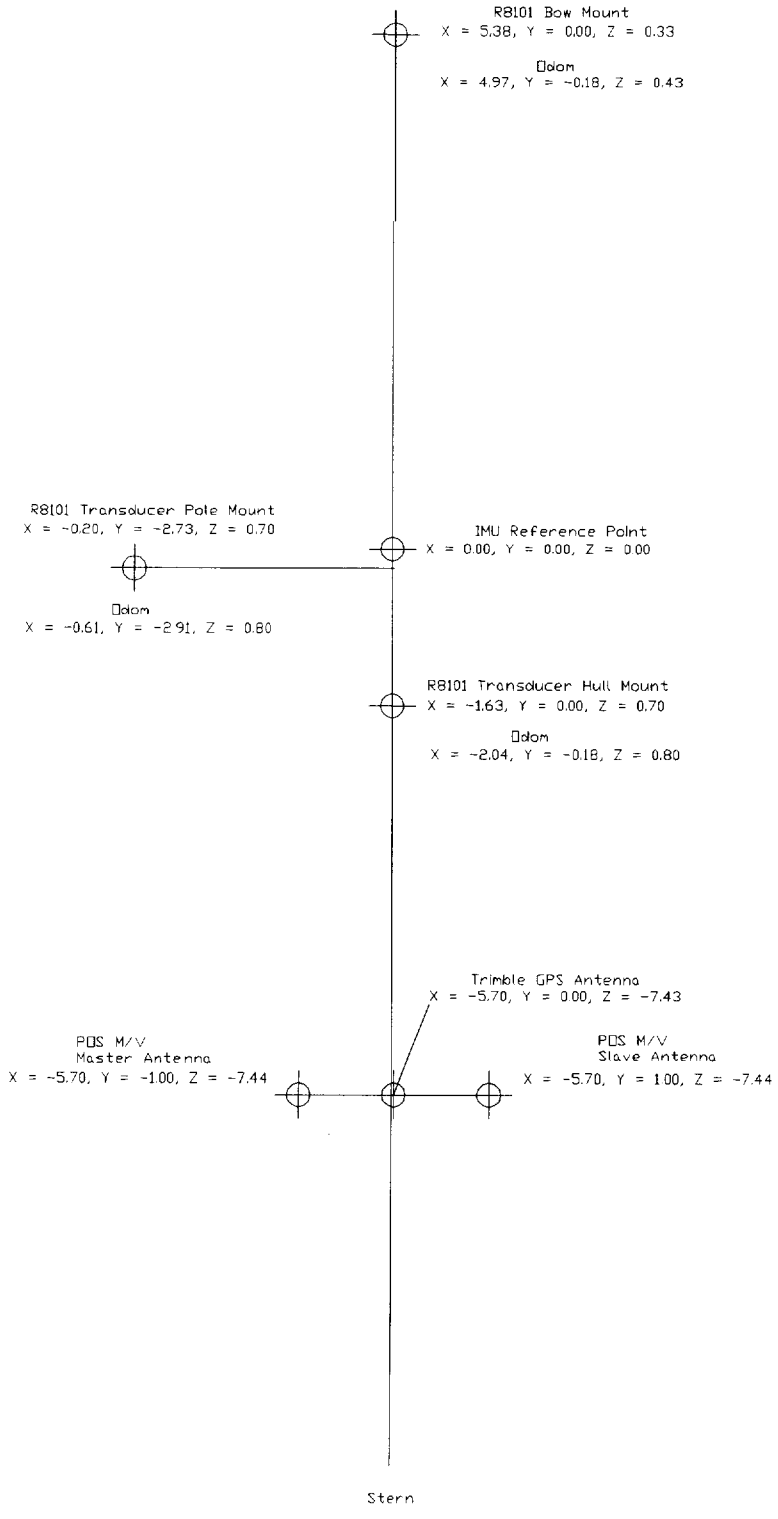
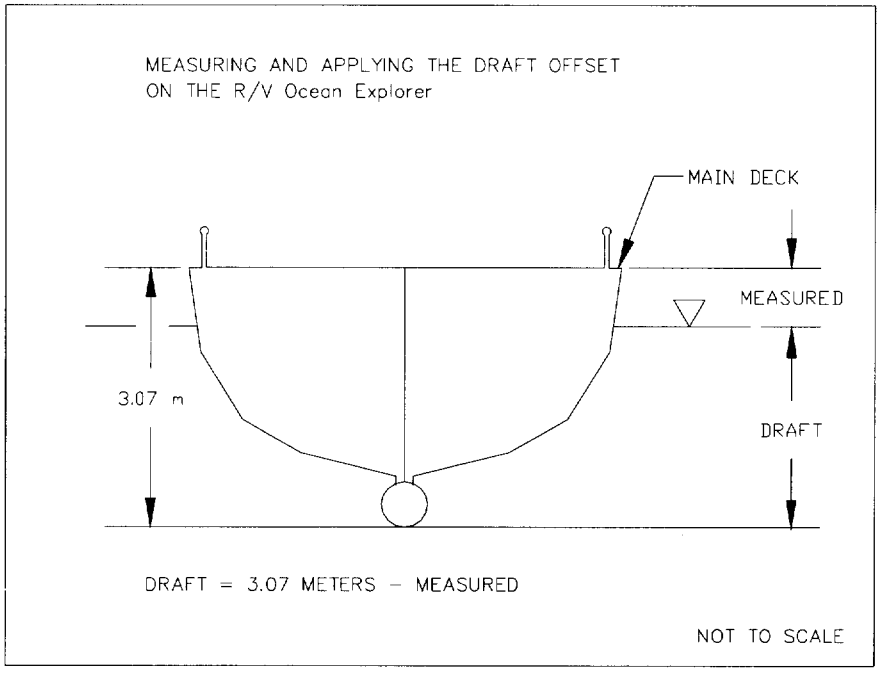


Table C-2. R/V OceanExplorer Antenna and Transducer Locations Relative to the POS/MV IMU Vessel Reference Point, measurements in meters

Sensor	Offset in ISS2000		POS/MV IMU	
Multibeam Reson 8101 Transducer Hull Mount			X	-1.63
			Y	0.00
			Z	0.70
ODOM Singlebeam Transducer	X	-2.04		
	Y	-.018		
	Z	0.80		
Trimble 7400 Antenna	X	-5.70		
	Y	0.00		
	Z	-7.43		
POS/MV GPS Master Antenna			X	-5.70
			Y	-1.00
			Z	-7.44

Figure C-2. R/V OceanExplorer Draft Determination



The SAIC Integrated Survey System (**iss2000**) and the RESON 8101 multibeam system utilize different coordinate systems, and care must be taken when inputting correctors to the system. The **iss2000** considers "z" to be positive down, while both the RESON and POS/MV consider "z" positive up. Both the **iss2000** and POS/MV consider "x" positive forward, the RESON considers "x" as positive athwart ships to starboard. The SAIC **iss2000** considers "y" positive athwart ships to starboard, the POS/MV considers "y" positive athwart ships to port and the RESON considers "y" as positive forward.

D. AUTOMATED DATA ACQUISITION AND PROCESSING

SEE ALSO THE EVALUATION REPORT

Data acquisition was carried out using the SAIC **iss2000** system. Real-time navigation, data time tagging and data logging were controlled by the **iss2000** on a Windows NT 4.0. Survey Planning and data processing were done on UNIX machines.

Navigation was recorded from both the POS/MV system and the Trimble 7400. Data from the POS/MV was used as the primary navigation merged with multibeam data. Positioning confidence checks were performed alongside survey control stations in port during Sea Acceptance Tests. Daily positioning confidence checks for the R/V OceanExplorer were done by comparing data recorded from the POS/MV to data recorded from the Trimble DGPS.

The RESON 8101 range scale was changed between 5 and 200 meters as necessitated by water depth. The data acquisition rate for the R8101 was set at 12 pings per second maximum rate. At an average speed of 8 knots and 12 per pings second, the average alongtrack coverage was 3.1 pings per meter in water depths to 25 meters, 2.4 pings per meter in water depths 25 meters to 40 meters, and 2.0 pings per meter in depths greater than 40 meters. In all cases, ensonification was adequate for detection of 2-meter by 2-meter objects.

Cleaning of the R8101 multibeam data began with an evaluation of the navigation track line. An automated filter was then applied for minimum and maximum depths of 1 and 150 meters. Interactive editing was performed to remove noise, fish, etc. The editing process used the **geoswath** geo-referenced editor which allows for both plan and profile views with each beam in its true geographic position and depth. Predicted tidal correctors were applied in real-time. Observed tides were down loaded from the NOAA/CO-OPS web page. Preliminary and verified data from Portland, ME (841-8150) were applied to the multibeam data using the zoning received June 12, 2000.

Depth data were then binned to 1.5-meter cells. The resulting grids were used for coverage and quality evaluation. When anomalies were seen in the 1.5 meter bins, the edited multibeam files were re-examined and re-edited as needed. When all multibeam files were determined to be satisfactory, the data were binned to a 5-meter cell size, populating the bin with the shoalest sounding in the bin and maintaining its true position and depth with tracking to the gsf multibeam data file.

Soundings were selected from the 5-meter binned layer using the **sel_sound** sounding selection program. This routine starts with the shoalest sounding in the survey, flags out soundings that would overlap it on the plot, proceeds to the shoalest remaining sounding and repeats the above process until all soundings in the 5-meter bin layer have been evaluated. The **set_sound** program was run to flag all selected soundings in the gsf multibeam data. The selected sounding file, the navigation aids file, and the feature file were combined to produce the smooth sheet in **AutoCAD** and **MicroStation**.

Throughout this descriptive report wherever software is mentioned, it is inferred that the most current version of the software available was used. A complete list of all software versions and dates is provided in Appendix I. FILED WITH THE ORIGINAL FIELD RECORDS

Multibeam Data Processing

The real time multibeam acquisition system used for the H10646 survey included:

- One Windows NT workstation – Used for system control, survey operations, real-time quality control, POS M/V and Trimble software.
- A custom computer from RESON was used to operate the 8101 system.
- A custom computer from RESON was used to operate the R6042 system.
- Uninterrupted power supplies (UPS) protected the entire system.
- One notebook computer – Used for maintaining daily real-time system logs.

Initial navigation quality control was done on the vessel shortly after the data was collected. Tracklines were created, verified, and corrected to ensure data coverage and to check for navigation errors. Where time allowed, multibeam data were edited onboard the vessel using the **geoswath** editor. At the end of each day, both the raw and processed data were backed up onto 4mm tape and shipped to the data processing lab in Newport, RI.

In the processing lab in Newport, RI, manual editing was completed and reviewed by a data manager or Hydrographer. Any questionable possible obstructions were noted and later evaluated by the Hydrographer. A data manager would then correct the data for draft and tides, update the coverage plots, tracklines, sounding bins, selected sounding plots and preliminary data products. The data manager's duties also included routine system backups on all computers and quality control on all data.

Feature analysis was performed correlating multibeam features from different swaths. Multibeam coverage and sounding plots were updated following changes found during the feature analysis. The **iss2000** system used proprietary algorithms to create the binned depths and selected soundings. Final plots were produced exporting data to a dxf format using the **iss2000** software. These data were then imported into **AutoCAD** and **MicroStation** for final map production.

E. SIDESCAN SONAR

Not used by contractor.

F. SOUNDING EQUIPMENT

The following components were used for acquisition of multibeam sounding data using the RESON SeaBat 8101 multibeam system:

- Transducer, Serial Number 099707
- 8101 Processor, Serial Number 13819
- R6042 Controller and Processing Unit, Serial Number 590 P0 794-387

Weekly comparisons of R8101 nadir soundings to ODOM EchoTrak 200 kHz vertical echo sounder are summarized in Appendix E. FILED WITH THE ORIGINAL FIELD RECORDS

G. CORRECTIONS TO SOUNDINGS

1. Tides and water levels

Preliminary and verified tide data were downloaded from the NOAA CO-OPS web page based on the Portland, ME (841-8150) station. Tide corrector files for each tide zone were created from actual tide data using the **iss2000 tid2hmps** routine. These corrector files were then applied to the multibeam data using the **appcors** program within the **iss2000 Survey Analysis** software. After verified tides were applied to all multibeam data, grids were created at 1.5 meter cell size. These grids were then analyzed using color change intervals of 0.1, 0.2, 0.5, and 1 meter. This analysis showed shifts due to tide correction errors, unusual currents, storm surges, etc. There were no significant shifts due to tides. APPROVED TIDES AND ZONES WERE APPLIED DURING FIELD PROCESSING.

2. Speed of Sound

The following systems were used to determine sound velocity profiles for corrections to multibeam sonar soundings.

Brooke Ocean Technology Ltd., Moving Vessel Profiler-30, Serial Number 4404
Calibration Dates: 1 May 2000

Brooke Ocean Technology Ltd., Moving Vessel Profiler-30, Serial Number 4523
Calibration Dates: 11 April 2000

Weekly confidence checks were obtained using consecutive casts with the two SVP sensors. After downloading the SVP casts, both were compared to each other and to the previously applied cast. Computed profiles were copied to the **iss2000** for comparison on the screen. A selected profile was applied to the system, recorded, and sent to the RESON 6042, where refraction was computed for application of speed of sound and ray tracing correctors to the multibeam sounding data. If sounding depths exceeded the cast depth, the RESON 6042 used the bottom sound velocity of the cast to extend the profile to the maximum depth.

Factors considered in determining how often a SVP cast was needed included: shape and proximity of the coastline, sources and proximity of freshwater, seasonal changes, wind, sea state, cloud cover, and changes from the previous profile. Casts were taken at approximately two-hour intervals.

Quality control tools, including real-time displays of color-coded coverage and a multibeam swath editor, were used to monitor how the sound velocity was affecting the multibeam data. Severe effects due to improper sound velocity could easily be seen by viewing multibeam data in an along track direction.

A table including all SVP casts, dates of each cast, the location of the cast, and the maximum depth of each cast is located in Table App. H-1, Appendix H. FILED WITH THE ORIGINAL FIELD RECORDS

2. Instrument Corrections

No instrument corrections were necessary after the initial installation and calibration was complete.

3. Static draft

Depth of the transducer below the deck was determined from measurements made while the boat was hauled in May 2000. The static draft was observed daily by measuring from the main deck to the waterline before getting underway and subtracting that measurement from the transducer distance below the deck. If the static draft value changed from the previously noted value, the new value was entered into the **iss2000** system. The static draft was again determined upon return to port and the change in draft was prorated on a daily basis. The measured and prorated draft results are reported in Table App. E-1, Appendix E. FILED WITH THE ORIGINAL FIELD RECORDS

4. Settlement and Squat

Measurements of settlement and squat were conducted near 41 31 56N 071 19 30W on day 134, May 13, 2000, in 18 meters of water off the end of the Coddington Cove breakwater, Narragansett Bay, RI. The following procedures were used to determine the settlement correctors:

Measurement by Surveyor's Level and Rod, the preferred method when the attitude sensor (IMU) and the transducer are not co-located.

1. Used a surveyor's level and a level rod with target, or a stadia board to measure the elevation of a spot above the attitude sensor (IMU) on the survey boat as the boat was operated at different shaft RPMs.
2. Selected a location to set up a surveyor's level ("level") overlooking adequate water for the survey vessel to run a survey line at various speeds, including full speed. Established communication between "level" and the boat.
3. Selected the "static" point for initial measurements, which was the point at which the vessel was to hold station.
4. Planned the "settlement and squat" survey line through "static". The vessel ran this line at various shaft RPM settings to make settlement and squat measurements. The line ran more nearly toward the "level" than across in front of it. This made it more likely that the observer was able to focus on and read, or direct the reading, of the level rod on the boat. For this reason, a breakwater end was chosen.
5. Marked a spot on the vessel above the attitude sensor (IMU) so that the level rod was always held at the same point on the boat.
6. Stopped the vessel at "static" with the starboard side toward "level".
   A. Held the rod on mark with face toward "level".
   B. Adjusted the rod target according to signals from "level".
   C. On signal from "level", recorded time and rod reading from target.
   D. Repeated the reading at least three times.
   E. The NOAA water level gauge at Newport was used to record water levels.
7. On a signal from the surveyor at "level", made way on "settlement and squat" survey lines at predetermined shaft RPM.
   A. On survey track, held rod on mark with face toward "level".
   B. Adjusted rod target according to signals from "level".
   C. On signal from "level", recorded time and rod reading from target. Readings were taken as nearly as possible at "static" to reduce errors from level instrument adjustment and earth curvature.
   D. Repeated the reading at least three times.
   E. The NOAA water level gauge at Newport was used to record water levels.
8. Increased speed to the predetermined shaft RPM settings up to and including full speed, and reran "settlement and squat" tests as described in Step 7.
9. Computed the **settlement and squat** correctors:

A. Computed the water level correctors from the time of the "static" reading to the time of each of the shaft RPM observations. (Water level during shaft RPM pass minus water level "static").
B. Applied the water level corrector to each of the shaft RPM rod observations.
C. Subtracted the corrected rod reading at each shaft RPM from the rod reading at "static". These differences are the settlement and squat correctors to be applied when operating at the corresponding shaft RPM.
D. Constructed a lookup table of shaft **RPM** and **settlement and squat correctors** so that the computer may interpolate a corrector based upon the shaft RPM entered into the system during the survey.
E. Entered these values in the **iss2000 .cfg** file.

All results are reported in Table App. E-4, Appendix E. *

5. Roll, Pitch and Heading Biases

The following sensor was used for acquisition of Heave, Roll, Pitch and Heading data:

- TSS POS/MV Inertial Navigation System, Serial Number 314

The POS/MV was used for heave, roll, pitch, and heading. The accuracy of the sensor was five percent of one meter or five centimeters for heave, ± 0.10° dynamic accuracy for roll and pitch, and ± 0.05° static accuracy for roll and pitch. The dynamic heading accuracy of the unit is better than 0.05°.

Heading, roll, and pitch biases were determined in a series of tests performed in the Narragansett Bay during the Sea Acceptance Test. Prior to conducting any of the tests, an SVP was calculated from the MVP-30 and entered into the RESON system. Initially, the roll, pitch, and heading biases were set to 0° in the RESON system.

For this project SAIC has used a combination of the **geoswath** editor and a spreadsheet to compute the roll bias between the POS/MV IMU and the transducer. This technique was developed and used on the Gulf of Mexico project for roll bias determination over flat bottom. Because the bottom is seldom truly flat, the test is accomplished by running the same line in opposite directions over a smooth bottom. An area is selected for the measurements, and an equal number of port and starboard depth pairs is measured from each direction. The apparent port to starboard slope of the bottom is computed for each pair of measurements. Averaging the equal number of slopes from each direction removes the bottom slope and leaves the roll bias. If a roll bias was in the system at the time of the test, it is added algebraically to the apparent slope to compute the values to be averaged.

On Julian day 132, three separate determinations of roll bias were made and then averaged for a bias value of 0.18.

Roll bias results are shown in Table App. E-2 in Appendix E.*

After the roll bias was calculated and entered into the RESON system, timing latency test and then pitch bias tests were conducted. Timing latency testing was conducted by running the same line in the same direction, at slow speeds then at fast speed, over distinct rocks on the bottom. The **geoswath** editor was used to measure the positions of the rocks from data taken at the two speeds. Differences in positions of the rocks were less than one meter and were both positive and

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negative in sign as well as across track. This indicated no timing latency, only the scatter associated with DGPS positioning.

Pitch bias testing was conducted by running the same line as for timing latency, but in the opposite direction at the same speed. Positioning of the rocks was similar to the timing results, indicating no pitch bias. Since there was no discernable timing latency or pitch bias as a result of these tests, a bias of 0.0° was kept in the system for the survey.

Following the roll and pitch bias tests, a heading bias test was conducted by running parallel lines in opposing directions so that the outer beams of adjacent swaths ensonified the same rocks used for timing and pitch. Positioning of the rocks was similar to the results of the timing and pitch tests, indicating no heading bias. Therefore, a heading bias of 0.0° was kept in the system for this survey.

Table App. E-5 contains the results of the Accuracy test conducted on JD 134. Roll, pitch, and heading biases applied in H10646 are shown in Table G-1.

Table G-1. Roll, Pitch, and Heading Bias for the R/V OceanExplorer

Julian Days	203-224
Roll	0.18
Pitch	0.00
Heading	0.00

H. HYDROGRAPHIC POSITION CONTROL

SEE ALSO THE EVALUATION REPORT

The following equipment was used for positioning on the **R/V OceanExplorer**:

- TSS POS/MV, Serial Number 314
- Trimble 7400 GPS Receiver, Serial Number 3713A18839
- Trimble Probeacon Differential Beacon Receiver, Serial Number 0220159406
- Leica MX41R Differential Beacon Receiver, Serial Number 3508-102-18550

The primary hydrographic positioning equipment was the POS/MV, which used correctors from the USCG differential station at Brunswick, ME. The **iss2000** monitored HDOP, number of satellites, elevation of satellites, and age of correctors to ensure the resulting hydrographic positioning errors did not exceed five meters at the 95% confidence level. On several occasions age of correctors jumped to between 20 and 25 seconds, with a single jump to 29 seconds. Duration of these jumps was generally less than 3 seconds, with a maximum duration of 12 seconds.

Daily position confidence checks were established using a Trimble DGPS with correctors from the U.S. Coast Guard station at Penobscot, ME. A real-time monitor raised an alarm when the two DGPS positions differed by more than 10 meters horizontally. Positioning confidence checks were well within the allowable inverse distance of less than 5 meters.

All antenna and transducer offsets were measured relative to the POS/MV's IMU. Two separate teams of two people measured and calculated all offsets using a measuring tape. The final offsets from both teams were compared and were found to agree.

I. SHORELINE

Not applicable, shoreline verification was not required.

J. CROSSLINES

There were 41 linear nautical miles of cross lines surveyed and 800 linear nautical miles of main scheme lines surveyed resulting in 5 percent coverage by cross lines.

Comparisons of all crossing data in H10646 show that 68 % of comparisons are within 30 centimeters and 77 % of comparisons are within 40 centimeters. The 23 % of comparisons larger than 40 centimeters are accounted for by the normal small DGPS position scatter in areas of steep slope and rocky bottom. Table J-1 shows the comparisons using all crossings in H10646.

Table J-1. Junction Analysis All Main Scheme vs. Cross Lines, H10646

Depth Difference Range			All Difference		Positive Difference		Negative Difference		Zero Difference
From		To	Count	Cumulative Percent	Count	Cumulative Percent	Count	Cumulative Percent	Count
00.0cm	->	10.0cm	276596	31.56	112197	41.71	148355	25.08	16044
10.0cm	->	20.0cm	186923	52.88	74923	69.56	112000	44.02	
20.0cm	->	30.0cm	136261	68.43	38550	83.88	97711	60.54	
30.0cm	->	40.0cm	74854	76.97	15300	89.57	59554	70.61	
40.0cm	->	50.0cm	51352	82.82	10130	93.34	41222	77.58	
50.0cm	->	60.0cm	32931	86.58	4950	95.18	27981	82.31	
60.0cm	->	70.0cm	21836	89.07	3658	96.54	18178	85.38	
70.0cm	->	80.0cm	18940	91.23	2574	97.49	16366	88.15	
80.0cm	->	90.0cm	12683	92.68	1584	98.08	11099	90.03	
90.0cm	->	100.0cm	9886	93.81	1251	98.55	8635	91.49	
100.0cm	->	110.0cm	54269	100.00	3907	100.00	50362	100.00	1.79
sub-totals ->			876531	100.00	269024	30.69	591463	67.48	16044
									1.79%
H10646 Cross Line Sounding Minus Main Scheme Sounding, approximately 800 crossings.									

Comparisons at 80 crossings in 12 different areas of H10646 comprise approximately 10% of the crossings in the survey, and are listed in the separates* to this report. These comparisons were made over relatively flat bottom, and reflect main scheme soundings taken on several different days. These comparisons show 90.1% are within 40 centimeters and 95.0% are with in 50 centimeters.

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K. JUNCTIONS SEE ALSO THE EVALUATION REPORT

The H10646 survey junctions with H10986 (2000). Table K-1 lists the Junction Analysis using all comparisons in the common area. These comparisons show 58.25% were within 50 centimeters. Differences exceeding 50 centimeters are attributed to position differences in steeply sloping and rocky bottom. Table K-1. lists the Junction Analysis using comparisons in areas of relatively flat bottom. These comparisons show 82.35% were within 40 centimeters and 97.71% were within 50 centimeters.

Table K-1. Junction Analysis H10646, vs. H10986 (all comparisons)

Depth Difference Range			All Difference		Positive Difference		Negative Difference		Zero Difference
From		To	Count	Cumulative Percent	Count	Cumulative Percent	Count	Cumulative Percent	Count
00.0cm	->	10.0cm	11958	12.17	5762	8.79	5500	17.18	696
10.0cm	->	20.0cm	11597	23.97	7355	20.01	4242	30.43	
20.0cm	->	30.0cm	13036	37.24	8974	33.7	4062	43.12	
30.0cm	->	40.0cm	10416	47.84	7704	45.45	2712	51.59	
40.0cm	->	50.0cm	10227	58.25	7962	57.6	2265	58.67	
50.0cm	->	60.0cm	6710	65.08	4831	64.97	1879	64.54	
60.0cm	->	70.0cm	5809	70.99	4458	71.77	1351	68.76	
70.0cm	->	80.0cm	5256	76.34	3856	77.65	1400	73.13	
80.0cm	->	90.0cm	3580	79.98	2556	81.55	1024	76.33	
90.0cm	->	100.0cm	3482	83.52	2555	85.45	927	79.23	
100.0cm	->	110.0cm	16190	100	9540	100	6650	100	
sub-totals ->			98261		65553		32012		696
H10646 Sounding Minus H10986 Sounding Junction Analysis, all comparisons									

Table K-2. Junction Analysis H10646, vs. H10986 (flat bottom)

Depth Difference Range			All Difference		Positive Difference		Negative Difference		Zero Difference
From		To	Count	Cumulative Percent	Count	Cumulative Percent	Count	Cumulative Percent	Count
00.0cm	->	10.0cm	1205	24.88	632	17.00	488	46.88	85
10.0cm	->	20.0cm	1213	49.93	865	40.27	348	80.31	
20.0cm	->	30.0cm	773	65.89	594	56.26	179	97.50	
30.0cm	->	40.0cm	797	82.35	773	77.05	24	99.81	
40.0cm	->	50.0cm	744	97.71	743	97.04	1	99.90	
50.0cm	->	60.0cm	81	99.38	80	99.19	1	100.00	
60.0cm	->	70.0cm	26	99.92	26	99.89	0	100.00	
70.0cm	->	80.0cm	4	100.00	4	100.00	0	100.00	
80.0cm	->	90.0cm	0	100.00	0	100.00	0	100.00	
90.0cm	->	100.0cm	0	100.00	0	100.00	0	100.00	
100.0cm	->	110.0cm	0	100.00	0	100.00	0	100.00	
sub-totals ->			4843		3717		1041		85
H10646 Sounding Minus H10986 Sounding Junction Analysis, flat bottom									

L. COMPARISON WITH PRIOR SURVEYS SEE ALSO THE EVALUATION REPORT

Comparison with prior surveys was not required under this contract; see Section N for comparison to the nautical chart.

M. ITEM INVESTIGATION REPORTS

AWOIS item 10426, a charted wreck covered 79 feet as reported on OPR-A329-RU is outside the limits of H10646.

N. COMPARISON WITH THE CHART SEE ALSO THE EVALUATION REPORT

H10646 was compared to Chart 13290, 33rd edition, 04 March 2000 at scale 1:40,000, Chart 13292, 35th edition, 04 March 2000 at scale 1:20,000, Chart 13288, 39th edition, 06 November 1999 at scale 1:80,000, and Chart 13260, 37th edition, 07 March 1999 at scale 1:378,838.

Recommend reconstruction of the common areas of all listed charts using data from these surveys. Recommend removal of the charted green tint and associated wire drag clearance symbols in the common areas. CONCUR

The following discrepancies were noted during chart comparisons:

In the vicinity of a charted 57 feet, position 43 35 19.67N, 070 07 38.82W, a depth of 89 feet was found for H10646. CONCUR PRESENT SURVEY DEPTHS ARE 79-89 FEET.

In the vicinity of a charted 57 feet, position 43 36 55.12N, 070 07 28.80W, a depth of 69 feet was found for H10646. CONCUR

In the vicinity of a charted 57 feet, position 43 35 12.53N, 070 06 38.03W, a depth of 82 feet was found for H10646. CONCUR. THE 57FT HAS BEEN SUPERCEDED ON THE 35TH EDITION OF CHART 13290

In the vicinity of a charted 33 feet, position 43 35 10.37N, 070 05 21.440W, a depth of 56 feet was found for H10646. CONCUR. THE 33FT HAS BEEN SUPERCEDED ON THE 35TH EDITION OF CHART 13290.

In the vicinity of a charted 67 feet, position 43 37 48.85N, 070 01 02.690W, a depth of 100 feet was found for H10646. CONCUR

Between charted 68 feet, position 43 37 02.4N, 070 01 29.3W, and the next charted 167 feet to the north west H10646 has depths of 61 and 63 feet. CONCUR

Numerous similar discrepancies occur throughout the survey because of the full coverage by H10646 compared to the partial coverage of previous surveys. CONCUR

Features

There were no items determined to be Dangers to Navigation on H10646. CONCUR

O. ADEQUACY OF SURVEY See also the Evaluation Report

Not used by Contractor.

P. AIDS TO NAVIGATION

U.S. Coast Guard buoys were found on station as listed in Table P-1. These buoys adequately serve their purpose. Concur

Table P-1. U.S. Coast Guard Buoys

Latitude	Longitude	Buoy Descriptor
43 36 30.3N	070 02 06.6W	G "1EC", Fl G 6s
43 36 01.9W	070 04 00.8W	RG N "BS"

Q. STATISTICS

Survey statistics are as follows:

905 nm	Linear nautical miles of sounding lines (multibeam)
21.6 nm^2	Square nautical miles of multibeam
18	Days of data acquisition
0	Number of detached positions
0	Number of bottom samples
80	Number of sound velocity casts
0	Number of tide stations installed

R. MISCELLANEOUS See also the Evaluation Report

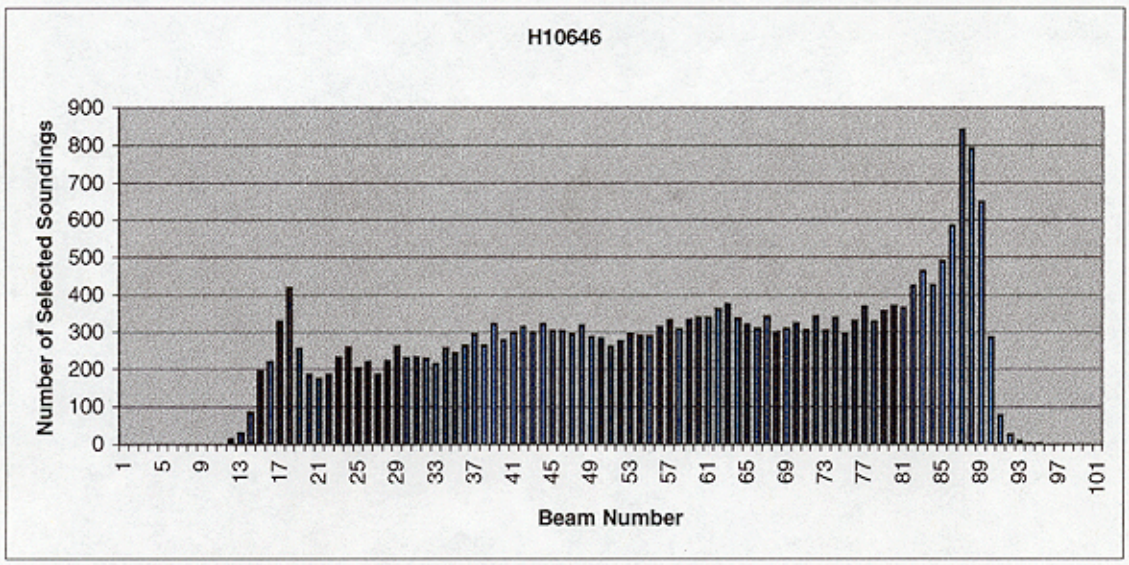


Figure R-1. Histogram of Selected Soundings by Beam Number – H10646

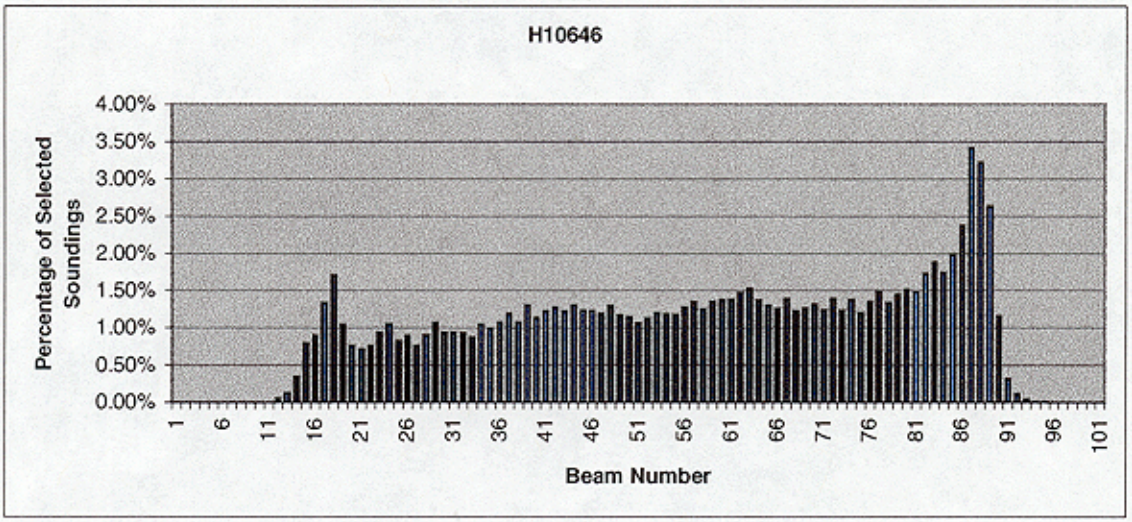


Figure R-2. Histogram of Percentage of Selected Soundings by Beam Number - H10646

S. RECOMMENDATIONS

Recommend the entire common area of charts 13292, 13290, 13288, and 13260 be reconstructed with data from this survey. There are no recommendations for further investigation. CONCUR

T. REFERRAL TO REPORTS

None.

September 22, 2000

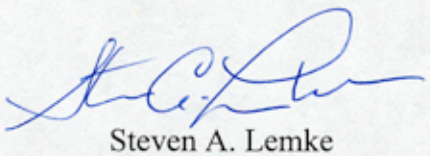
LETTER OF APPROVAL

REGISTRY NUMBER H10646

This report and the accompanying smooth sheet are respectfully submitted.

Field operations contributing to the accomplishment of survey H10646 were conducted under my direct supervision with frequent personal checks of progress and adequacy. This report and smooth sheet have been closely reviewed and are considered complete and adequate as per the Statement of Work.

SCIENCE APPLICATIONS INTERNATIONAL CORPORATION



Steven A. Lemke
Hydrographer
September 22, 2000

ATLANTIC HYDROGRAPHIC BRANCH
EVALUATION REPORT FOR H10646 (2000)

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.

D. AUTOMATED DATA ACQUISITION AND PROCESSING

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

MicroStation J, version 7.01
MapInfo, version 6.0
Caris HIPS/SIPS, version 5.1
NADCON, version 2.10
I/RAS B, version 5.01

The smooth sheet was plotted using a Hewlett Packard DesignJet 2500CP plotter.

H. HYDROGRAPHIC POSITION CONTROL

Horizontal control used for this survey during data acquisition is based upon the North American Datum of 1983 (NAD 83).

K. JUNCTIONS

H10986 (2000) to the south

A standard junction was effected between the present survey and survey H10986 (2000).

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

L. COMPARISON WITH PRIOR SURVEYS

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

N. COMPARISON WITH CHARTS 13290 (35th Edition, Aug/03) 13292 (36th Edition, Mar 16/02)

The charted hydrography originates with prior surveys and requires no further consideration. The hydrographer makes an adequate comparison in section N. of the Descriptive Report. Attention is directed to the following:

1. A charted Discontinued Disposal Area, in the vicinity of Latitude 43°37'22.30"N, Longitude 70°06'52.00"W, was fully developed using 100% multibeam. Present charted depths in the disposal area are from surveys of 1941 and 1969-1970. It is recommended that the charted discontinued Disposal Area limits and note be removed and the area be charted as shown on the present survey.

2. Bache Rk is presently charted with a least depth of 25 feet in Latitude 43°35'33.30"N, Longitude 70°05'25.00"W. The area was fully investigated using 100% multibeam. The shoalest depth found by the preset survey is 24 feet in Latitude 43°35'40.16"N, Longitude 70°05'18.70"W. It is recommended that the charted Bache Rk be revised to reflect present survey depths.

3. Charted Bulwark Shoal with a depth of 11 feet in the Latitude 43°36'03.90"N, Longitude 70°04'20.70"W was fully developed using 100% multibeam. The shoalest depth found by the present survey is 13 feet in Latitude 43°36'05.45"N, Longitude 70°04'21.33"W . It is recommended that the area of Bulwark Shoal be revised to reflect present survey depths.

4. East Cod Ledge Rk is presently charted with a least depth of 45 feet in Latitude 43°35'35.30"N, Longitude 70°02'55.50"W. The area was fully investigated using 100% multibeam. The shoalest depth found by the present survey is 46 feet on Latitude 43°35'36.52"N, Longitude 70°02'54.91"W. It is recommended that East Cod Ledge Rk be revised to 46 feet.

5. Round Shoal is presently charted with a least depth of 31 feet in Latitude 43°36'06.50"N, Longitude 70°02'25.80"W. The area was fully investigated using 100% multibeam. The shoalest depth found by the present survey is 32 feet in Latitude 43°36'07.31"N, Longitude 70°02'25.18"W. It is recommended that the chart be revised to reflect present survey depths.

6. A charted 63-ft depth, in the vicinity of Latitude 43°35'27.20"N, Longitude 70°06'42.90"W was developed using

100% multibeam. The shoalest depth found by the present survey is 68 feet in Latitude 43°35'26.60"N, Longitude 70°06'46.59"W. It is recommended that the chart be revised to reflect present survey depths.

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

O. ADEQUACY OF SURVEY

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

R. 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.

The following NOS Charts were used for compilation of the present survey:

13292 (36th Edition, Mar 16/02)
13290 (35th Edition, Aug/03)
Corrected Through NM July 26, 2003
Corrected Through LNM July 8, 2003

Toshihiko Uozumi
Physical Scientist
Verification of Field Data
Evaluation and Analysis

APPROVAL SHEET
H10646 (2000)

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 digital data have been completed and all revisions and additions made to the smooth sheet during survey processing have been entered in the digital data for this survey. The survey records and digital data comply with NOS requirements except where noted in the Evaluation Report.

R. H. Whitfield Date: 9/4/2003

Richard H. Whitfield
Cartographer,
Atlantic Hydrographic Branch

I have reviewed the smooth sheet, 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: E. B. Christman Date: 9/4/2003

Emily B. Christman
Commander, NOAA
Chief, Atlantic Hydrographic Branch

AWOIS ✓ & SURF ✓ by MBH 9/11/03

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. H10646

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
13292	8/12/03	[illegible]	Full ~~Part Before~~ After Marine Center Approval Signed Via
			Drawing No.
13290	8/28/03	[illegible]	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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SUPERSEDES C&GS FORM 8352 WHICH MAY BE USED