

10511

NOAA FORM 76-35A

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

## DESCRIPTIVE REPORT

*Type of Survey* ..... Hydrographic.....  
*Field No.* ..... RU-10-3-93.....  
*Registry No.* ..... H-10511.....

### LOCALITY

*State* ..... Massachusetts.....  
*General Locality* ..... Buzzards Bay.....  
*Sublocality* ..... 2.25 NM North of.....  
Cleveland Ledge Light

19 93

### CHIEF OF PARTY

LCDR. D.R. Herlihy.....

### LIBRARY & ARCHIVES

DATE ..... April 4, 1995.....

**HYDROGRAPHIC TITLE SHEET**

H-10511

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.

RU-10-3-93

State Massachusetts

General locality Buzzards Bay

Locality 2.25 NM North of Cleveland Ledge Light

Scale 1:10,000 Date of survey October 7 to November 3, 1993

Instructions dated May 3, 1993 Project No. OPR-B616-RU-93

Vessel NOAA Ship RUDE (9040)

Chief of party LCDR Daniel R. Herlihy, NOAA

Surveyed by D. R. Herlihy, T. A. Nichel, R. T. Brennan & T. A. Haupt

Soundings taken by echo sounder, hand lead, pole

Graphic record scaled by TAN, RTB & TAH

Graphic record checked by TAN, RTB & TAH

Protracted by N/A Automated plot by N/A Zata Plotter

Verification by N/A Atlantic Hydrographic Section (AHS)

Soundings in fathoms feet at MLW MLLW meters at MLLW

REMARKS: All times recorded in UTC.

Notes in the original Descriptive Report  
were made in Red during office processing

1-299  
DA 4/1/95 AWOIS and SURF ✓ RWD 5/95



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**A. PROJECT**

**A.1** This survey was conducted in accordance with Hydrographic Project Instructions OPR-B616-RU, Buzzards Bay, Nantucket and Vineyard Sounds, Massachusetts.

**A.2** The original date of the instructions is May 3, 1993.

**A.3** There have been two changes to these instructions:

- Change No. 1 dated July ~~30~~<sup>23</sup>, 1993
- Change No. 2 dated October ~~20~~<sup>13</sup>, 1993

**A.4** This Descriptive Report covers the survey of two general anchorages, designated as "C" and "D", conducted on sheet "A" of project B616-RU-93 in the Buzzards Bay navigation corridor as specified by the project instructions.

**A.5** Project OPR-B616-RU responds to requests from the U.S. Coast Guard and the Coast and Geodetic Survey's Mapping and Charting Branch to investigate certain reported submerged wrecks and obstructions in Buzzards Bay and to complete surveys of the four general anchorages in Buzzards Bay.

**B. AREA SURVEYED**

This survey encompasses the two general anchorages, designated as "C" and "D", located on either side of the southern end of Cleveland Ledge Channel, approximately two nautical miles north of Cleveland Ledge Light. The exact boundaries of the anchorages are as follows, beginning with the northernmost point and working clockwise:

<u>Anchorage C</u>		<u>Anchorage D</u>	
41°40'48"N	070°40'57"W	41°40'48"N	070°40'20"W
41°39'14"N	070°41'33"W	41°40'28"N	070°39'54"W
41°39'49"N	070°42'32"W	41°40'00"N	070°40'16"W
41°40'48"N	070°41'54"W	41°38'48"N	070°40'50"W
		41°39'03"N	070°41'13"W
		41°40'20"N	072°40'45"W

The data collection for this survey began on October 7, 1993 (DN 280) and concluded on November 3, 1993 (DN 307).

**C. SURVEY VESSELS**

C.1 The NOAA Ship RUDE (S590), EDP number 9040, was the only vessel used during this survey.

C.2 No unusual vessel configurations or problems were encountered.

**D. AUTOMATED DATA ACQUISITION AND PROCESSING**

D.1 Survey data acquisition and processing were accomplished using the HDAPS system with the following software versions:

Program	Version	Dates Used
DAS_SURV	6.38	280 - 307
POSTSUR	6.01	280 - 307

D.2 Other software includes VELOCITY 2.0, dated December 18, 1992, used to generate sound velocity corrector tables.

D.3 No non-standard automated acquisition or processing methods were used.

**E. SONAR EQUIPMENT**

E.1 Side scan sonar operations were conducted using an EG&G Model 260 image corrected side scan sonar recorder and a Model 272-T single frequency towfish. All side scan operations were conducted from the RUDE (vessel # 9040). The following list shows equipment serial numbers and corresponding dates used:

Equipment Type	Serial Number	Dates Used
Recorder	10884	285 - 295
Towfish	11901	285 - 295

E.2 The side scan sonar towfish was configured with a 20° beam depression, which is the normal setting and yields the best beam correction.

E.3 The 100 kHz frequency was used throughout this survey.

E.4 a) The 50-meter range scale was generally used for this survey. Given the average depth of water in the search area, this range scale was used to provide optimum contact resolution. The 100-meter and 75-meter range scales were also used for short periods during the start of side scan operations, before it was determined that the 50-meter range scale was the most practical throughout this survey area.

There were isolated areas where the sea floor rose up sharply, causing the coverage to narrow. These areas of reduced coverage were easily recognized because the on-line swath plot would "neck down" leaving "holidays", or areas with no overlap. To compensate for this lack of coverage, holiday coverage was run to close these gaps. All side scan coverage was ultimately checked with a smooth plot to ensure proper overlap between consecutive lines.

The current Field Procedures Manual (FPM) specification was used to determine maximum line spacing with Differential GPS positioning:

$$LS_{max} = 2RS - 2EPE_{max}$$

where: RS = range scale

EPE = expected position error

For a 1:10,000-scale survey, a maximum EPE of 15 meters is permitted. Using this value in the above equation, a maximum line spacing of 170 meters for RS = 100 meters, 120 meters for RS = 75 meters and 70 meters for RS = 50 meters is authorized. Data collected with an EPE of 15 or greater was either rejected or smoothed in the post-processing phase of the survey, so the maximum line spacing was never exceeded. In fact, since the actual EPE observed during the majority of the survey was considerably less than 15 meters, in order to maximize surveying efficiency, a line spacing of 80 meters was used with the primary 50-meter range scale. The actual line spacing for the other two range scales briefly utilized was 160 meters (RS = 100) and 120 meters (RS = 75).

Expected Position Error (EPE) values in excess of the 15 meters may be seen in the raw data printout, most typically ranging between 408.2 and 409.2. These values were not considered in the line spacing calculations shown above due to their acceptable corresponding Horizontal Dilution of Precision (HDOP) values. These excessive values were investigated in the HDAPS Graphic Sounding Edit program. The excessive EPE values were consistently found to be erroneous when accompanied by an acceptable HDOP value. The high EPE values appear to be caused by an HDAPS software deficiency.

b) Confidence checks were obtained by noting recognizable bottom characteristics at the edges of the sonar range scale in use. Features such as lobster pots and anchor drag marks were commonly used for this purpose.

c) Two hundred percent side scan sonar coverage was completed for this survey.

d) Large areas of the bottom on this sheet consisted of soft silt and sand. Due to the inherent characteristics of this bottom composition and the lack of contacts found there, there are segments of data with gaps between confidence checks. It is the opinion of the hydrographer that this data is acceptable due to confidence checks seen before and after these barren areas.

Except as noted above, all side scan sonar records acquired during this survey were clear with excellent returns. There were a few occasions when the side scan sonar towfish became entangled in lobster trap buoy lines, temporarily whiting out the sonagram. On these occasions, the towfish was brought on board, inspected and serviced as necessary, with all affected data subsequently being rejected.

e) The towfish was deployed exclusively from the stern during this survey.

E.5 Significant contacts were grouped into "developments" and examined by intensive echo sounder investigation. Tight line spacing, at times as close as 5 meters, was used to conduct these investigations.

None of the contacts investigated by echo sounder were deemed hazardous enough to warrant diver investigations, and none were conducted.

E.6 Overlap was checked on line using the real-time swath plot, with the edited swath plot used to identify holidays.

#### **F. SOUNDING EQUIPMENT**

F.1 All hydrographic soundings were acquired using a Raytheon 6000N Digital Survey Fathometer (S/N: A107).

F.2 No other sounding equipment was used for this survey.

F.3 There were no faults in sounding equipment which affected the accuracy or quality of the data.

**F.4** Both the high (100 kHz) and low (24 kHz) frequency sounding data were recorded during data acquisition. Only high frequency soundings were plotted.

**G. CORRECTIONS TO SOUNDINGS**

**G.1 a)** The velocity of sound through water was determined using an Odom Digibar Sound Velocity Probe (S/N 169). A Data Quality Assurance Test was conducted before each velocity cast to ensure the meter was operating within tolerance. Generally, velocity casts were conducted weekly with few exceptions.

All data were processed using Velocity 2.00 software. The computed velocity correctors were entered into the HDAPS sound velocity table and applied on line to both high and low frequency soundings. The sound velocity correctors applied to this survey are based on the casts recorded on the following dates:

Cast Number	Date	Latitude	Longitude	HDAPS Table #	Applied to Days
39	286	41°39.3'N	070°41.1'W	39	280-288
40	293	41°39.8'N	070°41.3'W	40	291-295
41	301	41°39.6'N	070°41.3'W	41	298-307

**G.1 b)** There was no variation in the DSF-6000N instrument initial.

**c)** No instrument correctors to the DSF-6000N were required.

**d)** A dual leadline comparison with the DSF-6000N was made in the project area:

DN 076 at 41°27.0'N and 70°54.0'W (38 ft depths)

The greatest variation between leadline and DSF soundings was 0.1 meters. Considering the ship's motion and the wire angle in the leadline from current (approximately 5°), this is excellent agreement and provides an adequate check that the echo sounder was functioning properly. \*Data from these comparisons are on file at the Atlantic Hydrographic Section in Norfolk, Virginia.

*Filed with original field records*

Both of the leadlines used in the leadline to DSF-6000N comparison were calibrated by steel tape prior to the above comparison. An average leadline correction of -0.45 feet was applied in comparisons between the DSF-6000N and the ship's leadlines.

e) All sounding correctors were applied to both the narrow (100 kHz) and wide (24 kHz) DSF-6000N beams.

f) During the winter 1988 dry dock period, an exact vertical measurement was taken from the DSF transducer to a fixed point on the bridge wing. After the ship was re-floated, the height above the waterline was determined for this point. The ship's static draft was thereby calculated to be exactly 2.26 meters (7.4 feet). This draft value was applied to the sounding data via the HDAPS offset table.

g) Settlement and squat correctors for the RUDE were determined on the Elizabeth River, Norfolk, Virginia on March 3, 1993. An observer, stationed with a level on a pier, measured changes in relative height by sighting to a staff held at the longitudinal position of the ship's transducer. The ship steamed directly toward and then away from the observer. The toward and away runs were averaged and applied to soundings through the HDAPS offset table.

h) Heave data were acquired by a Datawell heave, roll and pitch sensor (S/N 19128-C), and were applied to soundings in real time. Only the heave corrections were applied to the plotted soundings.

\*See Separate IV for data records. *Filed with original field records*

G.2 There were no unusual or unique methods or instruments used for correcting echo soundings.

G.3 Generally, sound velocity correctors resulting from weekly velocity casts were re-applied to the data acquired that entire week. Section G.1 a) gives the periods during which each set of velocity cast correctors were used.

G.4 Pneumatic depth gauges were not required for this survey as no diver investigations were conducted.

G.5 Generally, sea conditions greater than one meter affected the sounding record, creating a trace of constant peaks and deeps. Application of heave correctors to raw echo soundings appeared to accurately represent true depths.

G.6 a) The tidal datum for this project is Mean Lower Low Water. The operating tide station at Newport, Rhode Island (845-2660) served as direct control for datum determination. This station also served as the reference station for predicted tides. Data for predicted tides were provided on floppy disk before the start of the project.

b) Tidal data used during data acquisition were obtained from Table 2 of the East Coast of North and South America Tide Predictions, and applied to the digital tide data using the HDAPS software. The subordinate station for predicted tides was:

NO.	PLACE	POSITION	TIME		HEIGHT	
			High Water	Low Water	High Water	Low Water
1129	Mattapoissett, Mattapoissett Harbor	41°39'N 70°49'W	+0 11	+0 20	*1.09	*1.00

Tidal correctors were applied on line using HDAPS predicted tide table # 10 and 11 (October and November).

*Approved tides were applied during office processing*  
c) Zoning for this project is consistent with the project instructions.

A request for smooth tides was mailed on November 4, 1993.

#### H. CONTROL STATIONS

H.1 The horizontal datum for this project is the North American Datum of 1983 (NAD 83).

H.2 This survey was conducted exclusively using Differential GPS, which precluded the need for any shore based horizontal control stations.

H.3 No horizontal control stations were used or established for this survey.

H.4 No horizontal control stations were used or established for this survey.

H.5 Verification of horizontal control was not necessary since no land-based horizontal control stations were used.

H.6 There are no photogrammetric problems, positioning problems or unconventional survey methods pertinent to this survey.

## **I. HYDROGRAPHIC POSITION CONTROL**

**I.1** This survey was conducted exclusively using Differential GPS positioning.

**I.2** Accuracy requirements were met as specified by the Hydrographic Manual and Field Procedures Manual (FPM). The Horizontal Dilution of Precision (HDOP) and Expected Position Error (EPE) specified by the FPM were monitored during on line data collection. When these values exceeded the allowable limits (HDOP = 3.35, EPE = 15), survey operations were suspended until the Differential GPS improved. If the positioning degraded beyond the acceptable limits while on line, the data were either smoothed or rejected depending upon the extent of the affected data.

**I.3** Control Equipment:

### **DGPS**

Unit A:

Ashtech GPS Sensor  
S/N 700417B1083  
Firmware Version: 1E06D-P  
Magnavox MX50R DGPS Receiver S/N 078

Unit B:

Ashtech GPS Sensor  
S/N 700417B1012  
Firmware Version: 1E06D-P  
Magnavox MX50R DGPS Receiver S/N 160

Correctors were received from both the Montauk, New York and Portsmouth, New Hampshire radio beacons for the entire survey.

**I.4** The Differential GPS system requires no calibrations to its equipment from outside sources. However, to check the position accuracy of the DGPS system, a daily performance check was conducted. The Shipboard Data Integrity Monitor (version 1.2), or "SHIPDIM", program was utilized to conduct these performance checks.

For a DGPS performance check, section 3.4.5 of the FPM states that a DGPS performance check may be conducted using "SHIPDIM" when "two independent reference beacons are receivable, and two remote receivers are available on the ship. Each remote receives correctors from a different reference, then the computed positions are compared." The computed inverse between the check receiver and the reference receiver must not exceed  $\Delta P_{max}$ , where:

$$\text{delta } P_{\text{max}} = \text{SQRT} [ (\text{EPE})^2 + (\text{ECR})^2 ]$$

delta  $P_{\text{max}}$  = Maximum allowable inverse distance  
between the DGPS and check position

EPE = Expected Position Error of the DGPS  
position

ECR = Error Circle Radius of the check position

"SHIPDIM" compares four sample positions from both the check and reference receivers. Three of the four checks must be less than the delta  $P_{\text{max}}$  for a successful performance check.

I.5 No calibration data were required to be applied to the raw positioning data because DGPS was the primary positioning system.

I.6 a) There were no unusual methods used to calibrate or operate the electronic positioning equipment.

b) No shipboard DGPS malfunctions were experienced during the times of hydrography for this survey.

c) During times of heavy rains and/or thunderstorms, the ship would experience periods of intermittent service from either the Montauk, New York or the Portsmouth, New Hampshire radio beacons, or both, depending on the location of the degraded weather at the time. During such instances, control would be switched to the reference beacon sending the strongest, most interference-free signal. If both the Montauk and Portsmouth beacons were experiencing periods of degraded weather, the survey operations were suspended until such time as service from one or both beacons had resumed.

d) During the periods when local weather affected the DGPS radio beacons as described in section I.6.c, the on-line positioning would unexpectedly "drop out". These instantaneous outages were associated only with weather related beacon interference. During times of poor satellite coverage or geometry, there would be a steady deterioration of the HDOP which could be continuously monitored. Such weather-related outages could occur often, sometimes every few minutes, making it nearly impossible to begin or complete a survey line. The duration of these outages ranged from half an hour to a couple of hours.

e) No systematic errors were detected which required adjustments.

f) Antenna positions were corrected for offset and layback, and referenced to the position of the DSF-6000N transducer. These correctors were located in the HDAPS offset table, and applied on line to the positioning algorithm. A copy of the HDAPS offset table #1 is on file at AHS. ✕

g) Offset and layback distances for the A-frame (tow point) were located in the HDAPS offset table and applied on line. These offsets, along with the cable length, towfish height, and depth of water, were used by the HDAPS system to compute the position of the towfish. A copy of the HDAPS offset table #1 is on file at AHS. ✕

#### J. SHORELINE

No shoreline is contained within the boundaries of this survey.

#### K. CROSSLINES

A total of 9.38 nautical miles of crosslines were obtained for this survey, which represents 19.2% of the first 100% side scan mainscheme coverage.

An un-excessed plot of mainscheme soundings with crosslines superimposed was used to conduct mainscheme to crossline sounding comparisons. Soundings at intersections were compared to all other soundings within a 5 mm (50 meter) radius. Based on this procedure, agreement between mainscheme and crossline soundings was found to be excellent in all areas. The differences observed between soundings was generally one foot or less.

#### L. JUNCTIONS

L.1 There are no contemporary surveys which junction with this survey.

L.2 Not applicable.

L.3 Not applicable

L.4 Not applicable.

*\* filed with original field records*

**M. COMPARISON WITH PRIOR SURVEYS**

A comparison with prior surveys will be performed by the Atlantic Hydrographic Section as part of the office verification process.

**N. ITEM INVESTIGATION REPORTS**

**N.1.1 Area of Investigation**

AWOIS 7919

Buzzards Bay

Reported Position:

41°40'05.38"N

070°40'15.11"W

Datum: NAD83

Reported depths: 27-foot depths located in area  
of flat bottom

Feature: obstruction, rock

**N.2.1 Description and Source of Item**

This item is listed as a "dangerous sunken rock" reported in 1971 in Anchorage "D". The area was cleared in one direction to 20 feet during survey H-3391WD. The item was not reviewed during survey H-9712/1977, which reported 27-foot depths and a flat bottom in the general position of this reported item.

**N.3.1 Survey Requirements**

This item required two hundred percent side scan sonar coverage over a modified 250-meter search radius (a small portion of the eastern end of the search area being excluded due to depths too shallow to be surveyed), echo sounder development and a diver investigation.

**N.4.1 Method of Investigation**

Two hundred percent side scan coverage was achieved over the entire AWOIS 7919 search area. All significant contacts were investigated by echo sounder developments, using line spacing as close as 5 meters.

### **N.5.1 Results of Investigation**

A thorough review of all side scan contacts and their accompanying echo sounder developments in this area revealed no rock or obstruction which would be classified as "dangerous". The entire search area was found to exhibit a consistently flat, featureless bottom, with all depths in the 26 to 29-foot range.

7.9m 8.8m

### **N.6.1 Comparison with Prior Surveys**

A comparison with prior surveys will be performed by the Atlantic Hydrographic Section as part of the office verification process. *See section M in The Evaluation Report*

### **N.7.1 Comparison with Chart and Charting Recommendations**

Largest scale chart of the survey area:

Chart 13236  
"Cape Cod Canal and Approaches"  
25th. ed. September 14, 1991  
Scale: 1:20,000

AWOIS 7919, a rock ~~obstruction~~ charted in position  $41^{\circ}28'17.38''N$  and  $070^{\circ}40'15.11''W$ , has been disproven. It is the opinion of the hydrographer that the rock notation related to this item be removed from the chart and depths acquired during this survey be applied in its place. *Concur*

### **N.1.2 Area of Investigation**

AWOIS 4219  
Buzzards Bay  
Reported Position:  
 $41^{\circ}39'59.18''N$   
 $070^{\circ}42'16.11''W$   
Datum: NAD83  
Reported depths: 23-foot depths in the area  
Feature: wreck, barge

### **N.2.2 Description and Source of Item**

This item is listed as the wreck of a 40'x12'x4' wooden barge reported by the U.S. Army Corps of Engineers in Anchorage "C". The original Corps of Engineers survey (NM17/1966) conducted to locate the barge was unsuccessful.

During survey FE-207WD/1966, wire drag strips to effective depths of 18 and 20 feet were run over the wreck's reported position, but it was not found. Another survey, H-9724/1977, which conducted echo sounder splits between the reported position of the wreck and Bird Island, revealed a smooth rolling bottom with depths in the 23-foot range, but again no trace of a wreck. However, because of the possible existence of the wreck, the evaluator recommended retaining the SUBM WK ED chart notation with a note cleared to 20 feet.

#### **N.3.2 Survey Requirements**

This item required two hundred percent side scan coverage over a 750-meter search radius, echo sounder development and a diver investigation. Salvage documentation would be considered adequate for disproof.

#### **N.4.2 Method of Investigation**

Two hundred percent side scan coverage was achieved over that portion of the AWOIS 4219 search radius which falls within the limits of this survey, approximately 75% of the overall search area. All significant contacts in the search area were investigated by echo sounder developments, using line spacing as close as 5 meters.

#### **N.5.2 Results of Investigation**

Review of both the first and second 100% side scan coverages revealed no contact which gave the indication of being the wreck of a barge. All significant contacts within the search radius were investigated using tight echo sounder development, with still no indication that any of these contacts was that of a wreck.

#### **N.6.2 Comparison with Prior Surveys**

A comparison with prior surveys will be performed by the Atlantic Hydrographic Section as part of the office verification process.

#### **N.7.2 Comparison with Chart and Charting Recommendations**

Largest scale chart of the survey area:

Chart 13236  
"Cape Cod Canal and Approaches"  
25th. ed. September 14, 1991  
Scale: 1:20,000

AWOIS 4219, the wreck of a barge charted in position 41°39'59.18"N and 070°42'16.11"W, has been disproven to exist within the confines of this survey. A thorough review of the side scan sonar records and echo sounder trace failed to reveal conclusive evidence of a wreck existing within the survey boundaries. All contacts within this search area presented the signature of naturally occurring rocks.

It is the opinion of the hydrographer that the SUBM WK ED notation be deleted from the chart and replaced by soundings acquired during this survey. Although the wreck may exist within that portion of the search area not investigated, because it fell outside this survey's boundaries, there is no evidence to support this item's currently charted position.

Telcon 9/15/95; Cdr. Nick Perugini (Chief AHS), recommends *CONCUR*  
delete wreck from chart. RWD

#### **N.1.3 Area of Investigation**

AWOIS 1942

Buzzards Bay

Reported Position:

41°39'36.38"N

070°40'16.11"W

Datum: NAD83

Reported depths: 21 to 23-foot depths exist in the vicinity

Feature: wreck, barge

#### **N.2.3 Description and Source of Item**

This item is listed as the wreck of a barge, reported by the Coast Guard to have sunk in Anchorage "D" in 1939. During survey H-9712/1977, the wreck was neither verified or disproved, with 21 to 23-foot depths discovered in the vicinity of the wreck's approximate position.

#### **N.3.3 Survey Requirements**

This item required two hundred percent side scan sonar coverage over a 500-meter search radius, echo sounder development and a diver investigation. Salvage documentation would be sufficient for disproof.

#### **N.4.3 Method of Investigation**

Two hundred percent side scan coverage was achieved over that portion of the AWOIS 1942 search radius that falls within the limits of this survey, approximately 40% of the overall search area. All significant contacts were investigated by echo sounder developments, using line spacing as close as 5 meters.

### **N.5.3 Results of Investigation**

Review of both the first and second 100% side scan coverages revealed no contact which gave the indication of being the wreck of a barge. All significant contacts within that portion of the search radius under review were investigated using tight echo sounder developments, with still no indication of the presence of a wreck.

### **N.6.3 Comparison with Prior Surveys**

A comparison with prior surveys will be performed by the Atlantic Hydrographic Section as part of the office verification process.

### **N.7.3 Comparison with Chart and Charting Recommendations**

Largest scale chart of the survey area:

Chart 13236  
"Cape Cod Canal and Approaches"  
25th. ed. September 14, 1991  
Scale: 1:20,000

AWOIS 1942, the wreck of a barge ~~Charted~~ in position 41°39'36.38"N and 070°40'16.11"W, has been disproven to exist within the boundaries of this survey. It is the opinion of the hydrographer that since there is no currently charted wreck notation for this item, none should be added based on the results of this survey. CONCUR

**Development Abstract**

DEVELOPMENT ABSTRACT  
H-10511

NOAA Ship RUDE  
OPR-B616-93

DEV	Side Scan Contact Number(s)	Hydro Dev Positions	Least Depth (m)	LD Pos	Geographic Position	Remarks
1	656.14S 263.01P	929-938	6.23	931.2	41°40'50.260"N 070°41'52.607"W	
2	243.06P 678.01S	939-946	5.9 6.0	939.2	41°40'49.004"N 070°41'45.527"W	
3	303.58S	947-958	7.87	955.2	41°40'48.175"N 070°41'38.754"W	
4	326.33P	959-966	6.79	965.2	41°40'32.810"N 070°41'26.937"W	
5	291.18P, 291.20S, 296.48S, 362.24S, 627.24P, 627.38S, 627.44S	967-1033	5.25	984.3	41°40'00.215"N 070°42'28.478"W	
6	626.43S	1034-1081	5.87	1063.4	41°39'51.086"N 070°42'27.113"W	
7	813.42S	1082-1089	10.45	<del>1088.0</del> 1084.3	41°39'26.127"N 070°41'36.944"W	
8	179.04S 776.105P	1090-1103	9.87	<del>1090.0</del> 1094.2	41°39'19.434"N 070°41'49.862"W	
9	555.31S	1106-1113	<del>10.0</del> 9.9	1106.3	41°38'57.388"N 070°41'01.965"W	

DEVELOPMENT ABSTRACT  
H-10511

NOAA Ship RUDE  
OPR-B616-93

DEV	Side Scan Contact Number(s)	Hydro Dev Positions	Least Depth (m)	LD Pos	Geographic Position	Remarks
10	500.19S	1114-1121	10.0 9.7	1120.2 1114.2	41°38'52.607"N 070°40'51.237"W	938
11	554.21S	1122-1127	9.2	1122.3	41°39'09.206"N 070°40'56.734"W	
12	471.48S	1138-1149	7.32	1138.3	41°39'14.224"N 070°40'37.568"W	
13	479.11S	1128-1137	7.20	1130.3	41°39'25.473"N 070°40'34.265"W	
14	470.00P	1150-1157	6.88	1152.3	41°39'30.362"N 070°40'30.186"W	
15	420.01P	1158-1163	8.43	1158.2	41°39'46.655"N 070°40'41.151"W	Obstr
16	483.53S	1164-1169	7.54	1164.3	41°40'18.991"N 070°40'15.558"W	Obstr
17	414.47S, 447.30P, 415.02P, 442.36S	1170-1205	3.7 4.4 3.7	1202.2 1201.6 1202.3	41°40'01.422"N 070°40'00.909"W	
18	112.43S 449.31S	1206-1211	5.0	1206.2	41°39'45.535"N 070°40'18.845"W	
19	450.51P	1212-1221	5.56	1216.2	41°39'32.080"N 070°40'22.907"W	
20	454.05S	1222-1233	6.87	1226.6	41°39'29.132"N 070°40'26.333"W	

DEVELOPMENT ABSTRACT  
H-10511

NOAA Ship RUDE  
OPR-B616-93

DEV	Side Scan Contact Number(s)	Hydro Dev Positions	Least Depth (m)	LD Pos	Geographic Position	Remarks
21	109.05S	1234-1243	5.56	1240.2	41°39'11.316"N 070°40'32.199"W	
22	475.40S 475.07S	1244-1255	9.24	1244.2	41°38'48.953"N 070°40'46.164"W	
23	7.0m 23 & 26-FOOT CHARTED DEPTHS	1256-1312 1402-1413	8.9 9.0	1305.3	41°39'01.690"N 070°40'57.474"W	
24	22-FOOT CHARTED DEPTH	1313-1357	7.22	1316.3	41°39'24.123"N 070°40'30.292"W	
25	27-FOOT CHARTED DEPTH	1358-1401	9.20	1370.4	41°40'03.288"N 070°40'39.425"W	
26	23-FOOT CHARTED DEPTH	1414-1457	8.85	1440.0	41°39'09.890"N 070°40'49.507"W	
27	31-FOOT CHARTED DEPTH	1458-1479	9.62	1467.0	41°39'38.100"N 070°40'42.567"W	

**O. COMPARISON WITH THE CHART**

**O.1 Charts affected by this survey are:**

Chart 13236  
"Cape Cod Canal and Approaches"  
25th. ed. September 14, 1991  
Scale: 1:20,000

Chart 13230  
"Buzzards Bay"  
39th. ed. March 27, 1993  
Scale: 1:40,000

**O.2 A Danger to Navigation Report was not required based on the results of this survey.**

**O.3 The overall correlation between charted depths and survey soundings is excellent, with an average difference of one to two feet, except for two charted depths, one from each of the charts cited in section O.1, located in the southeast corner of Anchorage "D". In this location, a 23-foot depth from chart 13236 and a 26-foot depth from chart 13230 are surrounded by 32-foot soundings acquired during this survey. A 100-meter diameter circle area around each of these depths was thoroughly developed using 10-meter line spacing. No depths in the 23 to 26-foot range were found. As a result, it is the opinion of the hydrographer that the bottom in this area is generally flat and featureless, and has a consistent depth of 32 feet. Thus, the two charted depths in question are inaccurate and should be replaced with soundings acquired during this survey.** *Concur*

**O.4 The correlation between charted shoal areas and corresponding soundings from this survey is also excellent, with an average difference between soundings of two feet or less.**

**O.5 Chart 13230, 39th ed. March 27, 1992<sup>3</sup> is one of the main operating charts used by commercial vessels in this area. Since the primary navigation system in Buzzards Bay is still LORAN-C, it would be beneficial to have the LORAN-C time delay grid overlaid on this chart. In addition, the latitude and longitude scales in their present format are cumbersome to use, since they are only broken down into whole minutes, rather than tenths of minutes.**

During the course of this and other surveys conducted in Buzzards Bay, the ship has noted inconsistencies between charted depths of the same general area on two or more different scale charts. A case in point is the 26-foot depth charted in position 41°39'00.2"N and 070°40'54.00"W in the southeast corner of Anchorage "D" on chart 13230, and the 23-foot depth charted in almost the same position (41°38'59.00"N and 070°40'57.30"W) on the larger-scale chart 13236. If, during the chart compilation process, a depth like this shoaler 23-foot depth is judged to be legitimate, it should be applied to all charts that cover the area in question. These types of inconsistencies can be misleading and dangerous to the mariner and should be eliminated. *CONCUR*

**P. ADEQUACY OF SURVEY**

**P.1** All items investigated during this survey have been addressed.

**P.2** This survey is complete and contains no substandard data. AWOIS investigations were limited to the confines of this survey.

**Q. AIDS TO NAVIGATION**

**Q.1** The RUDE conducted no correspondence with the U.S. Coast Guard regarding floating aids to navigation.

**Q.2** There are four floating aids to navigation within the survey area. In U.S. Coast Guard Light List Volume 1, Atlantic Coast, they are identified as the following:

Light No.	Name	Position
16120	Lighted Gong Buoy 3 Marks shoal	41°39.4'N 070°41.4'W
16125	Lighted Buoy 4	41°37.4'N 070°41.2'W
16525	Buoy 10 Off north part of ledge	None Given
17120	Bird Island Reef Bell Buoy 13	None Given

The observed characteristics of these buoys agreed with their published characteristics. With respect to position verification, detached positions were obtained on all buoys. This was accomplished by maneuvering RUDE as close as possible to a buoy and then taking several detached positions. At the same time the distance and bearing of the ship's bow to the buoy was estimated. This distance was corrected for the position of the transducer and applied to the detached position to compute the following "true" positions:

Buoy G"3"	<sup>27.46</sup> 41°39. <del>46</del> 'N	<sup>21.65</sup> 070°41. <del>36</del> 'W	DP 136
Buoy R"4"	<sup>26.01</sup> 41°39. <del>43</del> 'N	<sup>9.8</sup> 070°41. <del>15</del> 'W	DP 134
Buoy N"10"	<sup>59.55</sup> 41°39. <del>99</del> 'N	<sup>17.73</sup> 070°40. <del>30</del> 'W	DP 131
Buoy G"13"	<sup>59.73</sup> 41°39. <del>98</del> 'N	<sup>23.32</sup> 070°42. <del>37</del> 'W	DP 139

A comparison between these positions and the positions contained in the Light List reveals an error in the published latitude for buoy R"4". The latitude for this buoy should be 41°39.4'N, rather than the published 41°37.4'N. The latitude value of buoy R"4" obtained by detached position closely matches its charted position, as well as the published and charted positions of buoy G"3", which is the buoy directly opposite to it, on the left side of Cleveland Ledge Channel.

Q.3 There were no aids to navigation other than those listed in the Light List found within the boundaries of this survey.

Q.4 No bridges, overhead cables or overhead pipelines are located within the survey area.

Q.5 No pipelines or designated ferry routes are located within the survey area.

Q.6 No ferry terminals are located within the survey area.

**R. STATISTICS**

<b>R.1</b>	<b>a) Number of Positions</b>	1479
	<b>b) Lineal Nautical Miles of Sounding Lines</b>	
	- nautical miles of survey with the use of the side scan sonar	103.01
	- nautical miles of survey without the use of the side scan sonar	43.66
<b>R.2</b>	<b>a) Square Nautical Miles of Hydrography</b>	
	- per 100% of coverage	4.44
	<b>b) Days of Production</b>	13
	<b>c) Detached Positions</b>	38
	- 4 for floating aids to navigation	
	- 34 for bottom samples	
	<b>d) Bottom Samples</b>	34
	<b>e) Tide Stations</b>	1
	<b>f) Current Stations</b>	0
	<b>g) Velocity Casts</b>	3
	<b>h) Magnetic Stations</b>	0
	<b>i) XBT drops</b>	0

**S. MISCELLANEOUS**

- S.1** a) No evidence of silting was found during this survey.
- b) No evidence of unusual submarine features was found during this survey.
- c) No evidence of anomalous tidal conditions was found during this survey.

There does appear to be an error in the predicted tide data used to correct a few sounding lines run in the southwest corner of Anchorage "C". The magnitude of the depth offset between the soundings in question and the surrounding soundings is approximately one foot. This error will be corrected with the application of smooth tides as part of the office processing and verification procedure. *Concur*

- d) No observations of unusual currents were recorded during this survey.

e) No evidence of magnetic anomalies was found during this survey.

8.2 Thirty-four bottom samples were obtained during this survey. As directed in the project instructions, the bottom samples were inspected and recorded, but none were submitted to the Smithsonian Institution.

#### **T. RECOMMENDATIONS**

T.1 There are no known inadequacies with this survey and no additional field work is required.

T.2 The RUDE is aware of no construction or dredging that will affect results of this survey.

T.3 No further investigation of the survey area is recommended.

#### **U. REFERRAL TO REPORTS**

No reports have been published which are not contained within this Descriptive Report.

**APPENDIX III**

**LIST OF HORIZONTAL CONTROL STATIONS**

No horizontal control stations were needed for this survey as Differential GPS was employed exclusively for all positioning control. The following are the geographic positions for the Differential GPS radiobeacons used during this survey:

Portsmouth, N.H.	41°04'02.047"N	071°51'38.274"W
Montauk, N.Y.	43°04'15.064"N	070°42'36.805"W

**APPENDIX VII**  
**APPROVAL SHEET**

**LETTER OF APPROVAL**  
**REGISTRY NO. H-10511**

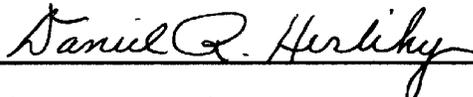
**This Descriptive Report and the accompanying field sheets are respectfully submitted.**



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**Richard T. Brennan, LT(jg), NOAA**  
**Field Operations Officer**  
**NOAA Ship RUDE**

**Field operations contributing to the accomplishment of this survey were conducted under my direct supervision, with frequent personal checks of progress and adequacy. This Descriptive Report and field sheets have been closely reviewed and are considered complete and adequate for charting.**



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**Daniel R. Herlihy, LCDR, NOAA**  
**Commanding Officer**  
**NOAA Ship RUDE**



UNITED STATES DEPARTMENT OF COMMERCE  
National Oceanic and Atmospheric Administration  
NATIONAL OCEAN SERVICE  
Office of Ocean and Earth Sciences  
Silver Spring, Maryland 20910

TIDE NOTE FOR HYDROGRAPHIC SURVEY

DATE: April 18, 1994

MARINE CENTER: Atlantic

HYDROGRAPHIC PROJECT: OPR-B616

HYDROGRAPHIC SHEET: H-10511

LOCALITY: Massachusetts, Buzzards Bay 2.25 Nautical Miles North of  
Cleveland Ledge Light

TIME PERIOD: October 7 - November 3, 1993

TIDE STATION USED: 844-7531 Mattapoisett, Ma.  
Lat.  $41^{\circ} 39.6'N$  Lon.  $70^{\circ} 48.8'W$

PLANE OF REFERENCE (MEAN LOWER LOW WATER): 8.75 ft.  
HEIGHT OF HIGH WATER ABOVE PLANE OF REFERENCE: 4.0 ft.

TIDE STATION USED: 845-2660 Newport, R.I.  
Lat.  $40^{\circ} 30.3'N$  Lon.  $71^{\circ} 19.6'W$

PLANE OF REFERENCE (MEAN LOWER LOW WATER): 1.67 ft.  
HEIGHT OF HIGH WATER ABOVE PLANE OF REFERENCE: 3.7 ft.

REMARKS: RECOMMENDED ZONING

Times and heights are direct on Mattapoisett, Ma. (844-7531).  
When data is not available for Mattapoisett, Ma., apply a +30  
minute time correction and a X1.10 range ratio to all heights using  
Newport, R.I. (845-2660).

Note: Times are tabulated in Eastern Standard Time.

*William M. Hulson*  
CHIEF, DATUMS SECTION



GEOGRAPHIC NAMES

Name on Survey	Source of Name										
	A	B	C	D	E	F	G	H	K		
	ON CHART NO.	ON PREVIOUS SURVEY NO.	ON U.S. QUADRANGLE MAPS	FROM LOCAL INFORMATION	ON LOCAL MAPS	P.O. GUIDE OR MAP	GRAND McNALLY ATLAS	U.S. LIGHT LIST			
BUZZARDS BAY (title)											1
CLEVELAND LEDGE (title)											2
MASSACHUSETTS (title)											3
											4
											5
											6
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											25

Approved:

*Charles E. Harrington*  
Chief Geographer - NJCG 275

MAR - 9 1994

03/02/95

HYDROGRAPHIC SURVEY STATISTICS  
REGISTRY NUMBER: H-10511

NUMBER OF CONTROL STATIONS		2
NUMBER OF POSITIONS		1479
NUMBER OF SOUNDINGS		6023
	TIME-HOURS	DATE COMPLETED
PREPROCESSING EXAMINATION	153	03/18/94
VERIFICATION OF FIELD DATA	226	02/01/95
ELECTRONIC DATA PROCESSING	18	
QUALITY CONTROL CHECKS	50	
EVALUATION AND ANALYSIS	38	01/27/95
FINAL INSPECTION	15	02/03/95
TOTAL TIME	500	
ATLANTIC HYDROGRAPHIC SECTION APPROVAL		02/08/95

**OFFICE of COAST SURVEY  
ATLANTIC HYDROGRAPHIC BRANCH  
EVALUATION REPORT FOR H-10511 (1993)**

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.

**G. CORRECTIONS TO SOUNDINGS**

**G.6.b.** Approved tides were applied during office processing.

**H. CONTROL STATIONS**

**H.7.** Horizontal control used for this survey during data acquisition is based upon the North American Datum of 1983 (NAD 83). Office processing of this survey is based on these values. The smooth sheet has been annotated with ticks showing the computed mean shift between the North American Datum of 1983 (NAD 83) and the North American Datum of 1927 (NAD 27).

To place the smooth plots on the NAD 27 datum, move the projection lines 0.381 seconds (11.753 meters or 1.18 mm at the scale of the survey) south in latitude and 1.883 seconds (43.560 meters or 4.36 mm at the scale of the survey) west in longitude.

All geographic positions listed in this report are on the NAD 83 datum unless otherwise specified.

**M. COMPARISON WITH PRIOR SURVEYS**

**M.1. Hydrographic**

H-2272	(1896)	1:10,000
H-2318	(1897)	1:20,000
H-9712	(1977-unreviewed)	1:10,000
H-9724	(1977)	1:10,000

**M.1.a.** Prior surveys H-9712 (1977-unreviewed) and H-9724 (1977) taken together cover the present survey area in its entirety. These prior surveys are in good agreement with the present survey, with prior and present survey soundings agreeing within plus or minus ( $\pm$ )1<sup>2</sup> m (4-ft) on H-9712 and ( $\pm$ )1<sup>5</sup> m (5-ft) on H-9724. These differences can be attributed to natural changes in the bottom configuration and more accurate surveying techniques used on the present survey.

Prior surveys H-2272 (1896) and H-2318 (1897) were not available for comparison.

The present survey is considered adequate to supersede the prior surveys within the common area.

### **M.2. Wire Drag**

FE-207WD (1967) 1:20,000

The above prior wire drag survey covers the western half of the present survey area, or anchorage area "C". Attention is directed to the following:

A charted 20-ft (6<sup>1</sup>m) sounding on a rock in Latitude 41°40'46.6"N, Longitude 70°41'45.9"W, originates with prior survey FE-207WD (1967). The present survey located a submerged rock with a least depth of 6 meters (19-ft) in Latitude 41°40'49.0"N, Longitude 70°41'45.5"W, which is approximately 74 meters NNW of the charted 20-ft (6<sup>1</sup>m) rock. It is recommended that a submerged rock with a depth of 6 meters (19-ft) be charted as shown on the present survey. The presently charted 20-ft (6<sup>1</sup>m) sounding on a rock should be removed from the chart.

There are 1-ft (0<sup>3</sup>m) conflicts between the prior survey effective clearance depths and the present survey soundings, in the area centered at Latitude 41°39'54"N, Longitude 70°41'36"W. These conflicts may be attributed to natural changes in the bottom configuration and more accurate surveying techniques used on the present survey.

The present survey is considered adequate to supersede the prior wire drag survey *with the common area.*

### **O. COMPARISON WITH CHARTS 13236 (25<sup>th</sup> Ed. Sept. 14, 1991) 13230 (39<sup>th</sup> Ed. Mar. 27, 1993)**

**O.6.** The charted hydrography originates with the previously discussed prior surveys and unascertainable sources require no further consideration. Specific items discussed in section N. of the Descriptive Report have charting recommendations that require no additional comments except as noted in that report. Attention is directed to the following:

1. An uncharted obstruction with an echo sounder least depth of 8<sup>3</sup> meters (27-ft) was located by the present survey in latitude 41°39'46.66"N, longitude 70°40'41.15"W. Surrounding depths are deeper by 1.5 meters (5 feet) or more. It is recommended that this obstruction be charted in its present location.

2. An uncharted obstruction with an echo sounder least

depth of 7<sup>4</sup> meters (24-ft) was located by the present survey in latitude 41°40'18.99"N, longitude 70°40'15.56"W. Surrounding depths are deeper by 0<sup>8</sup> meters (3-feet) or more. It is recommended that this obstruction be charted in its present location.

3. A charted 15-ft (4<sup>6</sup> m) sounding in Latitude 41°39'12.88"N, Longitude 70°40'05.32"W originates with prior survey H-9712 (1977-unreviewed). This 15-ft (4<sup>6</sup> m) sounding is outside the present survey limits. However, during office verification of this prior survey in 1989, it was determined that this 15-ft (4<sup>6</sup> m) sounding was charted incorrectly from the unverified field sheet. This error was noted in the Descriptive Report of H-9712 (1977) after office verification, by this verifier, however at present this sounding is still charted. It is recommended at this time that the charted 15-ft (4<sup>6</sup> m) sounding be removed from the chart. It is also recommended that survey data from the verified Smooth Sheet of H-9712 (1977-unreviewed) be considered for application to the chart.

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

**P. ADEQUACY OF SURVEY**

This is an adequate side scan sonar survey. No additional work is recommended.

**S. MISCELLANEOUS**

S.3. Chart compilation using the present survey data was done by Atlantic Hydrographic Branch personnel in Norfolk, VA. Compilation data will be forwarded upon completion of the project.

**RUDE Processing Team**

*Richard W. Blevins*  
**Richard W. Blevins**  
 Cartographic Technician  
 Verification of Field Data

*Robert R. Hill Jr.*  
**Robert R. Hill Jr.**  
 Cartographer  
 Evaluation and Analysis

APPROVAL SHEET  
H-10511

Initial Approval:

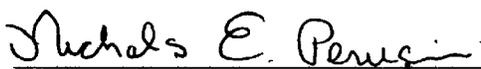
The completed survey has been inspected with regard to survey coverage, delineation of depth curves, development of critical depths, cartographic symbolization, and verification or disproval of charted data. The digital data have been completed and all revisions and additions made to the smooth sheet during survey processing have been entered in the magnetic tape record for this survey. Final control, position, and sounding printouts of the survey have been made. The survey records and digital data comply with NOS requirements except where noted in the Evaluation Report.



Date: 03 FEB 95

Deborah A. Bland  
Cartographer  
Atlantic Hydrographic Section

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.



Date: 08 Feb 95

Nicholas E. Perugini, CDR, NOAA  
Chief, Atlantic Hydrographic Section

Final Approval:

Approved:



Dated: April 18, 1995

Andrew A. Armstrong III  
Captain, NOAA  
Chief, Hydrographic Surveys Branch



