

10378

Diagram No. 1210-4

NOAA FORM 76-35A

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

DESCRIPTIVE REPORT

Type of Survey Hydrographic/Side Scan Sonar

Field No. RU-10-2-91

Registry No. H-10378

LOCALITY

State Rhode Island

General Locality Rhode Island Sound

Sublocality 3.5 NM Southeast of Point

Judith

1991

CHIEF OF PARTY  
LCDR N.E. Perugini

LIBRARY & ARCHIVES

DATE December 6, 1993

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U.S. DEPARTMENT OF JUSTICE  
1954 FORM 100

DESCRIPTIVE RECORD

Box of books  
Box No. 87-10-2-11  
Volume No. 1-2078

LOCALITY  
Date

1957  
CHIEF OF FIELD

LIBRARY & ARCHIVE  
DATE

CP-2  
13215  
13218  
13205  
12300

871301

**HYDROGRAPHIC TITLE SHEET**

H-10378

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 10-2-91

State Rhode Island

General locality Rhode Island Sound

Locality Three Point <sup>3.5 NM</sup> Five Nautical Miles Southeast of Point Judith

Scale 1:10,000 Date of survey May 2 to Nov 19, 1991

Instructions dated March 11, 1991 Project No. OPR-B660

Vessel NOAA Ship RUDE (9040)

Chief of party LCDR G.H. Tuell / LCDR N.E. Perugini

Surveyed by N.E. Perugini, J.E. Rix, P.L. Schattgen, M.J. Oberlies, J.A. Illg

Soundings taken by echo sounder, \_\_\_\_\_ and pneumatic depth gage

Graphic record scaled by NEP, JER, PLS, MJO, JAI, MAS

Graphic record checked by NEP, JER, PLS, MJO, JAI, MAS

Protracted by NA Automated plot by NA <sup>XYNETICS PLOTTER (1201)</sup> (AHS)

Verification by NA ATLANTIC HYDROGRAPHIC SECTION PERSONNEL

Soundings in meters \_\_\_\_\_ at \_\_\_\_\_ MLLW

REMARKS: All times recorded in UTC

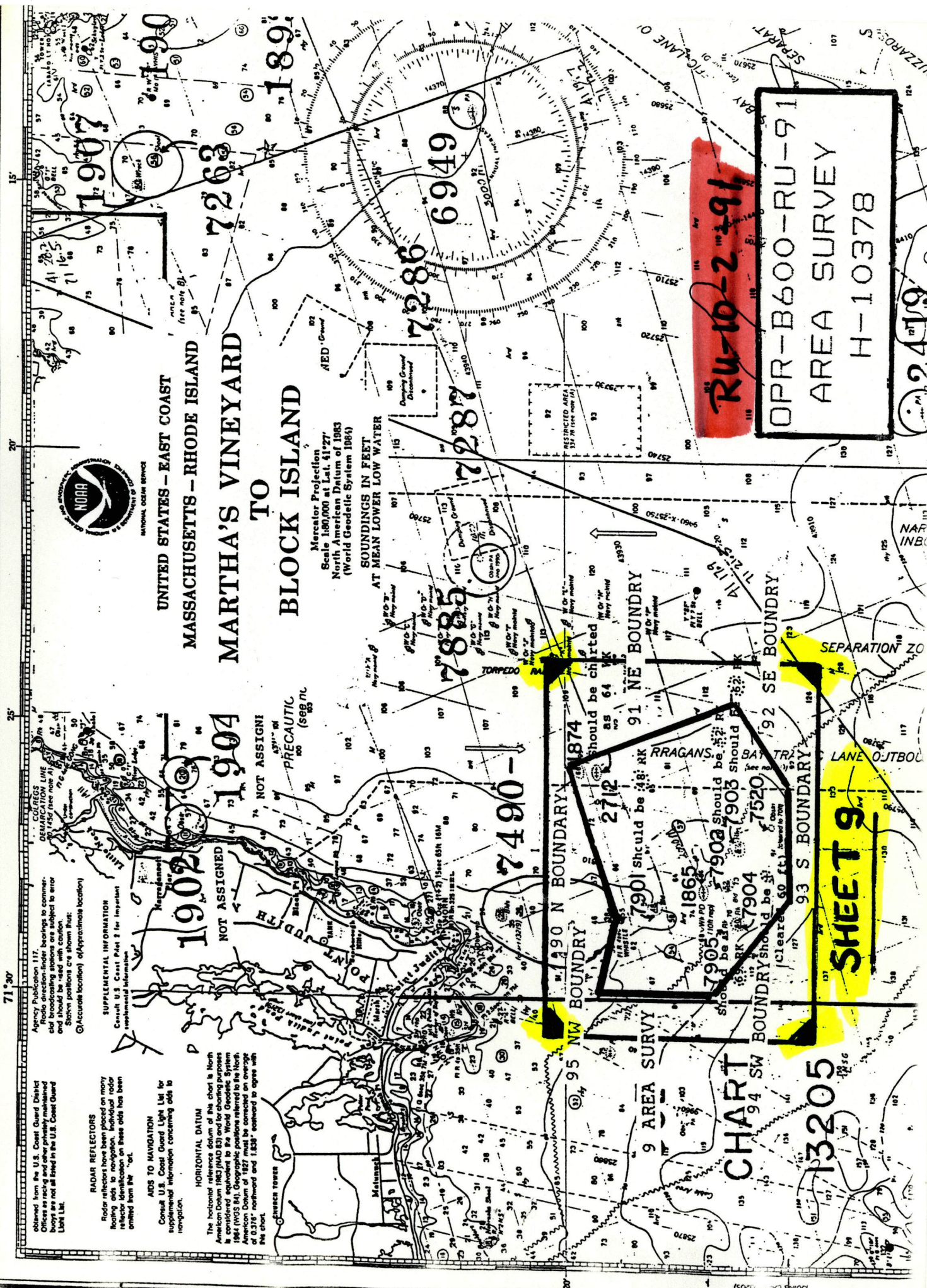
NOTES IN RED WERE MADE DURING OFFICE PROCESSING

AWOIS & SURF  
1/3/94 MCR

50 JAN 29 1997

X.W.W. 1/27/97

This nautical chart has been designed to promote safe navigation. The National Ocean Service encourages users to submit corrections, additions, or comments for improving this chart to the Director, Charting and Geodetic Services (NCGS22), National Ocean Service, NOAA, Rockville, Maryland 20852.



**SOUNDINGS IN FEET**

Obtained from the U.S. Coast Guard District Office, Boston, Massachusetts. All soundings are not all listed in the U.S. Coast Guard Light List.

**RADAR REFLECTORS**  
Radar reflectors have been placed on many leading aids to navigation. Individual radar reflector identification on these aids has been omitted from this chart.

**AIDS TO NAVIGATION**  
Consult U.S. Coast Guard Light List for supplemental information concerning aids to navigation.

**HORIZONTAL DATUM**  
The horizontal reference datum of this chart is North American Datum 1983 (NAD 83) and for charting purposes is North American Datum of 1983 (NAD 83). Geographic positions shown on this chart are based on the North American Datum of 1983. All positions must be corrected on a coverage of 0.375" northward and 1.838" eastward to agree with the chart.

**SUPPLEMENTAL INFORMATION**  
Consult U.S. Coast Pilot 3 for important supplemental information.

**NOT ASSIGNED**  
NOT ASSIGNED

**PRECAUTIC**  
PRECAUTIC (seg nl)

**SEPARATION ZONE**  
SEPARATION ZONE

**LANE OJTBO**  
LANE OJTBO

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**A. PROJECT**

**A.1** This survey was conducted in accordance with Hydrographic Project Instructions OPR-B660-RU-91, Southern New England Coast, Connecticut and New York.

**A.2** The original date of the instructions is March 11, 1991.

**A.3** The following changes to the original instructions are relevant to this survey:

Change # 1	August 8, 1991
Change # 2	September 3, 1991

Supplemental instructions were received through telephone conversations with LCDR Kenny regarding reconnaissance hydrography in Narragansett Bay. The RUDE was instructed not to complete the hydrography in the bay (delineated on the presurvey review charts).

**A.4** A sheet letter was not specified in the project instructions.

**A.5** Project OPR-B660-RU-91 responds to requests from the Northeast Marine Pilots, Inc., of Newport, Rhode Island, to verify or disprove and provide least depths for certain wrecks and obstructions in Long Island, Block Island, and Rhode Island Sounds. Also, the U.S. Navy, as well as state and local governments, have requested updated bathymetric and hydrographic survey data of this area for use in proposed studies and in the construction of new charts.

This basic survey, including 200-percent side scan sonar coverage, will be used to determine the existence of a large boulder field indicated by prior surveys in the area of Point Judith, Rhode Island.

**B. AREA SURVEYED**

B.1 This survey is located 3.5 nautical miles <sup>WHISTLE</sup> Southeast of Point Judith, Rhode Island, adjacent to navigational Buoy R"2". The majority of the area is between the 60 and 90 feet contour lines; existing depths are between <sup>44</sup>54 and <sup>108</sup>84 feet (16 to <sup>33</sup>26 meters). The area is also a known boulder field, with 6 charted rocks or obstructions and 3 wreck symbols.

The primary traffic in the area are tug-and-barge transports which transit between Long Island Sound and points to the East, and deep draft ships heading into or out of Narragansett Bay.

Buoy R"2" marks an important point in the area: the East/West tugs use the buoy to mark their turn around Point Judith, and local pilots use it to mark their pilot station. The charted wrecks in the proximity of the buoy are of particular concern to the pilots.

B.2 The area is delineated on the pre-survey review chart, extending from latitude 41° 16.8' to 41° ~~20.2'~~<sup>22.2'</sup> North, and from longitude 071° 24.5' to 071° 30.0' West. An irregularly shaped area, it is approximately 4 nautical miles (East/West) by 3 nautical miles (North/South).

B.3 Data acquisition began on May 2, 1991 (DOY 122) and concluded on November 13, 1991 (DOY 317).

**C. SURVEY VESSELS**

**C.1** The following vessels were used during this project:

<u>VESSELS</u>	<u>ELECTRONIC DATA PROCESSING NUMBER</u>	<u>PRIMARY FUNCTION</u>
NOAA Ship RUDE (S590)	9040	Hydrography/ Side Scan Operations
RUDE Launch (RU3)	1290	Diving Operations
RUDE Skiff (RU1)	N/A	Diving Operations/ Horizontal Control Support

**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:

<b>Program</b>	<b>Version</b>	<b>Dates Used</b>
SURVEY*	5.11	May 2 - Jun 16
SURVEY	6.00	Jun 17 - Jul 5
SURVEY	6.03	Jul 5 - Sep 9
DAS_SURV	6.02	Jun 17 - Jul 5
DAS_SURV	6.04	Jul 5 - Sep 9
POSTSUR	5.10	May 2 - Jun 16
POSTSUR	5.12	Jun 17 - Jul 5
POSTSUR	5.14	Jul 5 - Sep 9

\* This first version of SURVEY was split up into SURVEY 6.00 and DAS\_SURV 6.02

D.2 Other software includes VELOCITY 1.11 dated March 9 1990, used to generate sound velocity corrector tables, and MTEN (dated between 1985 and 1986) for horizontal control verification and establishment.

D.3 One nonstandard HDAPS processing method was utilized to correct a problem which occurred during the first days of data acquisition. The following is an explanation of the problem and the processing method developed for its resolution.

The selected sounding interval originally chosen for this survey was ten seconds. The Hydrographic Survey Guidelines require a selected sounding to be recorded between four and six millimeters at the scale of the survey. The ten second interval recorded a selected sounding approximately every two millimeters at the 1:10,000 scale. This problem was not realized until DOY 133, so data acquired up to this point contained twice the selected soundings required; DOY 122 through DOY 133 (at fix # 1289).

This problem was resolved by the application of the HDAPS program "DESELECTOR" to the affected data. This program, which was written in the field by LCDR Perugini, deselected every odd sounding between fixes (ie. the first, third, and fifth selected soundings between each fix).

Evidence of this condition remains only in the raw data. For the days that the "DESELECTOR" was run, new printouts labeled "EDITED MASTER" printout have been generated. These printouts reflect the new selected data. Data that were run through the "DESELECTOR" have two selected soundings between fixes (most of the time).

It should be noted that the contact numbering convention for this data is based on the original selected sounding interval. There was no problem using this scheme since it is based on the original marks made on the sonagram. Therefore, a contact numbered 1031.43 identifies the contact to be three tenths of the way out between the original fourth and fifth mark on the sonagram.

Two other items regarding data:

First, on DOY 127 the RAM overflowed during data acquisition. No data were lost, however a trailer was not written to the data when the computer automatically went into "Standby". These data (positions 150-235) were downloaded onto a 3.5 in. floppy disk, the first disk of the day. Data from the rest of the day:

positions 236-247

were downloaded onto a second 3.5 in. floppy disk. Because of the missing trailer, the second floppy could not be appended to the first (the two would not merge). So the first floppy (with missing trailer) was loaded and merged by itself (creating one data file for DOY 127), and then the second floppy was loaded and merged (creating a second data file for DOY 127).

Therefore, two edited data files exist for DOY 127. This is not a significant problem, however it may cause confusion when accessing data from DOY 127, and the last record of the first file may not be accessible (fix 235, DSN 4753).

Second, there were two occasions where the new "DP Mode" function in the HDAPS data acquisition program was not used. Instead, the "Print DP" function was used, so those positions have no digital record.

DP's from AWOIS Item 7902 on DOY 171:  
use position ~~3168~~ *3213 + 3*

DP's on Buoy R"2" on DOY 128:  
positions ~~248-250~~ *249*

These data must be entered manually as digital records. Information from the raw data printout can be used for time, position number, easting and northing, etc..

## E. SONAR EQUIPMENT

E.1 Side scan sonar operations were conducted using an EG&G Model 260 slant range corrected side scan sonar recorder and either a Model 272-T (single frequency) or 272-TD (dual 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	0012102	May 2 - May 31
Recorder	0011443	Jun 17 - Jul 8
Recorder	0012105	Sep 6 - Sep 9
Towfish	0011904 (Single Freq)	May 2 - May 28 and May 30
Towfish	11591 (Dual Freq)	May 29 and 31
Towfish	0011908 (Single Freq)	Jun 17 - Sep 9

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

E.3 The 100 Khz frequency was used throughout this entire survey.

E.4 a) The 100 meter range scale was used for all main scheme side scan coverage. The 50 meter range scale was used for contact development, as it yields a trace of higher definition.

The depth of water encountered throughout the survey area usually exceeded 20 meters, allowing excellent imagery on the 100 meter range scale.

Line spacing for main scheme coverage was determined using the formula provided in section 7.3.2.1 of the Field Procedures Manual ( $LS_{max} = 2RS - 2ECR_{max}$ ). The predicted maximum error circle radius (ECR) did not exceed 10 meters within the survey area, so a maximum line spacing of 180 meters was established for the 100 meter range scale.

However, in order to meet the line spacing requirements of a basic survey, all main scheme side scan lines were run in one direction (North/South). After the area was covered once using the 180 meter line spacing, the lines were offset 90 meters and the area was covered again. In effect, the line spacing was 90 meters over the entire area so that the basic hydrography line spacing requirements were met, as well as the side scan sonar coverage requirements.

b) Daily confidence checks were obtained by either towing the fish past a previously located feature, or by noting recognizable bottom characteristics at the edges of the sonar range scale in use.

c) Two hundred percent side scan sonar coverage was achieved over the entire area.

d) Slight side scan interference was noted on DOY 135 due to the sea conditions (swell on the stern). However, this distorted trace did not interfere with contact identification.

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

E.5 The excessive number of contacts identified during this survey required special procedures in determining significance for further development, both on-line and during processing. Refer to section M.2 for a thorough explanation of these procedures.

E.6 Overlap was checked on-line using the real-time plot and the edited swath plot for holidays. All holidays were filled in by running additional side scan sonar lines.

**F. SOUNDING EQUIPMENT**

**F.1** All hydrographic soundings were acquired using a Raytheon 6000N digital survey fathometer (DSF). One DSF 6000N was used during the entire survey: S/N A106N.

**F.2** All diver-determined least depths were measured with a pneumatic depth gauge. RUDE is equipped with two 3-D Instruments Inc. Precision Direct Drive Depth Gauges:

- |                                |             |
|--------------------------------|-------------|
| 1) 0- 70 fsw (feet salt water) | S/N 142697  |
| 2) 0-140 fsw                   | S/N 8606822 |

The 0-70 fsw gauge was used in water depths less than 20 meters (approx. 70 feet), and the 0-140 fsw gauge was used when the water depth exceeded 20 meters.

**F.3** Refer to section "G.4" for a discussion on the pneumatic depth gauges.

**F.4** Both the high (102 kHz) and the low (24 kHz) frequency sounding data were recorded during data acquisition. Only high frequency soundings were selected for plotting.

## G. CORRECTIONS TO SOUNDINGS

G.1 a) The velocity of sound through water was determined using a Digibar Sound Velocity Probe (S/N 169), made by Odom. A Data Quality Assurance Test was conducted before each velocity cast to ensure the meter was within tolerance.

All data were processed using Velocity 1.11 software. The computed velocity correctors were entered into the HDAPS sound velocity tables and applied on-line to both high and low frequency soundings. Sound velocity correctors applied to this survey were obtained on the following dates:

Cast Number	Date	Latitude	Longitude	HDAPS Table #	Applied to Days
3	5-01-91	41° 16.9'N	71° 27.4'W	3	127-130
4	5-21-91	41° 16.8'N	71° 27.4'W	4	133-151
8	6-19-91	41° 18.6'N	71° 24.8'W	8	168-178
9	7-09-91	41° 18.1'N	71° 32.9'W	9	182-189
13	8-29-91	41° 01.7'N	71° 32.9'W	13	249-252
18	11-04-91	41° 22.6'N	71° 19.9'W	18	317

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

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

d) Two dual lead line comparisons with the DSF-6000N were made:

April 25, 1991	at	41° 35.6'N	71° 21.3'W	(25 ft depths)
July 22, 1991	at	41° 20.9'N	71° 29.1'W	(35 ft depths)

The greatest variation between leadline and DSF soundings was less than 0.2 meters for both comparisons. Considering the ship's motion and scope in the leadline from current, this is excellent agreement and provides an excellent check that the echosounder was functioning properly. Also, comparisons between diver determined least depth by pneumatic depth gauge) and DSF soundings over particular items (with prominent features) were normally within 0.5 meters after reduced for correctors.

e) All sounding correctors were applied to both the narrow (100 kHz) and wide (24 kHz) 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 13, 1991. An observer, stationed with a level on a pier, measured changes in relative height as the ship ran toward and away from the pier at various speeds. Settlement and squat correctors were 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 correctors were applied to the plotted soundings. However, heave data were not recorded (because either the heave sensor was not initialized correctly or the acquisition program did not log the data) from:

DOY 141 through DOY 175.

Data from this period have been scanned with the knowledge that heave correctors were not applied. Also, these days were primarily "splits" and developments; the majority of main scheme sounding data were acquired before DOY 141, and were logged with heave correctors.

G.2 The HDAPS program "Reapply" was used for the first time this season, to reapply corrector tables to soundings. An evaluation of the most appropriate tables for each day's data was made, and compared to the tables actually used. New tables were then applied to those days which differed.

G.3 As stated in paragraph G.2, corrector tables were reapplied to soundings during processing, so that the most relevant correctors were applied to plotted soundings. Offset table number 3 was used for the entire survey, so these correctors were not reapplied. Special correctors were not applied to any soundings.

G.4 The ship's shallow water (0-70 fsw) and deep water (0-140 fsw) pneumatic depth gauges were calibrated by Instruments East, Inc. of Norfolk, VA on January 31, 1991. Corrector data from the calibrations were plotted graphically, but were not applied to pneumatic depths because they were less than 0.1 meters (see plots in SEPARATE IV). *FILED WITH ORIGINAL SURVEY RECORDS*

Periodic system checks were performed on the gauges as illustrated HSG 55. Rarely did the gauges check when substantial currents were present. Since the currents in the survey area were fairly strong and seemingly constant, it became practice to perform system checks on the gauges during times of ideal conditions. Therefore, days of use do not correspond to days on which the checks were performed.

In October, the ship's 0-70 fsw gauge (S/N 142697) was damaged. Both gauges were sent back to Instruments East Inc. in Norfolk; the 0-70 fsw for repairs and the 0-140 fsw for a critical system check. The shallow water gauge was found to be

beyond repair, and was not used during the remainder of this survey. The deep water gauge (S/N 8606822) tested within 0.25 of one percent of the full-face reading (0.35 feet), meeting the accuracy requirement prescribed in HSG 55. This gauge was recalibrated after it was tested.

Overall agreement between the pneumatic depth gauges, diver console depth gauge, and echosounder least depths was excellent, generally less than 0.3 meters. Considering this agreement and the closing critical check on the 0-140 fsw gauge, the RUDE is confident that all least depths determined by pneumatic depth gauge are correct.

**G.5** Generally, sea conditions greater than one meter affected the fathogram, creating a trace of constant peaks and deeps. But the application of heave correctors to raw echo soundings appeared to accurately represent true depths. Data acquisition was halted when the ship's motion was beyond what the heave sensor could accurately determine.

**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 Newport tides was provided on floppy magnetic disk before the start of the project.

**b)** The height and time correctors listed below were taken 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:

NO.	PLACE	TIME		HEIGHT	
		High water	Low water	High water	Low water
1191	Point Judith Harbor of Refuge	-10 min	+17 min	* 0.88	* 0.86

Tidal correctors were applied on-line using the HDAPS predicted tide tables.

**c)** Zoning for this project is consistent with the project instructions.

**NOTE:** After all dive investigations where a least depth was determined using a pneumatic depth gauge, a detached position (DP) was taken by the ship after the divers had surfaced and cleared the buoy site. So the DP was taken between 15 and 45 minutes after the pneumatic depth was observed, and in many cases the tide corrector had changed in that time. Using the "Edit DP's" function (HDAPS Post Survey), the raw sounding was replaced with the pneumatic depth gauge reading, and all correctors other than tide (draft, sound velocity, heave) were set to zero. Thus



the DP has the correct raw depth and position, but the time does not correspond to the dive time. The following is a list of all dives made during this survey for which the time of the detached position must be edited to reflect the time the pneumatic depth reading was taken:

DOY	Dive Item	DP Position No.	Time of* DP (UTC)	Time of Pneumo Reading (UTC)
171	AWOIS 7902	3168**	15:51:19	15:33:00
171	AWOIS 7901	3213.2***		
176	DEV #35	3419	14:09:05	13:57:00
176	DEV #5	3431	17:02:39	16:39:00
176	DEV #3	3473	20:31:57	20:12:00
178	DEV #31	3633	14:50:16	14:34:00
182	DEV #31A	3672	15:46:17	15:30:00
317	AWOIS 1874	3820	15:56:17	15:35:00
317	AWOIS 2712	3828	19:44:46	18:44:00

\* These times should be edited to show the time of the Pneumatic Depth Gauge reading.

\*\* This DP was not recorded digitally, therefore the entire data record must be entered manually (see section D.3).

\*\*\* The time for this item does not have to be edited, as the echo sounder least depth is shoaler than the diver determined least depth.

A request for smooth tides was mailed on October 2, 1991, and again on December 6, 1991, since two dives were made (DOY 317) after the October request.

Copies of all data sheets, tables, calibrations, etc., referred to in this section are provided in APPENDIX V. *FILED WITH ORIGINAL SURVEY RECORDS*

**H. CONTROL STATIONS** *SEE ALSO SECTION 2.2 OF THE EVALUATION REPORT*

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

**H.2** The list of Horizontal Control Stations is ~~located in Appendix III.~~ *APPENDED TO THIS REPORT*

**H.3** Newly established horizontal control stations were surveyed using standard NGS approved surveying techniques, primarily the "Geodetic Direct" and "Resection" procedures. The data were then entered into the NGS software "MTEN", which provided the latitude and longitude of the new station (referred to the NAD 83 ellipsoid).

Existing stations were verified by comparing observed horizontal angles and distances (to known stations) with angles and distances provided by inverse computations using "MTEN".

The following list describes the origins of the positions used for each of the ten stations on which positioning equipment was located:

- One station - NGS position (sta 111)
- Five stations - Offsets from Lighthouses with NGS positions (sta 113, 114, 120, 121, 122)
- Two stations - Established by Direct computations from NGS stations (112 and 201)
- Two stations - Established by Resection (116 and 202).

All horizontal control stations used during this survey are Third-order, Class I.

**H.4** All horizontal control stations are within the three Quadrants 410711, 410712, and 410713. All are referenced to the NAD 83 Horizontal Datum.

**H.5** Refer to the Horizontal Control Report (submitted to N/CG 233 under separate cover) for specific procedures and sites surveyed by the RUDE.

**H.6** Although no photogrammetric problems or positioning anomalies were encountered, the following problem was experienced during the early stages of this survey:

Initially, three Falcon Mini-Rangers were set in the Point Judith Area on two breakwater lights and the main lighthouse (stations 101,102,103). The positions of the two breakwater lights hosting Falcon systems were not checked before data were acquired. After large residuals were encountered on-line when both Falcon stations were included in the position

solution, the positions of the lights were checked with a theodolite. This check showed the East breakwater light (station 101) to be 17 meters from its registered NGS position. Further investigation revealed that this light had been torn down and rebuilt several times since the reported position had been entered into the NGS database.

So on DOY 122 and 123, positioning was in error approximately ten to twenty meters, explaining the high residuals encountered during acquisition. When the source of the poor positioning was determined, all data acquired on those two days were rejected.

A new position for the East Breakwater Light was determined by using the survey data obtained during verification of the Point Judith stations. Although this light was used for the majority of the survey, the new position was not reported to the U.S. Coast Guard since the aid was destroyed during hurricane "Bob".

**I. HYDROGRAPHIC POSITION CONTROL** *SEE ALSO SECTION 2.2. OF THE EVALUATION REPORT*

**I.1** Three different systems were used for vessel positioning during the survey: Falcon Mini-Ranger, Argo, and Differential Global Positioning System (DGPS). All three systems utilize the range range type of positioning. A detailed discussion of DGPS navigation is contained in Section I.4. The operating dates of the systems are as follows:

ARGO/Falcon (Hybrid Mode - 2 LOP each)	DOY 127-143, 189
ARGO/Falcon (Hybrid Mode - 3 Falcon, 1 ARGO)	DOY 148-182
Falcon (4 LOP)	DOY 170
GPS (with 2 Falcon LOP check)	DOY 249 - 317

**I.2** At no time during this survey did the maximum residual consistently exceed 5 meters (0.5 mm at the survey scale), and the 95% confidence error circle radius never consistently exceeded 15 meters (1.5 mm at the survey scale). The only time these requirements were not met was during the first two days of data acquisition (DOY 122 and 123) for this survey. As stated earlier, these data were subsequently rejected.

**I.3 Control Equipment:**

Sextants:

Two "Tamaya & Co." Marine Surveying Sextants were used, S/N's T2966 and T3000.

ARGO:

Cubic Western Data ARGO DM54.

Serial Numbers:

Shipboard System:

RPU R-1083665  
ALU A-047852  
CDU C-1083312

Warren Point Station (201):

RPU R-0980211  
ALU A-097895

Block Island Station (202):

RPU R-0682571  
ALU A-039127

Mini-Ranger:

Falcon 484 by Motorola Inc.

Serial Numbers:

RPU	F-0246	
R/T	F-3409	
R/S:	E-2969	F-3244
	F-3241	F-3297
	E-2907	F-3242
	E-2926	F-3217



(high residuals, etc.), either a calibration was performed and a printout was not generated, or the ARGO signal was never lost.

#### Falcon:

As stated in section 3.1.3.3 of the Field Procedures Manual for Hydrographic Surveying, a continuous critical system check is obtained "when data are acquired with three or more LOP's and ECR and maximum residual criteria are being met as required in section 3.1.3.1" (of the same manual). RUDE routinely conducted survey operations using at least three LOP's, and all other positioning criteria were met as required (see section I.2).

A pre-project baseline calibration of the Mini-Ranger system was conducted at the Atlantic Marine Center on March 6, 1991. Two more baseline calibrations were conducted in Bristol, RI on June 2 and July 14, 1991. See the Electronic Control Report submitted under separate cover for the data records of the calibrations.

#### GPS

As stated in section 6.2 of the Project Instructions (change No. 2 dated 3 September 1991), "Differential GPS ... can be used for this project as the Primary positioning system" with the following 1:10,000-scale accuracy requirements:

1. As a DGPS system check, at least one Falcon range must be recorded twice daily in a static mode, and must agree within 5 meters of the DGPS position.
2. During data acquisition, at least one Falcon range must be recorded and the computed residual must be less than 10 meters.
3. Survey operations may not be conducted when the HDOP exceeds 3.0.
4. Four satellites must be used for the DGPS position computation.

Since this is the first survey conducted using DGPS as the primary positioning system, extreme care was taken by the RUDE to insure the above requirements were met. The following are some points on the acquisition procedures and actual performance of the DGPS system:

1. The HDAPS survey acquisition program (DAS\_SURV) was modified by LCDR Perugini so that the HDOP is recorded with every selected sounding. Also, an extra line was added to the header information preceding each survey line, stating that DGPS is the primary positioning system. This information is found on the raw data printout.
2. Two Falcon ranges were recorded simultaneously with all data acquired when DGPS was the primary positioning system (DOY's 249 and 252), and two ranges on DOY 317. The maximum residual of these ranges was recorded on the raw data

printout (as well as electronically), and scanned off-line for values greater than 10 meters. Normally, the maximum residual was below 5 meters and never consistently exceeded 10 meters. Therefore, the 5-meter static agreement check was accomplished during data acquisition.

3. Survey operations were suspended when the HDOP value exceeded 3.0. Generally, whenever this value exceeded 2.5, the position would begin to deteriorate. High HDOP value was not a significant problem, as the duration was relatively short (several seconds) and the condition would correct itself.
4. Whenever less than four satellites were tracked by the DGPS unit, the HDOP would normally rise above 3.0, the residuals would climb, and the position would generally degrade. Normally, 5 to 6 satellites were visible and the same number were used in the position solution. Too few satellites never caused a substantial or extended problem.
5. Overall, it was obvious when the DGPS position was in error, because any (usually several) of the following conditions would occur: the position would jump, the HDOP would climb, the residuals would climb, the number of satellites would drop below four, or the DGPS system would switch from "NAV" (navigating) to "TRK" (tracking).

However, these conditions were not overly common, and rarely did a positioning problem with this system cause substantial "downtime". Whenever poor DGPS positioning was persistent, the Falcon system was selected as primary or operations were suspended until the DGPS system was navigating properly.

Also, never did the DGPS system fail and not independently warn the operator that the positioning was in error or the system was not functioning. The residuals between the Falcon ranges and the DGPS position would rise when the DGPS position was bad, but these residuals were never the only "flag" that DGPS was down.

I.5 Only the Falcon system required calibration data be applied to raw ranges. The range corrector and minimum acceptable signal strength (MASS) for each Mini-Ranger Reference Station were entered in the HDAPS system using the Pre-Survey C-O Table. These tables provided the mechanism by which HDAPS automatically applies the proper range corrector and removes from the position computation those LOP's with signal strengths below MASS.

Overall, calibration data applied to the raw Mini-Ranger ranges was adequate and effective.

I.6 a. See section I.4 for DGPS operating procedures and adequacy standards.

b. No data were affected by equipment malfunctions.

c. No atmospheric conditions affected data quality.

d. Although data were never accepted when the positioning was in question (high max residuals, ECR, etc.), residuals were lower when the Hybrid system of 3-Falcon/1-ARGO was used (as opposed to 2-Falcon/2-ARGO). Therefore, from DOY 148 until DOY 249 (excluding DOY 189), ARGO station 202 was not used for primary navigation.

e. The discovery of the incorrect position on the Point Judith East breakwater light (see section H.6) was the only significant positioning problem encountered. All data acquired prior to this discovery has been rejected.

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. Refer to SEPARATE III for a copy of offset table 3, which was the only table used during this survey. \*

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. Refer to SEPARATE III for offset table number 3. \*

*\* FILED WITH THE ORIGINAL FIELD RECORDS*



**J. SHORELINE** *SEE ALSO SECTION 2.6. OF THE EVALUATION REPORT.*

No shoreline areas are present within the limits of this survey.

**K. CROSSLINES** *SEE ALSO SECTION 3.2. OF THE EVALUATION REPORT*

**K.1** The percentage of crosslines as compared to mainscheme lines was 7 percent.

**K.2** Each crossline sounding was compared to mainscheme soundings. All crossline soundings agreed with the majority of surrounding mainscheme soundings within 1.0 meter.

**K.3** No significant differences were noted.

**K.4** The same sounding equipment was used to run both the mainscheme and crosslines.

**L. JUNCTIONS** *SEE ALSO SECTION 5. OF THE EVALUATION REPORT*

This survey does not junction with any current basic survey.

**M. COMPARISON WITH PRIOR SURVEYS**

*SEE ALSO SECTION 6. OF THE EVALUATION REPORT*

**M.1** Several prior surveys serve as a basis for charted depths in the survey area. These are:

H-6443	1:40,000	1939
FE-241WD	1:20,000	1982-1984
FE-269WD	1:20,000	1984

H-6443 is the basic hydrographic survey that covers the project area. This survey is the source of those charted depths that do not have special notes attached.

FE-241WD and FE-269WD were wire drag and side scan sonar surveys performed by the RUDE and HECK. Apparently, while searching for wrecks in this area, the ships encountered numerous hangs on uncharted boulders. Boulders were also identified and charted from side scan sonar records. The nine AWOIS items that fall within this survey area were addressed by these two surveys.

**M.2 AWOIS Items and Developments - General**

As foreseen during the project planning stages, the number of side scan sonar contacts found in the survey area exceeded a feasible number that could be investigated. Guidelines provided in the project instructions (section 6.13.1) addressed this problem, and the following requirements were set:

- \* In depths of water less than or equal to 20 meters, contacts with computed target heights of at least 1 meter should be considered for further investigation
- \* In depths of water greater than 20 meters, contacts with computed target heights rising above the bottom at least 10 percent of the depth should be considered for further investigation
- \* When significant contacts are closer than 3.3 millimeters apart using the largest scale chart of the area, investigate the contact with the shoalest apparent depth (this equates to 132 meters for the 1:40,000 scale chart)
- \* It may not be cost effective to investigate all contacts. In this case, the contacts with the highest computed target heights should be selected for further investigation.

Following these guidelines, over four hundred significant side scan sonar contacts were logged during main scheme 200 percent side scan sonar coverage. The investigation of all contacts was impractical, so the following criteria were established for determining which contacts were most significant:

- 1) Develop contacts which fall in the general vicinity of the reported positions of AWOIS items.

2) Develop features which have clearly identifiable "hits" on both the 100 percent and 200 percent coverage. Features with computed heights over 3 meters were given priority.

3) Generally, develop contacts with higher heights off the bottom in shallower water.

4) Give more credence to contact heights which were recorded on the mid-range side scan sonar trace over those which were located close to the centerline of the trace.

So the area was covered by 200 percent side scan and all contacts were logged either on-line or during processing. These contacts were then plotted, and a determination was made using the above criteria as to which contacts warranted further development. All developments were dealt with in the same manner, regardless of whether or not they were associated with an AWOIS item. The following is the basic development procedure:

First, 50 meter side scan passes were run for a more detailed trace and a more accurate height computation

Then, echosounder development, typically with 10 meter line spacing to determine the extent of the feature

And, diver investigation and least depth by pneumatic depth gage if the echosounder development was inconclusive, or the feature was very prominent

Using this system, 36 non-AWOIS features were developed (numbered 1 to 35 and 31A), as well as 6 of the 9 prior survey AWOIS Items (labeled with the AWOIS numbers). AWOIS items 1865, 7904, and 7905 had no official development, although development #13 was 200 meters Southwest of the position for AWOIS 7904 and development #11 was 250 meters Northeast of the position for AWOIS 7905.

A summary of the 36 developments can be found in section M.5, and the individual descriptions can be found in SEPARATE V.VI. \*

Following are the individual descriptions of the 9 AWOIS items within the survey area (1865, 1874, 2712, 7901, 7902, 7903, 7904, 7905, 7920).

*\* FILED WITH THE ORIGINAL FIELD RECORDS. DIVE INVESTIGATION REPORTS ARE APPENDED TO THIS REPORT*



AWOIS 2712

Charted Feature: Wreck of the "Blackpoint" (stern), 64 ft depth.

Charted Position: 41/19/33.34 N 071/25/45.93 W

Source: FE-241SS/82 OPR-B660-RU/HE-82 - Diver reported 64 ft LD  
*ORIGINATING SOURCE: NM 24/45*

Investigation Description: Three development side scan lines and 12 echo sounding lines were run. A dive was made on the wreck on DN 317.

Investigation Results: The dive least depth was found to be 21.1 M (69.2 FT) at position 3828. *CONCUR*

Charting Recommendation: The divers had a high degree of confidence that they determined the least depth over the wreck. Chart as a 69 ft wreck. *CONCUR. CHART 45 A 21.1 WK (69 FT) IN:*

<i>LATITUDE</i>	<i>LONGITUDE</i>
41/19/33.42 N <i>7</i>	071/25/45.42 W <i>33</i>

AWOIS 7520

Charted Feature: Dangerous submerged obstruction cleared to 70 ft

Charted Position: 41/17/09.37 N 071/26/42.18 W

Source: FE-269WD/84 - OPR-B660-RU/HE-84 - Evaluator scaled off boulder from sonargram. The scaled depth was 77 feet, however the subsequent drag cleared the rock at 70 feet.

Investigation Description: The rock was found on main scheme side scan lines and was subsequently developed with 50 meter range scale side scan and echo sounding lines.

Investigation Results: The echo sounder least depth was determined to be 23.6 meters (77.4 ft) at 3476.1 (DN 177). The survey position corresponds very closely to the originally reported position.

Charting Recommendation: Delete the 70 foot obstruction symbol. Chart a ~~(77 ft) depth~~ at:

*23.6 M RK*  
41/17/09.18 N 71/26/40.86 W

*CONCUR. SHOULD THE SCALE OF THE CHART ALLOW*

AWOIS 7901

Charted Feature: 48-foot charted boulder

Charted Position: 41/18/51.07 N 71/28/17.62 W

Source: FE-241WD/82 - OPR-B660-RU/HE-81 - Evaluator scaled off boulder from sonargram.

Investigation Description: Numerous lines at 50-meter side scan sonar range scale, echo sounding lines and diver investigation.

Investigation Results: The least depth determined by echo sounder was 14.5 m (47.6 ft) at position 3213.20 (DN 171). The diver least depth measured by pneumatic gage was found to be slightly deeper; 14.8 m (a DP was not taken over the dive buoy).

Charting Recommendation: The echo sounder least depth supports the currently charted 48-foot charted boulder. Chart the 14.5 m least depth at:

41/18/51.37 N 71/28/18.05 W

*CONCUR. SEE ALSO SECTION 6.6.1) OF THE EVALUATION REPORT.*

AWOIS 7902

Charted Feature: 52 foot boulder, wire drag hang

Charted Position: 41/17/45.33 N 071/27/48.70 W

Source: (two)

- 1) FE-241WD/82 - OPR-B660-RU/HE-81 - Evaluator scaled off boulder from sonargram.
- 2) FE-269/84 OPR-B660-RU/HE-84 - Temporary hang reported.

Investigation Description: Numerous side scan sonar lines at 50-meter range scale, echo sounding lines, and diver investigation.

Investigation Results: The diver least depth on a boulder was found to be 16.0 m (52.5 ft) at position 3168 (DN 171).

Charting Recommendation: <sup>DELETE</sup> ~~Retain~~ the 52 foot depth based on the ~~diver position~~. Remove the wire drag hang symbol. Chart at position:

41/17/45.09 N 71/27/48.80 W

*CONCUR. CHART A 16.1 RK (53FT) AS SHOWN ON THE PRESENT SURVEY*

AWOIS 7903

Charted Feature: 62 foot rock, obstruction, and wire drag cleared symbol.

Charted Position: 41/17/39.04 N 071/27/07.53 W

Source: FE-269WD/84 - OPR-B660-RU/HE-84 - Diver determined least depth.

Investigation Description: Numerous side scan sonar lines at 50-meter range scale and echo sounding lines were run over the boulder.

Investigation Results: The echo sounder least depth was found to be 19.0 m (62.3 ft) at position 3409.2 (DN 175).

Charting Recommendation: Retain the 62 foot charted depth based on the echo sounder least depth. Remove the rock, obstruction, and wire drag symbols. This particular rock deserves no special designation such as "Rk" or "Boulder" since it sits in the midst of a boulder field. Chart the least depth at: } CONCUR  
DO NOT CONCUR

41/17/39.47 N 071/27/06.96 W ✓  
CHART AS A 19.1 RK (62 FT) AS SHOWN ON THE PRESENT SURVEY

AWOIS 7904

Charted Feature: Submerged rock cleared to 60 feet

Charted Position: 41/17/37.94 N 071/28/31.90 W

Source: FE-269 OPR-B660-RU/HE-81 - Divers found least depth on hang to be 70 ft. A subsequent drag hung at 60 feet.

Investigation Description: The area was covered by 200 percent side scan coverage. A definite contact was discovered 150 m SW of the charted position of the AWOIS item. This contact was develop further by echo sounder under Development 13.

Investigation Results: No significant contacts which approached a 60-foot least depth were found within a 200 meter radius of the charted position. The echo sounder least depth in Development 13 was found to be 21.3<sup>4</sup> m (69.9<sup>2</sup> ft) at position 3333.2. See the writeup for Development 13 for further details. Approximately 180 m NNW of the charted position, a 20.3 m (66.6 ft) depth was found on a main scheme line. This represents the least depth within the 200 m radius. CONCUR LAT: 41°17'43.42"N, LON: 71°28'32.6"W

Charting Recommendation: The area was saturated with side scan sonar coverage. The only sizeable target in the area was defined to by Development 13. Delete the 60 foot depth. Chart representative development least depths in this area. CONCUR.

AWOIS 7905

Charted Feature: 69 foot sounding on a rock

Charted Position: 41/17/47.95 N 071/28/41.88 W

Source: FE-269WD/84 - OPR-B660-RU/HE-84 - A rock was hung by wire drag at an effective depth of 69 ft.

Investigation Description: The entire area was covered by 200 percent side scan coverage. Although there were several side scan sonar contacts within the 200 meter radius of the charted position, none were deemed to be of special significance. Many more significant contacts in the adjacent area were developed.

Investigation Results: A least depth of 21.0 m (68.9 ft) was found on a main scheme sounding line 150 m SE of the charted position of the AWOIS Item. *LAT: 41°17'45.82N, Lon: 71°28'36.56"W*

Charting Recommendation: Chart a 21.0 m (69 ft) <sup>ROCK</sup> depth based on the main scheme sounding line. ~~Remove the rock notation.~~ The entire bottom in this area is covered by boulders. It serves no purpose to single out individual rocks in this area. *DO NOT CONCUR.*  
*CHART A 21 RK (69FT) DELETE AWOIS ITEM #7905.*

M.3 After studying the prior surveys and the charts very carefully, the RUDE concluded that chart number 13218, (1:80,000) serves as an accurate document for representing all prior survey depths. Twenty-eight depths from this chart have their origins from H-6443. In addition, the nine AWOIS items from the wire drag surveys also appear on this chart. Thirty-seven positions and depths were scaled off this chart and entered into a carto table. These features were plotted on a mylar overlay and were used to compare the current survey to prior surveys. This overlay was also used to compare the current survey to the chart.

This overlay was placed on top of the main scheme sounding plot for comparison. The quality of agreement was generally within 0.5 meters over the entire area.

M.4 The soundings from <sup>THE PRESENT</sup> ~~this~~ survey are approximately 0.5 meters deeper than depths from prior surveys in areas of "normal" bottom topography (breaks in the boulder field). The current survey discovered many features that the 1939 "H" survey did not show. *(H6443)*  
In general, these features agreed with those identified by the 1982-84 RUDE and HECK surveys. *(FE-241WD AND FE-269WD)*

M.5 The procedures used for contact evaluation and development are outlined in section M.2. The following pages summarize the 36 developments of significant features. The individual reports can be found in SEPARATE V. *APPENDED TO THIS REPORT. PLOTS OF INDIVIDUAL DEVELOPMENTS ARE FILED WITH THE ORIGINAL FIELD RECORDS*



Dev	LD (M)	Posno	GP-LD	Item	SS Mn Schm	SS Dev	Ech Dev	Snd Dev	Dive Dev
1	15.9	3265.2	41/19/17.1 <sup>21</sup> 9N 71/29/21.88W	<del>RK Bld</del>	Y	Y	Y		N
2	17.1	3275.2	41/19/15.2 <sup>2</sup> 0N 71/29/10.03W	<del>RK Bld</del>	Y	Y	Y		N
3	<del>14.9</del> <sup>15.2</sup>	3369.1	41/19/18.1 <sup>17 16</sup> 0N 71/29/02.38W	Bld	Y	Y	Y		SEE DEV #3 FOR DIVE ON SEPARATE ROCK
4	16.4 <sup>3</sup>	3347.2	41/18/59.7 <sup>95 6</sup> 5N 71/28/43.73W	<del>RK Bld</del>	Y	Y	Y		N
5	15.1	3431	41/18/49.0 <sup>11</sup> 9N 71/29/21.43W	<del>RK Bld</del>	Y	Y	Y		Y
6	20.8 <sup>7</sup>	3289.2	41/18/21.4 <sup>4</sup> 2N 71/29/37.37W	<del>RK Bld</del>	Y	Y	Y		N
7	<del>21.0</del> <sup>20.9</sup>	3303.1	41/18/10.0 <sup>5</sup> 3N 71/29/20.69W	RK Bld	Y	Y	Y		N
8	21.2 <sup>1</sup>	3317.2	41/17/57.6 <sup>70 70</sup> 9N 71/29/01.30W	<del>RK Bld</del>	Y	Y	Y		N
9	20.0 <sup>1</sup>	3191.2	41/18/04.3 <sup>41</sup> 9N 71/28/45.89W	<del>RK Bld</del>	Y	Y	Y		N
10	20.4	3201.4	41/18/01.1 <sup>2</sup> 0N 71/28/42.84W	<del>RK Bld</del>	Y	Y	Y		N
11	20.1 <sup>2</sup>	3207.2	41/17/55.5 <sup>61</sup> 9N 71/28/35.20W	RK Bld	Y	Y	Y		N
12	25.5	3325.3	41/17/34.5 <sup>60</sup> 9N 71/29/01.88W	<del>RK Bld</del>	Y	Y	Y		N
13	21.3 <sup>4</sup>	3333.2	41/17/35.7 <sup>8</sup> 6N 71/28/34.99W	<del>RK Bld</del>	Y	Y	Y		N
14	18.7 <sup>5</sup>	3164.1	41/17/55.9 <sup>35.00 6.00</sup> 8N 71/28/00.42W	<del>RK Bld</del>	Y	Y	Y		N
15	18.8 <sup>9</sup>	3175.2	41/18/11.3 <sup>7</sup> 6N 71/28/04.12W	<del>RK Bld</del>	Y	Y	Y		N
16	21.5	3179.1	41/18/12.2 <sup>8</sup> 6N 71/28/28.99W	<del>RK Bld</del>	Y	Y	Y		N
17	18.6 <sup>7</sup>	3245.1	41/18/43.4 <sup>9</sup> 7N 71/28/39.44W	<del>RK Bld</del>	Y	Y	Y		N

Dev	LD (M)	Posno	GP-LD	Item	SS Mn Schm	SS Dev	Ech Dev	Snd Dev	Dive Dev
18	15.0	3217.1	41/19/00.99N 71/28/26.33W	<sup>101</sup> <del>Bld</del> RK	Y	Y	Y		N
19	15.2 <sup>3</sup>	3229.2	41/19/13.23N 71/28/03.99W	<sup>34</sup> <del>Bld</del> RK	Y	Y	Y		N
20	17.0 <sup>1</sup>	3239.1	41/19/02.33N 71/27/49.64W	<sup>85</sup> <del>Bld</del> RK	Y	Y	Y		N
21	19.5 <sup>6</sup>	3401.2	41/17/37.23N 71/27/17.27W	<sup>54</sup> <del>Bld</del> RK	Y	Y	Y		N
22	21.4	3453.2	41/17/21.42N 71/26/57.39W	<sup>84</sup> <del>Bld</del> RK	Y	Y	Y		N
23	21.3	3493.2	41/17/26.74N 71/26/29.78W	<sup>6</sup> <del>Bld</del> RK	Y	Y	Y		N
24*	18.8 <sup>5</sup>	3517.1	41/17/47.73N 71/26/11.39W	<sup>5</sup> <del>Bld</del> RK	Y	Y	Y		N
25	18.5 <sup>0</sup>	3529.1 <sup>35</sup>	41/18/02.65N 71/26/26.79W	<sup>70</sup> <del>Bld</del> RK	Y	Y	Y		N
26	17.3 <sup>2</sup>	3435.2	41/18/10.43N 71/26/58.58W	<sup>35</sup> <del>Bld</del> RK	Y	Y	Y		N
27	18.0 <sup>17.9</sup>	3541.1	41/18/24.47N 71/26/19.14W	<sup>9</sup> <del>Bld</del> RK	Y	Y	Y		N
28	No least depth. Item was insignificant after SS Dev								
29	22.5 <sup>8</sup>	3577.2	41/18/31.09N 71/25/26.33W	<sup>11</sup> <del>Bld</del> RK	Y	Y	Y		N
30	25.1	3563.1	41/18/16.38N 71/25/14.65W	<sup>40</sup> <del>Bld</del> RK	Y	Y	Y		N
31	19.6	3633	41/19/23.31N 71/26/06.29W	<sup>3</sup> Wk ✓	Y	Y	N		Y
31A	21.8 <sup>7</sup>	3672	41/19/25.60N 71/26/07.81W	<sup>2</sup> Wk ✓	Y	Y	N		Y
32	26.4 <sup>5</sup>	3662.2	41/16/55.63N 71/26/03.06W	<sup>25</sup> <del>Bld</del> RK	Y	Y	Y		N
33*	18.8 <sup>3</sup>	3377.2 <sup>1369.5</sup>	41/18/32.54N 71/29/03.97W	<sup>8</sup> <del>Bld</del> RK	N	N	Y		N

Dev	LD (M)	Posno	GP-LD	Item	SS Mn Schm	SS Dev	Ech Dev	Snd Dev	Dive Dev
34	<del>17.1</del> 16.0	3377.2 89	41/18/31.80N 71/28/29.95W	<sup>1</sup> <del>Ridge</del> RK	N	N	Y		N
35	<del>14.7</del> 13.4	3419 5+1	41/18/32.50N 71/28/42.83W	<sup>20</sup> <del>Ridge</del> RK <sub>93</sub>	N	N	Y		Y

\* Development numbers 24 and 33 were not plotted on the final depth plot, because the main scheme soundings which ran over both of these developments were shoaler than the development least depth. The Dev 24 least depth was 18.8<sup>3</sup> meters, and the main scheme sounding was 18.6 meters. The Dev 33 least depth was 18.6<sup>3</sup> meters, and the main scheme least depth was 18.4 meters.

M.6 Since 200 percent side scan sonar coverage was achieved over the entire survey area, the RUDE feels that all significant features were identified and developed. Any feature or sounding which was not developed, is insignificant and should not be charted. *DO NOT CONCUR. SEE ALSO SECTION 7. a. 4) OF THE EVALUATION REPORT*

M.7 There are no known authoritative non-NOS surveys which cover the area within this survey.

**N. COMPARISON WITH THE CHART** *SEE SECTION 7. OF THE EVALUATION REPORT.*

**N.1** The following charts are affected by this survey:

<u>Chart #</u>	<u>Edition</u>	<u>Date</u>	<u>Scale</u>
13205	<del>29</del> 30	<del>5 Aug, 1989</del> 18 MAY 1991	1: <del>40</del> <sup>80</sup> ,000
13218	<del>33</del> 30	7 Jul, 1990	1:80,000
13215	12	23 Jun, 1990	1: <del>80</del> <sup>40</sup> ,000

The above charts have had no notice to mariner updates affecting the survey area.

**N.2** There were no AWOIS items investigated during this survey which originated from a source other than a prior survey.

**N.3** There were no dangers to navigation reported during this survey.

**N.4** Refer to sections M.3 and M.4 for sounding comparisons.

**N.5** Refer to sections M.2 and M.5 for non-sounding features.

**N.6** No changes to the scale, coverage, or format of the published charts of the survey area are recommended.

**O. ADEQUACY OF SURVEY**

O.1 This survey is complete and adequate to supersede prior surveys. All assigned AWOIS Items and newly discovered features within the boundaries of this survey have been resolved.

O.2 The complexity of this survey has been discussed throughout this report. It has required many new procedures, during data acquisition and especially during data processing. The RUDE is confident however, that this survey is complete, although many features could not be developed due to the numbers involved. See sections D.3, I.4, and M.2 for explanations of individual techniques and processes developed during this survey to deal with the unique problems.

**P. AIDS TO NAVIGATION *SEE ALSO SECTION 9.2. OF THE EVALUATION REPORT***

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

P.2 Three Aids to Navigation were located during the survey:

Buoy R"2"	(3.5 NM SE of Point Judith)
East Breakwater Light "2"	(Point Judith Harbor of Refuge)
Center Breakwater Light	(Point Judith Harbor of Refuge).

Buoy "2" was the only floating aid found within the survey area, and its position was determined to be:

Latitude	41° 19' <sup>16.090</sup> 15.159" N
Longitude	071° 28' <sup>0 1</sup> 31.620" W.

The charted position of this buoy is:

Latitude	41° 19' 17" N
Longitude	071° 28' 31" W.

The Light List position is:

Latitude	41° 19.3' N
Longitude	071° 28.6' W.

Considering variance in scaling the position from the chart, the above positions are all within adequate agreement. The characteristics of the Buoy are charted and listed correctly.

Positions were determined for both breakwater lights (see the 1991 Horizontal Control Report) and compared to NGS NAD 83 positions. The position of the Center Breakwater Light was accurate, but the East Breakwater Light "2" position was 17 meters from that listed by NGS. The charted light characteristics as well as Light List characteristics were correct for both lights. The erroneous position of light "2" was never relayed to the Coast Guard, since hurricane "Bob" destroyed

the light.

**P.3** No other aids were located during the survey.

**P.4** No bridges, overhead cables or pipelines are within the survey limits.

**P.5 a.** No submarine cables cross the survey area.

**b.** No pipelines cross the survey area.

**c.** The primary ferry route to Block Island from the mainland is run from Galilee (just West of Point Judith) to Old Harbor, Block Island. This route is not shown on any charts of the area.

**P.6** The ferry terminal in Old Harbor Block Island is shown on chart 13217. The position of the terminal in Galilee should be charted at:

latitude 41° 22' 40"  
longitude 071° 30' 40".

**Q. STATISTICS**

Q.1 a.	Number of positions:	3,661
	- positions 1-128 were rejected	
	- positions 128-149 were intentionally skipped	
	- positions 150-3810 were actually used	
b.	Lineal nautical miles of sounding lines:	
	- with side scan sonar	233
	- hydro only	102
Q.2 a.	Total square nautical miles of hydrography	9
b.	Total days of production	31
c.	Detached positions	67
d.	Bottom samples	24
e.	Tide stations	1
f.	Current stations	0
g.	Velocity casts	6
h.	Magnetic stations	0
i.	XBT drops	0

**R. MISCELLANEOUS**

R.1 a. No unusual silting was noted during this survey.

b. All submarine features have been discussed previously.

c. On the final sounding plot, contour lines (mainly in the center of the sheet) appear "jagged", due to differences between main scheme sounding lines and "splits", which were run after all main scheme had been completed. These differences are as great as 0.3 meters in some areas.

This condition can be attributed to the inadequacy of predicted tide correctors. In most areas, adjacent sounding lines were run on different days. Differences in meteorological conditions on the affected days is the likely cause of the predicted tides discrepancy.

The RUDE is confident that the application of approved tide data will rectify any discrepancies between adjacent sounding lines.

d. No current observations were made.

e. No magnetic anomalies were encountered during this survey.

R.2 Bottom samples were not submitted to the Smithsonian Institution.

S. RECOMMENDATIONS

S.1 No inadequacies have been noted.

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

S.3 This survey should supersede all other prior survey depths. No further investigation of this area is recommended.

T. REFERRAL TO REPORTS

RUDE Electronic Control Report - 1991 Field Season  
(submitted to N/CG244 concurrent with this survey)

Horizontal Control Report - 1991 Field Season  
(submitted by N/CG23322)



CONTROL STATIONS as of 19 Dec 1991

← ANTENNA ELEVATION (METERS)

No	Type	Latitude	Longitude	H Cart	Freq	Vel	Code	MM/DD/YY	Station Name	
<del>101</del>	F	<del>041:21:32.180</del>	<del>071:29:34.958</del>	<del>5</del>	<del>250</del>	<del>0.0</del>	<del>0.0</del>	<del>7 05/01/91</del>	<del>PT JUDITH EAST BRKNTR LT 1048</del>	
<del>102</del>	F	<del>041:21:39.643</del>	<del>071:28:53.102</del>	<del>20</del>	<del>250</del>	<del>0.0</del>	<del>0.0</del>	<del>5 05/01/91</del>	<del>PT JUDITH LIGHT OFFSET</del>	
202	A	041:09:10.210	071:33:02.019	0	250	1646.7	299670.0	2 05/01/91	BLOCK ISL SE LIGHTHOUSE OFFSET	- FIELD POSITION
201	A	041:27:42.566	071:10:22.144	0	250	1646.7	299670.0	1 05/01/91	WARREN OFFSET (AT WARREN PT)	- FIELD POSITION
<del>103</del>	F	<del>041:21:45.270</del>	<del>071:30:26.176</del>	<del>8</del>	<del>250</del>	<del>0.0</del>	<del>0.0</del>	<del>5 05/03/91</del>	<del>MAIN BRKNTR CTR LT 2 - 1048</del>	<del>41 071 31 200 22</del>
* 111	F	041:21:15.270	071:30:26.176	7	250	0.0	0.0	4 05/07/91	MAIN BRKNTR CTR LT 2 - 1948	41 071 31 200 22
* 112	F	041:21:32.562	071:29:34.315	7	250	0.0	0.0	5 05/07/91	PT JUDITH EAST BRKNTR LT NEW	FIELD POSITION
113	F	041:21:39.621	071:28:53.024	20	250	0.0	0.0	8 05/07/91	PT JUDITH LIGHT OFFSET 2	FIELD POSITION
114	F	041:13:39.514	071:34:33.030	16	250	0.0	0.0	8 05/28/91	BLOCK ISLAND N LIGHT OFFSET	FIELD POSITION
115	F	041:18:14.006	071:51:30.696	18	250	0.0	0.0	5 07/01/91	WATCH HILL LIGHT OFFSET	FIELD POSITION
116	F	041:21:54.865	071:35:42.107	8	250	0.0	0.0	4 09/06/91	GREEN HILL BEACH	FIELD POSITION
117	F	041:18:14.045	071:51:30.689	18	250	0.0	0.0	3 09/06/91	WATCH HILL LIGHT OFFSET # 2	FIELD POSITION
118	F	041:09:09.918	071:33:06.592	61	250	0.0	0.0	5 09/06/91	BLOCK ISLAND SE LIGHT OFFSET 2	FIELD POSITION
119	F	041:04:15.499	071:51:25.373	80	250	0.0	0.0	2 09/06/91	MONTAUK LIGHT OFFSET	FIELD POSITION
120	F	041:21:39.717	071:28:52.946	20	250	0.0	0.0	8 09/27/91	PT JUDITH LIGHT OFFSET 3	FIELD POSITION
121	F	041:26:57.711	071:23:57.797	20	250	0.0	0.0	4 09/27/91	BEAVERTAIL LIGHT OFFSET	FIELD POSITION
122	F	041:27:43.708	071:21:46.539	12	250	0.0	0.0	6 09/30/91	CASTLE HILL LIGHT OFFSET	FIELD POSITION
125	F	041:27:42.566	071:10:22.144	12	250	0.0	0.0	2 10/21/91	WARREN OFFSET	FIELD POSITION

\* STATIONS 111 AND 112 ARE THE ONLY STATIONS SEAWARD OF THE HWL.

1991

1991

AREA SURVEY DEVELOPMENT #3  
DIVE INVESTIGATION REPORT

DATE: 25 JUNE 1991 DOY: 176 TIME: 2001Z

PERSONNEL:

DIVEMASTER\TENDER- M. SRAMEK

DIVERS- ENS OBERLIES

COXSWAIN\TENDER- J. BRAWLEY

- ENS ILLG

VISIBILITY: 15 FEET

CURRENT: 1\2 KNOT E

MAXIMUM DEPTH: 18.9 METERS

BOTTOM TIME: 16 MIN.

METHOD OF POSITION DETERMINATION: DETACHED POSITIONS

HDAPS POSITION: FIX 3473

EASTING: 137386.3

NORTHING: 257801.6

LATITUDE: 41-19-18.10 N

LONGITUDE: 71-29-02.38 W

AVERAGE LEAST DEPTH BY PNEUMATIC DEPTH GAUGE: 15.6 METERS

TIME OF READING: 2012Z

PNEUMATIC DEPTH GAUGE CORRECTOR: 0.0

PREDICTED TIDAL ZONE CORRECTOR: -0.7

LEAST DEPTH @ MLLW: 14.9 METERS

NARRATIVE REPORT: This development is a solitary boulder covered with marine growth. The least depth was determined by pneumatic depth gauge three times at the highest point of the boulder. The least depth determined by this method was 15.6 meters at the time of the survey. The diver's depth gauges found the least depth to be 52 feet (15.8 meters) and the base of the boulder to be 62 feet (18.9 meters).

AREA SURVEY DEVELOPMENT #5  
DIVE INVESTIGATION REPORT

DATE: 25 JUNE 1991 DOY: 176 TIME: 1629Z

PERSONNEL:

DIVEMASTER\TENDER- M. SRAMEK

DIVERS- ENS OBERLIES

COXSWAIN\TENDER- A. STYRON

- ENS ILLG

VISIBILITY: 20 FEET

CURRENT: 1 KNOT W

MAXIMUM DEPTH: 19.8 METERS

BOTTOM TIME: 16 MIN.

METHOD OF POSITION DETERMINATION: DETACHED POSITIONS

HDAPS POSITION: FIX 3431

EASTING: 136941.5

NORTHING: 256907.3

LATITUDE: 41-18-49.09 N

LONGITUDE: 71-29-21.43 W

AVERAGE LEAST DEPTH BY PNEUMATIC DEPTH GAUGE: 15.2 METERS

TIME OF READING: 1639Z

PNEUMATIC DEPTH GAUGE CORRECTOR:

0.0

PREDICTED TIDAL ZONE CORRECTOR:

-0.1

LEAST DEPTH @ MLLW:

15.1 METERS

NARRATIVE REPORT: This development is a large boulder covered with marine growth. As measured by diver's depth gauges, the top of the boulder is at 51 feet (15.5 meters) and the base of the boulder is at 65 feet (19.8 meters). The least depth was determined by pneumatic depth gauge three times at the point that was determined, by diver's depth gauges, to be the highest point from the bottom. The least depth determined by this method was 15.1 meters at the time of the survey.

AREA SURVEY DEVELOPMENT #31  
DIVE INVESTIGATION REPORT

DATE: 27 JUNE 1991 DOY: 178 TIME: 1413Z

PERSONNEL:

DIVEMASTER\TENDER- M. SRAMEK

DIVERS- LT SCHATTGEN

COXSWAIN\TENDER- J. BRAWLEY

- ENS OBERLIES

- ENS ILLG

VISIBILITY: 15 FEET

CURRENT: 1\2 KNOT SE

MAXIMUM DEPTH: 23.2 METERS

BOTTOM TIME: 25 MIN.

METHOD OF POSITION DETERMINATION: DETACHED POSITIONS

HDAPS POSITION: FIX 3633

EASTING: 141481.7

NORTHING: 257956.3

LATITUDE: 41-19-23.31 N

LONGITUDE: 71-26-06.29 W

AVERAGE LEAST DEPTH BY PNEUMATIC DEPTH GAUGE: 20.3 METERS

TIME OF READING: 1434Z

PNEUMATIC DEPTH GAUGE CORRECTOR: 0.0

PREDICTED TIDAL ZONE CORRECTOR: -0.6

LEAST DEPTH @ MLLW: 19.7 METERS

NARRATIVE REPORT: This development is a steel barge approximately 63 meters long and fairly well deteriorated. It is oriented generally in an East-West direction and fairly clean of marine growth. The least depth was determined by pneumatic depth gauge three times at a point that clearly projected the highest above the wreck. This point appears to be some sort of deck fitting, perhaps a bitt. The least depth determined by this method was 20.3 meters at the time of the survey. Diver's depth gauges found the least depth of this point to be 68 feet (20.7 meters) and the base of the wreck to be 76 feet (23.1 meters).

**DEVELOPMENT NUMBER 31A - Secondary Wreckage from Dev 31**

REFERENCE: Wreck Described in Development 31

A secondary piece of wreckage was identified while investigating the wreck described in Development 31. Divers dove on the secondary wreckage with the following results:

DIVE INVESTIGATION

DOY: 182  
DP FIX Nos: 3673, 3674 LD=3672  
Least Depth @MLLW = 21.8 M  
71.5 FT

See attached sheet for  
Dive description

Height off bottom = 1.0 m  
(measured by diver)  
EASTING: 141446.0  
NORTHING: 258956.8

LATITUDE: 41/19/25.60 N  
LONGITUDE: 71/26/07.81 W

CHARTING RECOMMENDATION

The position of the above wreckage lies about 80 meters and bears 026 degrees true from the main wreck described in Development 31. Since the least depth on this secondary piece of the wreckage is deeper than the least depth on the main wreck, it is recommended that this feature not be charted. Chart the wreck as described in Development 31.

AREA SURVEY DEVELOPMENT #31A  
DIVE INVESTIGATION REPORT

DATE: 01 JULY 1991 DOY: 182 TIME: 1520Z

PERSONNEL:

DIVEMASTER\TENDER- LT SCHATTEGEN DIVERS- ENS OBERLIES

COXSWAIN\TENDER- J. BRAWLEY - ENS ILLG

VISIBILITY: 15 FEET

CURRENT: 1 KNOT W

MAXIMUM DEPTH: 23.7 METERS

BOTTOM TIME: 14 MIN.

METHOD OF POSITION DETERMINATION: DETACHED POSITIONS

HDAPS POSITION: FIX 3672

EASTING: 141446.3

NORTHING: 258027.0

LATITUDE: 41-19-25.60 N

LONGITUDE: 71-26-07.81 W

AVERAGE LEAST DEPTH BY PNEUMATIC DEPTH GAUGE: 22.7 METERS

TIME OF READING: 1530Z

PNEUMATIC DEPTH GAUGE CORRECTOR: 0.0

PREDICTED TIDAL ZONE CORRECTOR: -0.9

LEAST DEPTH @MLLW 21.8 METERS

NARRATIVE REPORT: This object appears to be a part of development 31, the sunken barge. It also is fairly well deteriorated and free of marine growth. The least depth was determined by pneumatic depth gauge three times. The least depth determined by this method was 22.7 meters. Diver's depth gauges found the least depth of the wreck to be 75 feet (22.8 meters) and the base of the wreck to be 78 feet (23.8 meters).

AREA SURVEY DEVELOPMENT #35  
DIVE INVESTIGATION REPORT

DATE: 25 JUNE 1991 DOY: 176 TIME: 1344Z

PERSONNEL:

DIVEMASTER\TENDER- M. SRAMEK

DIVERS- LT SCHATTGEN

COXSWAIN\TENDER- P. KEANE

- ENS ILLG

VISIBILITY: 20 FEET

CURRENT: 1 KNOT W

MAXIMUM DEPTH: 16.7 METERS

BOTTOM TIME: 18 MIN.

METHOD OF POSITION DETERMINATION: DETACHED POSITIONS

HDAPS POSITION: FIX 3419

EASTING: 137838.5

NORTHING: 256393.9

LATITUDE: 41-18-32.50 N

LONGITUDE: 71-28-42.83 W

AVERAGE LEAST DEPTH BY PNEUMATIC DEPTH GAUGE: 15.2 METERS

TIME OF READING: 1357Z

PNEUMATIC DEPTH GAUGE CORRECTOR: 0.0

PREDICTED TIDAL ZONE CORRECTOR: -0.5

LEAST DEPTH @ MLLW: 14.7 METERS

NARRATIVE REPORT: This development is a ridge running generally East to West characterized by many boulders at or near one meter off the bottom. The bottom is almost completely covered with rocks of various sizes. The least depth was determined by pneumatic depth gauge three times at the highest point of what was determined, by diver's depth gauges, to be the highest point from the bottom. The least depth determined by this method was 15.2 meters at the time of the survey. The diver's depth gauges recorded a least depth of 51 feet (15.5 meters).

AREA SURVEY AWOIS ITEM 1874  
DIVE INVESTIGATION REPORT

DATE: 13 NOV 1991 DOY: 317 TIME: 1522Z

PERSONNEL:

DIVEMASTER\TENDER- LT SCHATGEN DIVERS- LTJG OBERLIES

COXSWAIN\TENDER- J. BRAWLEY - ENS ILLG

VISIBILITY: 15 FEET CURRENT: 1/2 KNOT SW

MAXIMUM DEPTH: 25.9 METERS BOTTOM TIME: 20 MIN.

METHOD OF POSITION DETERMINATION: DETACHED POSITION

HDAPS POSITION: FIX 3820

EASTING: 141969.2 NORTHING: 258711.9

LATITUDE: 41-19-47.82 N LONGITUDE: 71-25-45.36 W

AVERAGE LEAST DEPTH BY PNEUMATIC DEPTH GAUGE: 21.1 METERS

TIME OF READING: 1535Z

PNEUMATIC DEPTH GAUGE CORRECTOR: 0.0

PREDICTED TIDAL ZONE CORRECTOR: -0.7

LEAST DEPTH DETERMINED @MLLW 20.4 METERS

NARRATIVE REPORT: The object of this investigation is the bow section of the barge BLACKPOINT. This very large barge is in two pieces, the other being AWOIS 2712. The bow section is actually about two thirds of the entire length of the vessel. It lies upside down on the seafloor and slopes downward from the bow on aft. Because of the depth involved, the divers didn't go to the base of the barge, but instead investigated what they could see without going below 85 feet. A least depth was determined by three consecutive readings by pneumatic depth gauge. The least depth was 21.1 meters at the time of the survey. Diver's depth gauges found this same point to be at 70 feet (21.3 meters).



AREA SURVEY AWOIS ITEM 2712  
DIVE INVESTIGATION REPORT

DATE: 13 NOV 1991 DOY: 317 TIME: 1844Z

PERSONNEL:

DIVEMASTER\TENDER- LT SCHATTGEN DIVERS- LTJG OBERLIES

COXSWAIN\TENDER- J. BRAWLEY - ENS ILLG

VISIBILITY: 15 FEET CURRENT: 1/2 KNOT SW

MAXIMUM DEPTH: 25.9 METERS BOTTOM TIME: 22 MIN.

METHOD OF POSITION DETERMINATION: DETACHED POSITION

HDAPS POSITION: FIX 3828

EASTING: 141967.3 NORTHING: 258267.6

LATITUDE: 41-19-33.42 N LONGITUDE: 71-25-45.42 W

AVERAGE LEAST DEPTH BY PNEUMATIC DEPTH GAUGE: 21.8 METERS

TIME OF READING: 1856Z

PNEUMATIC DEPTH GAUGE CORRECTOR: 0.0

PREDICTED TIDAL ZONE CORRECTOR: -0.7

LEAST DEPTH DETERMINED @MLLW 21.1 METERS

NARRATIVE REPORT: The object of this investigation is the stern section of the barge BLACKPOINT. This very large barge is in two pieces, the other being AWOIS 1874. The stern section is actually about one third of the entire length of the vessel. It lies upright on the seafloor with the base of the wreck at about 85 feet by diver's depth gauge. This end of the barge, as opposed to the bow section, was very torn up. Shell plating and stringers are bent in erratic directions with wreckage strewn on the bottom nearby. A least depth was determined by three consecutive readings by pneumatic depth gauge at the tip of an upright steel girder. The least depth was 21.8 meters at the time of the survey. Diver's depth gauges found this same point to be at 72 feet (21.9 meters).

AREA SURVEY AWOIS ITEM 7901  
DIVE INVESTIGATION REPORT

DATE: 20 JUNE 1991 DOY: 171 TIME: 1855Z

PERSONNEL:

DIVEMASTER\TENDER- M. SRAMEK

DIVERS- LT SCHATTGEN

COXSWAIN\TENDER- P. KEANE

- ENS ILLG

VISIBILITY: 30 FEET

CURRENT: 1\2 KNOT SE

MAXIMUM DEPTH: 18.9 METERS

BOTTOM TIME: 23 MIN.

METHOD OF POSITION DETERMINATION: ECHO SOUNDER DEVELOPMENT

HDAPS POSITION: 3213.20

EASTING: 138419.9

NORTHING: 256978.2

LATITUDE: 41-18-51.47 N

LONGITUDE: 71-28-17.88 W

AVERAGE LEAST DEPTH BY PNEUMATIC DEPTH GAUGE: 15.8 METERS

TIME OF READING: 1855Z

PNEUMATIC DEPTH GAUGE CORRECTOR: 0.0

PREDICTED TIDAL ZONE CORRECTOR: -1.0

LEAST DEPTH @ MLLW: 14.8 METERS

NARRATIVE REPORT: This item is a large boulder approximately 3 meters off the bottom with a circumference of approximately 25 meters. Its surface is irregular and covered with marine growth. The least depth was determined by pneumatic depth gauge three times at the highest point of the boulder. The least depth determined by this method was 15.8 meters at the time of the survey. The diver's depth gauges recorded a least depth of 51 feet (15.5 meters) and the base of the boulder at 62 feet (18.9 meters). Nearby was a much smaller boulder estimated to be less than one meter off the bottom. Beyond this other boulder, the bottom is clean and free of silt and mud being composed primarily of large grain sand and tiny pebbles.

AREA SURVEY AWOIS ITEM 7902  
DIVE INVESTIGATION REPORT

DATE: 20 JUNE 1991 DOY: 171 TIME: 1522Z

PERSONNEL:

DIVEMASTER\TENDER- M. SRAMEK                      DIVERS- LT SCHATGEN  
COXSWAIN\TENDER- P. KEANE                                      - ENS ILLG

VISIBILITY: 30 FEET                                      CURRENT: 1\2 KNOT SE

MAXIMUM DEPTH: 21.6 METERS                              BOTTOM TIME: 13 MIN.

METHOD OF POSITION DETERMINATION: DETACHED POSITIONS

HDAPS POSITION: FIX 3168

EASTING: 139093.1                                      NORTHING: 254929.6

LATITUDE: 41-17-45.10 N                                      LONGITUDE: 71-27-48.80 W

AVERAGE LEAST DEPTH BY PNEUMATIC DEPTH GAUGE: 16.4 METERS

TIME OF READING: 1533Z

PNEUMATIC DEPTH GAUGE CORRECTOR: 0.0

PREDICTED TIDAL ZONE CORRECTOR: -0.4

LEAST DEPTH @ MLLW: 16.0 METERS

NARRATIVE REPORT: The item is a large boulder approximately 5.5 meters off the bottom. The East and North sides were flat and joined to form an abrupt edge. The South and West sides were slightly rounded. The entire rock was covered with marine growth. The uppermost surface of the rock was somewhat flat with an area of approximately 30.5 square meters with a difference in height of less than one foot. The least depth was determined by pneumatic depth gauge three times at the highest point of the relatively flat surface of the rock. The least depth determined by this method was 16.4 meters at the time of the survey. The diver's depth gauges recorded a least depth of 53 feet (16.2 meters) and the base of the rock at 71 feet (21.6 meters). At least for the extent of visibility this boulder stood alone on the sea floor. The bottom is clean and free of silt and mud, composed primarily of large grain sand and tiny pebbles.



**UNITED STATES DEPARTMENT OF COMMERCE**  
**National Oceanic and Atmospheric Administration**  
**Office of NOAA Corps Operations**  
**NOAA Ship RUDE 5-590**  
**439 W. York Street**  
**Norfolk, VA 23510-1114**

October 2, 1991

MEMORANDUM FOR: Chief, Sea and Lake Levels Branch  
FROM: Lieutenant Commander *Nicholas E. Perugini*, NOAA  
Commanding Officer, NOAA Ship RUDE  
SUBJECT: Request for Approved Tides

Please provide the following data:

1. Approved Tides Note
2. Approved Hourly Heights for Days of Hydrography
3. Hourly Heights on Magnetic Tape

Transmit the data to:

Atlantic Hydrographic Section (N/CG244)  
Atlantic Marine Center  
439 W. York Street  
Norfolk, VA 23510

These data are required for the processing of survey:

Registry No.: H-10378

Field Sheet No.: RU-10-2-91

Project No.: OPR-B660-RU-91

Locality: RHODE ISLAND  
RHODE ISLAND SOUND

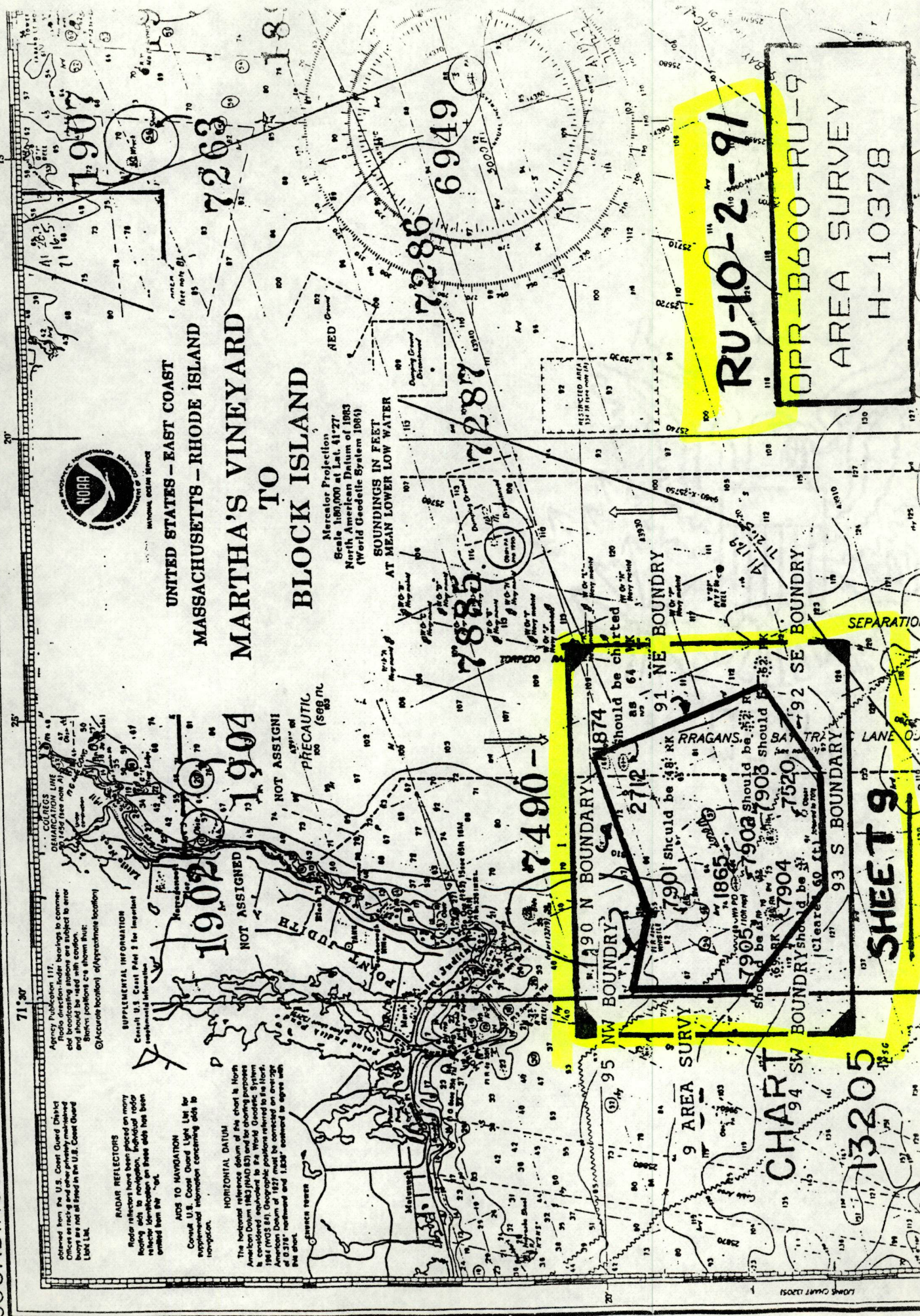
THREE POINT FIVE NAUTICAL MILES SOUTHEAST OF POINT JUDITH

A chartlet showing the survey area and an abstract of times of hydrography is included with this request. The final tide record package for this survey will be forwarded at the end of this month.

Tide data are required within 90 days of receipt of this request. If this schedule cannot be met, please advise: Chief, Atlantic Hydrographic Section, N/CG244, telephone FTS 827-6746.



SOUNDINGS IN FEET



This nautical chart has been designed to promote safe navigation. The National Ocean Service encourages users to report errors, additions, or corrections for improving the chart to the Hydrographic Office, National Ocean Service, 1205 National Harbor, Maryland 20812.



UNITED STATES - EAST COAST  
MASSACHUSETTS - RHODE ISLAND  
MARTHA'S VINEYARD  
TO  
BLOCK ISLAND

Mercator Projection  
Scale 1:60,000 at Lat. 41°27'  
North American Datum of 1983  
(World Geodetic System 1984)

SOUNDINGS IN FEET  
AT MEAN LOWER LOW WATER

Agency Publication 117.  
Radio direction-finder beacons to common  
aid broadcasting stations are subject to error  
and should be used with caution.  
Bearing positions are shown true.  
① Accuracy location of (approximate location)

SUPPLEMENTAL INFORMATION  
Consult U.S. Coast Pilot 3 for important  
supplemental information

NOT ASSIGNED  
NOT ASSIGNED  
NOT ASSIGNED

RADAR REFLECTORS  
Radar reflectors have been placed on many  
leading and other points. Individual radar  
reflectors are shown on these charts but  
printed from the "N".

AIDS TO NAVIGATION  
Consult U.S. Coast Light List for  
supplemental information concerning aids to  
navigation.

HORIZONTAL DATUM  
The horizontal reference datum of this chart is North  
American Datum 1983 (NAD 83) and for charting purposes  
is considered equivalent to the World Geodetic System  
1984 (WGS 84). Geographic positions are based on the North  
American Datum of 1983. Geographic positions are based on the  
North American Datum of 1983. Geographic positions are based on the  
North American Datum of 1983.

95 NW BOUNDARY  
91 NE BOUNDARY  
92 SE BOUNDARY  
93 S BOUNDARY  
94 SW BOUNDARY  
9 AREA SURVY  
CHART 13205  
SHEET 9

RU-10-21-91

OPR-B600-RU-91  
AREA SURVEY  
H-10378

Vessel	Day	Start Fix	End Fix	Start Time	End Time	Depth Corrector Tables		
						Tide	S. Velocity	Offset
40	122	8	51	21:46:52	22:47:01	5	3	3
40	123	65	128	13:54:18	15:33:15	5	3	3
40	127	150	235	20:48:07	22:32:34	5	3	3
40	127	236	247	22:40:31	22:53:05	5	3	3
40	128	251	661	13:12:05	00:03:57	5	3	3
40	129	663	1076	13:55:13	23:17:34	5	3	3
40	130	1077	1215	12:58:51	16:20:33	5	3	3
40	133	1217	1307	18:58:25	23:13:56	5	4	3
40	134	1308	1471	12:54:21	22:12:58	5	4	3
40	135	1472	1685	13:28:43	22:27:45	5	4	3
40	136	1688	1747	13:50:40	16:03:13	5	4	3
40	140	1748	1884	17:05:25	23:03:50	5	4	3
40	141	1985	2000	13:45:22	20:07:37	5	4	3
40	142	2001	2106	16:57:00	22:34:21	5	4	3
40	143	2111	2115	14:33:03	14:42:09	5	4	3
40	148	2117	2166	19:33:54	22:27:34	5	4	3
40	149	2167	2317	11:27:59	20:22:33	5	4	3
40	150	2318	2669	11:37:31	20:39:02	5	4	3
40	151	2670	2705	12:08:01	12:54:48	5	4	3
40	168	2707	2853	17:12:18	21:19:22	6	8	3
40	169	2855	2975	12:32:48	21:52:29	6	8	3
40	170	2976	3158	12:24:35	23:57:11	6	8	3
40	171	3160	3256	13:23:14	22:28:34	6	8	3
40	172	3257	3340	11:30:36	16:24:05	6	8	3
40	175	3341	3414	18:12:10	22:26:41	6	8	3
40	176	3415	3475	12:44:44	20:35:12	6	8	3
40	177	3476	3621	12:52:17	22:06:37	6	8	3
40	178	3622	3665	13:22:59	17:20:06	6	8	3
40	182	3666	3671	13:19:16	13:36:59	6	9	3
40	182	3672	3682	15:46:15	15:47:09	6	9	3
40	189	3683	3718	18:05:16	20:17:15	7	13	3
40	249	3720	3761	12:45:18	15:23:40	9	13	3
40	252	3762	3810	14:44:06	18:45:14	9	13	3



**UNITED STATES DEPARTMENT OF COMMERCE**  
**National Oceanic and Atmospheric Administration**  
**Office of NOAA Corps Operations**  
**Atlantic Marine Center**  
**439 W. York Street**  
**Norfolk, VA 23510-1114**

December 6, 1991

MEMORANDUM FOR: Chief, Sea and Lake Levels Branch  
FROM: Lieutenant Commander *Nicholas E. Perugini*, NOAA  
Commanding Officer, NOAA Ship RUDE  
SUBJECT: Request for Approved Tides

On October 2, 1991 the RUDE submitted a request for approved tides which included an abstract of the times of hydrography for the following survey:

Registry No.: H-10378

Field No.: RU-10-2-91

Project No.: OPR-B660-RU-91

Locality: RHODE ISLAND  
RHODE ISLAND SOUND

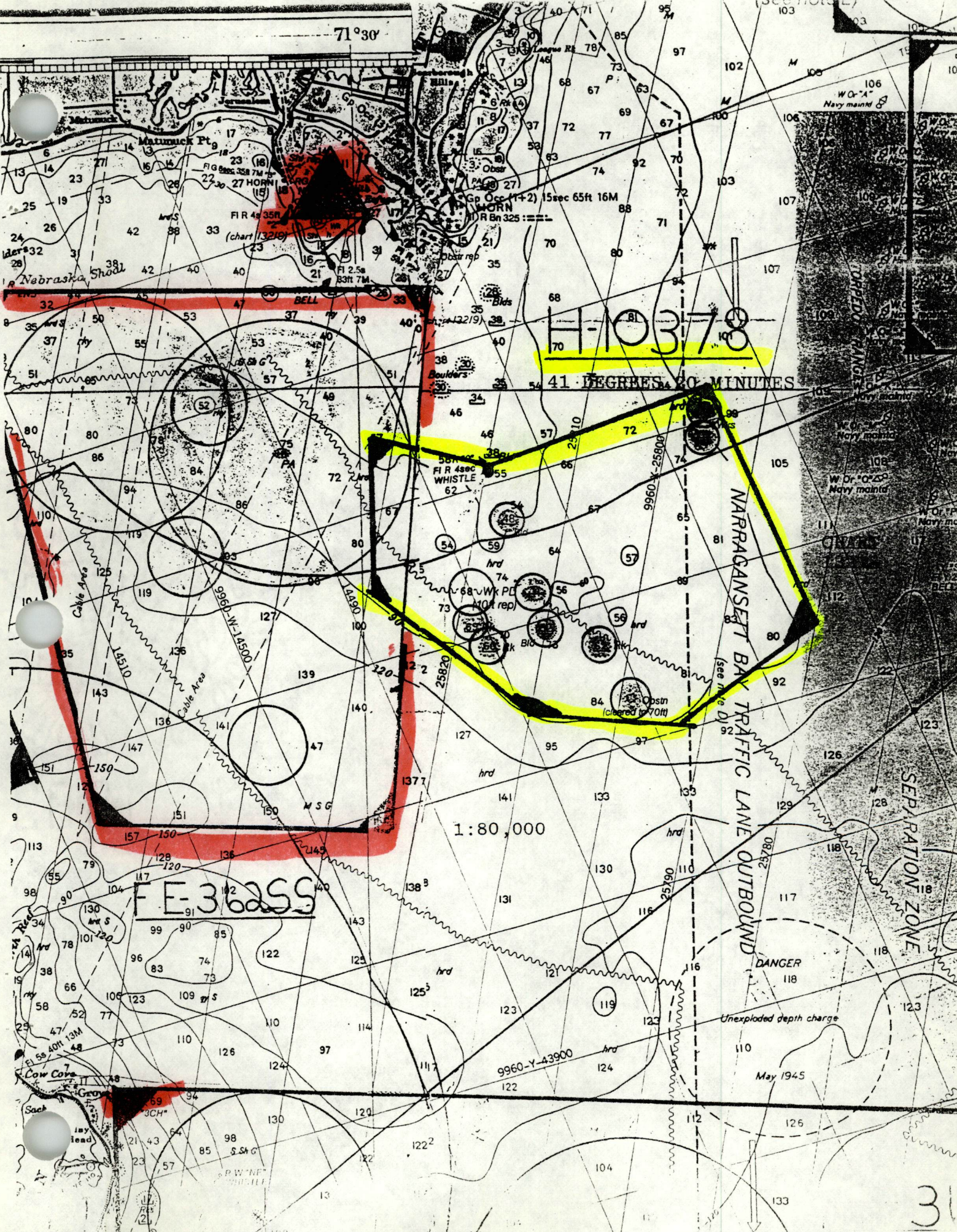
THREE POINT FIVE NAUTICAL MILES SOUTHEAST OF POINT JUDITH

This previous letter is attached. Due to unforeseen additional survey activities that occurred after that letter was submitted, we also request approved tides for the period below, in addition to those originally requested.

November 13, 1991 from 1500 GMT to 2000 GMT



71°30'



31



LETTER OF APPROVAL

REGISTRY NO. H-10378

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

*Nicholas E. Perugini, LCDR, NOAA*  
Nicholas E. Perugini, LCDR, NOAA  
Commanding Officer  
NOAA Ship RUDE

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			
JUDITH, POINT (title)											1
RHODE ISLAND (title)											2
RHODE ISLAND SOUND (title)											3
											4
											5
											6
											7
											8
											9
											10
											11
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											18
											19
											20
											21
											22
											23
											24
											25

Approved:

*Charles E. Harrington*

Chief Geographer - N/CG 2x5

OCT 28 1993

11/29/93

HYDROGRAPHIC SURVEY STATISTICS  
REGISTRY NUMBER: H-10378

NUMBER OF CONTROL STATIONS	15
NUMBER OF POSITIONS	3480
NUMBER OF SOUNDINGS	13247

	TIME-HOURS	DATE COMPLETED
PREPROCESSING EXAMINATION	184	04/09/92
VERIFICATION OF FIELD DATA	207	08/04/92
ELECTRONIC DATA PROCESSING	100	
QUALITY CONTROL CHECKS	151	
EVALUATION AND ANALYSIS	70	11/23/93
FINAL INSPECTION	12	10/26/93
TOTAL TIME	724	
ATLANTIC HYDROGRAPHIC SECTION APPROVAL		11/24/93

**COAST AND GEODETIC SURVEY  
ATLANTIC HYDROGRAPHIC SECTION  
EVALUATION REPORT**

**SURVEY NO.:** H-10378

**FIELD NO. :** RU-10-2-91

Rhode Island, Rhode Island Sound, 3.5 NM Southeast of Point Judith

**SURVEYED:** 2 May through 13 November 1991

**SCALE:** 1:10,000

**PROJECT NO.:** OPR-B660-RU-91

**SOUNDINGS:** RAYTHEON DSF-6000N Fathometer, EG&G Model 260 Side Scan Sonar, and Pneumatic Depth Gauge

**CONTROL:** CUBIC WESTERN DM-54 ARGO, MOTOROLA FALCON 484 Mini-Ranger and MAGNAVOX MX4200 Satellite Receiver/MAGNAVOX MX50R Beacon Receiver (Differential Global Positioning System) (Range/Range)

Chief of Party.....N. E. Perugini

Surveyed by.....P. L. Schattgen  
.....M. J. Oberlies  
.....J. A. Illg  
.....J. E. Rix

Automated Plot by.....XYNETICS 1201 Plotter (AHS)

**1. INTRODUCTION**

a. This is a combined basic hydrographic/side scan sonar survey. A RAYTHEON DSF-6000 fathometer was operated concurrently with the side scan sonar. When side scan sonar imagery is used to determine the depth of a feature, the depth is estimated by computing the height off the bottom using the side scan sonar record. Positions are determined by computing offsets from the vessel's track.

b. No unusual problems were encountered during office processing.

c. Notes in the Descriptive Report were made in red during office processing.

**2. CONTROL AND SHORELINE**

a. Control is adequately discussed in sections H., I., and T. of the Descriptive Report.

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 NAD 83 and the North American Datum of 1927 (NAD 27).

To place this survey on the NAD 27, move the projection lines .372 seconds (11.478 meters or 1.15 mm at the scale of the survey) north in latitude, and 1.808 seconds (42.06 meters or 4.21 mm at the scale of the survey) east in longitude.

b. There is no shoreline within the limits of the present survey.

### 3. HYDROGRAPHY

a. Soundings at crossings are in adequate agreement.

b. The standard depth curves are drawn in their entirety. Dashed and brown curves are also drawn to delineate bottom relief.

c. The development of the bottom configuration and determination of least depths is considered adequate with the exception of ten side scan sonar contacts noted during office processing (see section 7.a.4) of this report).

### 4. CONDITION OF SURVEY

The smooth sheet and accompanying overlays, hydrographic records and reports conform to the requirements of the HYDROGRAPHIC MANUAL, SIDE SCAN SONAR MANUAL, FIELD PROCEDURES MANUAL and Project Instructions.

### 5. JUNCTIONS

#### H-10424 (1991) to the west

A standard junction was effected between the present survey and survey H-10424 (1991). Present survey depths are in harmony with the charted hydrography to the north, east and south.

### 6. COMPARISON WITH PRIOR SURVEYS

#### a. Hydrographic

##### H-6443 (1939) 1:40,000

Prior survey H-6443 (1939) covers the present survey

in its entirety. The present hydrography is generally in good agreement with the prior hydrography with scattered prior soundings 1 to 2 feet ( $0^3$  to  $0^6$  m) shoaler than present soundings. The present survey shows significant differences due to the irregular bottom and numerous rocks found by the present survey.

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

b. Wire Drag

FE-241WD (1982-84) 1:20,000  
FE-269WD (1984) 1:20,000

1) FE-241WD (1982-84) is a modified prior survey with limited processing as discussed in the Evaluation Report for that survey. Five Automated Wreck and Obstruction Information System (AWOIS) Items, fall within the present survey area. AWOIS items #1865, #1874, #2712, and #7902 are adequately discussed in section M., pages 24-26, of the Descriptive Report. The following should be noted:

AWOIS item #7901 is charted as a dangerous boulder cleared by 48 feet ( $14^6$  m) on NOS chart 13218 and a dangerous submerged rock with an unknown depth on NOS charts 13205 and 13215 in Latitude  $41^{\circ}18'51.07''N$ , Longitude  $71^{\circ}28'17.62''W$ . The item originates with the prior survey as a 48-foot ( $14^6$  m) sounding on a rock. The present survey obtained a fathometer depth of  $14^5$  meters (47 ft) on a rock in Latitude  $41^{\circ}18'51.46''N$ , Longitude  $71^{\circ}28'18.06''W$ . It is recommended that the affected charts be revised to a rock with a depth of  $14^5$  meters (47 ft) ( $14^5Rk$ ) and charted as shown on the present survey.

2) FE-269WD (1984) is a modified prior survey with limited processing as discussed in the addendum accompanying the prior survey Descriptive Report. Three hangs (AWOIS items #7903, #7904, and #7905) and one side scan sonar contact (AWOIS item #7520) originate with FE-269WD (1984). These AWOIS items are adequately discussed in section M., pages 25 to 28, of the Descriptive Report. The following should be noted:

Two uncharted obstructions with estimated depths of 95 feet and 89 feet are shown on the prior survey in Latitude  $41^{\circ}17'22''N$ , Longitude  $71^{\circ}28'58''W$  and Latitude  $41^{\circ}17'21''N$ , Longitude  $71^{\circ}28'41''W$  (NAD 27) respectively. These two obstructions fall on the southwest edge of the present

survey and were not investigated. These obstructions were recommended by the evaluator not to be charted in section 2.g. and h. of the addendum accompanying prior survey FE-269WD. No change in charting is recommended.

7. COMPARISON WITH CHARTS 13205 (30<sup>th</sup> Ed., May 18/91)  
13215 (30<sup>th</sup> Ed., Jul 7/90)  
13218 (12<sup>th</sup> Ed., Jun 23/90)

a. Hydrography

The charted hydrography originates with the previously discussed prior surveys and miscellaneous sources not readily available. The following should be noted:

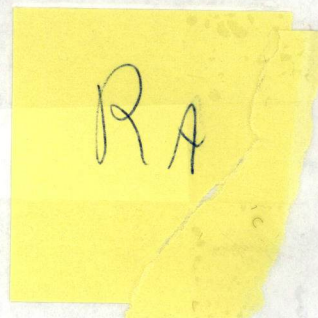
1) An uncharted rock with a depth of 18<sup>3</sup> meters (60 ft) in Latitude 41°10'<sup>8</sup>32.84"N, Longitude 71°29'03.79"W is in close proximity to a charted 54-ft (16<sup>4</sup> m) sounding. It is recommended that the 54-ft (16<sup>4</sup> m) sounding be deleted from the chart and a rock with a depth of 18<sup>3</sup> meters (60 ft) (18<sup>3</sup> Rk) be charted as shown on the present survey. - mcr  
4/20/95

2) There is no indication of any shoaling in the immediate area of a charted 57-ft (17<sup>4</sup> m) sounding in Latitude 41°18'27"N, Longitude 71°26'42"W that originates with prior survey H-1787 (1887). Present survey depths are 19<sup>5</sup> to 20<sup>1</sup> meters (64 to 66 ft). It is recommended that the 57-ft (17<sup>4</sup> m) sounding be deleted from the chart and the present survey supersede the chart in the common area.

3) There is no indication of any shoaling in the immediate area of a charted 56-ft (17<sup>1</sup> m) sounding in Latitude 41°17'54"N, Longitude 71°26'54"W that originates with an unknown source. Present survey depths are 19<sup>2</sup> to 19<sup>8</sup> meters (63 to 65 ft). It is recommended that the 56-ft (17<sup>1</sup> m) sounding be deleted from the chart and the present survey supersede the chart in the common area.

4) Eight significant side scan sonar contacts were noted during office processing. The positions and heights scaled from the side scan sonograms are listed as follows:

<u>Contact (M/FT)</u>	<u>Latitude (N)</u>	<u>Longitude (W)</u>
21 <sup>6</sup> Rk/71	41°17'36.40"	71°25'03.51"
14 <sup>1</sup> Rk/46	41°19'17.05"	71°29'42.91"
15 <sup>5</sup> Rk/51	41°19'01.70"	71°29'12.55"
15 <sup>9</sup> Rk/52	41°18'46.79"	71°28'55.24"
20 <sup>3</sup> Rk/66	41°17'58.59"	71°25'46.82"
22 <sup>4</sup> Rk/73	41°17'51.89"	71°25'30.66"



<u>Contact (M/FT)</u>	<u>Latitude (N)</u>	<u>Longitude (W)</u>
12 <sup>0</sup> Rk/39	41°19'15.58"	71°28'29.56" ✓
14 <sup>7</sup> Rk/48	41°18'51.76"	71°29'46.15" ✓

It is recommended that these rocks be charted as shown on the present survey.

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

**b. Dangers to Navigation**

There were no dangers to navigation submitted by the hydrographer on this survey. No dangers were noted during office processing.

**c. Aids to Navigation**

Three fixed aids to navigation outside the limits of the present survey were located by the hydrographer. One floating aid to navigation was located by the hydrographer on the present survey. These aids appear adequate to serve their intended purposes.

**8. COMPLIANCE WITH INSTRUCTIONS**

This survey complies with the Project Instructions

**9. ADDITIONAL WORK**

This is an adequate basic hydrographic/side scan sonar survey. Additional work at an opportune time is recommended to adequately develop the items listed in section 7.a.4) of this report.

*Robert Snow*

Robert Snow  
Cartographic Technician  
Verification of Field Data

*Richard H. Whitfield*

Richard H. Whitfield  
Cartographer  
Evaluation and Analysis

*Robert R. Hill*

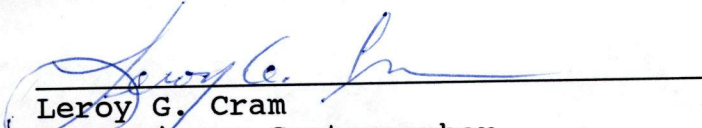
Robert R. Hill  
Senior Cartographic Technician  
Verification Check



APPROVAL SHEET  
H-10354

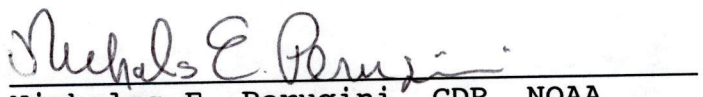
Initial Approvals:

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.

  
Leroy G. Cram  
Supervisory Cartographer  
Atlantic Hydrographic Section

Date: Nov. 24, 1993

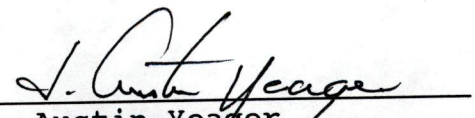
I have reviewed the smooth sheet, accompanying data, and reports. This survey and accompanying digital data meet or exceed NOS requirements and standards for products in support of nautical charting except where noted in the Evaluation Report.

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

Date: Nov 24, 1993

\*\*\*\*\*

Final Approval:

Approved:   
J. Austin Yeager  
Rear Admiral, NOAA  
Director, Coast and Geodetic Survey

Date: 1/6/94

