

10096

Diagram No. LS-9

NOAA FORM 76-35A

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

DESCRIPTIVE REPORT

Type of Survey ... Hydrographic
Field No. PE-20-4-83
Office No. H-10096

LOCALITY

State Wisconsin
General Locality Lake Superior
Locality Eagle Island to Bark Point

1983

CHIEF OF PARTY
CDR W.S. Simmons

LIBRARY & ARCHIVES

DATE March 21, 1985

☆U.S. GOV. PRINTING OFFICE: 1980-766-230

10096

See

14964 YOSEMITE
14952
14953
14954

*to sign up for
Search of Applications*

HYDROGRAPHIC TITLE SHEET

H-10096

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.

PE 20-4-83

State Wisconsin

General locality Lake Superior

Locality Eagle Island to Bark Point

Scale 1:20,000

Date of survey 12 June to 18 August, 1983

Instructions dated May 11, 1983

Project No. ORP-Z137-PE-83

essel: NOAA Ship PEIRCE⁽²⁸³⁴⁾ Launches PE-1 ²⁸³¹(3281), PE-2 ²⁸³²(3282), MONARK PE-3 ⁽²⁸³³⁾
Boston Whaler, PE-4 (2834)

Chief of party CDR Walter S. Simmons

Surveyed by LTJG M. ^{P.} CONRICOTE, LT. R. ^{M.} MANDZI, ENS S. ^{I.} ANDREEVA, LCDR A. ^{A.} ARMSTRONG

Soundings taken by echo sounder, hand lead, pole Ross Model 5000, Raytheon DE-719B

Graphic record scaled by MPC, RMM, SIA, RBH, IPR, WRM, TO, AND AAA

aphic record checked by MPC, GEL

Protracted by _____

Automated plot by Hydroplot

Verification by D. V. Mason

XYNETICS 1241 Plotter
(AMC)

Soundings in ~~XXXXXX~~ feet at ~~XXXX~~ ~~XXXX~~ IGLD 1955 (666.6 FT-LAKE SUPERIOR)

REMARKS: (1) All times in this survey are Coordinated Universal Time.

(2) Water level reducers are not applied to soundings.

All notes in the Descriptive Report were made in red
during office processing.

AWOIS + SURF 7/85 RWD

SC 5-2-97

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DESCRIPTIVE REPORT

TO ACCOMPANY

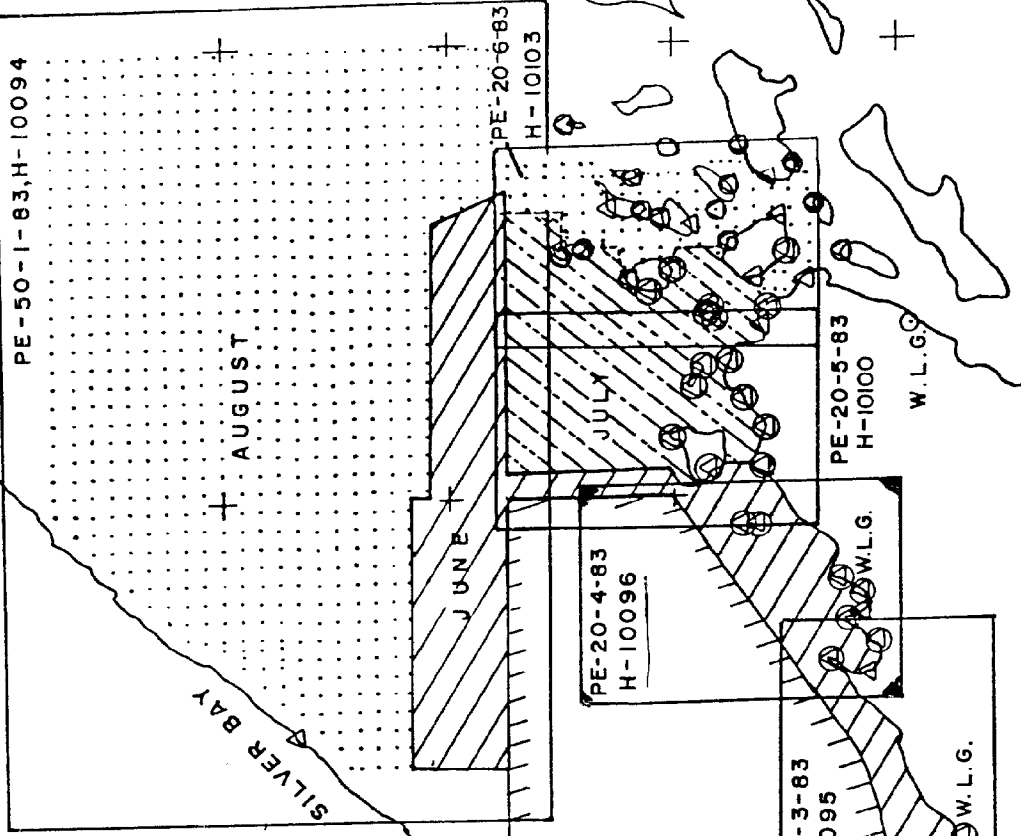
HYDROGRAPHIC SURVEY H-10096 (PE-20-4-83)

1:20,000 SCALE, 1983

NOAA SHIP PEIRCE

CDR. WALTER S. SIMMONS, COMDG.

	JUN	JUL	AUG	SEPT
SQ NM SOUNDING	177	116	350	—
LN MISC. DISTANCE	384	417	404	—
LN M DIST. TO & FROM	186	263	374	—
LN M SOUNDING LINE	1199	1366	1860	—
BOTTOM SAMPLES	123	126	98	—
CONTROL STATIONS	10	10	12	—
TEMPERATURE - DEPTH	12	8	12	—
NANSEN CAST	1	0	1	—
WATER LEVEL GAGE	5	0	5	—



PROGRESS SKETCH

+ LAKE SUPERIOR, Z137 +
 NOAA SHIP PEIRCE
 W. S. SIMMONS, CDR. NOAA

A. PROJECT

This basic survey, a part of OPR-Z137-PE-83, was conducted in accordance with Project Instructions dated May 11, 1983; change No. 1 dated May 17, 1983, and change No. 2 dated August 1, 1983. This project is a continuation of contemporary basic hydrographic surveys begun in 1981. These surveys will collectively contribute to a new data base for the maintenance of existing charts and construction of new, reformatted, or reschemed nautical charts. This project exemplifies the cooperative charting effort between the National Ocean Service and the Canadian Hydrographic Service. *See section 1.0 of the Evaluation Report also.*

B. AREA SURVEYED

The area surveyed is in western Lake Superior, along the south shore from Eagle Island to Bark Point. The area is bounded to the north by a line running from 46°54'44"N, 091°10'50"W northeast to 49°59'55"N, 091°00'50"W; to the west by 091°10'^{12' 18"}~~50~~"W; to the east by 091°00'50"W; and to the south by the south shore of Lake Superior. The shoreline in this survey is mostly rocky except for the area inside Bark Bay where there is a sloping sand beach. This survey commenced on 12 June 1983 (JD163) and was completed on 18 August 1983 (JD219).

C. SOUNDING VESSEL

Soundings were taken with PEIRCE (VESNO²⁸³⁴~~3280~~); the ship's two type 1 aluminum survey launches, PE-1 (VESNO²⁸³¹~~3281~~) and PE-2 (VESNO²⁸³²~~3282~~); the Monark, PE-3 (VESNO²⁸³³~~3283~~); and the Boston Whaler, PE-4 (VESNO²⁸³⁴~~3284~~). All bottom samples were done by PEIRCE (VESNO²⁸³⁴~~3280~~).

D. SOUNDING EQUIPMENT AND CORRECTIONS TO ECHO SOUNDINGS - See also section 4 of the Evaluation Report.

The ship and both launches were equipped with a Ross Model 5000 Fine-Line echo sounder; PEIRCE used S/N1079, Launch PE-1 used S/N1078, and Launch PE-2 used S/N1087. These echo sounders were used in depths from 4 to ~~276~~²⁸² feet. Launch PE-3 used a Raytheon DE-719B, S/N5441. This echo sounder was used in depths from 1 to 52 feet. Launch PE-4 was only used for pole soundings. All echo sounders performed satisfactorily throughout the survey. Temporary deviations of the initial were accounted for while scanning fathograms. Phase checks were done periodically and the recorder was adjusted when necessary. The draft corrections applied on-line were 10.6 feet for the ship, 1.6 feet for both Launches, and 0.5 feet for the Monark.

Corrections to sound velocity were determined from bar checks, Martek casts, and XBT's. Whenever possible, bar checks were taken at the beginning and end of the day. The following table lists the dates and positions of the stations observed for velocity corrections

<u>DATE</u>	<u>(JD)</u>	<u>STATION</u>	<u>LATITUDE</u>	<u>LONGITUDE</u>
10 June	(161)	XBT#2	46°50.7'N	091°24.0'W
13 June	(164)	XBT#3	46°55.3'N	091°01.0'W
16 June	(167)	XBT#4	46°54.9'N	091°09.4'W
20 June	(171)	XBT#5	47°10.0'N	091°16.0'W
21 June	(172)	XBT#6	46°55.9'N	091°12.2'W
25 June	(176)	XBT#7	46°58.8'N	091°02.8'W
28 June	(179)	XBT#8	46°52.1'N	091°06.6'W
29 June	(180)	XBT#9	47°06.8'N	091°00.9'W
30 June	(181)	XBT#10	47°06.8'N	091°00.9'W
6 July	(187)	XBT#11	49°07.3'N	090°59.2'W
9 July	(190)	Martek	46°57.2'N	091°58.7'W
13 July	(194)	Martek	46°57.3'N	090°53.6'W
14 July	(195)	XBT#12	47°07.5'N	090°52.0'W
18 August	(230)	Martek	47°07.2'N	090°38.0'W

XBT's 2 and 3 were taken from Launch PE-1. All the other XBT's and Martek casts were taken from PEIRCE. The Martek is a Model 167, SN/177, which was calibrated February 4, 1983. The XBT is a Sippican Model MK2A-1. Martek and XBT data were used to determine velocity correctors. Surface XBT temperature values read 12°C higher than simultaneous Martek, Nansen, and bucket thermometer readings between JD176 and JD190. Surface temperature values were assigned to the XBT by linearly interpolating between consecutive Martek casts. Both Martek and XBT data were processed through program RK530. Casts were grouped so that no soundings would be in error exceeding 0.25% of the depth. Graphs of meaned velocity correctors versus corresponding depths were plotted and the velocity table scaled a 0.2 foot increments for depths 0-120 feet, and 1.0 foot for depths 120-660 feet. The velocity tables were derived from graphs of averaged XBT and Martek correctors. These were then checked against the bar checks and were in agreement.

The velocity corrector graphs, tape listings, sounding correction abstracts, and Martek calibrations are in Appendix D.

Settlement and squat tests for the launches and Monark were done at the Corps of Engineers dock on June 2, 1983, in Duluth Harbor. Settlement and squat tests for PEIRCE were performed at Two Harbors on June 6, 1983. Settlement and squat correctors have not been used in the final field plot. The settlement and squat report and TC/TI tables can be found in Appendix D.

E. HYDROGRAPHIC SHEETS

Hydrographic data are presented on five sheets. All mainscheme hydrography is presented on one sheet. An overlay sheet depicts crosslines, mainscheme splits, and bottom samples. These sheets are at a scale of 1:20,000 with a skew of 037,21.5,55. One sheet depicts the Cornucopia Harbor inset. This sheet is at a scale of 1:2,500 with a skew of 0,20,20. All of the side scan data and the Eagle Island Shoal development are depicted on two sheets. Soundings are depicted on one sheet and a bottom texture map is depicted on the other. These sheets are at a scale of 1:10,000 with a skew of 90,21.5,32. All data have been plotted on the final field sheets except positions 8477 to 8558 from JD's 190 and 191. This was done because the area was too heavily congested with soundings. The least depths have been brought through to the final field sheets.

F. CONTROL STATIONS - *See also section 2.2 of the Evaluation Report.*

The following third order stations were used to control this survey.

<u>SIGNAL</u>	<u>STATION NAME</u>	<u>USE</u>	<u>SOURCE</u>
102	TWO HARBORS LIGHTHOUSE, 1952	CAL	NGS
103	TWO HARBORS RADIO MAST, 1977	CAL	NGS
106	DULUTH ENGER MEMORIAL TOWER, 1952	CAL	NGS
107	DULUTH HARBOR N PIER LT, 1982	CAL	PE
108	SUPERIOR ENTRY S BREAKWATER LT, 1982	CAL	PE
109	SKY HARBOR AIRPORT BEACON, 1982	CAL	PE
114	BARK, 1953	MR	NGS
115	LONG, 1982	MR	AP0*
116	TAYLOR, 1982	MR	AP0*
117	GUANO, 1982	MR	AP0*
121	SAND POINT, ¹⁹⁸¹ 1982	MR	AP0*
122	WEST BAY, ¹⁹⁸¹ 1982	MR	AP0*

<u>SIGNAL</u>	<u>STATION NAME</u>	<u>USE</u>	<u>SOURCE</u>
135	EAGLE ISLAND, ¹⁹⁸¹ 1982	CAL	APO*
146	AGATE BAY ARGO, 1983	ARGO	PE
147	SILVER BAY ARGO, 1983	ARGO	PE
158	TWO HARBORS PWR & Power and Light LT CO STK , 1952 ^{Stack}	CAL	NGS
163	CORN, 1982	CAL	APO*
165	ALMOST, 1982	CAL	APO*
166	CORNUCOPIA ST MARYS CH SPIRE, 1982	CAL	APO*
167	WAAND, 1982	AZ/MR	APO*
168	CORNUCOPIA EAST PIER LT, 1982	MR	APO*
169	ALMOST SIGNAL, 1983	CAL	PE
170	KEYES FLAGPOLE, ^(TEMP) 1983	CAL	PE
171	WALBAY, 1983	MR	PE
172	RAMP, 1983	MR	PE
173	CAMP STAKE, 1983 (TEMP)	AZ	PE
174	CAMP STAKE MR, 1983	MR	PE

*APO - Field position, 1982, Apostle Islands Project Report, OPR-Z137

All horizontal control used in this survey is based on the North American datum of 1927. However, BARK 1953 is not consistent with stations along the shoreline to the East. A distortion of about two meters exists. A complete list of signals is located in Appendix F of this report. Geodetic abstracts and computations for all PEIRCE control work are included in the project's horizontal control report. All stations in this report meet the required third-order, Class I accuracy standards. All calibration and MR sites are third-order, Class I or short offsets. Both intersection and traverse methods were used. See also section 2.2. of the Evaluation Report.

G. HYDROGRAPHIC POSITION CONTROL

Hydrographic position control was accomplished using the DM-54 Automatic Ranging Grid Overlay (ARGO), the MINI-RANGER III, and the MINI-RANGER FALCON systems. Both range-range and range-azimuth positioning

were used. The Hewlett Packard Electronic Distance Measurer (EDM) was used for positioning pilings.

The electronic equipment used for this survey follows.

<u>VESNO</u>	<u>EQUIPMENT</u>	<u>S/N</u>	<u>JD</u>
3280	ARGO		
	Range Processing Unit	R047859	172
	Control Display Unit	C047821	172-187
	Power Supply Unit	V0379124	172-187
	Range Processing Unit	R047850	180-187
3281	ARGO		
	Range Processing Unit	R047859	164-175
	Control Display Unit	C047821	164-230
	Power Supply Unit		164-230
	Range Processing Unit	R047859	176-230
	MINI-RANGER		
	Range Console	911027	164-179
	Receiver/Transponder	D2128	164-179
3282	MINI-RANGER		
	Range Console	B824118	163-179
	Receiver/Transponder	C2096	163-179
3283	MINI-RANGER		
	Range Console	B0295	174-175
	Receiver/Transponder	D2123	174-175
	Control Display Unit	0019	188
	Range Processing Unit	0062	188
	Receiver/Transponder	D2128	188
3284	Hewlett Packard Electronic Distance Measurer Model #3810B	1929A00361	174

SHORE STATIONS

<u>STATION</u>	<u>EQUIPMENT</u>	<u>S/N</u>	<u>JD</u>
<u>ARGO</u>			
Two Harbors	Range Processing Unit	R047854	163-230
	Antenna Loading Unit	A0379116	163-230
	Power Supply Unit	V0478108	163-230
Silver Bay	Range Processing Unit	R0379122	163-175
	Antenna Loading Unit	A0379123	163-230
	Power Supply Unit	V0379122	163-230
	Range Processing Unit	R0379117	176-230
Devils Island	Range Processing Unit	C037940	163-230
	Antenna Loading Unit	A0980310	163-230
	Power Supply Unit	V03789110	163-230
MINI-RANGER			
Code 1		C2058	163-205
Code 2		C2059	163-201
Code 3		C2075	163-230
Code 4		C2065	163-230
Code 5		C2067	163-230
Code 6		C2091	163-230

For the ARGO positioning system, two time slots were used on each vessel to give a one second update with a smoothing code of 2 and an ARGO frequency of 1646.70 KHz. Fixed shore station AGC valves and antenna range/tune values were recorded hourly during the hours of hydrography and are included in the supplemental data to this report.

The ARGO positioning system was generally calibrated twice daily using three point sextant fixes with a check fix or range-azimuth calibration using the EDM. The Mini-Ranger FALCON system was also used for calibration. Daily correctors were applied on line via the Nav-Cal feature of RK112. The average of the opening and closing daily ARGO calibration was used as the final corrector value and was applied

via the off line corrector tape for final field plotting. All calibrations of the ARGO positioning system can be found in Appendix E.

FALCON USAGE FOR ARGO CALIBRATION

The FALCON system proved to be ideal for on-line lane checks and for calibration-when-ever-you-need-it of the ARGO positioning system. Lane checks could be accomplished on-line whenever 2-4 ranges were being received. Calibrations were performed simply by stopping the ship anywhere in the work area where four ranges could be received and where geometry of the fix was adequate. This calibration capability saved a considerable amount of ship time running to and from calibration areas. The procedures follow:

- A. Procedures common to LANE CHECK and CALIBRATION (and parameters different from FALCON default values):
 1. Enter baseline correctors for each code to be used.
 2. Enter SITE NO; CODE; X, Y, & Z COORDINATES for each reference station location.
 3. Require "RANGE WITH X-Y".
 4. Require "PLANE" ranges.
 5. Enter "INITIAL POSITION ESTIMATE". (Not required but reduces chance of erroneous solution.)
 6. Require "RANGE WITHX-Y" screen or "POSITION STATISTICS" screen (which contains range residuals and X-Y).

- B. Lane Check Procedure:

After watching for consistency (no "fliers"), adequate signal strength (15+, depending on baseline calibration) and low residuals (less than 5 meters usually) simultaneously freeze FALCON screen and key "X" on Hydroplot TTY. This was done

frequently on-line. Typical differences were 0-8 meters in X and Y, thus immediately confirming lanes. This was recorded on the master printout.

C. Calibration Procedure:

1. Ship dead in water.
2. Simultaneously freeze FALCON screen and key "X" on TTY, as above.
3. Use program RK300 to convert FALCON least squares X-Y position to ARGO lanes.
4. By subtraction of lanes, determine lanes to be set in ARGO via delta lane feature and/or partial lane correctors to be entered on-line as "NAV-CAL" programs. These partial correctors were also the final electronic correctors applied to the corrector tape.

The freshwater operating area necessitated the calculation of a pseudo ARGO frequency. This was necessary because of the HYDROPLOT's pre-programmed seawater propagation velocity of 299,670 Km/s. The pseudo ARGO frequency was 1647.22 Khz with a calculated velocity of 299,575.4 Km/s. All calculations can be found in descriptive report H-10036. The pseudo frequency (1647.22) was verified by calibrations at short, intermediate and long ranges in 1982 and again in 1983.

The MINI-RANGER positioning system was generally daily checked twice daily using the fixed point method or three point sextant fix with a check fix. The final field sheet was plotted using an average of the beginning and ending baseline calibrations.

Mini-ranger baseline calibrations were performed on the following dates: May 31, 1983, June 1, 1983, June 13, 1983, June 17, 1983, June 20, 1983, July 1, 1983, July 5, 1983, and September 2, 1983. All of the calibrations were performed at the Duluth Corps of Engineers vessel yard with the exception of the June 13 calibration, which was done at Cornucopia, Wisconsin. All data pertaining to the calibrations are included in the supplemental data folder. A copy of the abstract of corrections to Electronic Position Control is included in Appendix E.

From past experience it was found to be better to interface the MINI-RANGER with the computer/hydroplot system using the RAYDIST mode instead of the Del Norte mode as the system was originally designed to be used. Unsmoothed data and no range averaging was used.

The FALCON system has many internally stored parameters and care must be taken that the correct values are used. For range-range data acquisition default values were used as shown on Table 3-5 from the MINI-RANGER FALCON 484 POSITIONING SYSTEM USER'S MANUAL. The "CAL. TABLE" was cleared during all system startups to assure that no correctors were applied via the FALCON system rather than by the normal hydroplot method.

H. SHORELINE - See also section 2.6 of the Evaluation Report.

The shoreline was obtained from an enlargement of U.S. Geological Survey Quadrangles (1:24,000), revised with 1981 NHAP photographs. A small section of shoreline, six-tenths of a mile in length, was not represented on the enlargement. This is located in the southwest section of Bark Bay to the west of $91^{\circ}12'$. The shoreline for this section was placed on the final field sheet from an enlargement of chart 14966. The shoreline, as mapped, was verified by the hydrographer and is adequate for charting.

I. CROSSLINES - See also section 4.2 of the Evaluation Report.

A total of 32.6 nautical miles of crosslines were run on this survey. This is a total of 8.5% of the total mainscheme hydrography. Crossline soundings agree very well with the mainscheme hydrography. All crossline comparisons fell within the 1-3% of depth criterion (Sec. 1.1.2 of the Hydrographic Manual).

J. JUNCTIONS - See also section 5 of the Evaluation Report.

This survey junctions with contemporary surveys H-10095 (PE-20-3-83) to the west, H-10036 (PE-50-1-82) to the north, and H-10100 (PE-20-5-83) to the east.

H-10095 (PE-20-3-83)

This survey junctions with H-10095 to the west. There was no overlapping of sounding in the junction area; however, the depth curves are continuous throughout the area with depths ranging from 7-271 feet. The line spacing at the junction area between the two surveys is 100 meters.

H-10036 (PE-50-1-82)

This survey junctions with H-10036 to the north. There was excellent agreement of overlapping soundings between the surveys with 100% of the soundings falling within 0-3 feet.

H-10100 (PE-20-5-83)

This survey junctions with contemporary survey H-10100 to the east. There was excellent agreement of overlapping soundings between the surveys with 100% of the soundings falling within 0-3 feet.

K. COMPARISON WITH PRIOR SURVEYS - *See also section 6 of the Evaluation Report.*

Comparisons were made with the following prior surveys, all by the U.S. Army Corps of Engineers:

<u>SURVEY</u>	<u>SCALE</u>	<u>YEAR SURVEYED</u>
1-457	1:120,000	1869
1-963	1:10,000	1902
1-1490	1:20,000	1927
1-1491	1:20,000	1927
1-1765	1:5,000	1941

No one prior surveys covers the entire area of the survey.

Prior survey 1-457 covers the deep water of this survey. There were twenty-two soundings within the limits of this survey. The prior does not contain a latitude-longitude grid which made comparisons difficult. The contours and soundings look very similar, showing a good comparison.

Prior survey 1-963 covers the northeast corner of this survey. There were seventeen soundings from the prior survey. All of these soundings have excellent agreement with the current survey.

Prior survey 1-1490 covers the area from Siskiwit Bay to the east survey limits. This prior survey is the combination of three prior surveys combined into one. A color code was used to distinguish the various surveys. These various soundings could not be distinguished on the ship's black and white copy. In Siskiwit Bay, the prior survey was generally six to eight feet shoaler than the contemporary survey. In Squaw Bay, the prior survey was generally four to six feet shoaler than the contemporary survey. The deeper waters to the north of Siskiwit and Squaw Bay had excellent comparison between the two surveys. The area of Eagle Island Shoals was generally four to six feet shoaler on the prior survey. The area around Eagle Island varied from four to ten feet shoaler on the prior survey. The deep water north of Eagle Island had good comparison between the two surveys with some of the sounding being shoaler and some being deeper. There was no apparent pattern to these discrepancies north of Eagle Island.

Prior survey 1-1491 covers the area of Bark Bay to Roman Point and north. Inside Bark Bay, the soundings were generally two to seven feet shoaler on the prior survey. The deeper water to the north of Bark Bay was found to be ten to fifteen feet shoaler on the prior survey. The prior survey was not done at the current water level datum. To convert the prior survey to the current water level datum, three feet needed to be added to all red soundings and one foot added to all black soundings. This could not be done since the ship's copy of the prior was in black and white.

Prior survey 1-1765 covers the area of the Cornucopia Inset. Direct comparison was difficult since the survey was done at a different scale, and no grid covered the prior survey. The soundings outside the harbor seemed to have excellent comparison. Comparison inside the harbor was generally very good.

In May 1982, Cornucopia Harbor was surveyed by the U.S. Army Corps of Engineers. A copy of this survey was obtained from the Corps of Engineers. There was excellent comparison between this survey and the present survey. A complete survey of the harbor was not done by the PEIRCE. Only a representative survey was done to verify the Corps of Engineers survey. More complete coverage was done in areas not covered by the Corps of Engineer's survey. A copy of this survey can be found in the supplemental data. Both the present survey and the 1982 Corps of Engineers survey found a two foot least depth shoal along the east pier.

L. COMPARISON WITH THE CHART - *See also section 7.2 of the Evaluation Report.*

Comparisons were made with chart 14966, 19th Edition, January 15, 1983, scale 1:120,000; and chart 14973, 24th Edition, January 19, 1980, scale 1:60,000. There were no presurvey review items within the limits of this survey.

There are 102 charted soundings from chart 14966 within the project area. Of these, 60 (58.8%) agreed with the survey to within \pm three feet. The following is a list of all charted soundings which disagree with this survey by over six feet:

LATITUDE 46°	LONGITUDE 091°	CHART DEPTH (ft)	SURVEY DEPTH (ft)	PRIOR SURVEY/DEPTH (ft)
51.7	10.1	55	62 59-62	1-1491 / 60
52.1	09.2	73	83 81-84	1-1491 / 81
52.3	09.0	49	97 95-97	1-1491 / 91
54.4	09.7	177	202 201-213	1-1491 / 202
55.2	08.6	283	253 248-252	1-1491 / 260
54.0	08.5	175	165 159-162	1-1490 / 160
54.8	07.8	205	190 188-192	1-1490 / 190
54.2	07.3	109	149 146-149	1-1490 / 149
53.4	07.3	103	123 122	1-1490 / 123
52.8	07.9	91	102 100	1-1490 / 91
52.7	06.1	43	60 58-61	1-1490 / 60
52.3	07.8	31	62 59-63	1-1490 / 54
52.2	06.3	43	50 49-54	1-1490 / 50
56.2	05.3	211	190 187-191	1-1490 / 190
56.3	04.0	55	150 139-145	1-1490 / 150
55.8	04.6	127	158 155-160	1-1490 / 158
54.4	05.3	111	121✓	1-1490 / 121
53.4	05.3	79	90✓	1-1490 / 90
53.4	04.4	43	51 50	1-1490 / 48
58.8	02.4	229	220 222	1-1490 / 222
57.9	03.5	229	215 210-217	1-1490 / 213
57.6	02.6	187	140 128-143	1-1490 / 140
57.2	03.3	121	170 162-170	1-1490 / 170
56.7	03.7	115	160 157-162	1-1490 / 160
54.2	03.2	43	53 50-53	1-1490 / 48
54.1	02.8	37	45 42	1-1490 / 37

53.3	03.4	31	41 ✓	1-1490 / 40
56.8	01.5	43	53 54	1-1490 / 43
56.6	01.7	30	40 36	1-1490 / 30
55.2	01.2	28	35 ✓	1-1490 / 28

The majority of the discrepancies between the chart and the current survey show the prior surveys, 1-1490 and 1-1491, to agree with the current survey. The origin of these disputed charted soundings is unknown. They cannot be found on any prior survey available to the PEIRCE.

There are 108 soundings from chart 14973 within the project area. Of these, 82 (75.2%) agreed with this survey to within \pm three feet. The following is a list of all charted soundings which disagree with this survey by over six feet:

Longitude LATITUDE 46° 49'	Latitude LONGITUDE 091°	CHART DEPTH (ft)	SURVEY DEPTH (ft)	PRIOR SURVEY/DEPTH (ft)
02.4	58.2	169	181 ✓	1-1490 / 169
00.8	58.5	127	126 131-135	1-1490 / 127
02.5	57.3	72	90 84-94	1-1490 / 72
01.8	57.2	72	80 75-83	1-1490 / 72
02.3	56.1	19	20 24-29	1-1490 / 19
01.6	55.8	24	34 29	1-1490 / 24
01.1	55.2	25	34 29	1-1490 / 25

All of the disputed chart soundings come from the prior survey 1-1490.

A representative sample of disputed prior soundings from charts 14966 and 14973 have been disproven. These disprovals are sufficient to discredit the prior survey. It is recommended that the charted soundings be superseded by soundings from this survey.

M. ADEQUACY OF SURVEY

This survey is complete and adequate to supersede presently charted soundings and prior surveys of this area. It is recommended that presently charted depths be replaced completely with depths from this survey.

N. AIDS TO NAVIGATION

Cornucopia East Pier Light was the only aid to navigation located within the limits of this survey. This light was located and reported in the 1982 AMC Apostle Island Horizontal Control Report. See Appendix I. This light is maintained by the U.S. Coast Guard.

O. STATISTICS

	<u>3280</u>	<u>3281</u>	<u>3282</u>	<u>3283</u>	<u>3284</u>	<u>TOTAL</u>
Total Number of Positions	155	1348	699	372	10	2584
Nautical Miles of Sounding Lines	33.6	368.8	168.7	21.2	-	592.5
Square Miles of Hydrography	-	-	-	-	-	35.4
Bottom Samples	41	-	-	-	-	41
Water Level Stations	-	-	-	-	-	5
Martek Casts	2	-	-	-	-	2
XBT's	9	2	-	-	-	11

P. MISCELLANEOUS

Bottom texture analysis of certain areas was required for this project. A report can be found in Appendix J, and a bottom texture overlay to the Eagle Island Shoals area is included with the survey. - See also section 1.c of the Evaluation Report.

Q. RECOMMENDATIONS

It is recommended that this survey supersede all previously existing charted soundings and prior surveys. Specific recommendations were made in Sections L and M of this report. No additional field work is required.

R. AUTOMATED DATA PROCESSING

<u>PROGRAM</u>	<u>PROGRAM NAME</u>	<u>VERSION</u>
112	Hyperbolic R/R Hydroplot	5/11/83
116	Range/Azimuth Hydroplot	12/15/82
201	Grid, Signal and Lattice Plot	4/18/81
211	Range/Range Non Real Time Plot	2/2/81
216	R/AZ Non Real Time Plot	2/9/81
300	Utility Computations	10/21/80
330	Reformat and Data Check	5/4/76
360	Electronic Corrector Abstract	2/2/76
407	Geodetic Inverse/Direct Computation	9/25/78
530	Layer Correction for Velocity	5/10/76
561	H/R Geodetic Calibration	12/1/82
602	Elinore-Extended Line Oriented Editor	12/8/82
612	Line Printer List	3/22/78

S. REFERRAL TO REPORTS

Water level records have been submitted to Tide and Water Levels Branch, Rockville, Maryland. The Coast Pilot Report was submitted to the Coast Pilot Section, Rockville, Maryland, in October, 1983. The Horizontal Control Report was submitted to Operations Branch, Atlantic Marine Center, October, 1983. The Geographic Names Report was submitted to Operations Branch, Atlantic Marine Center, September, 1983.

Respectfully submitted,



Martin P. Conricote
Lt. (jg), NOAA

APPENDICES

- *A. ELECTRONIC CONTROL PARAMETERS
- *B. FIELD WATER LEVEL NOTE
- *C. GEOGRAPHIC NAME LIST (FIELD)
- *D. ABSTRACT OF CORRECTIONS TO ECHO SOUNDINGS
- *E. ABSTRACT OF CORRECTIONS TO ELECTRONIC POSITION CONTROL
- F. LIST OF STATIONS
- *G. ABSTRACT OF POSITIONS
- *H. BOTTOM SAMPLES
 - I. LANDMARKS FOR CHARTS
 - J. BOTTOM TEXTURE ANALYSIS **
 - K. APPROVAL SHEET
- ** DIVE REPORTS APPENDED TO BOTTOM TEXTURE ANALYSIS
- * Removed from the original Descriptive Report and filed with the original survey data.

APPENDIX F
LIST OF STATIONS

SIGNAL NAME LIST

Revised list submitted by the field 8 Nov 1983

<u>SIGNAL #</u>	<u>NAME</u>	<u>SOURCE</u>	<u>YEAR</u>
102	TWO HARBORS LIGHT HOUSE	NGS	1952
103	TWO HARBORS RADIO MAST	NGS	1977
106	DULUTH FINGER MEMORIAL TOWER	NGS	1952
107	DULUTH HARBOR N PIER LT	PE	1982
107	SUPERIOR ENTRY S BREAKWATER LT	PE	1982
109	SKY HARBOR AIRPORT BEACON	PE	1982
114	BARK	NGS	1953
115	LONG	AMC/PE	1982
116	TAYLOR	AMC/PE	1982
117	GUANO	AMC/PE	1982
121	SAND POINT	AMC/PE	1982
122	WEST BAY	AMC/PE	1982
135	EAGLE ISLAND	AMC/PE	1982
146	AGATE BAY ARGO	PE	1983
147	SILVER BAY ARGO	PE	1983
158	TWO HARBORS PWR AND LT CO STK	NGS	1952
163	CORN	PE	1983
165	ALMOST	PE	1982
166	CORNUCOPIA ST MARY CH SPIRE	PE	1982
167	WAAND	AMC/PE	1982
168	CORNUCOPIA EAST PIER LT	PE	1982
169	ALMOST SIGNAL	PE	1982
170	KEYES FLAG POLE	PE	1983
171	WALBAY	PE	1983
172	RAMP	PE	1983
173	CAMP STAKE	PE	1983
174	CAMP STAAKE MR	PE	1983

SIGNAL TAPE

PE 20-4-83

H-10096

102	0	47	00	50488	091	39	49274	139	0000	000000
103	0	47	00	45259	091	41	13275	139	0000	000000
106	0	46	46	34185	092	07	29003	139	0000	000000
107	5	46	46	51551	092	05	17035	139	0000	000000
108	5	46	42	36746	092	00	222479	139	0000	000000
109	5	46	43	38172	092	02	462596	139	0000	000000
114	5	46	53	08683	091	10	49935	139	0004	000000
115	5	46	52	22318	091	08	05325	139	0005	000000
116	5	46	52	56059	091	05	30349	139	0006	000000
117	5	46	56	28290	091	02	11040	139	0006	000000
121	7	46	56	34486	090	58	16308	250	0002	000000
122	2	46	58	18795	090	58	19210	250	0009	000000
135	4	46	56	45695	091	02	05890	250	0004	000000
146	0	47	00	48487	091	39	47683	250	0000	164722
147	0	47	17	08757	091	15	08616	250	0000	164722
158	0	47	01	06717	091	39	35795	139	0000	000000
163	7	46	51	35108	091	06	16730	250	0002	000000
165	7	46	52	49051	091	05	36982	250	0001	000000
166	7	46	51	05628	091	06	00470	250	0000	000000
167	7	46	51	15771	091	09	56520	250	0002	000000
168	7	46	51	35110	091	06	16548	250	0000	000000
169	5	46	52	48815	091	05	36963	139	0000	000000
170	5	46	51	22750	091	07	31452	250	0001	000000
171	5	46	51	17366	091	12	054974	250	0001	000000
172	0	46	52	35181	091	11	17314	250	0001	000000
173	5	46	51	44349	091	05	46333 ²²	250	0001	000000
174	7	46	51	44281	091	05	46346	250	0000	000000

APPENDIX I

LANDMARKS FOR CHARTS

RESPONSIBLE PERSONNEL		ORIGINATOR
TYPE OF ACTION	NAME	<input type="checkbox"/> PHOTO FIELD PARTY <input checked="" type="checkbox"/> HYDROGRAPHIC PARTY <input type="checkbox"/> GEODETIC PARTY <input type="checkbox"/> OTHER (Specify)
OBJECTS INSPECTED FROM SEAWARD	Robert M. Mandzi, LT, NOAA NOAA Ship PEIRCE	
POSITIONS DETERMINED AND/OR VERIFIED	Robert M. Mandzi, LT, NOAA	FIELD ACTIVITY REPRESENTATIVE
FORMS ORIGINATED BY QUALITY CONTROL AND REVIEW GROUP AND FINAL REVIEW ACTIVITIES		OFFICE ACTIVITY REPRESENTATIVE <input type="checkbox"/> REVIEWER <input type="checkbox"/> QUALITY CONTROL AND REVIEW GROUP REPRESENTATIVE
INSTRUCTIONS FOR ENTRIES UNDER 'METHOD AND DATE OF LOCATION' (Consult Photogrammetric Instructions No. 64)		
OFFICE I. OFFICE IDENTIFIED AND LOCATED OBJECTS Enter the number and date (including month, day, and year) of the photograph used to identify and locate the object. EXAMPLE: 75E(C)6042 8-12-75	FIELD (Cont'd) B. Photogrammetric field positions** require entry of method of location or verification, date of field work and number of the photograph used to locate or identify the object. EXAMPLE: P-8-V 8-12-75 74L(C)2982	II. TRIANGULATION STATION RECOVERED When a landmark or aid which is also a triangulation station is recovered, enter 'Triang. Rec.' with date of recovery. EXAMPLE: Triang. Rec. 8-12-75
FIELD I. NEW POSITION DETERMINED OR VERIFIED Enter the applicable data by symbols as follows: F - Field L - Located V - Verified 1 - Triangulation 2 - Traverse 3 - Intersection 4 - Resection A. Field positions* require entry of method of location and date of field work. EXAMPLE: F-2-6-L 8-12-75 *FIELD POSITIONS are determined by field observations based entirely upon ground survey methods.	III. POSITION VERIFIED VISUALLY ON PHOTOGRAPH Enter 'V-Vis.' and date. EXAMPLE: V-Vis. 8-12-75 **PHOTOGRAMMETRIC FIELD POSITIONS are dependent entirely, or in part, upon control established by photogrammetric methods.	

APPENDIX J

BOTTOM TEXTURE ANALYSIS

Side Scan Procedures

Deployment

The towfish was pulled behind a survey launch by the data/tow cable. The cable was secured around the wooden cable stowage reel and tended by hand. The scope of cable was varied from idle to about 1600 RPM for adjustment of towfish height. Speed and scope changes were recorded on the data printout.

Side Scan Record

The graphic record was adjusted manually during most of the data collection as recommended in the training session provided at AMC. Some of the data were collected in the "auto-tune" mode. The data quality was much better in "auto-tune" than on "manual." PEIRCE believes that bottom texture analyses should generally be run in "auto-tune," and that training should be revised.

Other Records

The full hydroplot system was employed during the side scan effort. Annotations were made as usual on the narrow beam echogram and the data printout. Side scan annotations were also made on the data printout. Vessel track was plotted on-line at a very small "XPAN" to avoid clutter.

Texture Map Preparation

A single officer was assigned the task of interpreting all graphic side scan records. Since the presence of rubble suitable for lake trout spawning was the object of the search, interpretation was directed accordingly. A color code was devised to represent various apparent densities and grain-sizes of rubble. The side scan record was marked with the corresponding color. The color code was then transferred to the rough off-line plot by superimposing an appropriately colored line along the sounding track. The position of the colored line was adjusted to account for the length of the tow cable.

Nine ground-truth dives were conducted in sites selected by the interpreting officer. Preliminary interpretations were revised slightly on the basis of dive information.

Areas of common texture were outlined on the colored sheet and then redrawn on an overlay using symbols in black ink only.

DIVING OPERATIONS

DIVE #1

Date: 3 Aug 83 Unit: N.O.A.A. SHIP PEIRCE

Divemaster: T.R. Owens Diver-in-charge: T.R. Owens

Purpose of dive: Sea Bed Texture Univ. Wisc.

Equipment: SCUBA

Planned depth: Not to exceed 60' Planned duration: Not to exceed 30 min

Divers	IN Pressure	Out Pressure	Δ Pressure	In Time	Out Time	Δ Time	Depth	Comments
T.R. Owens	3300	2000	2000 1300	10:56	11:14	18 min	48'	
Conrigo	2800	1500	1300	10:56	11:14	18	48'	
Sullivan	2800	1500	1300	10:56	11:14	18	48'	
	Bottom	Gill	Sand					

Post dive comments: White
Preparing for DIVE #2 AFTER 20 MINUTES ON SURFACE (11:34)
DIVER SULLIVAN EXPERIENCED CHEST PAINS. O2 WAS ADMINISTERED TO
SULLIVAN WHILE LYING DOWN WITH FEET PROPPED. SCHEDULED DIVING PLANS
ABORTED AND SULLIVAN TAKEN DIRECTLY TO LITTLE SAND BAY AND TO SEEK
MEDICAL ADVICE AND FURTHER EVALUATION.

T.R. Owens
 Divemaster Signature

T.R. Owens
 Diver-in-Charge Signature

DIVING OPERATIONS

DIVE # 2

Date: 6 Aug 83 Unit: _____

Divemaster: OWENS Diver-in-charge: OWENS

Purpose of dive: To determine seabed composition

Equipment: _____

Planned depth: NOT TO EXCEED 60 FT. Planned duration: NOT TO EXCEED 30 min.

Divers	IN Pressure	Out Pressure	Δ Pressure	In Time	Out Time	Δ Time	Depth	Comments
OWENS	2200	750	1450	10:04	10:30	26 ^{min}	48'	"E" diver
BONZICOTE	2100	500	1600	10:04 10:28	10:25 10:30	26 ^{min}	48'	"E" diver

Post dive comments: Dive #2 → scattered rubble, picture #1 taken

Rocks were round → 12-14" → NO sharp edges, SAND bed

Rubble Scattered.

J. R. Owen
Divemaster Signature

J. R. Owen
Diver-in-Charge Signature

DIVING OPERATIONS

DIVE #3

Date: 10 AUGUST Unit: NOAA Ship PEIRCE

Divemaster: TR OWENS Diver-in-charge: OWENS

Purpose of dive: Scabed texture → LINIX WISC

Equipment: Scuba

Planned depth: NOT TO EXCEED 60' Planned duration: NOT TO EXCEED 30 MINUTES

Divers	IN Pressure	Out Pressure	Δ Pressure	In Time	Out Time	Δ Time	Depth	Comments
OWENS	2050	1150	900	11:15	11:33	18 min	45'	H Diver
CONRICOTE	2000	1000	1000	11:15	11:33	18 min	45'	H Diver

Post dive comments: 43 minutes between dives → "E" divers before dive #3
Densely packed rubble, 1-3' some larger boulders, NO sharp edges
bottom undeterminable, FRAME 2, 3, 4 (#3 → NO flash) more than one
H Divers GT end of Dive #3 Layer of rubble

J. R. Owens
 Divemaster Signature

J. R. Owens
 Diver-in-Charge Signature

DIVING OPERATIONS

DIVE #4

Date: 6 AUGUST 83 Unit: NOAA Ship Peirce

Divemaster: TR OWENS Diver-in-charge: TR OWENS

Purpose of dive: Seabed composition → UNIV. WISC.

Equipment: Scuba

Planned depth: NOT TO EXCEED ~~60~~ 35' Planned duration: NOT TO EXCEED 30 MIN.

Divers	IN Pressure	Out Pressure	Δ Pressure	In Time	Out Time	Δ Time	Depth	Comments
Owens	1200	400	500	2:41	2:54	13	23	
HENRICOTE	1000	400	600	2:41	2:54	13	23	

Post dive comments: FINE RUBBLE BOTTOM, SEVERAL LAYERS, GRAPEFRUIT SIZE

#5, 6 (\$ FLASH)

J.R. Owen
Divemaster Signature

J.R. Owen
Diver-in-Charge Signature

DIVING OPERATIONS

DIVE #5

Date: 6 Aug 83 Unit: NOAA Ship Peirce

Divemaster: TR OWENS Diver-in-charge: TR OWENS

Purpose of dive: Seabed Composition -> UNIV. WISC.

Equipment: Scuba

Planned depth: NOT TO EXCEED 60' 35' Planned duration: NOT TO EXCEED 30 min.

Divers	IN Pressure	Out Pressure	Δ Pressure	In Time	Out Time	Δ Time	Depth	Comments
OWENS	3150	2500	650	3:29	3:45	16 ^{min}	22	
CONRICOTE	3100	2100	1000	3:29	3:45	16 ^{min}	27	

Post dive comments: medium size rubble on bedrock 35 minute surface
paperfruit size to 3' boulders bottom interval between dives
5+6.

J.R. Owens
 Divemaster Signature

J.R. Owens
 Diver-in-Charge Signature

DIVING OPERATIONS

DIVE # 6

Date: 11 AUGUST 83

Unit: NOA Ship PEIRCE

Div Master: TR OWENS

Diver-in-charge: TR OWENS

Purpose of dive: Seabed Composition

Equipment: SCUBA

Planned depth: NOT TO EXCEED 35'

Planned duration: NOT TO EXCEED 30 minutes

Divers	IN Pressure	Out Pressure	Δ Pressure	In Time	Out Time	Δ Time	Depth	Comments
OWENS	2550	1850	400	4:11	16:22	11	22	
ONRIGOTE	3100	1450	650	4:11	16:22	11	22	

Post dive comments: SCATTERED RUBBLE -> VARIOUS SIZES -> BEDROCK BOTTOM

DIVING DAY COMPLETE 11/3/83

J. R. Owens

Divemaster Signature

J. R. Owens

Diver-in-Charge Signature

DIVING OPERATIONS

DIVE 6A

Date: 08/09/83 Unit: NOAA SHIP PEIRCE

Divemaster: TR OWENS Diver-in-charge: TR OWENS

Purpose of dive: SEABED COMPOSITION

Equipment: SCUBA

Planned depth: NOT TO EXCEED 60' Planned duration: NOT TO EXCEED 30 min.

Divers	IN Pressure	Out Pressure	Δ Pressure	In Time	Out Time	Δ Time	Depth	Comments
OWENS	2150	1150	1000	1035	1053	18 min	55	B diver
CONRICOTE	2000	800	1200	1035	1053	18 min	55	B diver

Post dive comments: Rubble dispersed in sandbed, some areas more than 1 layer deep. Grapefruit size to 2 1/2' - 3' boulders, 2 photos

J.R. Owen
Divemaster Signature

J.R. Owen
Diver-in-Charge Signature

DIVING OPERATIONS

DIVE #7

Date: 08/09/83 Unit: NOAA Ship Peirce

Divemaster: TR OWENS Diver-in-charge: TR OWENS

Purpose of dive: TO determine seabed texture

Equipment: Aqua

Planned depth: NOT TO EXCEED 60' Planned duration: NOT TO EXCEED 30 min.

Divers	IN Pressure	Out Pressure	Δ Pressure	In Time	Out Time	Δ Time	Depth	Comments
OWENS	1200	600	4 600	1150	1203	13 min	42'	"E" DIVER
CONRICOTE	2000	1400	4 600	1150	1203	13 min.	42'	"E" DIVER.

Post dive comments: Scattered rubble, 2' boulders, sandbed, 3 photos taken

J.R. Owen
Divemaster Signature

J.R. Owen
Diver-in-Charge Signature

DIVING OPERATIONS

DIVE #6

Date: 08/09/83 Unit: NOAA Ship PEIRCE

Divemaster: TR OWENS Diver-in-charge: TR OWENS

Purpose of dive: TO DETERMINE Seabed Texture

Equipment: Scuba

Planned depth: NOT TO EXCEED 60' Planned duration: NOT TO EXCEED 30 min.

Divers	IN Pressure	Out Pressure	Δ Pressure	In Time	Out Time	Δ Time	Depth	Comments
OWENS	2050	1500	Δ 550	1303	1316	Δ 13 min	40'	"H" coming out
CONTRICOTE	1400	750	Δ 650	1303	1316	Δ 13 min	40'	"H" coming out

Post dive comments: Rubble on Bedrock, assorted size \rightarrow NO large boulders.

2 PHOTOS TAKEN ALSO \rightarrow small fish

J.R. Owen
Divemaster Signature

J.R. Owen
Diver-in-Charge Signature

DIVING OPERATIONS

DIVE #9

Date: 8/09/83 Unit: NOAA Ship PEIRCE

Divemaster: TR OWENS Diver-in-charge: TR OWENS

Purpose of dive: to determine seabed texture

Equipment: Scuba

Planned depth: NOT TO EXCEED 60' Planned duration: NOT TO EXCEED 30 min.

Divers	IN Pressure	Out Pressure	Δ Pressure	In Time	Out Time	Δ Time	Depth	Comments
OWENS	1600	1000	Δ 600	11024	11036	Δ 12 min	42'	
CONRICOTE	3200	1300	Δ 1900	11024	11036	Δ 12 min	42'	

Post dive comments: "E" going in after 2 hour SURFACE INTERVAL.

Scattered rubble, various sizes, boulders 3-4', sand dispersed w/ bedrock
2 photos taken.

J.R. Owens
 Divemaster Signature

J.R. Owens
 Diver-in-Charge Signature

APPENDIX K

APPROVAL SHEET

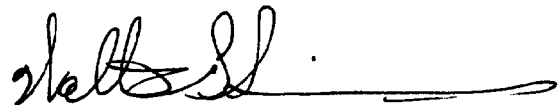
APPROVAL SHEET

H-10096

Field work on this survey was conducted under my supervision with frequent personal examination of the field sheet and records. This report and final field sheet have been reviewed and found to represent a complete and adequate survey.

No additional field work is required. This survey should supersede all prior surveys and charted information in the common areas.

Until such time as a new chart is constructed, the geographic position of any information from this survey must be converted to chart datum before application. Horizontal datum for this survey is NAD 1927.

A handwritten signature in black ink, appearing to read 'Walter S. Simmons', followed by a long horizontal line extending to the right.

Walter S. Simmons
Commander, NOAA
Commanding Officer
NOAA Ship PEIRCE

91° 03' 30"

91° 03' 00"

91° 02' 30"

Development "EAGLE ISLAND SHOALS"

Scale 1:10,000

Sounding Overlay

Excess Level 0

To Accompany H-10096

46° 55' 30"

46° 55' 30"

22 20 20
18 20
22 20 17 15 14 26
19 15 14 18 17 20
19 21 21
21

46° 55' 00"

46° 55' 00"

91° 03' 30"

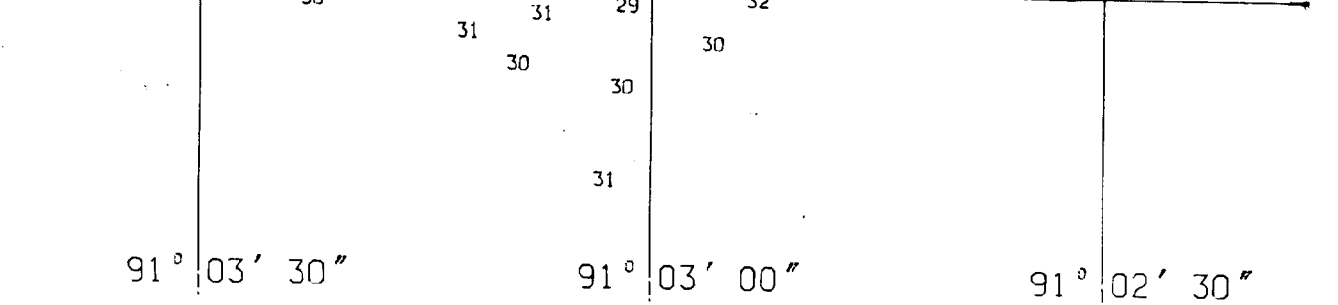
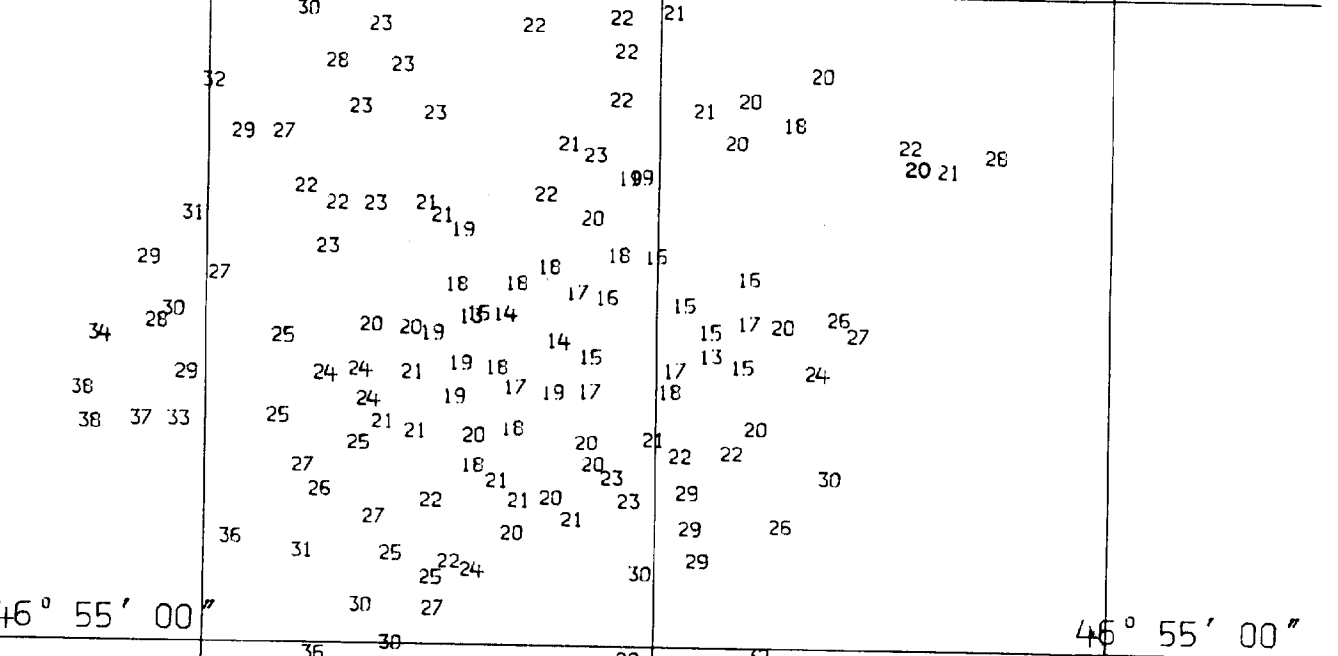
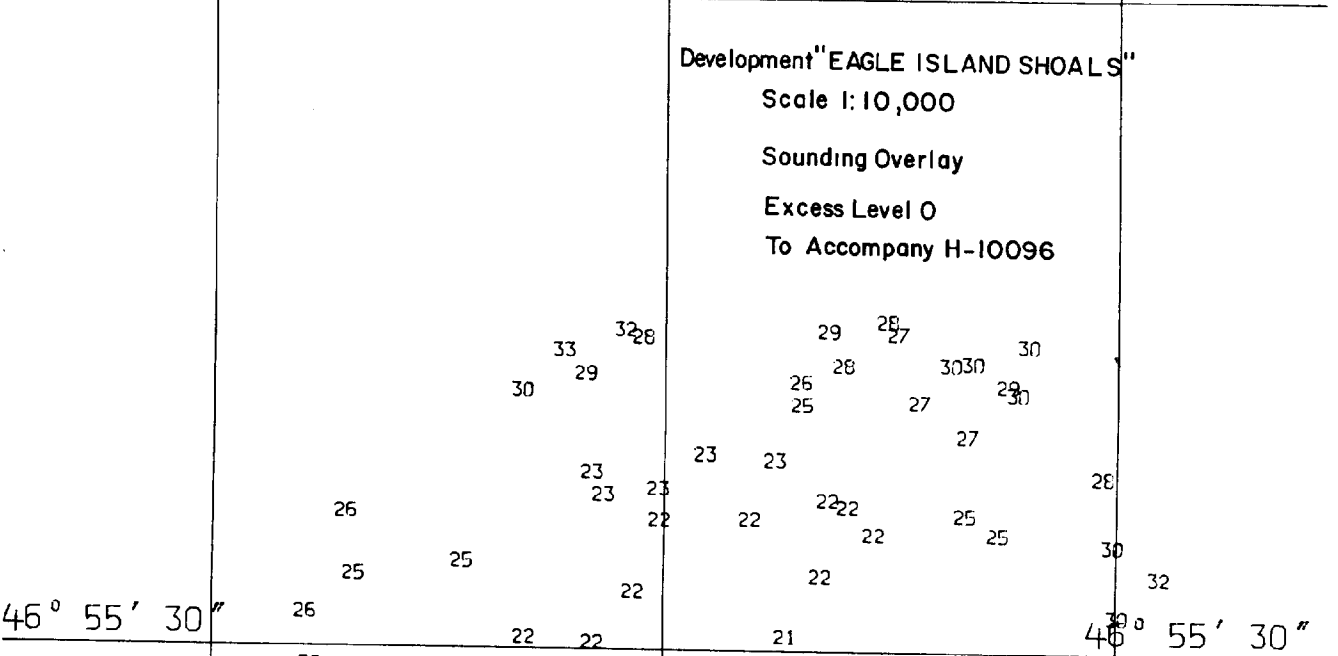
91° 03' 00"

91° 02' 30"

+

91° 03' 30" 91° 03' 00" 91° 02' 30"
 46° 56' 00" 46° 56' 00"

Development "EAGLE ISLAND SHOALS"
 Scale 1:10,000
 Sounding Overlay
 Excess Level 0
 To Accompany H-10096



91° 03' 30" 91° 03' 00" 91° 02' 30"

1 of 2

NOAA FORM 61-29 (12-71) U. S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION LETTER TRANSMITTING DATA	REFERENCE NO. MOA23-31-85
TO: CHIEF, DATA CONTROL SECTION HYDROGRAPHIC SURVEYS BRANCH, N/CG243 NATIONAL OCEAN SERVICE, NOAA ROCKVILLE, MD 20852	DATA AS LISTED BELOW WERE FORWARDED TO YOU BY (Check): <input type="checkbox"/> ORDINARY MAIL <input type="checkbox"/> AIR MAIL <input checked="" type="checkbox"/> REGISTERED MAIL <input type="checkbox"/> EXPRESS <input type="checkbox"/> GBL (Give number) _____ DATE FORWARDED 3/15/85 NUMBER OF PACKAGES one tube; two boxes

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

H-10096, OPR-Z137-PE-83, PE-20-4-83, Wisconsin, Lake Superior, Eagle Island to Bark Point
 Pkg 1 of 3 (tube)
 One smooth sheet
 One smooth position overlay
 Two smooth excess overlays
 One original Descriptive Report
 One copy of bottom texture map
 Three final field sheets
 One final field sheet overlay
 One preliminary field sheet
 Pkg 2 of 3 (box)
 Two accordian files containing echograms and field data printouts for:
 VESNO 2830 - days 163 (no fatho), 172, 180, 181, 187
 VESNO 2832 - days 163, 164, 165, 166, 167, 172, 176, 177, 178, 179
 VESNO 2831 - days 164, 165, 166, 167, 172, 173, 174, 175, 176, 178, 179, 180, 188, 189, 190, 191, 195, 230
 VESNO 2833 - days 174, 175, 179, 188
 VESNO 2834 - day 174 (no fatho)
 Four sounding volumes
 One envelope with data removed from Descriptive Report
 One envelope with position and excess overlays for enlargements
 One envelope with miscellaneous data

FROM: (Signature) D.B. MACFARLAND, JR., LCDR, CHIEF, HYDRO SURVEYS BRANCH	RECEIVED THE ABOVE (Name, Division, Date)
Return receipted copy to: HYDROGRAPHIC SURVEYS BRANCH, N/MOA232 ATLANTIC MARINE CENTER NOAA - NATIONAL OCEAN SERVICE 439 WEST YORK STREET NORFOLK, VA 23510	

NOAA FORM 61-29
(12-71)U. S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

REFERENCE NO.

MOA23-31-85

LETTER TRANSMITTING DATA

DATA AS LISTED BELOW WERE FORWARDED TO YOU
BY (Check): ORDINARY MAIL AIR MAIL REGISTERED MAIL EXPRESS GBL (Give number) _____

DATE FORWARDED

3/15/85

NUMBER OF PACKAGES

one tube; two boxes

TO:

CHIEF, DATA CONTROL SECTION
HYDROGRAPHIC SURVEYS BRANCH, N/CG243
NATIONAL OCEAN SERVICE, NOAA
ROCKVILLE, MD 20852

L

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

Two log books

Pkg 3 of 3 (box)

One cahier with final control printout; final position printout

One cahier with final sounding printout; L-File (Z-record) printout

Three notebooks with calibration data

One notebook with miscellaneous data

Binder with original velocity data

FROM: (Signature)

D. B. MACFARLAND, JR., LCDR, CHIEF, HYDRO SURVEYS BRANCH

RECEIVED THE ABOVE

(Name, Division, Date)

Return receipted copy to:

HYDROGRAPHIC SURVEYS BRANCH, N/MOA232
ATLANTIC MARINE CENTER
NOAA - NATIONAL OCEAN SERVICE
439 WEST YORK STREET
NORFOLK, VA 23510

HYDROGRAPHIC SURVEY STATISTICS
REGISTRY NO.: H-10096

Number of positions	<u>2458</u>
Number of soundings	<u>13529</u>
Number of control stations	<u>27</u>

	<u>TIME-HOURS</u>	<u>DATE COMPLETED</u>
Preprocessing Examination	<u>45</u>	<u>21 NOV 1983</u>
Verification of Field Data	<u>382</u>	<u>17 JAN 1985</u>
Quality Control Checks	<u>63</u>	
Evaluation and Analysis	<u>67</u>	<u>21 FEB 1985</u>
Final Inspection	<u>16</u>	<u>27 FEB 1985</u>
TOTAL TIME	<u>573</u>	
Marine Center Approval		<u>28 FEB 1985</u>

Transmittal letter of survey and survey records will be included in the Descriptive Report to identify the records accompanying the survey.

GEOGRAPHIC NAMES

H-10096

Name on Survey	A ON CHART NO. 14966 B ON PREVIOUS SURVEY NO. C ON U.S. QUADRANGLE MAPS D FROM LOCAL INFORMATION E ON LOCAL MAPS F P.O. GUIDE OR MAP G RAND McNALLY ATLAS H U.S. LIGHT LIST K											
	BARK BAY	X										
BARK POINT	X											2
BARK RIVER	X											3
CORNUCOPIA	X											4
EAGLE ISLAND	X											5
EAGLE ISLAND SHOALS	X											6
LAKE SUPERIOR	X											7
LOST CREEK	X											8
SAXINE CREEK	X											9
SISKIWIT BAY	X											10
SISKIWIT RIVER	X											11
SQUAW BAY	X											12
SQUAW POINT	X											13
WISCONSIN (title)	X											14
ROMAN POINT	X											15
												16
												17
												18
												19
												20
												21
												22
												23
												24
												25

Approved

Charles E. Harrington

Chief Geographer - NCG25

FEB 14 1985

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

WATER LEVEL NOTE FOR HYDROGRAPHIC SHEET

Processing Division: Atlantic Marine Center: MOA231

Hourly heights are approved for

Water Level Station Used: Cornucopia, Wisconsin (909-9055)

Period: June 12, 1983 - August 18, 1983

HYDROGRAPHIC SHEET: H-10096

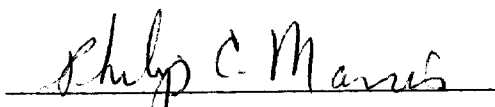
OPR- Z137-PE-83

Locality: Lake Superior

Plane of reference: Low Water Datum (IGLD 1955: 600.00Feet)

Remarks:

Zoning not required. Data from other gages on Lake Superior indicate no unusual water level movement during the survey period.


Chief, Water Levels Section

ATLANTIC MARINE CENTER
EVALUATION REPORT

SURVEY NO.: H-10096

FIELD NO.: PE 20-4-83

Wisconsin, Lake Superior, Eagle Island to Bark Point

SURVEYED: 12 June through 18 August 1983

SCALE: 1:20,000

PROJECT NO.: OPR-Z137-PE-83

SOUNDINGS: Ross Digital Echo
Sounder, Raytheon
DE-719B Fathometer

CONTROL: CUBIC WESTERN
DM-54 ARGO (Range/Range),
Motorola Mini-Ranger
(Range/Range), Mini-
Ranger/Theodolite
(Range/Azimuth)

Chief of Party.....W. S. Simmons

Surveyed by.....A. A. Armstrong
.....R. M. Mandzi
.....M. P. Conricote
.....S. I. Andreeva

Automated Plot by.....Xynetics 1201 Plotter (AMC)

1. INTRODUCTION

- a. No unusual problems were encountered during office processing.
- b. Notes in the Descriptive Report were made in red during office processing.
- c. Side scan sonar data and the sheets referenced in section E of the Descriptive Report for the bottom texture map have been processed separately as survey D-13 as required by Change No. 3 to the Project Instructions, dated 12 October 1983. The bottom texture map and data have been forwarded to Headquarters, Rockville, Maryland.

2. CONTROL AND SHORELINE

a. Control is adequately discussed in sections F, G, and S of the Descriptive Report. The stations AGATE BAY ARGO 1983 and SILVER BAY ARGO 1983 were located by the Doppler satellite method. These positions are probably accurate to plus/minus (+/-) two (2) meters with respect to the local net in the vicinity of the Apostle Islands. This variance is insignificant regarding the ARGO positioned hydrographic data in the survey area. This affected only ARGO stations for this survey. Additional information may be obtained from Mr. Larry D. Hothem, NGS, Rockville, Maryland, or Mr. J. Gary Fredrick, AMC, Norfolk, Virginia. A memorandum concerning this situation is appended to this report. The hydrographer's discussion of the two (2) meter inconsistency found at

station BARK, 1953 (page 5 of the Descriptive Report) with respect to the local net is not significant at the scale of the survey.

b. Brown shoreline originates with photo enlargements of 1:24,000 U.S. Geological Survey quadrangles. This shoreline is for orientation purposes only. Black shoreline in the inset on the smooth sheet originates with 1:5,000 scale Class III final reviewed photogrammetric manuscript TP-01253 of 1982-83. Shoreline in the inset was enlarged and portrayed on the smooth sheet to a scale of 1:2,500.

3. HYDROGRAPHY

a. Soundings at crossings agree within the criteria stated in sections 4.6.1 and 6.3.4.3 of the Hydrographic Manual and section 6.6 of the Project Instructions.

b. The standard depth curves could be adequately drawn. The zero (0) curve was not delineated; the six (6) and twelve (12) foot depth curves were not completely delineated. The curves were not delineated because of their close proximity of the shoreline and vessel safety. The twenty-four (24) foot depth curve is charted and was also drawn on the smooth sheet.

c. Development of the bottom configuration and determination of least depths is considered adequate with the following exceptions:

1) In the vicinity of Latitude 46°56'16"N, Longitude 91°02'24"W, the lines of hydrography were run parallel to the depth curves. *Also on the west side of Squaw Point.*

2) The area northwest of Eagle Island would have been better portrayed to the twenty-four (24) foot depth curve if additional lines of hydrography had been run.

3) Hydrography south of Eagle Island was not sufficient to verify or disprove the rocks awash found on prior survey LS-962 (1902). See also section 6 of this report.

4. CONDITION OF SURVEY

The smooth sheet and accompanying overlays, hydrographic records and reports are adequate and conform to the requirements of the Hydrographic Manual with the following exceptions:

a. The hydrographer failed to run crosslines in Bark Bay or in the 1:2,500 development in the vicinity of Cornucopia. Even though the minimum requirement (overall percentage) for crosslines was exceeded, it is the responsibility of the hydrographer to run crosslines in the survey area to provide sufficient checks on the mainscheme hydrography.

b. The hydrographer failed to submit a negative dangers to navigation comment in section L of the Descriptive Report as required in section 6.13 of the Descriptive Report.

CARTON
PLEASE NOTE

c. Bottom samples were not taken on Eagle Island Shoals as required by section 4.5.9.2 of the Hydrographic Manual and section 8.1 of the Project Instructions.

d. Bottom samples were not collected at the proper interval required by sections 1.6.3 and 4.7.1 of the Hydrographic Manual or section 8.1 of the Project Instructions.

e. Daily bar check echograms were not a part of the continuous daily record.

f. Correlation of velocity tables and velocity graphs was difficult because the hydrographer assigned numbers to the tables and letters to the velocity graphs.

g. Original velocity data was not submitted with the survey data package. If this is not done, a package of original velocity data should be submitted for the entire project. This data was submitted after a request was made to the PEIRCE for the original data.

h. The abstracts of days of hydrography submitted to Tides and Water Levels Section was incomplete. Several days were omitted. Tabulated water level data provided by Tides and Water Levels, Rockville, Maryland, covered these omissions.

i. The hydrographer failed to provide elevations for the landmarks and fixed aids on the 76-40's submitted with the survey.

j. The hydrographer did not investigate Presurvey Review Item #9 (AWOIS Item 2387) as required by the Project Instructions update dated 5/11/83. See section 7.a. of this report for charting recommendation.

k. The vessel identification numbers (VESNO) on the data tapes was 3280 and should have been 2830 as shown on Hydrographic Survey Guideline No. 23.

l. The discussion of shoreline section H of the Descriptive Report is not complete. There is no discussion of the source of shoreline in the Cornucopia inset. A more complete discussion is found in section 2.b. of this report.

m. The hydrographer failed to determine the complete delineation of the pilings charted in Latitude $46^{\circ}51'28''N$, Longitude $91^{\circ}06'20''W$ on the inset of Cornucopia found on chart 14966. The chart shows extensive detail of these pilings extending approximately 125 meters from shore in one area and 110 meters in another area. The shoreline manuscript shows these pilings extending from thirty (30) to fifty (50) meters offshore. See section 7.a. of this report for charting recommendation.

n. The hydrographer did an excellent job writing sections A, B, D, E, F,G, J, and K of the Descriptive Report.

o. Twice daily bar checks were not taken as required by section 1.5.2 of the Hydrographic Manual. Twenty-two (22) out of a possible

thirty-six (36) bar checks were taken for launch 2831; eleven (11) out of twenty (20) for launch 2832, and zero (0) out of eight (8) for launch 2833.

p. The hydrographer failed to obtain vertical cast data for the NOAA Ship PEIRCE as required by section 4.9.5.1.2 of the Hydrographic Manual.

q. The hydrographer failed to locate and/or address the charted piles that are inside the Cornucopia breakwater on a line from Latitude 46°51'33"N, Longitude 91°06'09.5"W, to Latitude 46°51'32.6"N, Longitude 91°06'07.7"W. See section 7.a. of this report for charting recommendation.

r. The hydrographer did not locate the offshore end of the submerged pier ruins that extend approximately fifty (50) meters offshore from the station RAMP, 1983. The information that these ruins exist was found in the station description of control station RAMP, 1983. This type of information should be in the hydrographic records. The pier was added to the smooth sheet in red and the submerged ruins in black. A copy of the description of station RAMP, 1983 will be included in the hydrographic survey data.

5. JUNCTIONS

H-10036 (1982) to the north
H-10095 (1983) to the west
H-10100 (1983) to the east

Adequate junctions were effected with the above surveys. A junction was also effected between the main sheet and the inset of Cornucopia.

6. COMPARISON WITH PRIOR SURVEYS

LS-457 (1869) 1:120,000
LS-962 (1902) 1:10,000
LS-963 (1902) 1:10,000
LS-1490 (1927) 1:20,000
LS-1491 (1927) 1:20,000
LS-1765 (1941) 1:5,000

The above prior surveys taken together cover the present survey area in its entirety.

LS-457 (1869) has no grid and comparison was difficult. The two (2) surveys compare well when the general depth curve configuration is compared.

LS-962 (1902) has no hydrography common with the present survey; however, there are rocks and gravel shown south of Eagle Island that were not located by the hydrographer. The rocks and gravel awash were brought forward to supplement present survey data in this area.

LS-963 (1902) compares very well with the present survey; depths vary plus or minus (+/-) one (1) to three (3) feet.

LS-1490 (1927) is generally one (1) to three (3) feet shoaler than the prior survey soundings. There are two (2) exceptions:

a. A twenty-two (22) foot prior survey sounding in Latitude $46^{\circ}52'14''\text{N}$, Longitude $91^{\circ}06'03''\text{W}$, is twenty-one (21) to thirty-four (34) feet shoaler than surrounding depths on the present survey.

b. A seventy (70) foot prior survey sounding in Latitude $46^{\circ}55'36''\text{N}$, Longitude $91^{\circ}08'12''\text{W}$, is twenty (20) to thirty (30) feet shoaler than adjacent soundings on the present survey.

In the vicinity of Latitude $46^{\circ}53'\text{N}$, Longitude $91^{\circ}03'\text{W}$, the shoreline has receded approximately twenty-five (25) meters.

There are no conflicts between the swept areas on the prior survey and present survey depths in the common areas.

LS-1491 (1927) is generally one (1) to two (2) feet shoaler than the present survey depths. An exception to this is a twenty-eight (28) foot prior survey sounding in Latitude $46^{\circ}52'15''\text{N}$, Longitude $91^{\circ}11'07''\text{W}$. Present survey depths are fourteen (14) to twenty-one (21) feet deeper than this prior survey sounding.

Shoreline in the vicinity of Latitude $46^{\circ}51'30''\text{N}$, Longitude $91^{\circ}09'00''\text{W}$, has receded approximately fifty (50) meters, and in the vicinity of Latitude $46^{\circ}51'\text{N}$, Longitude $91^{\circ}10'\text{W}$, has accreted approximately one hundred twenty (120) meters.

LS-1765 (1941) contains several harbor surveys. The portion involving Cornucopia was compared with the present survey. Agreement is good with the present survey depths being one (1) to three (3) feet deeper than the prior survey soundings. Considerable cultural change has taken place inside the harbor. The breakwater (east pier) has also been lengthened. The pilings in Latitude $46^{\circ}51'28''\text{N}$, Longitude $91^{\circ}06'20''\text{W}$ were brought forward to the present survey.

The shoreline west of the Cornucopia west pier has receded from fifteen (15) to thirty-five (35) meters between the west pier and the last row of pilings shown on the prior survey.

A comparison between a 1982 U.S. Army Corps of Engineers condition survey and the present survey show good agreement. The present survey data in the Cornucopia area (Siskiwit River) was called a "representative survey" by the hydrographer.

The present survey is adequate to supersede the prior surveys within the common area except as noted above.

7. COMPARISON WITH CHARTS 14966 (19th Edition, JAN 15/1983)
14973 (24th Edition, JAN 19/1980)

a. Hydrography

The charted hydrography originates with the previously discussed prior surveys, U.S. Army Corps of Engineers surveys and miscellaneous sources. It should be noted that the majority of charted hydrography for chart 14966 originates with miscellaneous sources and some soundings from the prior surveys. The charted hydrography for chart 14973 originates almost exclusively with survey LS-1490 (1927).

A general comparison with the chart is good. The hydrographer's tabulation found on pages 15 and 16 of the Descriptive Report notes the extreme discrepancies between the charted hydrography and the present survey. The discrepancies found in the tabulations show the present survey depth being deeper than charted depths in less than one hundred fifty (150) foot depths. In depths greater than one hundred fifty (150) feet, the present survey depths are generally shoaler than the charted depths.

Attention is also directed to the following:

1) Presurvey Review Item #9 (AWOIS Item 2387) was not investigated by the hydrographer. A telephone call to the city highway garage in Cornucopia, (715) 742-3356, confirmed that the wreck is still in place. It is recommended that the non-dangerous sunken wreck, charted in Latitude 46°51'26.40"N, Longitude 91°06'06.90"W, remain as charted.

2) The charted piles in a line from Latitude 46°51'33.6"N, 91°06'09.5"W to 46°51'32.6"N, Longitude 91°06'07.7"W, should be charted as submerged pilings. A telephone conversation with Mr. Bruce Nelson, U.S. Army Corps of Engineers, Duluth Office, FTS 783-9262, revealed that these piles are not visible.

3) Two (2) uncharted pilings were located east of the breakwater at the entrance of Cornucopia Harbor in Latitude 46°51'33.17"N, Longitude 91°06'06.52"W, and Latitude 46°51'32.56"N, Longitude 91°06'06.02"W. It is recommended that these piles be charted.

4) A combination of Corps of Engineers 1982 condition survey and present survey data should be used to chart the area in the vicinity of Cornucopia (Siskiwit River) unless subsequent Corps of Engineers data is available.

The charted piles in Latitude 46°51'28"N, Longitude 91°06'20"W should be charted as submerged piles with the same delineation as shown on the inset of Cornucopia on chart 14966.

5) An examination of aerial photographs of Cornucopia, Wisconsin, reveals the charted marine railway in Latitude 46°51'25"N, Longitude 91°06'11"W (Cornucopia Inset, chart 14966) does not exist and should be deleted from the chart.

The present survey, except as noted above, is considered adequate to supersede the charted hydrography within the common area.

b. Controlling Depths

The charted controlling depths agree with the present survey except in the vicinity of Latitude 46°51'35"N, Longitude 91°06'15"W, where the present survey depths are one (1) to two (2) feet shoaler than the charted notation "9 FEET MAY 1982". See also section 7.a.4) of this report.

c. Aids to Navigation

A single fixed aid to navigation was located within the present survey area, and it appears adequate for its intended purpose.

8. COMPLIANCE WITH PROJECT INSTRUCTIONS

This survey adequately complies with the Project Instructions except as noted in section 4 of this report.

9. ADDITIONAL FIELD WORK

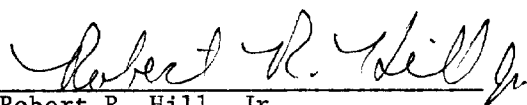
This is an adequate basic survey; no additional field work is recommended.



Douglas V. Mason
Cartographic Technician
Verification of Field Data



Robert G. Roberson
Supervisory Cartographer
Evaluation and Analysis



Robert R. Hill, Jr.
Cartographic Technician
Verification Check



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
~~NATIONAL OCEANIC AND ATMOSPHERIC SERVICE~~
Rockville, Md. 20852
NATIONAL OCEAN SERVICE
CHARTING AND GEODETIC SERVICES N/CG142:LDH

July 18, 1983

TO: Cdr. Paul M. Duernberger
Chief, Operations Branch
ATTN: N/MOAll
Atlantic Marine Center
National Ocean Service, NOAA
439 W. York Street
Norfolk, Virginia 23510

FROM: N/CG142 - Larry D. Hothem *L.D. Hothem*

SUBJECT: Doppler Point Position Results for Lake Superior Doppler Project

Attached are the following information and data for the point position results of the Doppler observations performed by AMC in the Lake Superior region during September 1982:

1. Geodetic Summaries for all Doppler stations of the Lake Superior project and Apostle Island project (performed in 1978).
2. Tables of datum shift computations used to transform the Doppler stations to the NAD 1927 datum.

It is apparent from Table 3 there is considerable inconsistencies in the horizontal control between station FINLAND (50281) located on the west side of the lake and project area, and station MCM91 (50299) located on the eastern part of the project area. The differences between the NAD 1927 and transformed Doppler are relative to the two stations TORONTO (50302) and BLACK (50303) located in the central region of the project area. Because of the large spread in latitude of 4 meters and in longitude of 5.4 meters between the 4 stations, the Doppler coordinates were transformed using the datum shift appropriate for each region.



The transformed stations and corresponding datum shift used were:

<u>Datum Shift Computed From</u>	<u>Stations Transformed</u>
50281	50283, 50284, 50285, 50286, 50287
Mean 50302 and 50303	50288, 50289, 50300, 50301, 50290, 50291, 50292
50299	50293, 50294, 50295, 50296, 50297, 50298, 50304, 50305, 50306

The estimated uncertainties for the horizontal coordinates are given for each station in the geodetic summaries.

We are now in the final stages of testing the most updated version of the Doppler short arc program GEODOPV. We expect to begin within a couple of weeks the reduction of the Lake Superior data. The relative position results will be analyzed by comparison with the point position data. It is expected there will be some improvement in the internal consistency of the Doppler derived raw coordinates. However, the improvements will only be in the precision of the unadjusted coordinates since the distortions in the NAD 1927 network will affect the accuracy of the final transformed Doppler coordinates. After the NAD 83 readjustment is completed, the differences between the Doppler derived control and NAD 83 should be under a few decimeters.

Should you have any questions or if you would like additional information, please contact Ms. Madeline White, Lt. David Minkel, or myself. Our telephone number is (FTS) 443-8580.

Attachments

cc:

Mr. Gary Fredericks, AMC


The Argo positioning data (stations Agate Bay Argo, 1983 and Silver Bay AR60, 1983) were located from Doppler stations) relative to the local net in the vicinity of the Apostle Islands are probable accurate to ± 2 meters. This is insignificant regarding the Argo positioned hydrographic data in the survey area. Further inquiring if desired may be had by contacting Mr. Larry D. Hathorn, NAS Mackinac Island or Mr. Gary Fredericks, AMC.

R.W. Sawicki

Inspection Report
H-10096

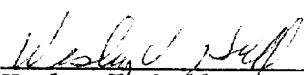
The completed survey has been inspected with regard to survey coverage, delineation of depth curves, development of critical depths, cartographic symbolization, and verification or disproof of charted data. The digital data have been completed and all revisions and additions made to the smooth sheet 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 complies with National Ocean Service requirements except as noted in the Evaluation Report. The survey records comply with NOS requirements except where noted in the Evaluation Report.

Inspected



R. D. Sanocki
Acting Chief, Hydrographic Surveys
Branch

Approved February 28, 1985



Wesley V. Hull, RADM, NOAA
Director, Atlantic Marine Center

