10144

Diagram No. LS-9

NOAA FORM 76-35A

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

DESCRIPTIVE REPORT

Type of Survey ... Hydrographic

Field No. ... OP-20-1-84

Registery No. ... H-10144

LOCALITY

State ... Minnesota

General Locality ... Lake Superior

Sublocality ... Silver Creek to Little Two Harbors

19 84

CHIEF OF PARTY
P.H. Kronfield

LIBRARY & ARCHIVES

DATE ... November 20, 1986

☆U.S. GOV. PRINTING OFFICE: 1985—566-054

10144

Area 7
Chl
14966 } TO SIGN OFF SEE
14961 } "RECORD OF APPLICATION"

NOAA FORM 77-28
(11-72)

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

HYDROGRAPHIC TITLE SHEET

REGISTER NO.

H-10144

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.

OP-20-1-84

State MINNESOTA

General locality LAKE SUPERIOR

Locality SILVER ~~CLIFF~~ CREEK TO LITTLE TWO HARBORS

Scale 1:20000 Date of survey 25 July - 6 Oct. 1984

Instructions dated _____ Project No. Z137-OP-84

Vessel M/V AVON (8000) and R/V MYSIS (8001)

Chief of party P. H. KRONFIELD

Surveyed by B. FRANCIS, J. HUDSON, R. FROST, J. BAKER, A. SIBOLD, J. GRANT, B. COONROD

Soundings taken by echo sounder, ~~hand lead, pole~~ DE 719; IT412; IT 440/441

Graphic record scaled by GARDLINE SURVEYS personnel B. Coonrod, J. Grant, J. Baker

Graphic record checked by BC, JF, AS, JB, CE, JM, JH, CSL

Protracted by N/A Automated plot by VOYAGER (FIELD) XYNETICS 1201 PLOTTER (AMC)

Verification by _____

Soundings in ~~fathoms~~ feet at ~~MLW~~ ~~MLLW~~ ~~Great Lakes Datum = 600.0 ft. MSL~~ LWD (IGLD 1955: 600.0 Ft.)

REMARKS:

NOTES IN RED WERE MADE DURING OFFICE PROCESSING

AWOIS and SURF ✓ RWD 1/87

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FOR VERIFICATION USE

SC 4-21-97

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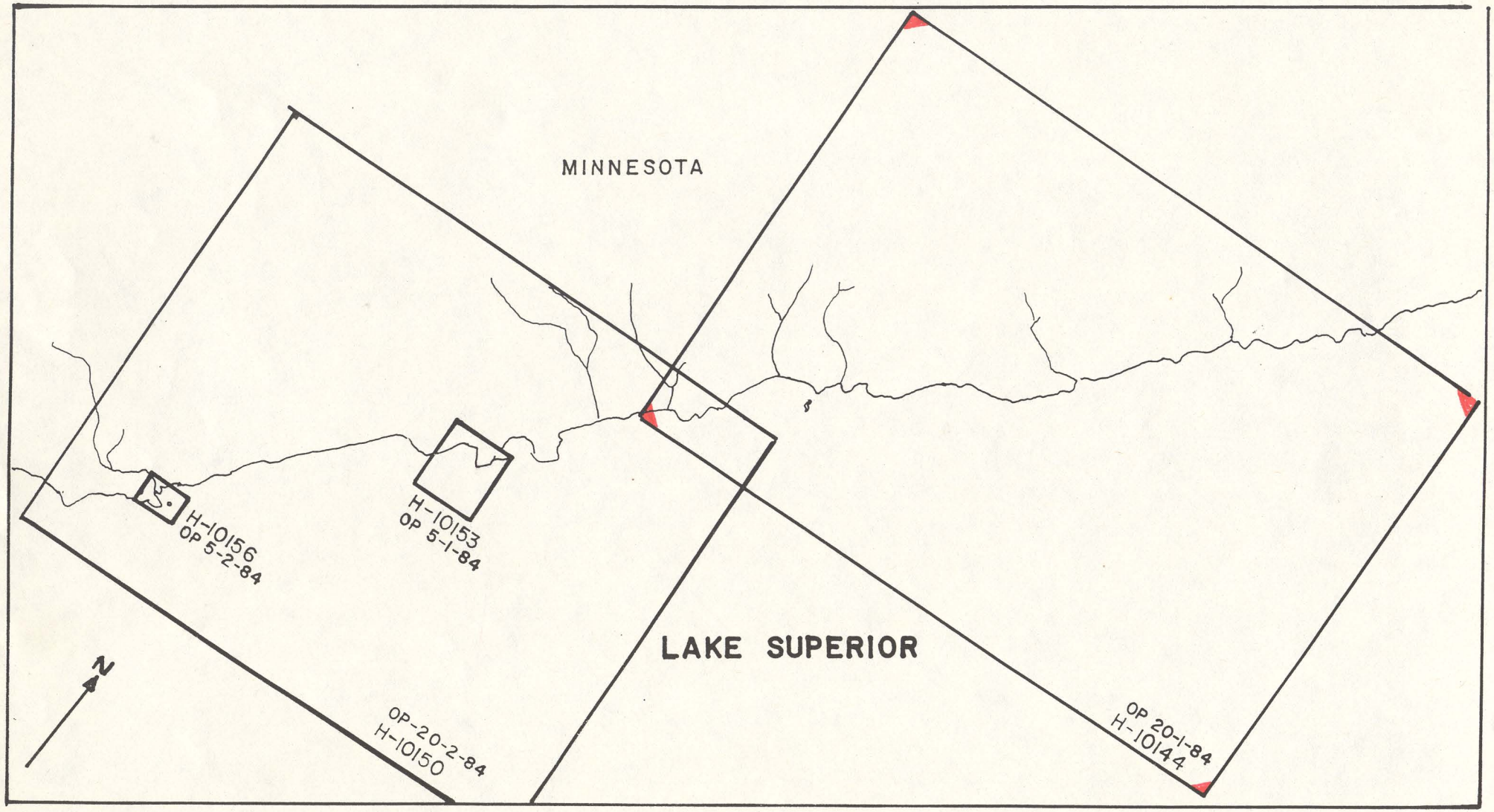
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DESCRIPTIVE REPORT

to accompany

HYDROGRAPHIC SURVEY H-10144

OP-20-1-84

Surveyed By:	Oceanprobe, Inc.
Subcontractors:	Seaway Engineering, Inc. Gardline Surveys, Inc. Roger Zaunere Kenneth A. MacDonald
Hydrographers:	Bruce Francis, Art Sibold, John Hudson, Richard Frost

A. PROJECT

This survey was accomplished under Project instructions OPR-Z-137-OP-84.

The survey was to obtain basic hydrographic data, in order to update Nautical Chart 14966.

Oceanprobe, Inc. (Houston), Seaway Engineering, Inc. (Duluth) and personnel from Gardline Surveys, Inc. (Houston) conducted the field work.

B. AREA SURVEYED

The area surveyed lies along the western shore of Lake Superior. The area extends from the shoreline, to approximately 12.5 ~~10~~ nautical miles offshore, where the survey junctions with other modern surveys. The southwest side of the survey is at Silver Point, and the area sounded extends northeasterly, about 13 nautical miles, to the point upon which Split Rock Lighthouse sits.

Field work was started on 10 July, 1984. Sounding work was accomplished between 27 July and 10 August, then between 20 and 25 August, and then between 23 September and 6 October, 1984. Project field work was completed on 7 October, 1984.

C. SOUNDING VESSEL

All soundings on this survey were collected by:

MYSIS (VESNO 8001) - 55 Ft. Steel Hull Survey Vessel

AVON (VESNO 8000) - 26 Ft. Inflatable Launch

C.1. SOUNDING AREAS

MYSIS sounded generally from 105 feet out to deep water limit of survey. AVON sounded depths from 180 feet, to the coastline. Soundings from the two vessels overlap in water depths between 110 and 170 feet.

Bottom samples were obtained by each vessel, in their respective sounding zones.

C.2. LAUNCH AVON

AVON is a flat-bottom, inflatable rubber launch. It has no keel. It is made of two hull pontoons, separated by a rigid plywood floor and a one-piece wooden transom. The launch was seaworthy. Interior space was tight. It was powered by twin outboard motors. The echosounder transducer was mounted at the transom, between the two outboard motors. The electronic positioning master unit was mounted on a pole directly over the transducer.

The graphic recorder, data acquisition computer, and positioning receiver were mounted on a wood table along the port pontoon. The track plotter was installed on the forward end of the table, so that the helmsman could view it.

The helmsman's guidance display was installed in front of the helm console, located forward and along the starboard pontoon.

The launch had a canvas and plastic canopy; open at the rear. The front flap could be closed; it was normally open during fair and calm days, and closed on windy and cold days.

The hydrographic team consisted of three persons. The party chief, who controlled the daily survey operations, was a hydrographic surveyor. He also operated the fathometer (graphic recorder). The helmsman steered and handled the radio. The data acquisition system operator was a survey technician, responsible for computer operation, track plot annotation, recordkeeping in NOAA 77-44 "Soundings", positioning receiver operation, and radio operation.

A gasoline generator set (Honda model EM1800X - 1.5kw) was mounted on the rear of the starboard pontoon. This generator provided adequate 120 volt AC power to the computer, plotter and printer. A bank of six lead-acid batteries (12 volt DC automobile type) provided DC power to the positioning receiver, fathometer, and radio.

D. SOUNDING EQUIPMENT

D.0. Equipment - AVON

Vessel: 8000 (M/V AVON)

Raytheon DE719B fathometer was installed aboard this survey launch. This fathometer was used for all AVON echosounding between 27 July through 3 October. We used an Innerspace Technology Model 440 with Model 441 Digitizer, for the period 4 to 6 October.

	Model	Unit	S/N
Analog Depths:	Raytheon DE719B	Transceiver/Recorder	4805
	Innerspace 440	Transceiver/Recorder	028
Digital Depths:	Innerspace 412	Depth Digitizer	013
	Innerspace 441	Digitizer	

D.1. Installation - AVON

A standard 208 kHz transducer was installed, upon the transom of the launch. The transducer was threaded onto a galvanized pipe, with the cable running up the inside of the pipe. The mounting pipe in turn was fitted inside a circular clamp bolted to the transom. A hex bolt served as the set screw to hold the transducer pipe in place, and a ring was welded around the uppre end of the pipe, like a collar, so that the transducer could not slip down if the hex bolt came loose. In other words, the transducer could be lowered and clamped at the same level.

The start/stop signal from the DE719 was hard-wired to a depth digitizer. The digitized depth was then fed to the data acquisition interface of the VOYAGER data acquisition system.

This combination of DE719 and IT412 was used by AVON to sound depths from two to 399 feet. The IT 440/441 was installed in order to sound an area where depths ranged to 600 feet. This echosounder was left in place for the final sounding work (4-6 Oct).

D.2. Operation

Between 2 and 199 feet, the DE719 was generally run on the high resolution scale.

Depth Range	Analog Coding
0 to 55 Feet	Solid transducer line
50 to 105 Feet	
100 to 155 Feet	
150 to 205 Feet	

Between 200 and 400 foot depths, the DE719 was shifted to the X2 scale. On occasion, the X2 scale was also used in areas less than 200 foot depth, where the hydrographer was searching for shoaling indications.

The IT412 was operated at a sounding update date of 2 soundings/second (approx.).

The DE719 and IT412 operated as independent units; that is, the start/stop signals were split. The DE719 fired the transducer and the firing pulse was transmitted to the depth digitizer as the "start" pulse. The returning acoustic pulse burned the graphic record and also was passed to the digitizer as the "stop" pulse. An oscillator circuit timed out the elapsed time and displayed it as a digital value converted to feet.

Consequently, depths scaled from the analog record are subject to errors from:

1. Stylus belt rotation speed (cal zero and cal 50 controls)
2. Initial setting (tide & draft control)

Digital soundings are subject to errors from:

3. Speed of sound oscillator circuit frequency (sound velocity control)
4. Digital draft setting (draft control)

It should be noted that improper adjustment or setup of one instrument does not adversely affect the operation of the other instrument. If the DE719 is incorrectly adjusted, this does not change the reading of the digital depth; if the depth digitizer is out of adjustment, this will not change the analog depth which is being recorded.

D.3. Other Sounding Equipment - AVON

Echosoundings were supplemented by pole soundings on sunken rocks. SEE ALSO SECTION 4.6. OF THE EVALUATION REPORT.

D.4. Static Draft - AVON

The static draft is recorded on the "Direct Comparison Log".

From JD	To JD	Static Draft
209	224	1.3 Feet
233	234	1.0 Feet
235	277	0.9 Feet
278	280	1.5 Feet

The reason the static draft changed, is because on both 17th (JD 230) and 18th of August, the transducer struck sunken rocks while sounding the shoreline and the mounting pipe was broken. In order to avoid further damage the decision was made to lower the transducer only to 0.9 feet, and run the launch at a lower rpm, beginning 22nd (JD 235) August. The 1.5 feet static draft on JD278-280 reflects the change in echosounder, from DE719 to IT440.

The static draft, as tabulated, was added to the observed analog and digital depths, when completing the direct comparison log. The bar check abstracts therefore include static draft.

D.5. Settlement & Squat - AVON

A settlement & squat test was performed on the M/V AVON on JD207 (25th July), at the breakwater at Two Harbors.

Settlement & squat results were tabulated as correction vs. rpm. In the sounding volume, we recorded the rpm and changes in rpm. so that the dynamic draft could be determined at any time.

We used the method described in the HM 4.9.4.2 (level instrument and rod readings).

D.6. Direct Comparisons

Normal procedure was to obtain two bar checks each sounding day; one in the morning and one after the sounding day ended. On some occasions, only one bar check was obtained; the reasons are noted in the sounding volume.

From 26 July through 2 August, a 9" wide steel bar, 10 feet long, suspended by two steel cables, was used as the reflector. This check bar proved unwieldly and the procedure was time-consuming. On 3 August, we shifted to using a 2 ft diameter aluminum plate, weighted with three lead diver weights. This circular plate was raised and lowered by a single steel cable connected in turn to three short (2 foot length) steel cables from which the plate was suspended.

The bar check lines were marked at 5 foot intervals, to 80 feet.

The procedure used for bar checks:

1. Launch AVON was anchored. The reflector plate was lowered.

2. In the case of the bar, two men were required to lower and raise it. The third man recorded the digital depth. The analog depth was scaled from the record later, at the office.

3. In the case of the circular disk reflector, one man could easily lower and raise the plate. A second man recorded the digital depths; the analog depths were scaled later, at the office.

4. A frequency meter was used to monitor the oscillator frequency of the IT412 depth digitizer. During bar checks, the frequency was kept within ± 20 cycles of 240,000 cycles, by fine-tuning the speed-of-sound potentiometer. (During actual sounding operations, the frequency was maintained within ± 50 cycles.

D.7. Other Instrument Corrections

Digital Draft: This particular depth digitizer (IT412 s/n 013) added a constant +0.2 feet to all digital depths. Gardline was unable to reduce this value to zero, despite the exchange of three circuit boards inside the digitizer. Therefore, all digital depths include this +0.2 feet initial error, and it is treated as a fixed instrument error. See D.8 (a) for more detail.

Analog Draft: In cases where the analog draft (tide/draft control) drifted off zero, by more than ± 0.2 feet, a correction has been applied to any analog depths scaled off and inserted into the magnetic tape file. However, an error here does not affect the digital depth recorded on tape.

Analog Sound Velocity:

If the indicator marks from the stylus do not hit exactly on the 0 and 50 foot marks, then the stylus belt is rotating too fast or too slow.

For example, if the marks are too close together (e.g. 49 feet apart instead of 50 feet apart), then the stylus belt is rotating too <u>slow</u> and all analog depths during this period must be adjusted by 2% (i.e. multiply the scaled depth by 1.02).

D.8. Depth Digitizer

Innerspace Technology Model 412 "Autotrack" s/n 013

This depth digitizer takes the "start" and "stop" signals from the DE719B and converts the elapsed time to depth. Therefore the digitizer operated independently of the DE719 as far as depth measurement goes.

Two controls affect the digital result:

a. DRAFT Control

A potentiometer allows the hydrographer to set a value into the depth display, which corresponds to the static draft. By NOAA practice, this value should be zero. The value can be checked at any time by turning a display switch. To set any desired draft value, the pot is turned until the desired "draft" value is displayed. At this point the pot is normally "locked" so it cannot be turned accidently.

b. SOUND VELOCITY Control

A potentiometer allows the hydrographer to adjust the timing circuit oscillator so that it clocks at a frequency corresponding to a known or measured sound velocity. The potentiometer knob is a ten-turn marked knob.

In order to maintain the oscillator circuit at 240 kHz, (which corresponds to a two-way travel time of 4800 ft/second), a Fluke frequency meter was wired to the oscillator circuit, so that the hydrographer and system operator could visually monitor the oscillator frequency. The frequency was kept within ± 50 cycles of 240 kHz. Most of the time the frequency was maintained within ± 20 cycles.

Circuit and outside temperature affected the oscillator frequency; during the first hour of the day, frequency drift of approximately 300 cycles was noted, and this required that the operator monitor the digitizer every few minutes and make a fine-tune adjustment of the oscillator pot.

50 240,000 = 0.02%, or 0.04 feet at 200 feet depth.

D.9. Echosounding Equipment (R/V MYSIS)

Vessel: 8001 (R/V MYSIS)

Two transducers (208 kHz and 41 kHz) were installed in the keel of R/V MYSIS while it was drydocked in July 1984 at Grand Haven, Michigan. The transducers were individually installed, each in a threaded pipe. The transducer cables ran up inside the pipe, then to the recorder itself which was mounted in the wet lab.

	Model	Unit	S/N
Analog Depths:	Innerspace 440	Transceiver/Recorder	028
	Innerspace 441	Digitizer	

The recorder/digitizer was set as follows:

Velocity of Sound:	4800 ft/sec	(thumbwheel)
Initial (Draft):	0.0 ft	(thumbwheel)
Tide:	0.0 ft	(thumbwheel)
Scale Switch:	X10 Scale	

D.10. Static Draft (R/V MYSIS)

The transducer draft was measured at 8.1 ft below the rubrail on the hull. Measurements were made and logged, of the distance between the rubrail and the water surface. The measurements are appended. The vessel draft did not change enough to warrant applying a correction to echosounding.

The static draft used for reduction of echosoundings was 4.7 ft.

D.11. Settlement & Squat

S&S test was observed on 16 August, just outside the breakwater at Knife River. A level rod was held over the transducer location. The level instrument was set up on the breakwater.

The level rod readings were tabulated as a correction vs rpm. The rpm while sounding is recorded in the sounding volume.

D.12. Direct Comparison

A bar check was observed on 2nd August. No further bar checks were made, because the bar proved too heavy to handle safely.

A leadline comparison was observed on 14th Aguust, while MYSIS was anchored.

Results of the bar check, leadline, and XSV casts have been plotted on Form 75-21. The resulting curve indicates:

a. static draft of 4.7 feet is correct.

b. use velocity table No. 1 for correction of echosoundings obtained by R/V MYSIS.

R/V MYSIS

Static Draft

Date	Distance to Water Surface (Ft)
August 6	3.42
August 7	3.42
August 8	3.44
August 9	3.36
August 10	-
August 11	-
August 12	3.50
August 13	3.50
August 14	3.36
August 15	-
August 16	-
August 17	3.42

Average = 3.4 Ft.

8.1 Ft - 3.4 Ft = 4.7 Ft (Static Draft)

D.13. Instrument Correction

Per HM and AMC OPORDER 84, instrument correction was applied to analog insert soundings and to missed digital depths.

D.14. Velocity of Sound Determinations

Model	Unit
Sippican MK9	XSV Probe

A Nansen cast was obtained on 2 August, at the same location as XSV #1. Reversing thermometers recorded insitu temperature, and water samples were analysed for conductivity using a YSI conductivity instrument. Standard Hewlett-Packard programs were run on our HP-41CV converting conductivity to chlorinity and then converting temperature and chlorinity to sound velocity. Data derived using this classical method compared with the XSV results very closely. LCDR D. Peterson and LT V. Newell observed this procedure and verified accuracy.

JD	XSV Probe Nbr.	Lat.	Long.	Posit. Nbr.	Depth
215	XSV 1	47-09-19	91-19-22	5001	984 Ft.
221	XSV 2	47-09-20	91-20-55	5674	984 Ft.
228	XSV 3	47-59-09	91-40-49	6634	262 Ft.

These were the only three velocity casts obtained during the project. COTR LCDR D. Peterson was consulted on numerous occasions throughout the project regarding drops and advised the project management that data gathered was sufficient so long as frequent bar checks were obtained. One XSV drop from the Avon launch was attempted in deep water off Two Harbors on October 8, and the unit did not operate. Two probes were deployed with no data gathered. SEE SECTION 4.G. OF THE EVALUATION REPORT

Oceanprobe became aware during a February meeting at Atlantic Marine Center that NOAA field units the previous year in Lake Superior dropped very frequent XBT probes. At no time, from negotiations for the contract, to award, and throughout the field work, did NOAA offer this information to Oceanprobe. Had project management become aware of this fact, Oceanprobe would have acquired XBT probes and deployed them very frequently. SEE SECTION 4.G. OF THE EVALUATION REPORT.

During the survey period, a University of Wisconsin research vessel, L.L. Smith, Jr., conducted temperature profiles in our general area using a YSI Tele-thermometer model 4-3 TD serial #22167. Temperature profile data is enclosed herewith to further substantiate our velocity correctors.

All three XSV casts indicated a very stable water column below 200 feet with no noticeable variation in sound velocity - a constant 1,424 m/sec. The apparent depth of thermocline where sound velocities began to stabilize was 40 feet.

Subcontractor Gardline Surveys hydrographer inexplicably chose to use the shallowest XSV drop for velocity data for the entire project. AMC verifiers returned data to Oceanprobe in February, 1985, for further work. AMC found that a potential serious general deficiency existed because of insufficient numbers of XSV probe drops. Moreover, Gardline Surveys grouped daily bar check data in an improper fashion, and generated an insufficient number of velocity tables. Furthermore, Gardline Surveys hydrographers selected the 80-foot depth to measure analog-digital error from the bar check data - standard NOAA procedure is approximately 20-foot depths.

When data was returned to Oceanprobe in a flawed and incomplete state, Gardline Surveys was terminated as subcontractor for their poor workmanship and negligence. Oceanprobe solely reworked, corrected, and verified the data.

The velocity curve of August 8 was selected for velocity correction tables to be applied to all MYSIS hydrography and for deep correctors applied to shallow water hydrography. Paul Kronfield analyzed each day's bar checks and individually graphed them. After careful comparison, bar check derived correctors were mated to the August 8 velocity correction curve at the 40-foot level. Bar checks were typically taken to 80-foot depths, but appeared to be most accurate commencing at 40 feet and shallower. XSV data indicated a zero sound velocity correction from 40 to 55 feet throughout the survey.

Fourteen velocity corrector tables were compiled based upon this study. Table 1 was used for all MYSIS corrections, computed from the August 8 XSV data, and the 4.7 foot draft. Table 2 utilized averaged corrector data from JD 209, 210, 211, and 212 bar checks. This table corrects hydrography on JD 210 and 212. Sound velocity correctors computed from bar check data on JD 213 were not used, but the curve is included in this report. Similarly, correctors averaged from bar checks on JD 214 and 216 were not used but are included herewith.

Table 3 is compiled solely from bar check data on JD 217, and corrects hydrography completed on that date. Table 4 utilizes data averaged from JD 219, 221, 222, and 223. This data corrects hydrography from JD 219, 221, and 223. JD 224 data was not used for corrector tables, nor was JD 230 data. Table 5 averaged bar check data gathered on JD 231, 232 and 233. This table corrects hydrography of JD 232 and 233. Table 6 utilizes JD 234 bar check data and corrects that day's hydrography. Table 7 is for JD 235 correctors. Table 8 averages JD 236, 238 and 239 bar check data,

correcting those day's hydrography. Table 9 is for JD 267 correctors. Table 10 is for JD 272 correctors. Table 11 is for JD 273 correctors. Table 12 is compiled from data gathered late on JD 274 and corrects hydrography completed late on JD 274 and very early on JD 275. Table 13 corrects hydrography of JD 280.

Table 14 was necessary to compile after the fact when, in reviewing Sheet H-10150 (Area C), I found the bar check echogram for JD 237. This data could not be averaged with that of JD 236, 238 and 239 (velocity corrector table 8). Table 14 corrects JD 237 solely.

D.15. Corrections to Echo Soundings

AMC OPORDER 84, plus HM 4.9.1, 4.9.4, and 4.9.5 were used as guidelines in developing and abstracting the various correctors.

Workpapers prepared by the ex-supervising hydrographer are included in the supplemental data folder labelled "Echosounding Corrections".

E. HYDROGRAPHIC SHEETS (FIELD SHEETS)

Track plot sheets and preliminary field sheets were plotted in the field, by the VOYAGER Data Acquisition/Plotting System. These working sheets were plotted on paper. Working charts were plotted at same scale used for the field sheet.

VOYAGER calculates and plots data in plane coordinate, either Lamber or Transverse Mercator. Gardline Surveys chose to use the Minnesota State Plane Coordinates (Lambert Projection) to make working charts for this project. All X, Y coordinates shown on Gardline's printouts and working charts are Minnesota North Zone.

The field sheet was plotted on the same Minnesota North Zone projection. The geographical graticle was super-imposed upon this field sheet for registration of junction hydrography and shoreline manuscripts.

The field sheet was plotted by a HP Model 7585B Plotter, driven by Voyager offline program CHART. This program plots soundings, DP's, and other positions by X, Y coordinate. The field sheet was prepared at Gardline's Houston office. Gardline surveys denied entry to Oceanprobe management throughout the data processing. Oceanprobe management never saw the product until a February, 1985, meeting at the Atlantic Marine Center in Norfolk.

Hydrographic records, supporting data, and work papers were forwarded 2 weeks late to NOAA Atlantic Marine Center for processing.

AVON mainscheme hydrography, shoreline and electric control stations are plotted on the field sheet. An overlay to the field sheet shows MYSIS hydrography and AVON crosslines.

F. CONTROL STATIONS *SEE SECTION B. OF THE EVALUATION REPORT.*

Most hydrographic control stations were established specifically for this project by a traverse which was run along the coast by Seaway Engineering Company of Duluth. The traverse was closedand adjusted between existing NGS stations (JERN, SPLIT, SPLIT ROCK, LIND BACHMAN and PION). Based upon field review of data, this traverse meets third-order, class 1 standards. Gardline Surveys lost all orginal traverse data and records. Seaway Engineering Company sent copies to the Atlantic Marine Center for processing.

The newly established hydrographic control stations were generally sited upon salient ledges or coastal features. These stations were marked by NOS disks.

Refer to Horizontal Control Project Report for further details and lists.

G. HYDROGRAPHIC POSITIONING CONTROL

The launch AVON was positioned and controlled by the range-angle method.

The ship MYSIS was positioned by the range-range method.

Details are in the Project Report Electronic Position-Fixing, a copy of which is in Appendix E.

H. SHORELINE *See section 2. and 4.b. of the Evaluation Report*

Shoreline was from a NOAA - provided enlargement of USGS topographic maps (published scale 1:24000). The shoreline was compiled onto a mylar base at 1:20000 scale. Numerous rocks close to the coastline, are shown on this shoreline tracing.

The shoreline was visually inspected by the AVON hydrographer during sounding. The AVON crew estimated the distance to shore, from the last fix on a sounding line, or first fix on an outbound sounding line. These estimated distances are recorded in the sounding volume.

A separate run along the shoreline was made, for the purpose of confirming rocks and other features. Notes by the hydrographer indicate the results of the inspection, and are on the mylar shoreline basemap.

I. CROSSLINES *See section 3.a. of the Evaluation Report.*

Adequate crosslines were run. The crossing agreement was good. No misties were noticed. Lines were run in shallow water, parallel to the coastline, as close as was safe. The soundings on these lines agreed excellently with the mainscheme soundings.

The soundings on this survey were obtained by two vessels. Overlap occurred in depths between 100 and 180 feet. Junction soundings were in good agreement.

Each vessel used a different positioning systems and a different echosounder.

J. JUNCTIONS *See Section 5 of the Evaluation Report*

This survey junctions with the two following surveys:

Registry	Year	Scale		Location
H-10094	1983	1:50000		To ~~On~~ the ~~West~~ EAST
H-10036	1982	1:50000	(PEIRCE)	To ~~On~~ the South

(NOAA provided the soundings from both surveys on a 1:20000 mylar overlay, for direct comparison.)

This survey also junctions with a 1984 survey, accomplished as part of this single project.

H-10150	1984	1:20000	To ~~On~~ the West

J.1. H-10036

Soundings from the current survey agreed very well with this 1982 survey, and no problems in matching depth curves at the smooth sheet stage are expected. No anomalous comparisons were detected. There is adequate junction junction overlap from 47/07 and 91/25, to the SW limit of the survey.

A shoal at 47/04/~~.68~~ 41.5 and 91/32/~~.30~~ 19.0 from H-10036, was better defined by the more dense line spacing of H-10144.

At 47/07.4 and 91/24.0, a small holiday between H-10036 and H-10144 occurs. Water depth is 1,800 feet (approximately) at this location. The two sounding lines from H-10036 should have been run a bit further to the south. No additional soundings could be extracted from the field records.

J.2. H-10094

Most soundings from the current survey agreed within 1%. There were only fifteen soundings available from H-10094. Depths at the junction range from 870 to 913 feet.

K. COMPARISON WITH PRIOR SURVEYS *See Section 6.0 of the Evaluation Report.*

Parts of two prior surveys fall within the area sounded:

Registry No.	Date	Scale
LS-425	1868	1:16,000
LS-1994	1956	1:120,000

There were two specific PSR items to be investigated. The PSR reports follow.

PSR	Item
2392	22' Sounding
3068	13' Sounding - Gooseberry Reef

In addition, four other seafloor features from prior surveys were investigated (all from LS-425 1868). Reports were written for investigations 1, 2, and 5.

	Item	Lat/Long
1)	14' Sounding in general depths of 20 to 50 feet.	47/06/1 91/32.2
2)	Castle Danger Reef - foul ground and sunken rocks.	47/07.2 91/29.0
3)	Shoals around Encampment Island, including sunken rocks dangerous to small craft navigation.	47/05.5 91/33.0
4)	Shoals and sunken rocks around exposed rock outcrop just offshore Sve's dock. (Split Rock Cabins)	47.10.4 91/24.7
5)	26' Shoal Just S of station LIND.	47/09.75 91/25.3

K.1 Prior Survey LS-425 *See section 6. of the Evaluation Report*

Soundings from this survey are in feet. No geographical graticle is shown on this survey. Selected soundings were transferred by the following method:

a. Common shoreline features were identified and labelled on the prior survey and on the shoreline mylar.

b. Representative soundings ~~(circled in red)~~ were transferred by three-arm protractor.

c. Results of comparison are tabulated below.

LS425	BOTTOM	H-10144
96	Sloping	85'
84	Sloping	80'
60	Sloping	62'
84	Sloping	80'
76	Sloping	74-78'
87	Sloping	80-88'
39	Sloping	35-38'
20	Edge of Slope	17'
17	Shoal	16'
13	Shoal	15
40	Sloping	38'
100	Sloping	101'
87	Sloping	81'
85	Sloping	84-88'
60	Sloping	50-60'
14	Isolated Shoal	6'
69	Sloping	66'
28	Edge of Shoal	26'
21	Edge of Shoal	22'
51	Sloping	40-90'
36	Sloping	33'
27	Edge of Shoal	28'
69	Sloping	50'
28	Sloping	24-27'
90	Sloping	90'
48	Sloping	40-45'
25	Edge of Shoal	24'
28	Edge of Shoal	28'
8	Edge of Shoal	8'
20	Edge of Shoal	18-30'
17	Edge of Shoal	16-30'
93	Sloping	87-96'
20	Edge of Shoal	18'
23	Edge of Shoal	18-32'
126	Sloping	123-129'
75	Sloping	75'
114	Sloping	109-117'
54	Sloping	52-57'
114	Sloping	110-112'
24	Edge of Shoal	18-29'
28	Edge of Shoal	20-30'
66	Sloping	48-70'
30	Sloping	30'
100	Sloping	102'
51	Sloping	40-60'
90	Sloping	50-90'
98	Sloping	88'
78	Sloping	83-90'
114	Sloping	115'

In general, the sounding from LS-425 agree very well with soundings from the current survey. No unexplainable discrepancies were discovered.

K.2 Prior Survey LS-1994 (Scale 1:120000) *See section 6 of the Evaluation Report.*

Soundings from this survey are in feet. Soundings were transferred by three arm protractor, using the geographical intersections of LS-1994. There is a scale change of 6X. However, the soundings compare very well, with no unreasonable or unexplainable discrepancy.

LS 1994	H-10144
582'	570'
630'	600'
690'	680'
870'	840-850'
930'	900-920'
942'	920-935'
906'	870-880'
900'	870-880'
774'	750-760'
696'	670'
768'	750-760'
930'	890-900'

PSR REPORT

Project: OPR-Z137-OP-84 Survey: H-10144

AWOIS Nbr.: 02392 (22' Sounding)

Chart Nbr.: 14966 (19th Edition/Jan 83)

Source: -

Investigated On:

JD/Position Nbrs.	Sndg Vol/Page	Results Plotted On 1:5000 Scale Subplan (FIELD PLOT)
236/1259-1299	2/21-23	
236/1308-1329	2/24-25	
280/1791-1840	-	

Geographic Position:	Latitude	Longitude	Method
Charted:	47/11/30	91/22/15	
Observed:	47/11/35.~~783~~	91/22/~~11.6~~ 10.51	Scaled from Field Sheet

Method of Investigation:

Survey launch with echosounder. Positioning control by range-angle method.

JD 213: Area sounded but data was rejected and rerun (JD236).

JD 236: Ran fifteen lines spaced 150' apart over this reef, going 700' to SW of PSR location and 1500' to NE of PSR location. Line direction was NW/SE.

JD 280: Ran nine lines (line direction E/W) at spacing 50', centered on the least depth location obtained on JD 236. Survey conditions were marginal (2' to 3' seas, from East). Splits run until shoal dropped away to 50' depth on NE, and then to 56' depth on the SE and SW.

Position	Raw LD	Corrected LD
236/1277 + 2	~~28~~ 29.2	~~26~~ 28.6
236/1277 + 2.8	~~28~~ 29.5	~~26~~ 28.9
280/1795	~~25.0~~ 25.4	~~25.2~~ 25.7
280/1811	~~23.0~~ 22.4	~~23.2~~ 22.7
~~280/1840~~	~~24.2~~	~~24.4~~ REJECTED

Charting Recommendation: SEE SECTION 7.a.4) OF THE EVALUATION REPORT.

Chart the ~~23.1~~ 22 FT. sounding at new location. CONCUR

PSR REPORT

Project: OPR-Z137-OP-84 Survey: H-10144

AWOIS Nbr.: 03068 (13' Sounding)

Chart Nbr.: 14966 (19th Edition/Jan 83)

Source: LS-425

Investigated On:

JD/Position Nbrs.	Sndg Vol/Page
217/388-438	1/35
235/1171-1225	2/16-18
273/1600-1608	2/39
223/5804-5806	3/50

Geographic Position:	Latitude	Longitude	Method
Charted:	47/07/48.0	91/27/12.0	
Observed:	47/07/48.75	91/27/10.327	Scaled from Field Sheet

Method of Investigation:

JD 223: MYSIS crossed reef by mistake and obtained a 9.0 ft. raw sounding.

JD 217: AVON ran eleven lines at 300 ft. spacing. Lines run to 200' contour.

JD 235: AVON ran ten lines at 300 ft spacing, out to 200' depths. Lines run 2000' to SW and 2400' to NE of the reported location. Ran five splits at 150 ft. spacing the shoalest area within the 70' depth contour, as defined by previous ten lines. Divers searched for reported 4' shoal, in this location, but nothing less than 13' was found. The 13' depth was by diver's pressure gage.

JD 273: Dropped buoy at shoal location. Sounding vessel circled buoy trying to pick up LD. The reef was visible from the boat. Obtained DP's while watching fathometer. LD obtained on echosounder.

Position	Raw Digital Depth	Corrected LD
217/415	~~14.5~~ 14.9	~~14.0'~~ 14.9
235/1198 + 1.5	~~16.1~~ 15.9	~~15.0'~~ 15.7
273/1605	~~13.6~~ 12.9	~~12.2'~~ 11.5
273/1607	~~13.3~~ 12.5	~~11.9'~~ 10.9
223/5805	9.0	~~12.6'~~ 12.3
218/Diver	13	12'
235/Diver	13	12'

Diver Report:

Divers Kronfield & Zaunere dove on visible reef on JD 218, and measured shoalest visible rock at 13' by diver depth gage.

Diver investigation was repeated on JD 235, to look for the reported 4' shoal, but no shoal feature was seen at this vicinity. LD again measured at 13' by depth gage.

Charting Recommendation:

Chart ~~12~~ 11 Ft. sounding, at latitude 47/07/48.7 and longitude 91/27/10.~~3~~ 27. CONCUR. SEE ALSO SECTION 6.B. OF THE EVALUATION REPORT.

PSR REPORT

Project: OPR-Z137-OP-84 Survey: H-10144

AWOIS Nbr.: - N/A - (14' Sounding)

Chart Nbr.: 14966 (19th Edition/Jan 83)

Source: LS-425 (1868)

Investigated On:

JD/Position Nbrs.	Sndg Vol/Page
272/1480-1489	2/38

Geographic Position: Latitude Longitude Method

Charted:

Observed: See field sheet and subplan

Method of Investigation:

Survey launch with echosounder. Positioning control by range-angle method.

1) Ran one line over scaled location, then ran six more lines at 50 ft. spacing, to establish size of shoal. Covered an area 250 ft to SW and 100 ft. to NE of scaled location.

2) Having defined the shoal area, a sounding line was run 25 ft. to SW of scaled location and a LD of 8' was detected. A buoy was dropped on this location.

3) The rock outcrop was clearly visible. The launch was maneuvered around the buoy and the least depth was found.

Position	Raw Depth	LD Corrected
1482 + 2.5	9.8	~~8.2~~ 9.0
~~1487 + 2.5~~	~~8.6~~	~~7.2'~~ REJECTED
~~1489~~	~~8.0~~	~~6.6'~~ REJECTED.

Charting Recommendation: SEE SECTION 6.A. OF THE EVALUATION REPORT.

~~Results plotted on 1:5000 scale subplan.~~

PSR REPORT

Project: OPR-Z137-OP-84 Survey: H-10144

AWOIS Nbr.: - N/A - (Castle Danger Reef)

Chart Nbr.: 14966 (19th Edition/Jan 83)

Source: -

Investigated On:

JD/Position Nbrs.	Sndg Vol/Page
221/569-588	1/46-47
272/1501-1580	2/53

Geographic Position:	Latitude	Longitude	Method
Charted:	47/07/2.5	91/29/06	
Observed:	See field sheet and subplan		

Method of Investigation:

Survey launch with echosounder. Positioning control by range-angle method.

JD 221: Three mainscheme lines at 600' spacing. Visible rocks and boulders.

JD 272: Ran twenty-two lines at 75 ft. spacing, out to the 50' depth contour. Development lines cover about 1700 feet of coastline from the SW to the NE. The investigation extended to 15' edge of the shoal to the SW, and to the 11' depth curve on the NE. The least depths were found at the offshore edge of the shoal. Breakers were observed during SW and NE gales, along this outer boundary. The whole area appears to be a shelf of rock, rather than an area containing a number of loose boulders. Depths across this feature are generally 4 to 7 feet, but numerous rocky peaks covered 2 to 3 feet exist. Depths drop off rather quickly beyond the 6 foot contour.

Charting Recommendation: *See Section 7, a.10) of the Evaluation Report.*

~~Chart as foul ground, with foul limit along 6 ft contour.~~
~~Refer to 1:5000 scale subplan.~~ *Do not concur.*

PSR REPORT

Project: OPR-Z137-OP-84 Survey: H-10144

AWOIS Nbr.: None (Shoal SE of LIND)

Chart Nbr.: 14966 (19th Edition/Jan 83)

Source: -

Investigated On:

JD/Position Nbrs.	Sndg Vol/Page
210/104-135	1/9-10
274/1638-1689	1/42-44

Geographic Position:	Latitude	Longitude	Method
Charted:			
Observed:	47/09/45.744	91/25/20.829	Scaled from Field Sheet

Method of Investigation:

Survey launch with echosounder. Positioning control by range-angle method.

1) 31' Shoal sounding found on JD 210, during mainscheme lines.
2) Development by sixteen lines at 75 ft. spacing, on JD 274. Development lines run parallel to mainscheme lines (NW/SE). The feature appears to be a ridge running E/W for about 500 ft.

Position	Raw Depth	LD Corrected
1677 + 2.8	27.5	~~25.9~~ 26.7

Charting Recommendation:

Chart 26' sndg (LD) on this feature. Refer to ~~1:5000 scale subplan.~~ SMOOTH SHEET Concur.

K.3 Conclusions

From Split Rock Lighthouse to 1 mile SW of Castle Danger Reef, eleven bottom samples were obtained by MYSIS in the inshore area. All were "no sample", indicating hard bottom, or "gravel", with the exception of one off traverse station KRONE which was brown silty clay. This compares favorably with all "rock" bottom characteristics on survey LS-425 (1868) except for the sample off station KRONE which is somewhat outside the limits of survey LS-425. Since the 1868 survey was by leadline with extensive bottom sampling, it is felt the current survey samples are adequate to supplement the 1868 bottom characteristics in the NE half of the surveyed area. *Concur*

From 1 mile SW of Castle Danger Reef SW to the southern limit off Silver Cliff, eight bottom samples were obtained by the MYSIS, being a mixture of "no sample", (indicating hard bottom), and clay, sand, and gravel. These compare with all rock bottom from LS 425 except for one "sand" just SW of Encampment Is. This appears to be a transition area from the rock bottom (to the NE), to the sand and clay bottom (to the SW, around Two Harbors).

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

This survey was compared to Chart 14966 (19th Edition/Jan 83). This chart is 1:120000 scale, and is a general navigation chart.

NOAA provided a 6X blowup of the chart, on mylar, for direct overlay to field sheet. Within the area surveyed, four offlying features are shown. Two of the four were designated PSR items (2392 and 3068). The third feature, the shoals around Encampment Island, were extensively surveyed. The fourth feature, the exposed rocks and surrounding shoals offshore Split Rock cabins/camp, were also developed.

In general, the comparison was fair to poor. Of more than forty chart soundings compared, only twenty-three can be considered to agree reasonably, even considering the scale change and the method of sounding used on surveys prior to 1930. Consistently poor comparisons occurred with those chart soundings located more than six n.m. from the coast, and/or deeper than 800 feet.

M. ADEQUACY OF SURVEY

This survey is complete and adequate to supersede prior surveys for charting, except for bottom characteristics. It is recommended that prior survey bottom characteristics ~~be retained~~. SUPPLEMENT THE PRESENT SURVEY.

N. AIDS TO NAVIGATION SEE SECTION 7.6. OF THE EVALUATION REPORT.

No fixed or floating aids were found within the survey area.

The lighthouse at Split Rock is an NOT active aid to navigation; it is now a museum/state park.

O. STATISTICS

	AVON	MYSIS
Total number of positions	1700	1200
Lineal n.m. of mainscheme hydrography	124.6	262.8
Lineal n.m. of development hydrography	19.2	18
Lineal n.m. of crosslines and coastline hydrography	48.2	79.2
Number of bottom sample stations	30	80
Water level stations	3	
XSV casts	3	

P. MISCELLANEOUS

Nothing to report.

Q. RECOMMENDATIONS

Further field work is not necessary within the survey area. CONCUR

R. AUTOMATED DATA PROCESSING

R.0 Automatic Data Processing

Sounding data was collected by M/V AVON and by R/V MYSIS, using the VOYAGER data acquisition/plotting system. This system logged raw survey data onto magnetic tapes, as it was received by three sensors. Raw data was logged once per second. All logged data was time-tagged.

Refer to Project Report Data Acquisition System and to the VOYAGER/23 Operation Manual (January 1984 edition) for a more detailed explanation of the programs and hardware.

R.1 Hydrographer Data Acquisition - AVON

The sequence of daily activity is outlined below, in order to acquaint NOAA processors and verifiers with the particulars of this survey.

After getting underway, the M/V AVON proceeded to the work area. Electronic equipment was warmed up enroute.

The launch was anchored. A bar check was observed. Helmsman lowered the reflecting plate over the stern. Party Chief (or system operator) observed and logged the digital depths on a form. Depth digitizer was monitored by the frequency counter.

A daily positioning system check was observed. Online program HYDROS loaded. Data constants loaded and printout made of survey data. When both shore control team, and survey system operator were ready, simultaneous observations were made, of position location.

In order to begin running sounding lines, the system operator called up the coordinates of the initial line, and entered the offset to that line. The helmsman's left/right screen showed the boat position relative to the intended sounding line. The track plotter was activated, making the pen move automatically to the position on chart corresponding to the boat location.

Just before the boat reached the starting point of the line, the following sequence took place (listed in chronological order):

1) the shore control observer notified to commence tracking,

2) the data logging onto tape was activated, and

3) the automatic fixing was activated.

The party chief normally operated the fathometer, including changing scales, annotating event marks with position number, and adjusting the gain. The party chief also had to keep track of shoal indications, and plan ahead for positioning control. He made descisions about development sounding lines, rocks, shoreline sounding, and weather conditions.

While the sounding line was being run, VOYAGER operator annotated the track plot by hand, adding position numbers as time allowed. He also wrote notes in the Sounding Volume, and annotated his online printout.

At the end of the working day, a positioning system check was observed, and a bar check was made. The echosounder scroll, track chart, online printout, and data tapes were removed from the launch each night.

Bar checks were normally abstracted at the field office the following day. The previous day's work was plotted onto a preliminary field sheet, by hand.

R.2 Hydrographic Data Acquisition - MYSIS

After getting underway, the X, Y coordinates for the Miniranger units were loaded. From the vessel, looking towards shore, the station on the right was normally designated as range 1, and the station on the left was normally desginated as range 2. (This is opposite to NOAA practice). However, when the Master Hydrographic File was produced, the raw range 1 field and the raw range 2 field were swapped. A printout of the Master File will have range 1 and range 2 in correct columns.

After arriving at the survey area, the MYSIS stopped and drifted, while sextant fix with check angle was observed three times. The crew then commenced running hydrographey hydrography.

The Innerspace 440 echosounder was automatically marked by VOYAGER at the selected sounding interval (normally 30 seconds). This echosounder has a microprocessor which automatically printed sequential position number on the graphic record, each time an external "fix" signal was received. The echosounder operator had to manually override these printed position numbers and put the correct position number on the record, by hand.

R.3 Offline Data Reduction

Once the data was logged onto tape online, it was extracted offline, by Gardline's CHART program, and an output file was created. This file is the equivalent of the NOS HYDROPLOT punched paper tape produced online. This output file was reduced and edited offline by Gardline, to produce the input for the Master Hydrographic Data File.

For each survey data, the following hydrographic data records were produced aboard the survey launch:

a. graphic sounding record
b. track plot
c. printout - online survey record
d. cartridge containing logged survey data
e. sounding volume (NOAA 77-44 and attachments)

Offline, the following data records was produced:

f. printout of logged data at each event mark. (This printout was annotated by hand to include position numbers.)

In the Houston office, the above records were utilized to reduce and edit the hydrographic data, and then produce the field sheet and final data tape.

R.4 Tape Records

Instead of the standard NOAA practice of correcting observed soundings (on the Master Hydrogrphic Data File) by means of the Corrector File, Oceanprobe followed the procedures described below:

a. Additional soundings were inserted into the master file in chronological sequence.

b. Soundings inadvertently not logged due to operator error were added to the file in proper chronological order.

c. Soundings associated with bad positioning data were deleted.

d. Incorrectly digitized soundings were corrected.

These processing procedures were discussed with COTR in advance, and a written request made to NOAA. The letter and NOAA reply are included and are self-explanatory.

The result was a master file containing:

Time
Position
Raw Positioning Data
Raw Soundings (a)
Corrected Soundings (original raw sounding replaced) (d)
Additional Soundings (d) (inserts for peaks and slope changes)
Analog Soundings not initially recorded online (b)

Note that:

Raw Soundings (a)
Corrected Soundings (d)
Analog Soundings not initially recorded (b)

were put onto the Master Hydrographic Data File as a "Fix Record", because they have raw positoning data still associated with them. The "additional soundings" were put onto the Master Hydrographic Data File as a "Depth Record".

R.5 Online Hydrographic Printout

Verifiers and processor should be aware that the VOYAGER operator controls the various data acquisition operations by keyboard command. In reading through the on-line printout, the following messages continually appear:

Command (Printout)	Which Means
R1:RA	Begin range-angle computation of boat position
R6:FT	Begin automatic fixing on time interval
R8:LO	Begin logging data onto tape
R8:SU	Suspend logging data onto tape

Several other commands, messages, and abreviations appear on the online printout; however, familiarity with all of them is not essential to analyzing the hydrographic record. Refer to the VOYAGER Operation Manual if explanation is needed (Appendix D).

S. REFERRAL TO REPORTS

The following Project Reports with supporting field notes and records were submitted separately to Atlantic Marine Center.

a. Horizontal Control

b. Electronic Position-Fixing

c. Automated Data Processing (VOYAGER System)

d. Coast Pilot

e. NOS Product Evaluation

Personnel from Oceanprobe, Inc., and its subcontractors, performed the hydrographic and topographic field work. Initial data processing reduction, editing and production of the field sheet and report were accomplished by Gardline Surveys. Final corrections to the incomplete and flawed data were executed by Oceanprobe, Inc. Oceanprobe divers investigated the PSR items at Gooseberry Reef, and installed and serviced the water level recorders. A field crew from Seaway Engineering Company (Duluth) established the primary horizontal control by traverse. Additional hydrographic stations were surveyed in by Oceanprobe. Captain Ken MacDonald (retired NOAA) was invaluable in his assistance and guidance throughout this survey, particularly in those cases where Gardline Surveys was unable, or unwilling, to perform their hydrographic duties.

This report was written, and is respectfully submitted by:

Paul H. Kronfield
Oceanprobe, Inc.
Chief of Party

Dated: March 15, 1985

Station Name	X-Coord	Y-Coord	Z-Coord
THOMAS 1984	2,435,556.803	268,126.633	606
LEE 1984	2,433,201.812	262,875.582	716
JERN MNDOT 1977	2,433,310.783	265,128.720	841
SPLIT MNDOT 1977	2,430,812.192	260,181.469	766
LITE 1984	2,431,010.756	260,245.811	713
DEB 1984	2,430,775.917	260,184.483	725
BUG 1984	2,428,276.514	258,530.022	606
MARK 1984	2,426,867.201	255,825.317	639
SPLIT ROCK 1943	2,426,096.670	255,596.420	764
ROCK POINT 1984	2,426,087.418	255,460.008	759
KRONE 1984	2,422,468.790	253,044.988	608
ISLE 1984	2,419,914.205	250,231.076	607
LIND MNDOT 1977	2,417,191.267	247,194.587	626
IDEAL 1984	2,413,841.146	244,288.685	609
LEDGE 1984	2,412,101.463	241,552.078	612
FALLS 1984	2,409,413.784	237,947.999	615
BERRY 1984	2,407,879.624	235,804.797	609
BACHMAN MNDOT 1977	2,406,783.868	234,601.939	609
MOAT 1984	2,403,824.722	232,364.247	607
GRATE 1984	2,403,120.412	232,233.632	621
KING 1984	2,402,502.567	232,112.985	608
PRINZ 1984	2,400,604.075	231,453.403	609
STAR 1984	2,397,688.089	229,999.585	608
GERI 1984	2,393,944.357	225,348.252	608
SLUG 1984	2,393,453.901	224,592.670	614
MEEHAN 1984	2,393,144.729	224,348.861	612
JOHN 1984	2,391,125.949	223,780.157	621

HAACK 1984	2,388,294.780	222,390.826	670
LAFAYETTE 1984	2,386,119.590	220,395.911	612
GULL 1984	2,385,807.047	218,352.259	632
EFA 1984	2,379,380.798	217,038.012	607
FJORD 1984	2,377,541.543	212,794.245	611
PION MNDOT 1977	2,375,329.446	210,388.972	814

NOAA FORM 76-40
(8-74)

Replaces C&GS Form 567.

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

~~HOMELOCATING AIDS OR~~ LANDMARKS FOR CHARTS

ORIGINATING ACTIVITY
- [x] HYDROGRAPHIC PARTY
- [ ] GEODETIC PARTY
- [ ] PHOTO FIELD PARTY
- [ ] COMPILATION ACTIVITY
- [ ] FINAL REVIEWER
- [ ] QUALITY CONTROL & REVIEW GRP.
- [ ] COAST PILOT BRANCH

(See reverse for responsible personnel)

- [x] TO BE CHARTED
- [ ] TO BE REVISED
- [ ] TO BE DELETED

REPORTING UNIT (Field Party, Ship or Office): Oceanprobe, Inc.
STATE: MINNESOTA
LOCALITY: LAKE SUPERIOR
DATE: 17 Aug 1984

The following objects HAVE [x] HAVE NOT [ ] been inspected from seaward to determine their value as landmarks.

OPR PROJECT NO.: Z137
JOB NUMBER: H-10144
SURVEY NUMBER: H-10144
DATUM: North American 1927

CHARTING NAME	DESCRIPTION (Record reason for deletion of landmark or aid to navigation. Show triangulation station names, where applicable, in parentheses)	POSITION LATITUDE ° ′	LATITUDE ″ D.M. Meters	POSITION LONGITUDE ° ′	LONGITUDE ″ D.P. Meters	METHOD AND DATE OF LOCATION (See instructions on reverse side) OFFICE	METHOD AND DATE OF LOCATION FIELD	CHARTS AFFECTED
ABAND. LT. HO.	(SPLIT ROCK LIGHTHOUSE) 1952 ABANDONED LIGHTHOUSE	47° 12′	00.25	91° 12′	00.62		NGS (PUBLISHED DATA) 14966	

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SERVICE

ATLANTIC MARINE CENTER

July 26, 1984 N/MOA23:DBM

TO: N/CC24x5 - David H. Peterson

FROM: N/MOA23 - David B. MacFarland, Jr.

SUBJECT: Request for Data

Requested data is listed below.

Vessel Identification Numbers
8000
8001

Station Name	POSITION LATITUDE	LONGITUDE
FLOOD 1982	47°02'29.39868"	91°38'09.52385"
WICK 1981	47°07'31.51490"	91°28'54.04840"
STONEY PT. 1983	46°55'26.4408"	91°49'02.1535"

These are field computed positions only.

Attachments

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SERVICE
OFFICE OF CHARTING AND GEODETIC SERVICES
ROCKVILLE, MARYLAND 20852

September 11, 1984

Mr. Paul Kronfield
President, Oceanprobe, Inc.
Two Harbors, MN 55616

Ref: Gardline Surveys letter dated 29 August 1984

Dear Mr. Kronfield:

With respect to the question raised by your subcontractor in the above referenced letter, I have been advised by the Atlantic Marine Center that corrected depths are acceptable on the Master Hydrographic Data File, provided that:

1) a hard copy record of the raw depth data is furnished with the survey records;

2) the required corrector tapes containing the positioning correctors, etc. are also furnished as specified in the contract.

Direct communication between your subcontractor and AMC regarding tape formatting questions continues to be authorized as before. If you have any questions, do not hesitate to consult with me.

Sincerely,

David H. Peterson
Lt. Cdr., NOAA
COTR

Received Gardline 15 Sept

GARDLINE SURVEYS, INC.
Hydrographic and Geophysical Surveys

(713) 568-3881
WX 910-881-2710 "GHS HOU"

10849 Kinghurst • Suite 150 • Houston, Texas 77099

August 29, 1984

LCDR Dave Peterson, NOAA
COTR

Reference: Lake Superior Hydrographic Survey

In planning the hydrographic data reduction and digital tape production at our Houston office, we have encountered a potential problem, betweem our data reduction/editing program, and the SOW.

The SOW states that raw hydrographic data on the Master data file shall not be manipulated (3.4.2.8). An earlier paragraph specifically mentions position ranges and angles (3.4.2.2) as the raw data which NOAA requires as Harris/7 input.

1. Our proposal (pages 54-55 and 82) stated that the recorded sounding would be subject to amendment, and deletion, and insertion of additional soundings. Gardline will not manipulate or correct position ranges and angles.

2. The NTM 2 instructions describe the use of Corrector Files and Master Files. We understand that NOAA's software uses the corrector file short record to amend or delete digital soundings already on the Master File, or to insert additional soundings into the computer for plotting. We further understand that the observed digital soundings on the Master File punch paper tape are preserved and can be reviewed at any stage of processing.

3. We point out that the editing process used by Gardline will alter some of the digitized soundings on the Master File. Our edit command"AMEND" will cause a corrected sounding value to be written onto the output tape. (The original digitized sounding is preserved, unaltered, on the raw data tape, however.)

4. In order to comply with SOW 3.4.2.8, we propose to do the following:

   a. Make a hardcopy printout of the data contained on the raw data cartridges. (This annotated hardcopy will be delivered along with the other daily survey records, to AMC.)

Gt. Yarmouth
Norfolk (U.K.)
(0493) 50723
TLX 975296

Aberdeen
Scotland
(0224) 573241
TLX 73535

The Hague
Netherlands
070 634946
TLX 32656

Kuala Lumpur
Malaysia
482305
TLX MA 31070

Singapore
2532622
TLX RS 36214

4. b. Preserve the raw data until the IBM tape has been examined by NOAA and the smooth sheet plotted. (This raw data will be held at Gardline, Houston office.)

Are 4a. and 4b. acceptable to NOAA for the purpose of preserving the original digital sounding data?

Phone call 9/10/84 to D. Peterson COTP

1) cannot eliminate corrector tape

2) ok to correct the raw snds on the output tape.

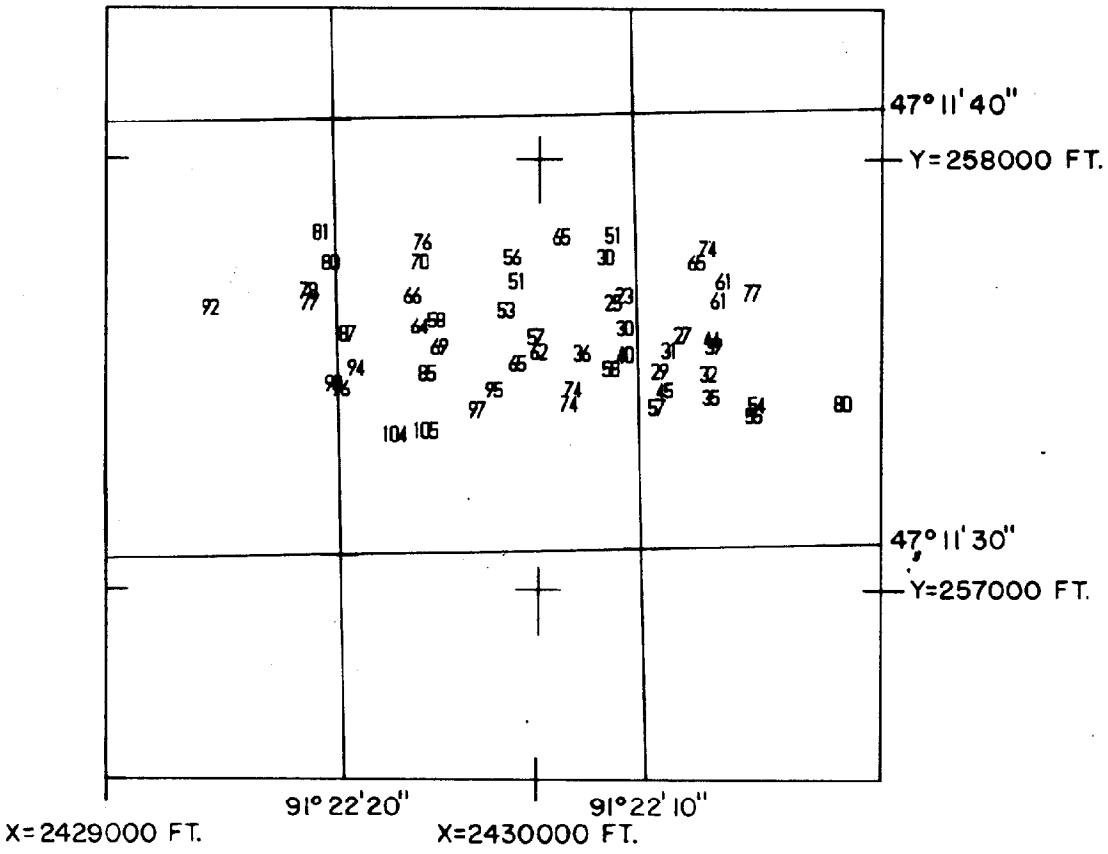
Respectfully,

Arthur Sibold
Supervising Hydrographer

GARDLINE SURVEYS, INC.

AS/mk

GARDLINE SURVEYS

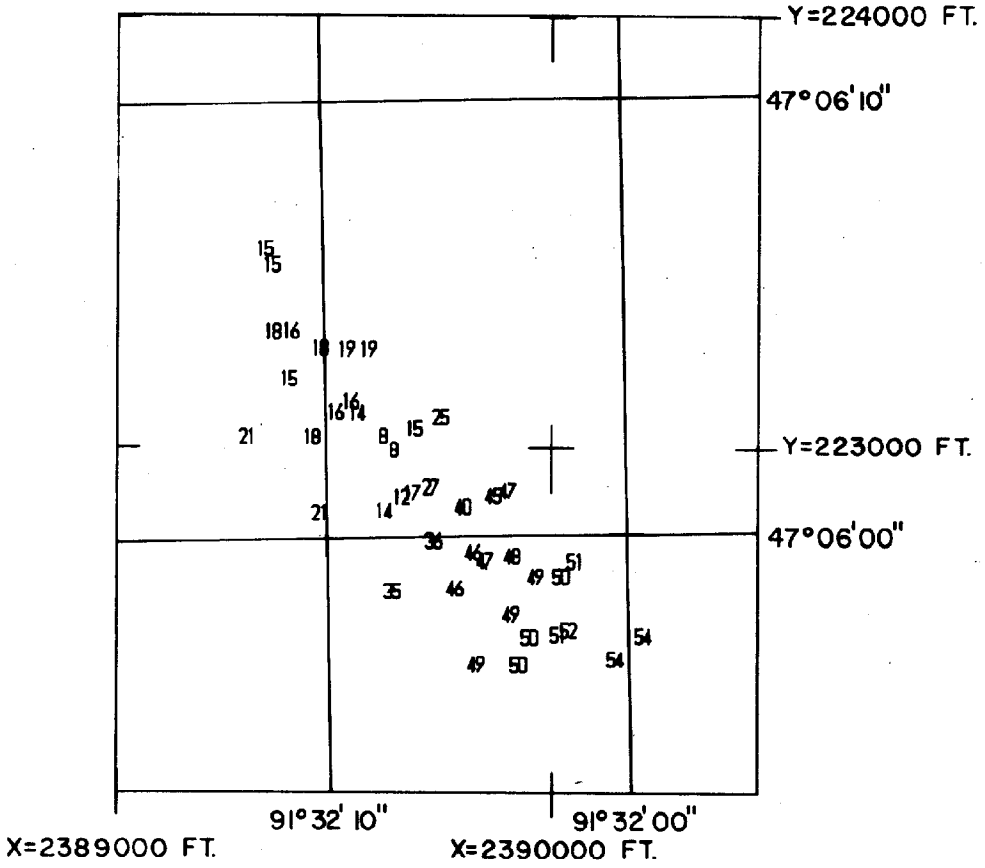


SHEET: H-10144

PSR 2392

SCALE: 1 TO 5000

GARDLINE SURVEYS



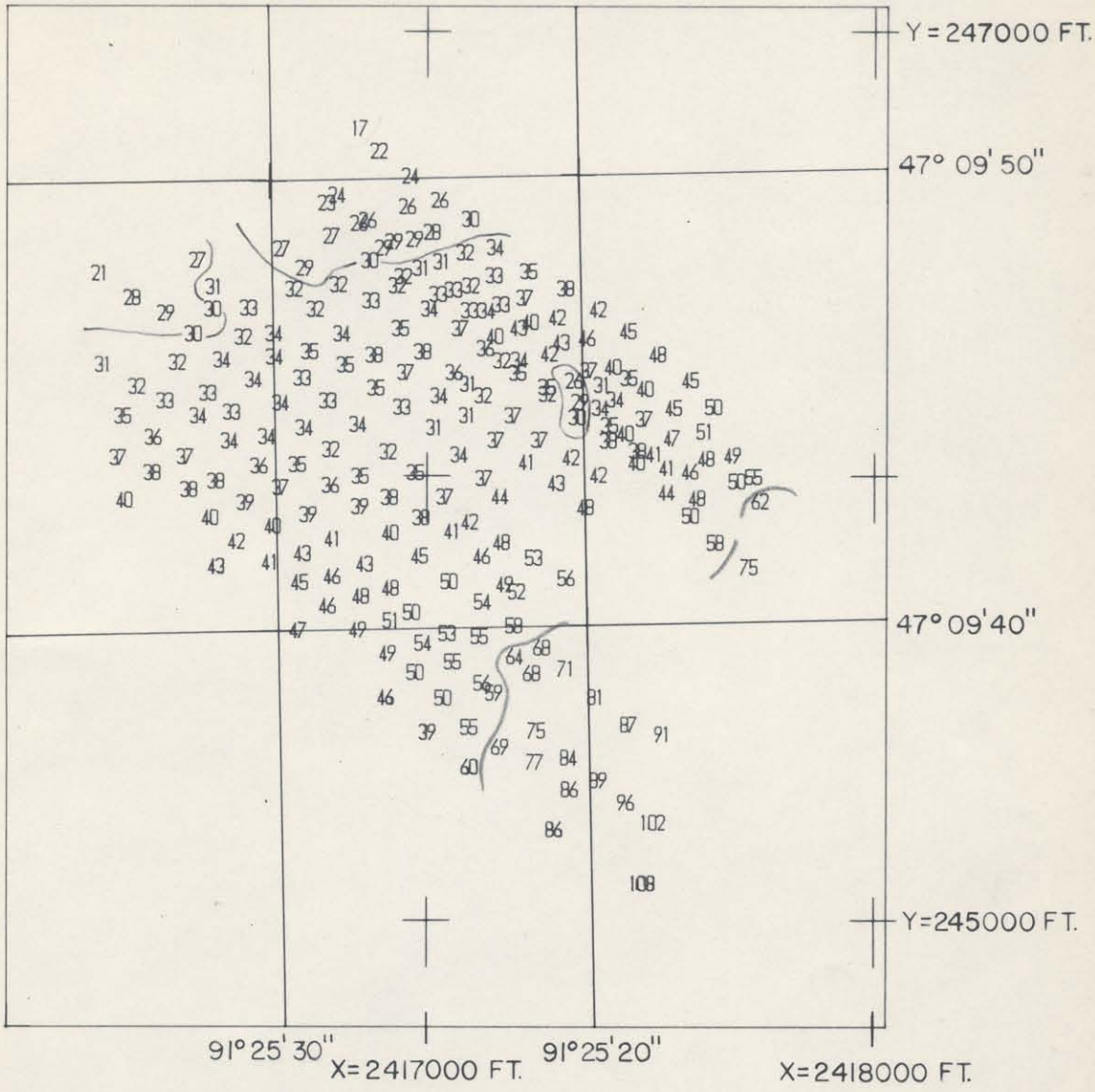
SHEET: H-10144

ITEM I

SCALE: 1 TO 5000

INVESTIGATION OF REPORTED 14' SOUNDING

GARDLINE SURVEYS



SHEET : H-10144

ITEM 5

SCALE : 1 TO 5000

SHOAL JUST S. OF STATION LIND

FIELD DATA, UNCORRECTED

APPROVAL SHEET

Oceanprobe completed delivery of processed data on Sheet H-10144 to AMC by December 3, 1984, two weeks after the deadline date of November 19, 1984. Data processing was carried out by Oceanprobe's subcontractor, Gardline Surveys.

In February of 1985, AMC found the data did not meet Government specifcations and therefore deemed it unacceptable by NOAA and returned all data to Oceanprobe. Oceanprobe took final delivery of all the data returned by AMC on Feb. 26, 1985.

I first learned of the problems with the data in late January, 1985, and viewed the final product at a meeting at AMC on Feb. 6-8, 1985, where I was able to discuss all the necessary changes and corrections that would render the data acceptable to NOAA standards.

It was at this time that I became aware of the deficiencies in Gardline Surveys' data processing and the degree to which they fell short of what was required of them. Prior to this point, Oceanprobe had been refused access to view any of the data processing sequence. Gardline also omitted to make any reports, verbal or written, to Oceanprobe regarding progress on the data processing they had agreed to perform under contract to Oceanprobe, although frequently requested to do so. This is mentioned here solely to demonstrate that Oceanprobe made numerous attempts to apprise itself of the progress of the work, but lacked Gardline's cooperation.

I would like mention here that it is my opinion that six weeks is an insufficient amount of time in which to complete processing of data and submission of the final field sheets and descriptive reports. This is an admirable goal to be sought after for NOAA units, but in the case of a private contractor attempting the science and art of hydrography under strict NOAA standards and procedures for the first time, this may be impossible.

In spite of this, Oceanprobe did succeed in delivering the majority of the processed data to AMC by the deadline with final delivery being completed by December 3, 2 weeks after deadline.

To highlight this point, I learned that a NOAA survey of Sheet H-1011, authority HFP-20-2-83 in Lake Ontario from Point Breeze to Sandy Hook began work on June 14, 1984. Surveying was completed on August 15, 1984. The six-week deadline date for delivery of data to AMC was September 26, 1984. This data was not delivered until January 7, 1985 - a 3.5 month late delivery. The complexity of this survey was 26, where our Sheet H-10144 complexity was rated 30.

I point this out as I feel it is partly due to this very tight schedule that Gardline submitted data that did not meet NOAA requirements. However, after having completely reviewed the data

submitted by Gardline to AMC, I am forced to conclude that the main reason for the deficiencies and errors in the data processing can only be attributed to Gardline Surveys' inability to perform the work to the standards required by Oceanprobe, and by NOAA.

Concerning this sheet H-10144, we note the following deficiencies of the data as processed and submitted by Gardline Surveys:

* 154 position numbers needed to be inserted
* 208 position numbers needing to be changed on the master digital tape, as well as the sounding volumes, the position abstracts, and the analog records.
* 37 incorrect shore control station heights.
* 37 incorrect shore control codes on the signal tape.
* 224 faulted files in the T1 corrector tape.
* 235 faulted/useless files in the velocity corrector tape.
* 39 sounding lines needing to be deleted from the digital file after rejection by the hydrographer.
* 32 erroneous corrector records in the range-azimuth master tape.
* 2 erroneous corrector records in the range-range master tape.
* 4663 reversed range fields in the master tape.

Moreover, Gardline Surveys had not included positions of bottom samples. Oceanprobe extracted them from the Voyager printout in Lambert X-Y coordinates and converted them to the required latitude-longitude.

All position and sounding abstracts were required to be redone.

158 peaks, deeps, and corrections were not inserted by Gardline Surveys into the digital records for this sheet. This was accomplished by Oceanprobe. Gardline's magnetic data files were not in their proper order.

All the above have been corrected to specifications solely by Oceanprobe, Inc.

Oceanprobe plotted each day's bar checks and generated 14 velocity tables for the correction of soundings.

After receiving all the data returned by AMC (February 26, 1985) I have worked solely on completing the data processing to the satisfaction of NOAA. This sheet was completed today, March 15, 1985. My work hours were 10 hours per day for 7-day weeks. Oceanprobe is grateful to Integrated Data Systems Inc., Houston, for the use of their HP-1000 computer facilities and the programming abilities of Don Baeker. I also am indebted to Captain Ken MacDonald who gave his time at his home to look over and correct the horizontal survey data.

In personally correcting this data, I have given great attention to all details of this sheet. I was present for all field work, and supervised all of the hydrography and surveying. At this time I am very familiar with all details of the sheet, and feel the survey is complete and adequate.

I would like to point out in conversations with Dan Mumford at AMC, he indicated in response to my questions that AMC computer needs a "flag" inserted when a sounding file ends or begins a new hydrographic line. We have inserted peaks or deeps at ends and beginning of some lines. The following areas will appear to need a position number at the end of a line, where in fact a "flag" only is needed: Position 1029, 1167, 2062, 5110, 5247, 5269, 5312, and 5479. There may be a few other cases requiring a flag, but they will be immediately obvious and easy to locate.

I am including with the data shipment listings of the original Gardline data requiring corrections and completion. My working notes on this listing should be of great assistance to the verifier if he has questions concerning position numbers and any other changes I have made on this final submission.

I am convinced that velocity data and correctors should be sufficient for this hydrographic data to stand up to international, and NOAA, convention for accuracy. My work on bar check data is included in this report, and supplemental temperature data gathered by University of Wisconsin research vessel is also included.

I therefore approve of this field sheet and all accompanying records for completeness and accuracy in accordance with the Statement of Work.

Paul H. Kronfield
Chief of Party

SIGNAL LIST 1/2

NUM	STATION NAME	YEAR	LATITUDE	LONGITUDE	ELEV	SOURCE
001	JERN MNDOT	1977	47 12 48.5816	91 21 22.8718	256.3	NGS
002	LEE	1984	47 12 26.3723	91 21 25.1857	218.2	SE
003	SPLIT MNDOT	1977	47 12 00.3178	91 22 00.6619	233.5	NGS
004	BUG	1984	47 11 44.5811	91 22 37.9063	184.7	SE
005	THOMAS	1984	47 13 17.6627	91 20 49.3614	184.7	SE
006	SPLIT ROCK USLS	1943	47 11 16.125	91 23 10.367	232.9	NGS
007	KRONE	1984	47 10 51.7243	91 24 03.7292	185.3	SE
008	ISLE	1984	47 10 24.5091	91 24 41.5909	185.2	SE
009	LIND MNDOT	1977	47 09 55.1303	91 25 21.9476	190.8	NGS
010	IDEAL	1984	47 09 27.1684	91 26 11.3242	185.6	SE
011	LEDGE	1984	47 09 00.5333	91 26 37.3397	186.5	SE
012	FALLS	1984	47 08 25.5347	91 27 17.3255	187.5	SE
013	BERRY	1984	47 08 04.7072	91 27 40.1695	185.6	SE
014	BACHMAN MNDOT	1977	47 07 53.0663	91 27 56.3823	185.6	NGS
015	MOAT	1984	47 07 31.5997	91 28 39.8492	185.0	SE
016	GRATE	1984	47 07 30.4566	91 28 50.0716	189.3	SE
017	KING	1984	47 07 29.3936	91 28 59.0407	185.5	SE
018	PRINZ	1984	47 07 23.2759	92 29 26.6872	185.6	SE
019	STAR	1984	47 07 09.5261	91 30 09.2789	185.3	SE
020	GERI	1984	47 06 24.3860	91 31 04.7758	185.5	SE
021	SLUG	1984	47 06 17.0288	91 31 12.0876	187.2	SE
022	MEEHAN	1984	47 06 14.6851	91 31 16.6279	186.7	SE
023	JOHN	1984	47 06 09.4790	91 31 45.9706	189.3	SE
024	HAACK	1984	47 05 56.3344	91 32 27.2912	204.2	SE

SIGNAL LIST 2/2

NUM	STATION NAME	YEAR	LATITUDE	LONGITUDE	ELEV	SOURCE
025	LAFAYETTE	1984	47 05 37.0798	91 32 59.3029	186.5	SE
026	GULL	1984	47 05 16.9743	91 33 04.4107	192.6	SE
027	E 1 NORTH(a)	1984	47 05 26.852	91 33 08.542	185.3	OP
028	EFA	1984	47 05 05.2651	91 34 37.6312	185.0	SE
029	FJORD	1984	47 04 23.7428	91 35 05.4050	186.2	SE
030	PION MNDOT	1977	47 04 00.4335	91 35 38.0336	248.0	NGS
~~031~~	~~TRAV PT SC~~	~~1984~~	~~47 03 46.7436~~	~~91 35 57.7522~~	~~188.5~~	~~SE~~
103	LITE	1984	47 12 00.9087	91 21 57.7663	217.3	SE
104	DEB	1984	47 12 00.3554	91 22 01.1861	221.0	SE
105	MARK	1984	47 11 18.2009	91 22 59.1783	194.8	SE
106	ROCK POINT	1984	47 11 14.7669	91 23 10.5827	231.3	SE
~~107~~	~~CHURCH(i)~~	~~1984~~	~~47 01 33.3602~~	~~91 38 44.4379~~	~~185.0~~	~~SE~~
~~108~~	~~COON~~	~~1984~~	~~47 00 54.9803~~	~~91 39 37.4380~~	~~186.2~~	~~SE~~
~~109~~	~~DART~~	~~1984~~	~~47 00 07.2144~~	~~91 42 29.3287~~	~~185.6~~	~~SE~~
~~110~~	~~TH 102~~	~~1982~~	~~47 00 48.8204~~	~~91 39 54.5481~~	~~185.6~~	~~SE~~
~~111~~	~~KNIFE ISLAND~~	~~1984~~	~~46 56 48.7397~~	~~91 46 18.7238~~	~~184.7~~	~~SE~~
~~112~~	~~MARINA~~	~~1984~~	~~46 56 41.9078~~	~~91 46 57.3439~~	~~184.4~~	~~SE~~
~~113~~	~~CLOUD~~	~~1984~~	~~46 56 17.0753~~	~~91 47 45.7151~~	~~185.6~~	~~SE~~
203	SPLIT RK LTHS	1943	47 12 00.25	91 12 00.62	.	NGS
211	PALISADE MAST(h)	1977	47 19 12.937	91 12 42.038	.	NGS
~~215~~	~~TWO HBRS LTHS(j)~~	~~1952~~	~~47 00 50.488~~	~~91 39 49.274~~	~~.~~	~~NGS~~
~~216~~	~~STACK,POWER CO.~~		~~47 01 06.710~~	~~91 39 35.787~~		~~NGS~~
217	TWO HBRS R.M.(k)	1977	47 00 45.259	91 41 13.274	.	NGS
304	DEB ECC (m)	1984	47 12 00.262	91 22 01.117	221.	OP

SIGNAL LIST NOTES

(a) E.I. NORTH is an unmonumented spur station, used as a visual calibration signal (for sextant resections). No check on this position.

(b) FLOOD was established by PEIRCE in 1981. The field position from 1981 differs slightly from the adjusted position calculated from the Seaway 3rd order traverse 1984.

~~(c) FB not monumented. Traverse stations KLINK SOREN and DOG are monumented.~~

~~(d) AGATE BAY ARCO was established by PEIRCE in 1983. It was connected by spur observation, during the Seaway 3rd order traverse. The co-ordinates differ by about 9 feet. The 1983 coordinates were used for plotting soundings on the the field sheet, but the coordinates on the 1984 signal list were computed from the 1984 traverse observations (traverse spur).~~

~~(e) STONY POINT established by PEIRCE in 1983. Position obtained from N/MOA23.~~

~~(f) CHURCH may be called BASELINE in some hydrographic and traverse records.~~

~~(g) AGATE BAY and TH101 not part of Seaway 3rd order traverse. Plane coordinates obtained from INMAN-FOLTZ & ASSOC., and adjusted slightly, to fit with TH100 and TH102, as computed by Seaway. The shift was about 1.2 feet for both stations.~~

(h) PALISADES STATE PATROL MAST.

(j) TWO HARBORS LIGHTHOUSE.

(k) TWO HARBORS RADIO MAST (Pork Chop Hill).

(m) This is an unmarked eccentric station, used for hydrographic control.

The following established horizontal control stations were recovered during this project.

Station Name	Year Established	Quad No.	Signal List
~~BUCHANAN~~	~~1952~~	~~460914~~	
~~BURLINGTON~~	~~1943~~	~~470913~~	
GOOSEBERRY	1943	470912	
SPLIT ROCK LTHSE	1943	470912	Y
SPLIT ROCK USLS	1943	470912	Y
~~TWO HARBORS LTHS~~	~~1952~~	~~470913~~	~~Y~~
~~TWO HARBORS POWER/LIGHT CO. STACK~~	~~1952~~	~~470913~~	~~Y~~
PALISADES STATE PATROL RADIO MAST		470912	Y
JERN MNDT	1977	470912	Y
SPLIT MNDT	1977	470912	Y
LIND MNDT	1977	470912	Y
BACHMAN MNDT	1977	470912	Y
PION MNDT	1977	470913	Y

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: Beaver Bay, Minnesota (909-9075)

Period: July 27, 1984 to October 6, 1984

HYDROGRAPHIC SHEET: H-10144 (Area D)

OPR- Z 137-OP-84

Locality: Lake Superior

Plane of reference: Low Water Datum (IGLD 1955: 600.0 Feet)

Remarks:

Zoning not required, data from other gages on Lake Superior indicates no unusual water level movement during the survey period.

Harry C. Lyppincott

Chief, Great Lakes Acquisition Unit

NOAA FORM 76-155
(11-72)

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

SURVEY NUMBER

H-10144

GEOGRAPHIC NAMES

Name on Survey	A ON CHART NO.	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	
CASTLE DANGER (title)										1
CORUNDUM POINT										2
CROW CREEK										3
ENCAMPMENT ISLAND										4
ENCAMPMENT RIVER										5
GOOSEBERRY REEF										6
GOOSEBERRY RIVER										7
LAKE SUPERIOR										8
LITTLE TWO HARBORS										9
MINNESOTA (title)										10
SILVER CREEK										11
SPLIT ROCK CABINS (locality)										12
SPLIT ROCK POINT										13
										14
										15
										16
										17
										18
					Approved:					19
										20
					Charles E. Harrington					21
					Chief Geographer - N/CG2x5					22
					JUL 10 1986					23
										24
										25

NOAA FORM 76-155 SUPERSEDES C&GS 197

HYDROGRAPHIC SURVEY STATISTICS
REGISTRY NO.: H-10144

Number of positions	2423
Number of soundings	9486
Number of control stations	30

	TIME-HOURS	DATE COMPLETED
Preprocessing Examination	78	05/02/85
Verification of Field Data	603	06/12/86
Quality Control Checks	158	
Evaluation and Analysis	90	08/28/86
Final Inspection	23	08/26/86
TOTAL TIME	952	
Marine Center Approval		08/29/86

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

ATLANTIC MARINE CENTER
EVALUATION REPORT

SURVEY NO.: H-10144 FIELD NO.: OP-20-1-84

Minnesota, Lake Superior, Silver Creek to Little Two Harbors

SURVEYED: 27 July through 6 October 1984

SCALE: 1:20,000 PROJECT NO.: Z137-OP-84

SOUNDINGS: RAYTHEON DE 719B fathometer, INNERSPACE TECHNOLOGY Model 440 echosounder and Sounding Pole

CONTROL: FALCON 484 and DEL NORTE (Range/Range), FALCON 484 and Digital Transit (Range/Azimuth)

Chief of Party.....P. H. Kronfield

Surveyed by.....B. Francis
.....J. Hudson
.....R. Frost
.....J. Baker
.....A. Sibold
.....J. Grant
.....B. Coonrod

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

1. INTRODUCTION

a. No unusual problems were encountered during verification.

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

2. CONTROL AND SHORELINE

a. The control is adequately discussed in sections F., G., S. and Appendix E of the Descriptive Report.

b. Shoreline was added in brown from 1:20,000 scale enlargements of 1:24,000 scale U. S. Geological Survey Quadrangles photo revised with 1983 NOS CC photographs and is for orientation purposes only.

Some of the rock features originating with the U. S. Geological Survey enlargement are shown on the present survey smooth sheet in red as islets. This information is based on the hydrographer's notes of elevations in the sounding volumes and on the shoreline field sheet. See also section 4.b. of this report.

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 3.3.1.6.3. of the Statement of Work (SOW).

b. Except for the 6-foot curve which could not be completely developed in the alongshore areas because of the proximity of the shoreline, the standard depth curves and the charted 24-foot supplemental depth curve were drawn in their entirety. Brown curves were added to better show bottom topography.

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

1) In the vicinity of Latitude 47°09'51"N, Longitude 91°24'57"W additional lines of hydrography would have been desirable to define a feature that rises to a depth of 53 feet from surrounding depths of 83 feet on the present survey.

2) In the vicinity of Latitude 47°06'54"N, Longitude 91°28'51"W additional lines of hydrography would have been desirable to define a feature that rises to a depth of 94 feet from surrounding depths of 117 feet on the present survey.

3) In the vicinity of Latitude 47°05'29"N, Longitude 91°33'45"W several shoal depths of 13 feet shown on the prior survey LS-425 (1868-89) were not investigated by the present survey. Sounding line spacing of 200 meters should have been reduced in this area.

4) In the vicinity of Latitude 47°06'24"N, Longitude 91°30'45"W additional lines of hydrography would have been desirable to define a feature that rises to a depth of 23 feet from surrounding depths of 49 feet on the present survey.

5) In the vicinity of Latitude 47°06'45"N, Longitude 91°30'24"W additional lines of hydrography would have been desirable to define a feature that rises to a depth of 22 feet from surrounding depths of 28 feet on the present survey.

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 is to be commended for excellent shoreline descriptions throughout the survey.

b. Rocks verified by the hydrographer did not always have adequate information to determine their position and depth or elevation. There was lack of cross referenced position data, position numbers, times of observation and date of observation. This is especially so when the hydrographer was in the process of verifying alongshore features. These rocks were assigned position numbers during office processing and are shown on the present survey based on the descriptions and distances provided by the hydrographer in the sounding volumes.

c. The sounding volumes did not have an index for detached positions. An index for detached positions was added to the sounding volumes during office processing.

d. No NOAA form 75-44 "Oceanographic Log Sheet-M" was submitted for VESNO 8000 (AVON) and VESNO 8001 (MYSIS) on calendar days 221 and 225 respectively. These bottom samples were added during office processing.

e. TC/TI correctors were not annotated correctly. Speed changes were referenced to position numbers rather than times. This was corrected during office processing.

f. Velocity graphs and tables were revised for correctors in shallow water (0 - 60 feet) during office processing.

g. No vertical cast was taken for vessel number 8000 as required by section 4.9.5.1.2. of the Hydrographic Manual. Velocity determination via XSV observations may not have been frequent enough for duration of survey. Section 3.3.1.7.2. of the "Statement of Work" required weekly observations from large vessels when bar checks were not practical. Observations were necessary to the maximum depths the vessel was obtaining soundings in addition to bar checks to observe daily variations. It appears the observational data was adequate to define the velocity corrections for the survey; but, this cannot be substantiated by observational data.

h. Settlement and Squat corrector graphs were not drawn correctly. Settlement and Squat correctors were redetermined during office processing.

5. JUNCTIONS

H-10036 (1982) to the south
H-10094 (1983) to the east
H-10150 (1984) to the west

The smooth sheet for survey H-10036 (1982) is archived at headquarters in Rockville, Maryland and a standard junction was not made. In this case, the note "ADJOINS" has been shown on the present survey smooth sheet. The comparison between a stable base copy of survey H-10036 shows good agreement between soundings in the junctional area; however, due to the large scale difference between the surveys, the junctional curves are not precisely in coincidence. Any correction for coincidence will have to be made by the chart compiler.

Excellent junctions were effected between the present survey and surveys H-10094 and H-10150.

There are no contemporary surveys to the northeast of the present survey. The charted depths and present survey depths are in harmony to the northeast.

6. COMPARISON WITH PRIOR SURVEYS

LS-256 (1861-68) 1:200,000
LS-425 (1868-89) 1:16,000
LS-1994 (1956) 1:120,000

Prior survey LS-256 (1861-68) does not have a grid and is too small in scale to meaningfully compare with the present survey. This prior survey should serve only as a historical document of the area.

Prior survey LS-425 (1868) covers the alongshore area of the present survey out to the approximately 80 to 200 foot depths. The prior survey agrees well with the present survey with soundings agreeing within plus or minus one (1) to three (3) feet. A few scattered soundings vary from five (5) to twenty (20) feet deeper than the present survey. These differences are attributed to sounding methods and control methods. Several rocky bottom characteristics were brought forward to supplement the present survey.

Prior survey LS-1994 (1956) is a small scale survey that sparsely covers the northern offshore half of the present survey. Soundings less than 800 feet compare well with the present survey while further offshore soundings 800 feet to 954 feet are 12 feet to 34 feet deeper that present survey soundings. These differences are attributable to survey methods and scale differences.

In addition to the discussion in section K.1 of the Descriptive Report the following should be noted:

a. A 14-foot sounding shown on the prior survey in Latitude 47°06'02"N, Longitude 91°32'09"W was developed by the hydrographer. The hydrographer located a rock with a least depth of seven (7) feet in Latitude 47°06'02.35"N,

Longitude 91°32'08.09". It is recommended that a rock with a least depth of 7 feet (7 Rk) be charted in the position located by the present survey.

b. AWOIS Item #03068 is a charted 12-ft sounding on Gooseberry Reef in Latitude 47°07'48"N, Longitude 91°27'12"W that originates from prior survey LS-425 (1868-1889) as a 13-foot sounding. The charted 12-ft sounding first appeared on chart 14966, 1939 edition in the same position as the 13-foot sounding shown on the prior survey. Additionally a 4-foot shoal originating with Chart Letter 431/1983 and Local Notice to Mariners 12/1983 was reported in Latitude 47°07'45"N, Longitude 91°27'10"W. The reported 4-foot sounding falls in depths of 52 feet on the present survey. The hydrographer developed the area of the 12-foot sounding and obtained an echo sounder least depth of 11 feet in Latitude 47°07'48.75"N,Longitude 91°27'10.27"W. Additional investigation for the reported 4-foot shoal was conducted by a diver with negative results. It is recommended that the 12-foot sounding be removed from the chart and the 11-ft sounding be charted in the position located by the hydrographer as shown on the present survey and the 4-foot shoaling remain uncharted unless additional information indicates otherwise.

Except as noted above the present survey is adequate to supersede the prior surveys in the common area.

7. COMPARISON WITH CHART 14966 (19th Ed., Jan. 15/83)

a. Hydrography

The charted hydrography originates with the previously discussed prior surveys and miscellaneous sources and is generally 10 feet deeper to 57 feet shoaler with approximately one half of these soundings agreeing well with the present survey. Two charted soundings of 110 and 169 feet are shoaler than the present survey by 103 feet and 164 feet respectively. These soundings fall in areas where present survey soundings show no indication of shoaling and should be considered discredited by the present survey.

The following is noted in addition to the items discussed by the hydrographer in section K. of the Descriptive Report.

1) Numerous uncharted cultural and natural features were located by the hydrographer during the survey. It is recommended that these features be charted as shown on the present survey providing the scale of the chart allows.

2) The hydrographer discussed in sounding volume II (page 36, item 1) but failed to locate the two charted rocks

in the vicinity of Latitude 47°11'57"N, Longitude 91°22'00"W. It is recommended the two rocks be retained as charted.

3) The charted rock in the vicinity of Latitude 47°11'39"N, Longitude 91°22'30"W is believed to be one of two rocks located by the hydrographer and shown as two islets in Latitude 47°11'42.5"N, Longitude 91°22'33.9"W and Latitude 47°11'41.1"N, Longitude 91°22'35.2"W on the present survey. It is recommended that the rock be removed from the chart and the two islets be charted in the positions shown on the present survey.

✓ 4) AWOIS Item #02392, a charted 22-ft sounding in Latitude 47°11'30"N, Longitude 91°22'15"W originates from an unknown source and first appeared on chart 14966 in 1939. An echosounder least depth of 22 feet was located by the present survey in Latitude 47°11'35.83"N, Longitude 91°22'10.51"W. It is recommended that the 22-ft sounding be charted in the position located by the hydrographer.

5) The charted rock in the vicinity of Latitude 47°11'21"N, Longitude 91°23'00"W was discussed in sounding volume II (page 36, item 4) but was not located by the hydrographer. It is recommended that the rock be retained as charted.

6) The charted rock in the vicinity of Latitude 47°10'50"N, Longitude 91°23'50"W falls in the same area of three rocks and a foul area shown on the present survey. The three rocks on the outer limits of the foul area were described and located by the hydrographer in Latitude 47°11'00.5"N, Longitude 91°23'53.9"W, Latitude 47°10'57.29"N, Longitude 91°23'54.46"W and Latitude 47°10'56.54"N, Longitude 91°23'57.23"W. The foul limit line, added to the present survey smooth sheet during office processing, was derived from from notes and drawings found in the hydrographer's raw data printouts for VESNO 8000 (AVON) on JD 236. It is recommended that the charted rock be removed from the chart and that the three rocks located by the hydrographer and the foul limits be charted in the positions shown on the present survey providing the scale of the chart allows.

7) The charted rock in the vicinity of Latitude 47°10'24"N, Longitude 91°24'45"W was located by the hydrographer in Latitude 47°10'25.53"N, Longitude 91°24'46.00"W. It is recommended that the charted rock be charted in the position located by the hydrographer on the present survey.

8) The small island charted in Latitude 47°10'17"N, Longitude 91°24'40"W is in error. The island is two small islands close together and were brought forward to the present survey from an enlargement of the U. S. Geological

Survey quadrangle map. It is recommended that the charted island be revised and charted as shown on the present survey.

9) The charted rock in the vicinity of Latitude 47°09'00"N, Longitude 91°26'30"W was neither discussed or located by the hydrographer. It is recommended that the rock be retained as charted.

10) The three charted rocks in the vicinity of Latitude 47°07'15"N, Longitude 91°29'00"W (locally known as Castle Danger Reef) were developed by the hydrographer on the present survey. One rock bearing 2 feet above LWD was located by the hydrographer in Latitude 47°07'23.1"N, Longitude 91°29'08.2"W. Nine rocks originating with the U.S. Geological Survey quadrangle shoreline field sheet were brought forward to the present survey because they were considered neither verified nor disproved by the present survey. It is recommended that the charted rocks be revised and the area charted as shown on the present survey.

11) The charted rock in Latitude 47°05'25"N, Longitude 91°33'05" on the northeast side of Encampment Island was located by the hydrographer in Latitude 47°05'27.40"N, Longitude 91°33'03.99"W as a rock bearing 5 feet above LWD. It is recommended that the rock be revised and charted as an islet bearing 5 feet above LWD as shown on the present survey.

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

b. Aids to Navigation

There are no fixed or floating aids to navigation in the survey area. Split Rock Lighthouse is no longer an aid to navigation. It is now a museum with the Minnesota State Parks.

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.

For Robert R. Hill

Franklin L. Saunders
Cartographic Technician
Verification of Field Data

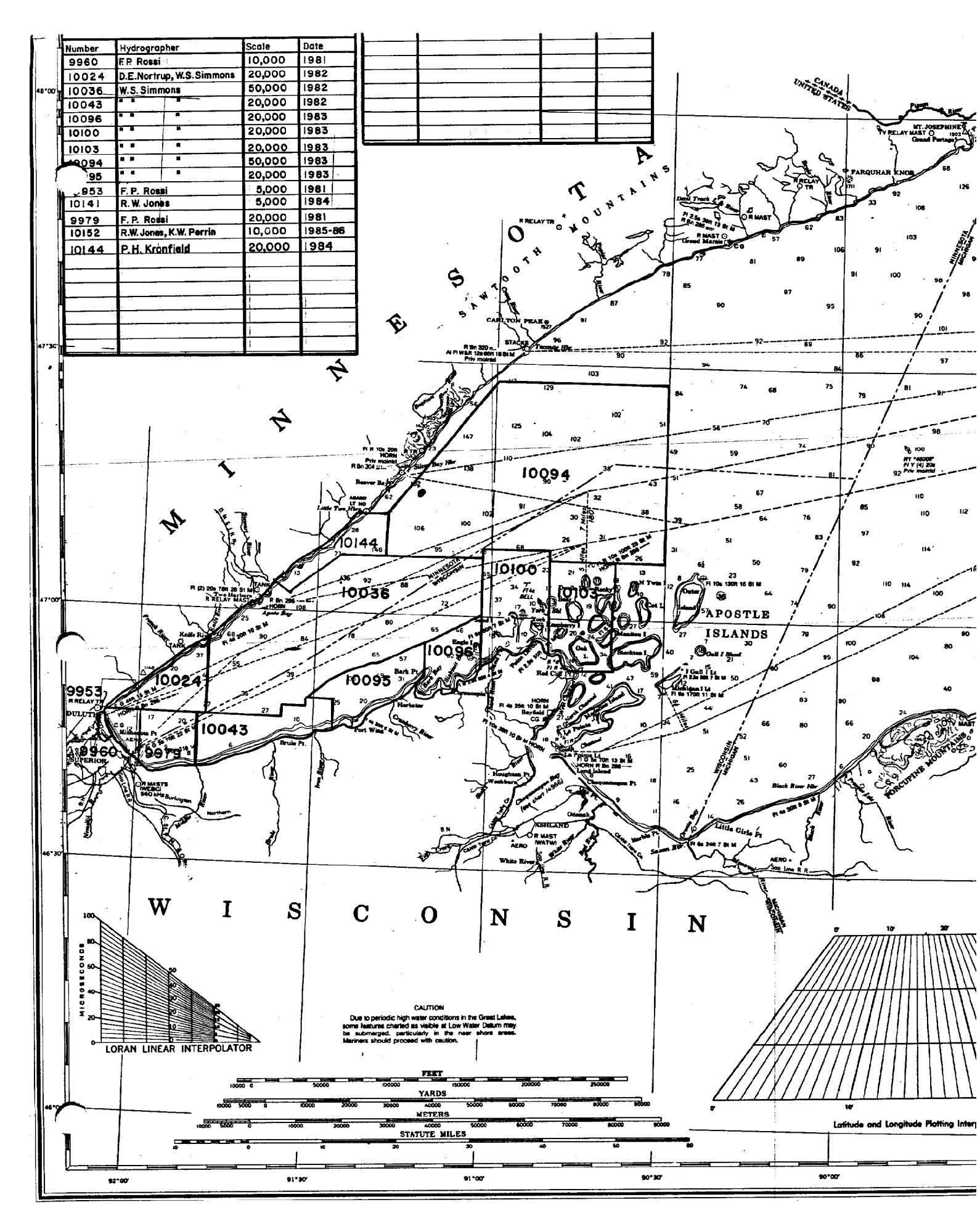
Richard H. Whitfield

Richard H. Whitfield
Cartographic Technician
Evaluation and Analysis

Robert R. Hill

Robert R. Hill
Senior Cartographic Technician
Verification Check

Number	Hydrographer	Scale	Date
9960	F.P. Rossi	10,000	1981
10024	D.E.Nortrup, W.S.Simmons	20,000	1982
10036	W.S. Simmons	50,000	1982
10043	" " "	20,000	1982
10096	" " "	20,000	1983
10100	" " "	20,000	1983
10103	" " "	20,000	1983
10094	" " "	50,000	1983
10095	" " "	20,000	1983
9953	F. P. Rossi	5,000	1981
10141	R. W. Jones	5,000	1984
9979	F. P. Rossi	20,000	1981
10152	R.W. Jones, K.W. Perrin	10,000	1985-86
10144	P.H. Kronfield	20,000	1984



LORAN LINEAR INTERPOLATOR

MICROSECONDS

CAUTION

Due to periodic high water conditions in the Great Lakes, some features charted as visible at Low Water Datum may be submerged, particularly in the near shore areas. Mariners should proceed with caution.

FEET

YARDS

METERS

STATUTE MILES

Latitude and Longitude Plotting Interv

92°00' 91°30' 91°00' 90°30' 90°00'

LS-9

NOAA FORM 75-96
(10-83)

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

MARINE CHART BRANCH

RECORD OF APPLICATION TO CHARTS

FILE WITH DESCRIPTIVE REPORT OF SURVEY NO. H-10144

INSTRUCTIONS

A basic hydrographic or topographic survey supersedes all information of like nature on the uncorrected chart.
1. Letter all information.
2. In "Remarks" column cross out words that do not apply.
3. Give reasons for deviations, if any, from recommendations made under "Comparison with Charts" in the Review.

CHART	DATE	CARTOGRAPHER	REMARKS
14960	8-19-87	J. Pirone	(Full) Part Before (After) Marine Center Approval Signed Via
			Drawing No. 5 Applied in full
14961	8-19-87	J. Pirone	(Full) Part Before (After) Marine Center Approval Signed Via
			Drawing No. 5 Applied in full
			(Full) Part Before After Marine Center Approval Signed Via
14966	8-8-89	D MCALINDEN	Drawing No. 5 APPLIED IN FULL
			Full Part Before After Marine Center Approval Signed Via
			Drawing No.
			Full Part Before After Marine Center Approval Signed Via
			Drawing No.
			Full Part Before After Marine Center Approval Signed Via
			Drawing No.
			Full Part Before After Marine Center Approval Signed Via
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			Full Part Before After Marine Center Approval Signed Via
			Drawing No.
			Full Part Before After Marine Center Approval Signed Via
			Drawing No.
			Full Part Before After Marine Center Approval Signed Via
			Drawing No.

SUPERSEDES C&GS FORM 8352 WHICH MAY BE USED.

app'd to Stds 11-24-86 [initials]