
**PHOTOGRAMMETRY BRANCH
COASTAL MAPPING PROGRAM**

**PROJECT CM-8411
COMPLETION REPORT**

MICHIGAN

LAKE SUPERIOR - KEWEENAW PENINSULA

**Fourteen Mile Point to Eagle Harbor
TP-01332, TP-01333, TP-01334 and Inset,
TP-01335, TP-01336, TP-01337, TP-01547**

Agency Vault - Original Report

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TP-01335, TP-01336, TP-01337, TP-01547

Year of Source - 1985

UNITED STATES DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL OCEAN SERVICE
OFFICE OF CHARTING AND GEODETIC SERVICES

Agency Vault - Original Report

PHOTOGRAMMETRY BRANCH
COASTAL MAPPING PROGRAM

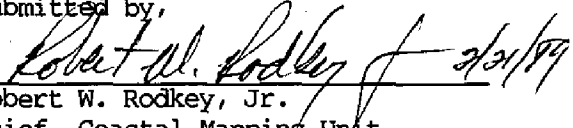
PROJECT CM-8411
COMPLETION REPORT

Michigan
Lake Superior - Keweenaw Peninsula
Fourteen Mile Point to Eagle Harbor
TP-01332, TP-01333, TP-01334 and Inset,
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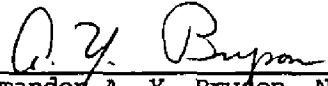
Clearance and Approval

This report summarizes the photogrammetric operations related to project completion and is submitted for approval. The maps, associated project data, and this report meet the requirements and standards of the Photogrammetry Branch Coastal Mapping Program. Clearance for project registration is requested.

Submitted by,


Robert W. Rodkey, Jr.
Chief, Coastal Mapping Unit
Photogrammetry Branch, NCD

Approved by,


Commander A. Y. Bryson, NOAA
Chief, Photogrammetry Branch
Nautical Charting Division, Office of Charting and Geodetic Services

2/23/89
Date

COASTAL MAPPING PROGRAM PROJECT CM-8411
Michigan
Lake Superior - Keweenaw Peninsula
Fouteen Mile Point to Eagle Harbor

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COASTAL MAPPING PROGRAM PROJECT CM-8411

Introduction

Coastal Mapping Program Project CM-8411 was originally planned to provide six coastal survey maps depicting the shoreline and other cartographic features of mapping interest in the coastal zone of the southern shore of Lake Superior between Fourteen Mile Point and Eagle Harbor located on the Keweenaw Peninsula, Michigan. Prior to the compilation phase, a 1:20,000 scale map (TP-01547) was added to the southwestern portion of the project area to complete a tie to a prior survey, i.e. TP-00358 of CM-8406. A 1:20,000 scale inset was added to complete a tie to another prior survey, i.e. TP-00440A of CM-7705, at the southwestern corner of TP-01334. With the addition of map TP-01547, the project now covers the coastal zone from Ontonagon northeasterly to Eagle Harbor. Refer to FIGURE 1 for a graphic reference of the project site location.

The maps were assigned map identifiers TP-01332 through TP-01337 and TP-01547. Refer to FIGURE 2 for information on the general area of coverage for each map and geographic limit coordinates. Map TP-01333 was prepared at 1:10,000 scale, while all other maps and the inset were prepared at 1:20,000 scale. All maps were prepared with the Transverse Mercator projection based on the North American Datum of 1927. The Michigan State Plane Coordinate System (West Zone) is depicted on the 1:20,000 scale graphics with grid ticks at a 10,000 foot interval and on the 1:10,000 scale graphic at a 5,000 foot interval.

The purpose of the project is consistent with the Photogrammetry Branch Coastal Mapping Program, which is to provide contemporary coastal zone survey data for the maintenance of the National Ocean Service Nautical Charting Program.

Planning

The Coastal Planning Unit, headquarters office, initiated the planning phase for this project in February 1985. The Atlantic Marine Center Coastal Surveys Unit was assigned all horizontal control activities. The Flight Operations Unit of the headquarters office was assigned the task of providing the proper conditions for aerial photography. Field instructions were issued on March 8, 1985 with Change No. 1 issued on February 19, 1986. The instructions are bound in Appendix A. They fully define requirements for the field operations phase of this project.

Field Operations

Field operations in support of this project were performed in May 1985 and consisted of aerial photography and the recovery, establishment and identification (premarking) of horizontal control necessary for aerotriangulation. Subsequent horizontal control photoidentification operations were performed in June 1986. Field surveying activities conducted in

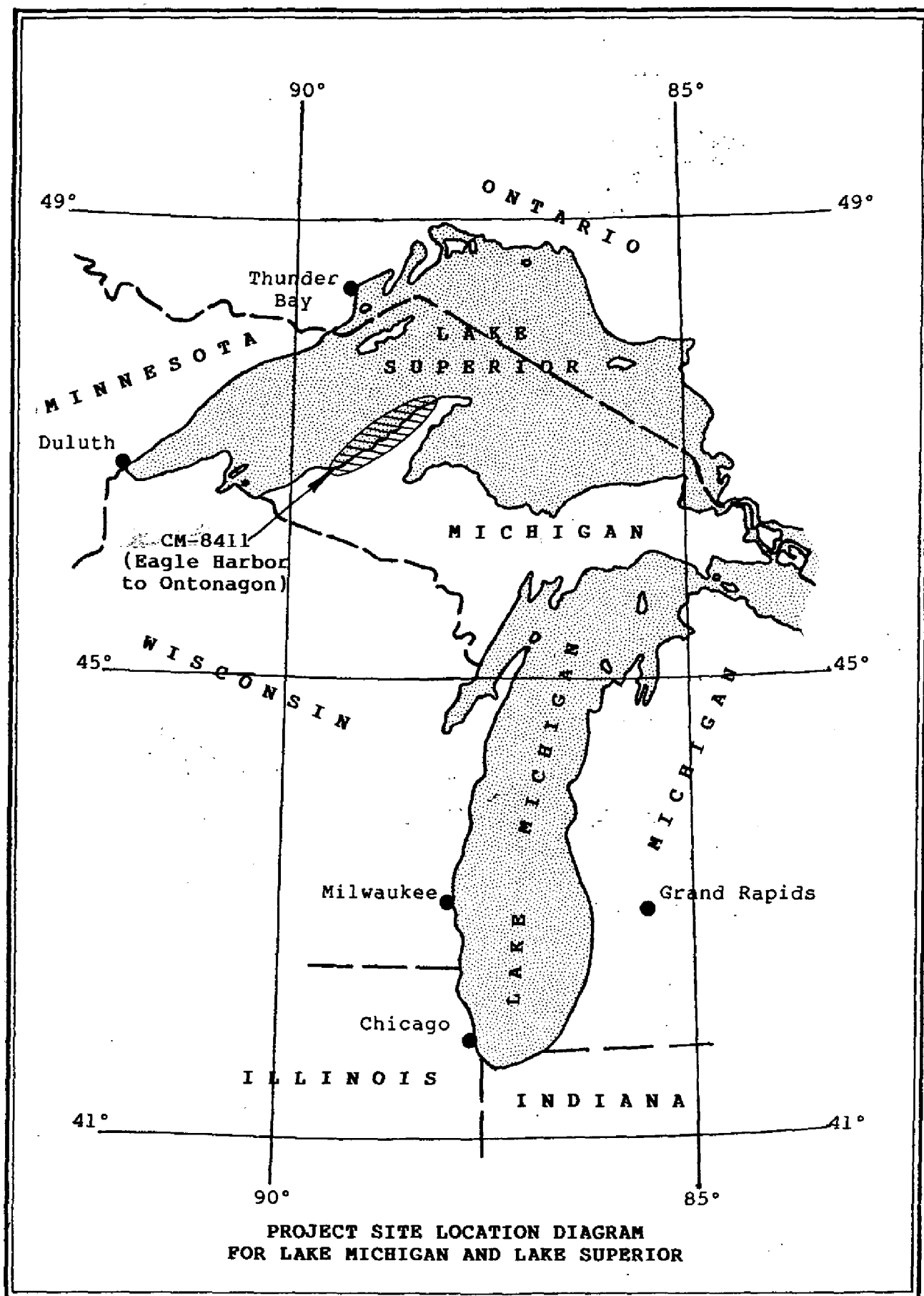
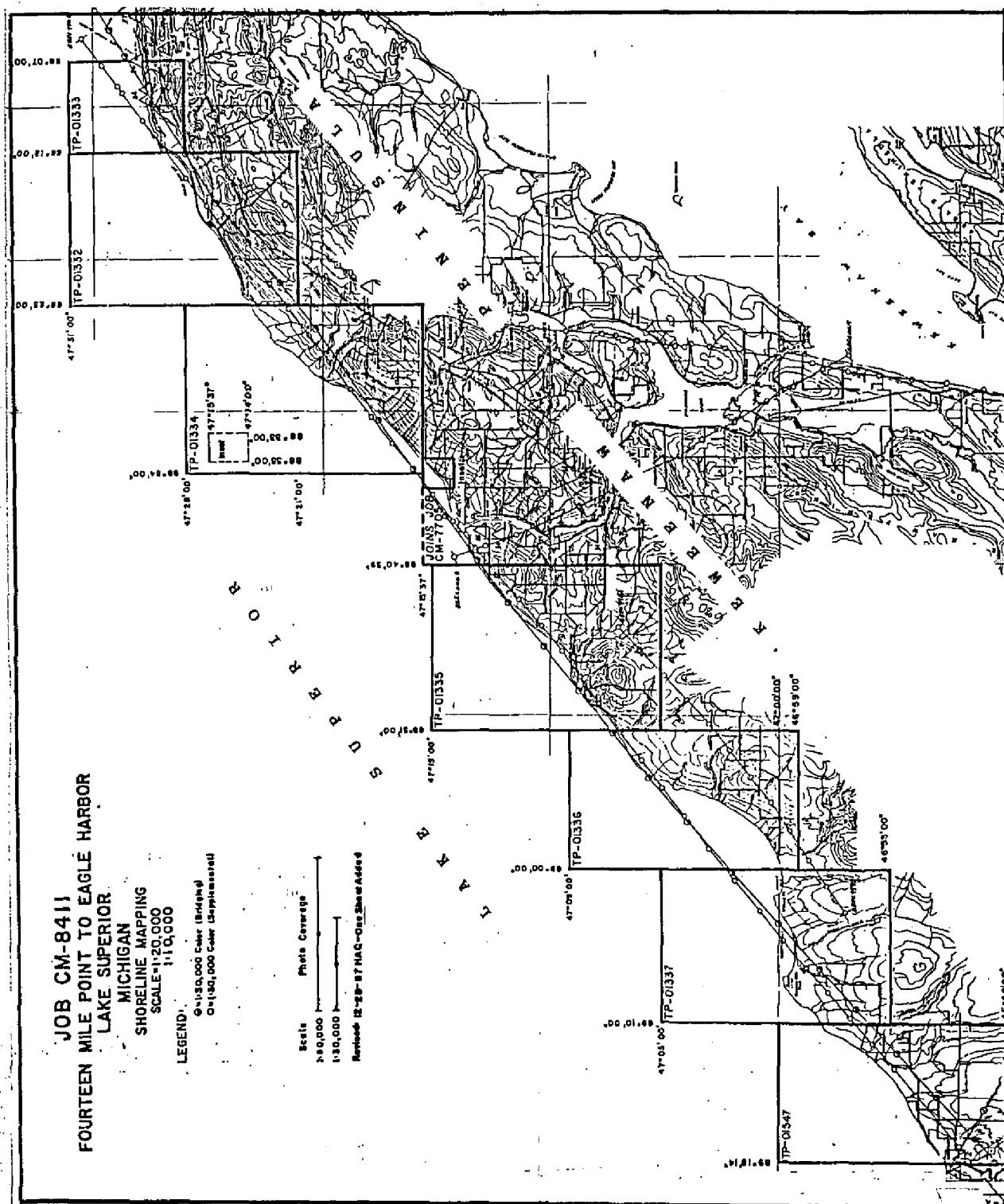


FIGURE 1



May 1985 were summarized by the Chief of Party in a report bound in Appendix B. Field operations conducted in June 1986 were summarized by the Chief of Party in a report also bound in Appendix B. Refer to LISTING 1 for information on the horizontal control related to this project.

A Turbo Commander aircraft (#57074) was used for the photographic operation. The photographs utilized for this project were exposed in June 1985. Natural color photographs were acquired for basic aerotriangulation and compilation at 1:50,000 and 1:30,000 scales using a Wild RC-8 camera with "E" cone which has a calibrated focal length of 152.71 mm.

The aerial photographs of the project site were reviewed in June 1985 by the Coastal Planning Unit, headquarters office, for proper endlap, horizontal control target visibility and adequate coverage of the project site. The photographs were examined in June 1985 by the Quality Control Unit, headquarters office, for proper qualities required for mapping photographs under as defined in the quality assurance program.

Aerotriangulation

Formal instructions for the aerotriangulation phase were issued on April 20, 1987 and are bound in Appendix C. The aerotriangulation phase was completed in June 1987 by the Aerotriangulation Unit, headquarters office. The Aerotriangulation Report is bound in Appendix D and contains information on placement of horizontal control, photographs selected for data acquisition, fit to control statistics and a summary of the procedures employed in phase completion.

Compilation

Formal instructions for the office phase were issued on January 12, 1987 and are bound in Appendix E. The instructions offer a summary of project operations and define the requirements for the office phase. Standard program procedures were followed for completion of the project.

The compilation phase was initiated in January 1988 and completed in April 1988 by the Coastal Mapping Unit, headquarters office. The Photogrammetric work station utilized in the data acquisition was a Wild B-8 (S/N 1167). Compilation was accomplished through application of standard analog compilation techniques.

For information on the photographs used in the compilation phase, refer to the control and photographs diagram of the Aerotriangulation Report. Map Compilation Sources (MCS) pages also provide information on the photographs used in the completion of each map and are bound in Appendix F. The actual limits of this photogrammetric survey may not coincide with the geographic limits of each map. The limits of a photogrammetric survey are determined by the extent and quality of photographic coverage, the density and placement of geodetic and aerotriangulated control and program requirements.

The final maps were smooth drafted except for the application of annotation which was accomplished using waxed back stripper film. Geographic names depicted on the maps were acquired from corresponding NOS nautical charts and USGS quadrangles and applied after approval by the Staff Geographer. The Final Geographic Names listings are bound in this report as Appendix G.

Office review of the project products was conducted in April 1988 by the Coastal Mapping Unit, headquarters office. The results of a comparison against the NOS nautical charts of the area were annotated on the Chart Maintenance Print for each map.

Comparisons were made against the following NOS nautical charts:

- 14964, 18th Edition (Nov. 14, 1987), 1:120,000 scale
- 14965, 16th Edition (Apr. 2, 1983), 1:120,000 scale

Final Review

The final review phase was initiated in May 1988 by the Coastal Mapping Unit, headquarters office. The coastal survey maps and associated discrete point data of this project were evaluated as meeting the requirements of the National Standards of Map Accuracy. Refer to Appendix H for the final listing of cartographic features of charting interest for application in the nautical charting program. The coastal survey maps and project data sets comply with the general requirements for a standard coastal mapping project. All source data, photographic devices, surveying and photogrammetric measurement instruments meet the standards of accuracy established for the disciplines of photography, field surveying and photogrammetry.

During the final review phase, all necessary copies of project products and data were acquired. A Chart Maintenance Print was generated for each map within the project.

This Project Completion Report is the authoritative summary for project CM-8411 and is in compliance with Section 14, Project Completion Report of the Photogrammetry Branch Coastal Mapping Program Operations Manual.

Dissemination of Project Data

The dissemination of project data was executed in accordance with the following:

Federal Records Center of the National Archives and Records Admin.

Copy of this Project Completion Report

Brown Jacket containing:

Field Data Binder titled "Original Field Data" containing Control Station Identification forms, numerous computational forms and diagrams

Field Data Binder titled "Project CM-8411 Change No. 1" containing numerous computational forms, diagrams and two contact prints with sub point locations pricked

One copy of Descriptive Report Control Record (2 pages)

One copy of Aerotriangulated Control listing
One copy of Project Diagram (page size)
One copy of Aerotriangulation Report
One copy of Cartographic Features of Charting Interest listing
One NOAA Form 76-52, Observations of Horizontal Directions

Agency Archives

Registration Copy of Each Map
Original Project Completion Report

Photogrammetric Electronic Data Library

There is no project digital data maintained in the library

Reproduction Branch, Aeronautical Charting Division

8X Reduction Negative of Each Map

Marine Chart Branch

Chart Maintenance Print of Each Map
Abbreviated Copy of this Project Completion Report

All final project data and products were forwarded to the Production Control Unit, headquarters office for registration and dissemination.

PROJECT GEODETIC CONTROL LISTING

Page 1 of 1

PROJECT: CM-8411; Fourteen Mile Point to Eagle Harbor, Lake Superior, Michigan

GEODETIC DATUM: North American Datum of 1927

The following permanent geodetic control was recovered or established during project operations. Data pertaining to stations is resident in the National Geodetic Survey Division (NGSD) Horizontal Control Databank.

The Station Identifier (STA ID) consists of the NGS Quad Number (Q) and the assigned station number (S) within the Quad, e.g., QQQQQSSSS. Doppler Satellite Observation Stations are identified with a five digit station number, e.g. XXXXX54321.

Refer to Nautical Charting Division Standard Digital Data Exchange Format documentation for quality code (QC) criteria.

STATION NAME	STA ID	Geodetic Coordinates ("-'-")		QC	Location Day/Year
		Latitude	Longitude		
498 A USE	XXXXX50295	47-13-58.655	088-37-25.648	3	263/1982
AGATE	4708821013	47-28-05.778	088-04-03.149	3	001/1934
BUMBLETOWN	4708821015	47-16-48.40	088-25-40.98	3	001/1934
CENTRAL	4708821016	47-24-29.171	088-11-44.090	3	001/1934
CHAMPION	XXXXX50292	46-52-34.764	089-19-39.711	3	260/1982
EAGLE HARBOR	UNKNOWN	47-27-34.392	088-09-31.353	3	001/1982
EAGLE HARBOR LIGHTHOUSE	4708821026	47-27-35.130	088-09-32.702	3	001/1934
MISERY	UNKNOWN	46-59-52.880	088-58-48.892	3	001/1985
ONTONAGON FIBRE CO WATER TK	4608911009	46-52-11.059	089-19-34.892	3	001/1939
ONTONAGON MUN WATER TK	4608911010	46-52-00.590	089-18-41.952	3	001/1939

- end -

Remarks: The aforementioned stations were recovered in 1985 by the Atlantic Marine Center Photo Party or confirmed during the aerotriangulation and map compilation phases.

Listing approved by:

Final Reviewer

Robert W. Rodkey Jr.

Date

May 25, 1988

APPENDIX A



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

March 8, 1985

N/CG2313:EP

Chief, Photogrammetry Branch
Atlantic Marine Center

PROJECT INSTRUCTIONS: FIELD - Job CM-8411, Lake Superior, Fourteen Mile Point to Eagle Harbor, Michigan, Shoreline Mapping.

1.0. PURPOSE

The purpose of this instruction is to provide specifications and a schedule for placing targets on horizontal control stations required for aerotriangulation.

2.0. AREA

Shoreline mapping at 1:10,000 and 1:20,000 scale will cover the shoreline and adjacent waterways from Fourteen Mile Point to Eagle Harbor, Michigan.

3.0. PHOTOGRAPHY

3.1. Aerotriangulation photography, at 1:50,000 scale, and supplemental bridging and compilation photography, at 1:30,000 scale, will be obtained using color film.

3.2. Target identification photography will be obtained at 1:15,000 scale and may be obtained at less than optimum photographic conditions.

4.0. ASSIGNMENT

You are assigned all field operations required to place targets on horizontal control stations. The Chief, Air Photo Mission 2, will be responsible for scheduling photography at the required times.

5.0. HORIZONTAL CONTROL

5.1. Horizontal control requirements for aerotriangulation have been furnished as part of the field data.

5.2. Limit recovery of horizontal control stations to those needed to meet aerotriangulation requirements. Prepare and submit recovery notes for each station for which a search was made.



5.3 New control stations, where needed, shall be established by triangulation, trilateration, traverse, or a combination of the three methods, in accordance with Third-Order, Class I specifications provided in the Director's Instructions for Third-Order Surveys, dated October 31, 1974.

5.4. Notify the Chief, Coastal Planning Unit (N/CG2313), if recovery of existing control does not meet aerotriangulation requirements. An alternative will be selected, if possible, to avoid establishing new control.

6.0. PREMARKING OF CONTROL

Note 1: As soon as possible after all control stations have been paneled, the field party will forward to the Rockville Office, Attention: N/CG2313, a chart section, quad, or any graphic depicting the station location, panel array used, and the panel number. This will assist in the film quality review and target identification and will help expedite the results to the field unit.

Note 2: Wing panels will be used with all targets in accordance with established specifications but may be modified to conform with local terrain conditions.

6.1. Panel each station selected to meet horizontal control requirements in accordance with specifications given on the attached sheet for the various scales of photography indicated on the control requirements diagram.

6.2. Use panel array No. 1 for targets with a normal background; it may be modified, as necessary, to conform with local terrain conditions. Any deviation from given panel and spacing dimensions should be indicated on the large-scale sketch on NOAA Form 76-53, Control Station Identification Card.

6.3. Panel array No. 3 shall be used in areas where the background offers poor contrast to the center panel, such as on sandy terrain.

6.4. The distance given for dimension "C" may be increased, but not decreased.

6.5. Panel substitute stations wherever shadows or relief displacement will obscure the home stations.

6.6. In cases where the target might be subject to vandalism, select two photoidentifiable objects. Observe directions and distances to them from the home station and record with sketch and description on separate NOAA form 76-53.

7.0. CONTROL STATION IDENTIFICATION CARD

7.1. Prepare and submit a NOAA form 76-53 for each paneled station. Observe Photogrammetric Instruction No. 22, Revised September 30, 1965, except as follows:

a. Record distances and directions in the usual manner to the center of the station panel of all targets used as substitutes for horizontal control stations.

b. In the space provided for the sketch of Substitute Station A, make a large-scale sketch of the immediate vicinity showing the array used.

8.0. SCHEDULE

All stations shall be premarked and ready for photography by June 30, 1985. If premarking is not completed by this date, inform the Chief, Coastal Planning Unit (N/CG2313), so that this information can be relayed to the air photo mission.

9.0. REPORT

A field operations report covering all pertinent information as to field work performed is required within 30 days after completion of the field phase of the project.

10.0. RECORDS

All field records will be sent through N/MOA2222 for review prior to being forwarded to the Rockville Office, Attention: N/CG2313.

11.0. MODIFICATIONS OF INSTRUCTIONS

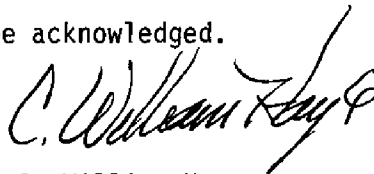
If changes in procedures and methods seem advisable, please make appropriate recommendations to this office.

12.0. COSTS

All costs incurred on this assignment shall be charged to Task 8K6C01.

13.0. RECEIPT

Receipt of these instructions shall be acknowledged.

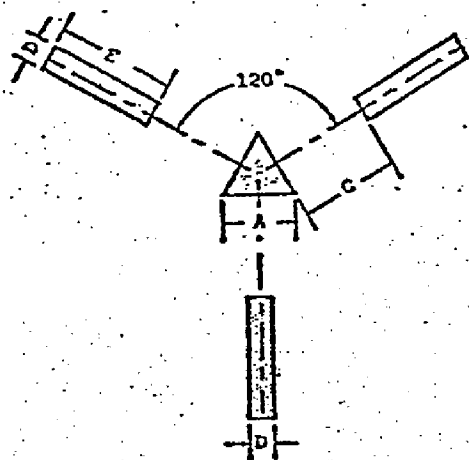


Wesley V. Hull
Director
Atlantic Marine Center
Marine Operations

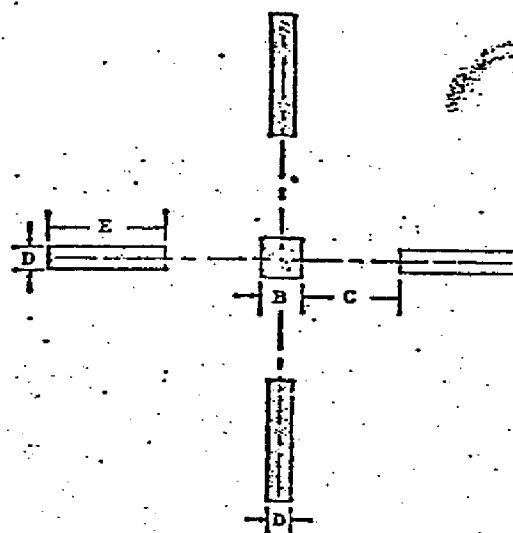
C. William Hayes
Chief, Nautical Charting Division
Charting and Geodetic Services

SPECIFICATIONS FOR PREMARKING CONTROL STATIONS
Revised November 23, 1976

ARRAY NO. 1

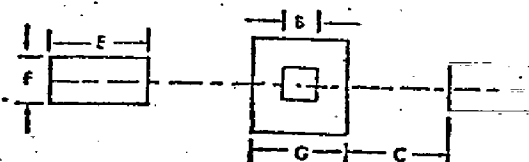


ARRAY NO. 2

**NOTE:**

1. The dimensions and centering of center panel over station or substitute station are critical.
2. Panel array No. 1 is preferred but No. 2 is acceptable.
3. Array No. 3 -- for contrast in very light colored areas. The border surrounding center panel and the recognition panels shall be black.
4. Chief of party will select array that makes best application of field conditions and is authorized to adjust or omit one of the recognition panels if terrain is not suitable for placement of entire array.

ARRAY NO. 3



Photography
Scale

PANEL AND SPACING DIMENSIONS (IN METERS)

	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>	<u>E</u>	<u>F</u>	<u>G</u>
1:10,000	0.5	0.3	1.3	0.2	0.9	0.9	1.5
1:20,000	1.1	0.7	2.6	0.4	1.8	0.9	1.9
1:30,000	1.6	1.0	3.9	0.5	2.7	0.9	2.2
1:40,000	2.2	1.3	5.2	0.7	3.6	0.9	2.5
1:50,000	3.2	2.0	7.8	1.1	5.4	1.8	3.8
1:60,000	3.8	2.3	9.1	1.3	6.3	1.8	4.1
1:70,000	4.4	2.6	10.4	1.4	7.2	1.8	4.4
1:80,000	5.0	3.0	11.7	1.5	8.0	1.8	4.8
1:100,000	6.4	4.0	18.2	2.2	10.8	3.6	7.6

R E C E I P T

TO: N/CG2 - C. William Hayes
ATTN: N/CG23

THRU: N/MOA - Wesley V. Hull *WVH*

Receipt of Project Instructions FIELD - Job CM-8411, Lake Superior,
Fourteen Mile Point to Eagle Harbor, Shoreline Mapping dated March 8, 1985
is acknowledged.

D. Y. Bryson

Chief, Photogrammetry Branch
Atlantic Marine Center

3/10/85

Date



13

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

February 19, 1986

N/CG2313:JM

Chief, Photogrammetry Branch
Atlantic Marine Center

PROJECT INSTRUCTIONS: FIELD - Job CM-8411, Lake Superior,
Fourteen Mile Point to Eagle Harbor, Michigan, Shoreline Mapping

CHANGE NO. 1: Amendment to Instructions

1. Section 1.0. PURPOSE is amended to read:

These instructions provide specifications and a schedule for photoidentifying additional horizontal control stations required for aerotriangulation.

2. Section 3.0. PHOTOGRAPHY is amended to read:

Aerotriangulation photography has been obtained at 1:50,000 scale using color film. Selected black-and-white negative prints of the color film and duplicate positive color prints covering the project area have been furnished.

3. Section 4.0. ASSIGNMENT is amended to read:

You are assigned all field operations required to photoidentify horizontal control stations on the 1:50,000-scale photography.

4. Section 5.0. HORIZONTAL CONTROL is amended to read:

5.1. Areas in which horizontal control is required are circled on copies of the paper negative prints. One horizontal control station in each circled and numbered area will be recovered or established and photoidentified on the color photographs. Identification shall include two substitute stations for each control station and shall conform with requirements of Photogrammetric Instruction No. 22, Revised September 30, 1965.

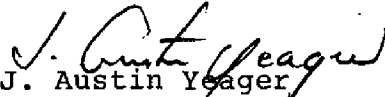


5. Section 8.0. SCHEDULE is amended to read:

Scheduling will be at your earliest opportunity.

6. All other provisions of the basic instructions remain unchanged.
7. Acknowledge receipt of this CHANGE.

Wesley V. Hull
Director
Atlantic Marine Center
Marine Operations


J. Austin Yeager
Chief, Nautical Charting Division
Charting and Geodetic Services

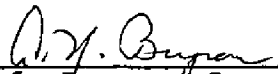
R E C E I P T

TO: N/CG2 - J. Austin Yeager
ATTN: N/CG23

THRU: N/MOA - Wesley V. Hull


for

Receipt of CHANGE NO. 1, dated February 19, 1986, to Project Instructions FIELD - Job CM-8411, Lake Superior, Fourteen Mile Point to Eagle Harbor, Michigan, Shoreline Mapping, dated March 8, 1985, is acknowledged.



Chief, Program Services Division
Atlantic Marine Center

Date 2/25/86

FEB. 26 1986

APPENDIX B

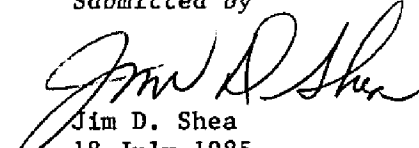
Project Report
CM-8411
Lake Superior, Fourteen Mile Point to Eagle Harbor, MI

This project was completed in accordance with CM-8411 Project Instructions dated March 8, 1985.

Field work was accomplished during the last two weeks in May, 1985.

Six horizontal control targets were placed for this project. Targets 1, 2, and 3 were positioned using published NGS Horizontal Control Data. Targets 4 and 6 were positioned using horizontal control established by Geodetic Doppler Satellite observations (Magnavox MX1502 Geocivers) in 1983. Target 5 was positioned by Geodetic Doppler Satellite observations obtained during this project. A NOS standard survey monument was set at this site and named MISERY. The Doppler Satellite position was determined with Magnavox MX1502 Geocivers using the translocation solution.

Submitted by



Jim D. Shea
18 July 1985

PROJECT REPORT JOB CM-8411
FOURTEEN MILE POINT TO EAGLE HARBOR, MICHIGAN

CHANGE NO. 1

1.0 PURPOSE: This project was accomplished to provide additional photoidentified horizontal control stations required for 1:50,000 scale aerotriangulation in accordance with Project Instructions FIELD - JOB CM-8411 CHANGE NO. 1 dated February 19, 1986.

2.0 PHOTOGRAPHY: We were furnished 50,000 scale aerotriangulation photography with black-and-white negative prints of the color film and duplicate positive color prints covering the project area.

3.0 PARTICIPATION: The following personnel were involved with field operations on this project: P. Walbolt, J. Koster, T. Parker, and A. EbadiRad. P. Walbolt was in charge of field operations.

4 3.0 HORIZONTAL CONTROL: The horizontal control requirements diagram required two additional areas to be photoidentified.

Two new control stations were established with the Magnavox MX 1502 Geocivers using translocation method. All sub-points were positioned in accordance with Photo Instruction No. 22. Two sub points were located for each station.

All positions were determined on North American Datum of 1927.

Station sub points were located by the following methods:

Doppler Site 1: Traverse from satellite station established on this job.

Doppler Site 2: Traverse from satellite station established on this job.

5.0 SCHEDULE: Work on this project was performed in the field from 11 June thru 18 June 1986.

6.0 CONTROL STATION IDENTIFICATION: A NOAA Form 76-53 (CSI Card was submitted for each site.

7.0 RECORDS: All field records were submitted to N/CG2314 on Aug. 1, 1986.

Submitted by

Philip B. Walbolt

Philip B. Walbolt

APPENDIX C



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

April 20, 1987

N/CG2321:GLF

Chief, Aerotriangulation Unit
Photogrammetry Branch
Rockville, Maryland 20852

PROJECT INSTRUCTIONS: AEROTRIANGULATION - Job CM-8411, Fourteen Mile Point to Eagle Harbor, Lake Superior, Michigan, Shoreline Mapping

1.0. PURPOSE

This project will provide contemporary shoreline and other photogrammetric data in support of the nautical charting program. These instructions indicate the basic aerotriangulation requirements that will provide the network of control necessary for compilation. The accuracy of aerotriangulated control shall meet the requirements of National Standards of Map Accuracy.

2.0. GENERAL

2.1. Scope. The production of six shoreline maps (TP-01332 through TP-01337) is planned. These maps will depict portions of the southern shore of Lake Superior between Fourteen Mile Point to Eagle Harbor. Map TP-01333 will be compiled at 1:10,000 scale, the other five maps will be compiled at 1:20,000 scale. Supplemental data sets associated with each final map will be prepared for use by nautical charting and hydrographic activities. All data collection and processing will be based on NAD 27.

2.2. Field Operations. Field work generally consisted of aerial photography and the recovery, establishment, and identification of geodetic control necessary for aerotriangulation. There was no field inspection of the shoreline.



2.3. Photography. General information relating to the project photography is indicated below.

<u>Type</u>	<u>Scale</u>	<u>Camera</u>	<u>Date</u>
Color	1:30,000	Wild RC-8 (E)	6/1/85
Color	1:50,000	Wild RC-8 (E)	6/2/85
Color	1:30,000	Wild RC-8 (E)	6/2/85
Color	1:30,000	Wild RC-8 (E)	7/16/85

2.4. Charts Affected. Charts 14964 and 14965 will be affected by this survey.

3.0. DATA FURNISHED

- a. Control data
- b. USGS quadrangles
- c. Nautical charts
- d. Project diagrams
- e. Color contact prints and film positives
- f. Field data

4.0. AEROTRIANGULATION OPERATIONS

4.1. Analytic aerotriangulation is required for the 1:50,000-scale color photographs and the 1:30,000-scale coverage of TP-01333. Field identified geodetic control is premarked (paneled). Establish tie points and/or use office identified geodetic intersection stations as supplemental control. Elevations from U.S. Geological Survey quadrangles will be used as the vertical control.

4.2. Locate all visible landmarks and fixed aids to navigation during bridging.

4.3. Establish shoreline points on all strips of the bridging photographs and determine ratio values necessary to prepare enlargement prints at map scale. Include values as part of the Aerotriangulation Report.

4.4. Perform the final adjustment of aerotriangulated points to ground on NAD 27.

4.5. Base manuscripts will be prepared depicting the following based on NAD 27:

- a. Transverse Mercator Projection
- b. Grid ticks based on the Michigan State Plane Coordinate System (West Zone)
- c. Recoverable geodetic control
- d. Aerotriangulated and field established control points

One additional base for each map, depicting only the projection and grid as previously defined, will also be required, Manuscript coordinates are identified on the project diagram.

5.0. SCHEDULE

Schedule the aerotriangulation operations to be completed by July 1, 1987. The assignment and final schedule for map production will be determined when the aerotriangulation phase is completed.

6.0. MODIFICATION OF INSTRUCTIONS

If any changes in procedures and methods seem advisable, please make appropriate recommendations to this office.

7.0. COST

Charge all costs to 8K6C01.

8.0. RECEIPT

Acknowledge receipt of these instructions.

A. Y. Bryson

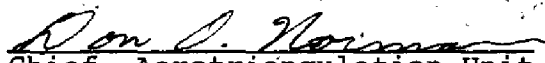
Commander A. Y. Bryson
Chief, Photogrammetry Branch
Nautical Charting Division

R E C E I P T

TO: N/CG23 - Commander A. Y. Bryson

THRU: N/CG232 - Ivey O. Raborn

Receipt of Project Instructions AEROTRIANGULATION - Job CM-8411, Fourteen Mile Point to Eagle Harbor, Lake Superior, Michigan, Shoreline Mapping, dated April 20, 1987, is acknowledged.


Chief, Aerotriangulation Unit
Photogrammetry Branch

4-24-87
Date

APPENDIX D

AEROTRIANGULATION REPORT
CM-8411
FOURTEEN MILE POINT TO EAGLE HARBOR
LAKE SUPERIOR, MICHIGAN

JUNE 1987

21. AREA COVERED

This report covers portions of the southern shore of Lake Superior between Fourteen Mile Point to Eagle Harbor, Michigan. The project consists of five 1:20,000-scale sheets; TP-01332, TP-01223, TP-01335, TP-01336, TP-01337, and one 1:10,000-scale sheet; TP-01333.

22. METHOD

One strip of 1:50,000-scale color photographs and two strips of 1:30,000-scale color photographs were bridged by analytical aerotriangulation methods using the STK comparator.

The two 1:30,000-scale strips were adjusted to ground with the analytic program strip adjustment. The 1:50,000-scale strip was adjusted to ground using GIANT.

Ratio values were determined for the bridging compilation photographs. A copy of these values and a sketch of the photocoverage are attached to this report.

The base manuscripts were plotted on the Kongsburg plotter using the Michigan State Plane Coordinate System, West Zone. This system is a Transverse Mercator projection. All positions are on NAD 1927.

23. ADEQUACY OF CONTROL

The control was adequate. The horizontal control consisted of premarked, photoidentified, and office identified stations. Tie points were also used to supplement the control. The project will meet the National Ocean Service requirements.

24. SUPPLEMENTAL DATA

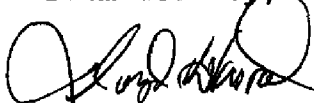
USGS topographic quadrangles were used to obtain vertical control for bridging. NOS nautical charts were used to locate aids and landmarks.

25. PHOTOGRAPHY

Strip 1 is 1:50,000 scale and contains 26 photos. Two of the photographs are largely water exposures with very little land area for pass points. The pass point area on photo 7891 is about 1.25 inches long and on photo 7892 the pass point area is about 0.75 inches long. This produces poor geometry.

The 1:30,000-scale photography for the compilation of TP-01333 is too far offshore on the eastern half of the sheet. Photographs are used from the adjacent project (CM-8415, Eagle Harbor to Traverse Pt., Michigan) to obtain adequate coverage.

Submitted by



Lloyd Harrod

Approved and Forwarded:



Don O. Norman
Chief, Aerotriangulation Unit

FIT TO CONTROL

STRIP #1

<u>STATION NAMES</u>	<u>POINT NO.</u>	<u>VALUES IN FEET</u>	
		<u>X</u>	<u>Y</u>
Eagle Harbor Lt. 1934	875100	-1.2	+6.5
▲ Panel #2	876101	-1.2	+2.1
▲ Panel #3	881100	+0.8	-1.6
▲ Panel #4	884100	+1.2	-1.1

Satellite Station Site #1

▲ Sub. Pt. 1	891101	-1.7	+0.3
Sub. Pt. 2	891102	-2.0	+0.6
▲ Panel #5	892100	+2.1	-1.6

Satellite Station Site #2

Sub. Pt. 1	895101	4.5	+2.0
▲ Sub. Pt. 2	895102	-1.7	+2.2
▲ Panel #6	898100	+0.6	-0.3
Ontonagon, Municipal Water Tank	898110	+7.2	-10.3
Ontonagon Fibre Co. Water Tank	898111	+6.0	+1.7

STRIP #2

▲ Panel #1	826101	0.0	0.0
Tie From Project CM-8415	770801	0.2	0.6
Tie From Project CM-8415	770802	-0.5	0.1
Tie From Project CM-8415	770803	0.5	-0.9
Tie From Project CM-8415	772801	-0.9	-2.4
Tie From Project CM-8415	772802	-1.9	-1.9
Tie From Project CM-8415	722803	-1.3	-1.3
Tie From Project CM-8415	723801	-0.8	-1.2
Tie From Project CM-8415	773802	-0.4	-1.8
Tie From Project CM-8415	773803	-2.2	1.3
Eagle Harbor Lighthouse 1934	828100	-6.0	-5.5
▲ Panel #14 From CM-8415	828101	0.0	0.0

STRIP #3

▲ Tie From Strip #1	877801	-4.1	1.0
▲ Tie From Strip #1	877802	1.3	-3.2
▲ Tie From Strip #1	877803	-3.1	- .2
▲ Tie From Strip #1	876801	2.0	1.2
▲ Tie From Strip #1	876802	6.5	-3.0

2

▲ Tie From Strip #1	876803	2.8	6.8
▲ Tie From Strip #1	874801	-2.9	-2.7
▲ Tie From Strip #1	874802	-3.4	-4.5
▲ Tie From Strip #1	874803	1.9	.7
▲ Eagle Harbor Light 1934	828100	-1.1	3.7

▲ Points held in the adjustment

RATIO VALUES
CM-8411

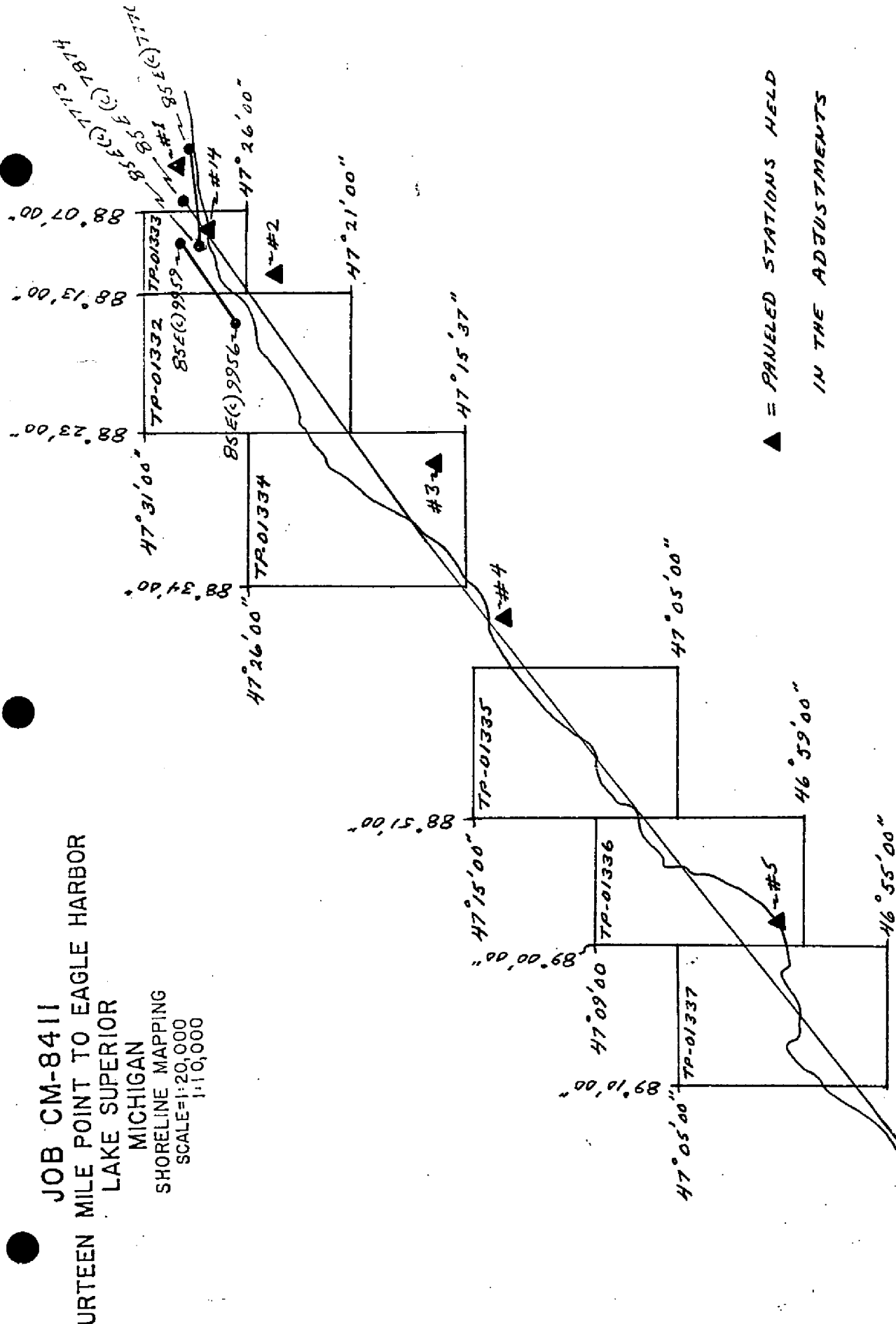
1:50,000 BRIDGING PHOTOGRAPHS:

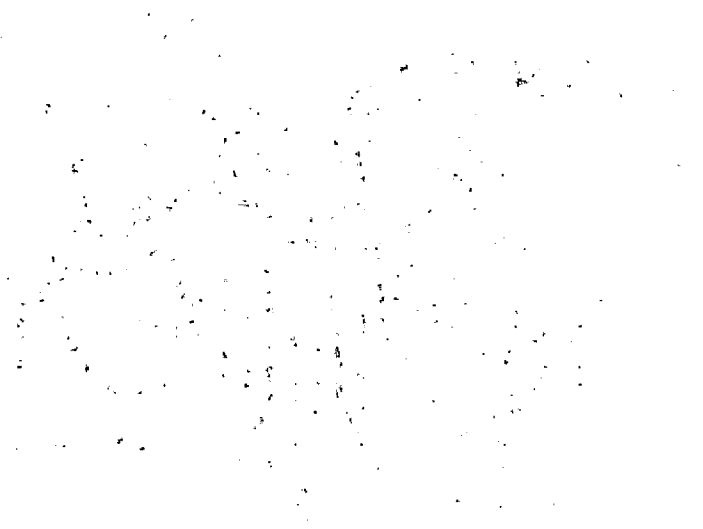
	<u>RATIO VALUE</u>
85-E(C)-7874-7899	2.485

1:30,000 BRIDGING PHOTOGRAPHS:

85-E(C)-7770-7773	3.038
85-E(C)-9956-9959	3.018

JOB CM-8411
 FOURTEEN MILE POINT TO EAGLE HARBOR
 LAKE SUPERIOR
 MICHIGAN
 SHORELINE MAPPING
 SCALE=1:20,000
 1:10,000





APPENDIX E



28

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

January 12, 1988

N/CG2321:GLF

Chief, Coastal Mapping Unit
Photogrammetry Branch
Rockville, Maryland 20852

PROJECT INSTRUCTIONS: OFFICE - Job CM-8411, Fourteen Mile Point
to Eagle Harbor, Lake Superior, Michigan, Shoreline Mapping

1.0. PURPOSE

1.1. These instructions provide basic specifications for the compilation of data to be used in the nautical charting program. Compilation shall be based on aerotriangulation that has met the requirements of National Standards of Map Accuracy and on an office interpretation of aerial photographs.

1.2. Unless otherwise specified in these instructions, compilation, processing, and dissemination of all data shall be in accordance with the C&GS Topographic Manual, Part II, and applicable amending NOS Photogrammetric Instructions.

2.0. GENERAL

2.1. Scope. The production of seven shoreline maps (TP-01332 through TP-01337 and TP01547) is planned. These maps will depict portions of the southern shore of Lake Superior between Ontonagon Harbor and Eagle Harbor. Map TP-01333 will be compiled at 1:10,000 scale, the other six maps will be compiled at 1:20,000 scale. Supplemental data sets associated with each final map will be prepared for use by nautical charting and hydrographic activities. All data collection and processing will be based on NAD 27.

2.2. Field Operations. Field work generally consisted of aerial photography and the recovery, establishment, and identification of geodetic control necessary for aerotriangulation. There was no field inspection of the shoreline.



2.3. Photography. General information relating to the project photography is indicated below.

<u>Type</u>	<u>Scale</u>	<u>Camera</u>	<u>Date</u>
* Color	1:30,000	Wild RC-8 (E)	6/1/85
Color	1:50,000	Wild RC-8 (E)	6/2/85
Color	1:30,000	Wild RC-8 (E)	6/2/85
Color	1:30,000	Wild RC-8 (E)	7/16/85

* This photography was performed under project CM-8415.

2.4. Charts Affected. Charts 14964 and 14965 will be affected by this survey.

2.5. Aerotriangulation. Three strips of color photographs were bridged using analytical aerotriangulation methods; one strip is 1:50,000 scale and two strips are 1:30,000 scale. Geodetic control used was premarked. Tie points between overlapping strips of photographs were established to augment datum tie and ensure that sufficient control was used for each strip adjustment. Elevations from U.S. Geological Survey quadrangles were used as vertical control. The amount of aerotriangulated control proved adequate and meets National Standards of Map Accuracy.

3.0. DATA FURNISHED

- a. Control data
- b. USGS quadrangles
- c. Nautical charts
- d. Project diagrams
- e. Color contact prints and film positives
- f. Field data
- g. Aerotriangulation Report
- h. Enlargement prints of bridged photographs
- i. Water level data
- j. Base manuscripts
- k. Bridging data

4.0. ASSIGNMENT

You are assigned all office operations to effect shoreline mapping and to provide the data sets required in support of charting and hydrographic activities.

5.0. COMPILATION

5.1. Limits. Standard shoreline manuscripts are required. The offshore limit of compilation will be directly related to the extension, density, and placement of the aerotriangulated control provided.

5.2. Delineation

5.2.1. Delineation will be accomplished using analog or analytic stereoinstrument methods based on interpretation of the bridged photographs.

5.2.2. Where selectivity is required because of density of detail, features that have landmark significance or of interest to a mariner are always retained. When features are too small or too numerous to show to scale, no attempt should be made to show all. Instead, a representative pattern of the symbol or area outline is to be shown, augmented by an explanatory note. Small features, especially when dangerous to navigation, may be slightly exaggerated in size, closely resembling their true shape; e.g., bare rock, islet.

5.2.3. Final manuscripts will depict, based on NAD 27, the Transverse Mercator Projection (full line) and grid ticks based on the Michigan State Plane Coordinate System (West Zone).

5.3. Cartographic Comparison. A comparison with the most recently published chart(s) shall be made during all compilation phases. This effort (1) is particularly important to ensure charted alongshore and offshore features shown as bare or uncovering are investigated, and (2) will complement the interpretation of detail and/or identification of conflicts. Major differences between map detail and the chart(s) shall be noted and reported on map copies prepared in support of charting and hydrography; e.g. Chart Maintenance Print and Notes to Hydrographer Print.

5.4. Shoreline. Compile the visible line of contact between land features and the water surface as the shoreline.

5.5. Alongshore and Offshore Detail. Refer to "Vertical Datum References for Map Features, Photogrammetric Surveys, Great Lakes," dated July 13, 1976, for related symbolization and labeling.

5.6. Datums. A statement shall be added to the manuscript specifying the shoreline datum. The statement shall read: "The Shoreline Datum is the water level at the time of photography and plane of reference for symbolization. Based on the International Great Lakes Datum (1955) the water level taken at Ontonagon, Michigan, gage was 601.4 feet. Low Water Datum for Lake Superior is 600.0 feet."

5.7. Geodetic Control. Refer to memorandum instructions "Listing and Plotting of Control Stations on Shoreline Manuscripts," dated July 23, 1968, and "Labeling Triangulation

Stations Field Positions on NOS Maps and in NOS Descriptive Reports," dated November 3, 1978.

5.8. Navigational Aids

5.8.1. Locate or affirm geodetic positions of visible charted landmarks, fixed aids to navigation, and/or cartographic features that have possible landmark value.

5.8.2. Refer to Photogrammetric Instruction No. 78 for symbolization and labeling. Cartographic features of possible landmark value are to be symbolized the same as charted landmarks, however, label with upper and lower case letters; e.g., Tank (Possible Landmark).

5.8.3. Prepare a listing of the charted landmarks and/or fixed aids identified on each final map. The listing shall also contain features of possible landmark value. The listing shall outline:

- a. Map identifier
- b. Map scale
- c. Feature description
- d. Carto Code
- e. Geographic position
- f. NCD quality code
- g. Date of photogrammetric source
- h. Horizontal datum

Refer to Nautical Charting Division Standard Digital Data Exchange Format (NCD SDDEF), Version 1 documentation dated April 1, 1985, for clarification of NCD quality and carto codes. Carto code "993" shall be assigned to cartographic features of possible landmark value. Geodetic positions shall be reported to three decimal places; positional data determined using approved photogrammetric methods as described in NCD SDDEF, appendix D, shall be reported to two decimal places.

5.8.4. The medium for reporting information concerning charted navigational aids investigated and not compiled will be the Chart Maintenance Print.

5.9. Roads and Streets. Requirements for symbolization are outlined in Photogrammetric Instruction No. 56, Amendment 1.

5.10. Bluffs and Cliffs. Compile prominent bluffs and cliffs. Delineate with a dashed line and label.

5.11. Bridges and Cable Crossings. Procedures are outlined in Photogrammetric Instruction No. 27, Revision 1.

5.12. Drafting. The manuscript will be drafted in accordance with Photogrammetric Instruction No. 55, Revision 2. When drafting small features or related symbols, the minimum length/size shall be .7 mm. The use of type (stick-up), in lieu of standing requirements, is permitted for lettering.

5.13. Geographic and Object Names

5.13.1. Requirements for names, including their placement, are outlined in Photogrammetric Instruction No. 63.

5.13.2. Obtain final geographic names list using the procedures outlined in Photogrammetric Instruction No. 63, section 2.03.1, last paragraph.

5.14. Reports. Refer to sections 1.2 and 7.2 of these instructions. Include a brief statement in paragraph 49 (Notes to Reviewer) of the Compilation Report when selectivity of detail is required. Information required for inclusion in the Project Completion Report will be provided by N/CG2321.

5.15. Chart Maintenance Print. Prepare a stable base copy of each reviewed map and label Chart Maintenance Print. General requirements are specified in Photogrammetric Instruction No. 69 for completing this print. When preparing this print, keep in mind the objective is to provide comprehensive information about the adequacy, reliability, and completeness of map detail, as well as differences noted between the map and chart(s). Examples are (1) the inability to satisfactorily interpret photographic detail and (2) a difference between the chart(s) and map in the representation of a feature. This effort cannot be emphasized too strongly, because proper evaluation and usage of map detail will depend on this information. Include a statement regarding features not located as discussed in section 5.8.4.

5.16. Support Data. Supplemental survey data required to support charting and hydrographic activities are indicated below; coordinate the distribution of these data with N/CG2321. Refer to sections 2.1, 5.3, 5.8.3, 5.8.4, and 5.15.

<u>Type of Data</u>	<u>Distribution</u>
Chart Maintenance Prints	N/CG2222
Listings of navigational aids	
* Notes to Hydrographer Prints	N/CG241
Listings of navigational aids	

* These prints will be stable base map copies; the same information that is reported on each of the corresponding Chart Maintenance Prints shall be included.

5.17. Miscellaneous. Registered maps TP-00440A (CM-7705) will adjoin TP-01334 and TP-01335, registered map TP-01344 (CM-8415) will adjoin TP-01333, and the inset of Ontonagon Harbor on registered map TP-00358 will adjoin TP-01547.

5.18. Communication

5.18.1. Forward a copy of each transmittal letter to N/CG2314 and N/CG2321.

5.18.2. Report major technical type problems that are encountered to N/CG2321; e.g., problems with data acquisition, selection, and processing. Data prepared in support of N/CG22 or N/CG24 functions shall be routed through N/CG2321.

5.18.3. Approved maps, reports, and materials to be archived shall be routed to N/CG2321 for distribution.

6.0. SCHEDULE

Schedule project completion by September 30, 1988. If this schedule cannot be met, inform N/CG2321 immediately.

7.0. MODIFICATIONS OF INSTRUCTIONS

7.1. If any changes in procedures and methods seem advisable, please make appropriate recommendations to this office.

7.2. Departures from basic specifications, as necessitated by unique characteristics and special requirements for this mapping project, shall be contained in supplementary instructions or described in the text of the Project Completion Report and each applicable Descriptive Report; e.g., feature symbolization.

8.0. COST

Charge all costs to 8K6C01.

9.0. RECEIPT

Acknowledge receipt of these instructions.



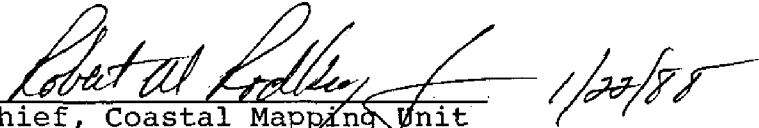
Commander A. Y. Bryson
Chief, Photogrammetry Branch
Nautical Charting Division

R E C E I P T

TO: N/CG23 - Commander A. Y. Bryson

THRU: N/CG232 - Ivey O. Raborn

Receipt of Project Instructions Office - Job CM-8411, Fourteen Mile Point to Eagle Harbor, Lake Superior, Michigan, Shoreline Mapping, dated January 12, 1988, is acknowledged.


Chief, Coastal Mapping Unit
Photogrammetry Branch

APPENDIX F

MAP COMPILATION SOURCES for PROJECT CM-8411

MAP TP-01332 MAP SCALE = 1:20,000

PHOTOGRAPHY

YEAR/TYPE/NUMBERS	DATE	TIME	SCALE	LAKE LEVEL / GAGE
85E(C)7876 - 7879	06/02/85	1342-1345	1:50,000	+1.4 FT LWD/Ontonagon

Photography Type: (C) = Natural Color

Standard Time is referenced to Eastern Time Zone (Meridian = 075°)

Office Reviewer -


 Edward D. Allen

 4-6-88
 Date

REMARKS: The Low Water Datum for Lake Superior is 600.0 FT.

MAP TP-01333 MAP SCALE = 1:10,000

PHOTOGRAPHY

YEAR/TYPE/NUMBERS	DATE	TIME	SCALE	LAKE LEVEL / GAGE
85E(C)7771 - 7773*	06/01/85	1540-1541	1:30,000	+1.4 FT LWD/Ontonagon
85E(C)9957 - 9958	07/16/85	1612	1:30,000	+1.7 FT LWD/Ontonagon

Photography Type: (C) = Natural Color

Standard Time is referenced to Eastern Time Zone (Meridian = 075°)

Office Reviewer -


 Edward D. Allen

 4-11-88
 Date

REMARKS: The Low Water Datum for Lake Superior is 600.0 FT.

* = Photographs from project CM-8415

MAP TP-01334 and INSET MAP and INSET SCALE = 1:20,000

PHOTOGRAPHY

YEAR/TYPE/NUMBERS	DATE	TIME	SCALE	LAKE LEVEL / GAGE
85E(C)7879 - 7883	06/02/85	1345-1349	1:50,000	+1.4 FT LWD/Ontonagon
85E(C)7883 - 7884*	06/02/85	1349-1350	1:50,000	+1.4 FT LWD/Ontonagon

Photography Type: (C) = Natural Color

Standard Time is referenced to Eastern Time Zone (Meridian = 075°)

Office Reviewer -


 Edward D. Allen

 4-20-88
 Date

REMARKS: The Low Water Datum for Lake Superior is 600.0 FT.

* = Photographs for Inset compilation.

MAP COMPILATION SOURCES for PROJECT CM-8411

MAP TP-01335 MAP SCALE = 1:20,000

PHOTOGRAPHY

YEAR/TYPE/NUMBERS	DATE	TIME	SCALE	LAKE LEVEL / GAGE
85E(C)7885 - 7889	06/02/85	1351-1355	1:50,000	+1.4 FT LWD/Ontonagon

Photography Type: (C) = Natural Color

Standard Time is referenced to Eastern Time Zone (Meridian = 075°)

Office Reviewer - Edward D. Allen 4-7-88
Date

REMARKS: The Low Water Datum for Lake Superior is 600.0 FT.

MAP TP-01336 MAP SCALE = 1:20,000

PHOTOGRAPHY

YEAR/TYPE/NUMBERS	DATE	TIME	SCALE	LAKE LEVEL / GAGE
85E(C)7889 - 7892	06/02/85	1351-1358	1:50,000	+1.4 FT LWD/Ontonagon

Photography Type: (C) = Natural Color

Standard Time is referenced to Eastern Time Zone (Meridian = 075°)

Office Reviewer - Edward D. Allen 4-14/88
Date

REMARKS: The Low Water Datum for Lake Superior is 600.0 FT.

MAP TP-01337 MAP SCALE = 1:20,000

PHOTOGRAPHY

YEAR/TYPE/NUMBERS	DATE	TIME	SCALE	LAKE LEVEL / GAGE
85E(C)7892 - 7895	06/02/85	1358-1401	1:50,000	+1.4 FT LWD/Ontonagon

Photography Type: (C) = Natural Color

Standard Time is referenced to Eastern Time Zone (Meridian = 075°)

Office Reviewer - Edward D. Allen 4-20-88
Date

REMARKS: The Low Water Datum for Lake Superior is 600.0 FT.

MAP COMPILATION SOURCES for PROJECT CM-8411

MAP TP-01547 MAP SCALE = 1:20,000

PHOTOGRAPHY

YEAR/TYPE/NUMBERS	DATE	TIME	SCALE	LAKE LEVEL / GAGE
85E(C)7895 - 7898	06/02/85	1401-1403	1:50,000	+1.4 FT LWD/Ontonagon

Photography Type: (C) = Natural Color

Standard Time is referenced to Eastern Time Zone (Meridian = 075°)

Office Reviewer - Edward D. Allen 4-20-88
Edward D. Allen Date

REMARKS: The Low Water Datum for Lake Superior is 600.0 FT.

APPENDIX G

GEOGRAPHIC NAMES

FINAL NAME SHEET

CM-8411 (Lake Superior, Michigan)

TP-01332

Eagle River

Eagle River (locality)

Fivemile Point

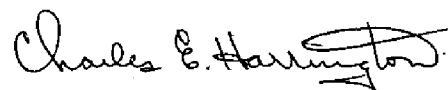
Garden City Creek

Great Sand Bay

Silver Creek

Superior, Lake

Approved:



Charles E. Harrington
Chief Geographer
Nautical Charting Division

GEOGRAPHIC NAMES

FINAL NAME SHEET

CM-8411 (Lake Superior, Michigan)

TP-) 01333

Cat Harbor

Eagle Harbor

Eagle Harbor (locality)

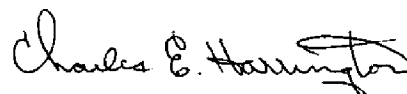
Eliza Creek

Eliza Lake

Little Grand Marais Harbor

Superior, Lake

Approved:



Charles E. Harrington
Chief Geographer
Nautical Charting Division

GEOGRAPHIC NAMES

FINAL NAME SHEET

CM-8411 (Lake Superior, Michigan)

TP-01334

Black Creek

Brewery Creek

Gardeners Creek

Gratiot River

Hills Creek

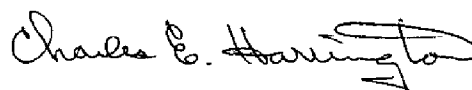
Mud Lake

Sevenmile Creek

Sevenmile Point

Superior, Lake

Approved:



Charles E. Harrington
Chief Geographer
Nautical Charting Division

GEOGRAPHIC NAMES

FINAL NAME SHEET

CM-8411 (Lake Superior, Michigan)

TP-01335

Beacon Hill

Deer Creek

Freda

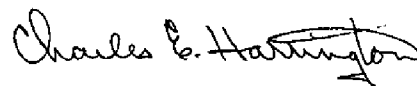
Graveraet River

Redridge

Salmon Trout River

Superior, Lake

Approved:



Charles E. Harrington
Chief Geographer
Nautical Charting Division

GEOGRAPHIC NAMES

FINAL NAME SHEET

CM-8411 (Lake Superior, Michigan)

TP-01336

Agate Beach

Elm River

Little Elm River

Little Misery Bay

Misery Bay

Misery River

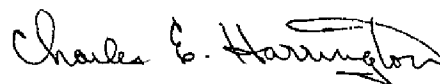
Rockhouse Point

Santa Monica Beach

South Branch

Superior, Lake

Approved:

Charles E. Harrington
Chief Geographer
Nautical Charting Division

GEOGRAPHIC NAMES

FINAL NAME SHEET

CM-8411 (Lake Superior, Michigan)

TP-01337

Black Creek

East Sleeping River

Fourteen Mile Point

Holland Creek

McCarthy Creek

Misery Bay

Sleeping Bay

Superior, Lake

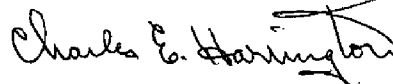
Tenmile Bay

Tenmile Creek

West Sleeping River

Willard Point

Approved:



Charles E. Harrington
Chief Geographer
Nautical Charting Division

GEOGRAPHIC NAMES

FINAL NAME SHEET

CM-8411 (Lake Superior, Michigan)

TP-01547

Bear Creek

Firesteel River

Flintsteel River

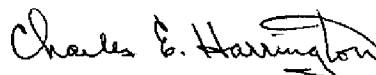
Ontonagon

Paddys Creek

Superior, Lake

Tenmile Point

Approved:



Charles E. Harrington
Chief Geographer
Nautical Charting Division

APPENDIX H

CARTOGRAPHIC FEATURES OF CHARTING INTEREST

Page 1 of 1

COSATAL MAPPING PROJECT: CM-8411; Fourteen Mile Point to Eagle Harbor,
Lake Superior - Keweenaw Peninsula, Michigan

NOS Nautical Charts Affected: 14964, 14965

Geodetic Datum: North American Datum of 1927

The following charted cartographic features have been identified and measured during photogrammetric operations. Refer to Nautical Charting Division Standard Digital Data Exchange Format documentation for quality code (QC) criteria and clarification of cartographic codes (CC). Clarifications in upper and lower case are for internal use.

FEATURE DESCRIPTION	NCD CC	GEOGRAPHIC POSITION(°-'-")		NCD QC	DATE OF LOCATION
		LATITUDE	LONGITUDE		
Chart 14964:					
EAGLE HARBOR LIGHT	200	47-27-35.130	088-09-32.702	3	001/1934
EAGLE HARBOR RGE F LT	208	47-27-18.75	088-09-04.87	6	153/1985
EAGLE HARBOR RGE R LT	209	47-27-09.71	088-08-57.09	6	153/1985
RADIO MAST (Eagle Harbor)	198	47-27-35.04	088-09-35.33	6	153/1985
SPIRE (Eagle Harbor)	086	47-27-28.66	088-09-46.31	6	153/1985
SPIRE (Eagle Harbor)	086	47-27-23.12	088-09-54.81	6	153/1985
CUPOLA (Eagle Harbor)	086	47-27-17.16	088-09-34.75	6	153/1985
TOWER (Aband Lt Ho - 5Mi Pt)	086	47-23-30.96	088-22-13.59	6	154/1985
Charts 14964 and 14965:					
STACK (Redridge)	086	47-09-04.95	088-46-22.69	6	154/1985
STACK (Freda)	086	47-08-01.78	088-49-19.41	6	154/1985
Chart 14965:					
ABAND LT HO (Fourteen Mile Pt)	086	46-59-34.42	089-07-32.23	6	154/1985
- end -					

Listing approved by:

Final Reviewer

Date

5/25/88