PHOTOGRAMMETRY BRANCH
COASTAL MAPPING PROGRAM

PROJECT CM-8604
COMPLETION REPORT

MICHIGAN
LAKE MICHIGAN
GROS CAP TO POINT PATTERSON
TP-01447, TP-01448, TP-01449,
TP-01450, TP-01451
Year of Source -1987
Agency Vault-Original Report

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

Agency Vault - Original Report

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PROJECT CM-8604
COMPLETION REPORT

Michigan
Lake Michigan
Gros Cap to Point Patterson
TP-01447, TP-01448, TP-01449, TP-01450, TP-01451

Clearance and Approval

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

Submitted by,

John A. Mooney

John A. Mooney
Chief, Compilation Section B
Photogrammetry Branch, NCD

Approved by,

Lewis A. Lapine

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

Feb 12, 1990
Date

COMPLETION REPORT

COASTAL MAPPING PROJECT CM-8604
MICHIGAN
Lake Michigan - Gros Point to Patterson

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COASTAL MAPPING PROGRAM PROJECT CM-8604

Introduction

Coastal Mapping Program Project CM-8604 consist of five coastal survey maps depicting the shoreline and other cartographic features of mapping interest in the coastal zone area of Lake Michigan from Gros Cap to Point Patterson, Michigan at a 1:20,000 scale. Refer to FIGURE 1 for a graphic reference of the project site location. The assigned map identifiers for this project were TP-01447 through TP-01451. Refer to FIGURE 2 for information on area coverage and geographic limits of the maps. Final map manuscripts depict the Lambert Conformal Conic Projection. The North American Datum of 1983 is shown by full line projection; the North American Datum of 1927 is shown by unlabeled offset ticks.

The purpose of this project is to provide contemporary coastal zone survey data for the maintenance of the National Ocean Service Nautical Charting Program.

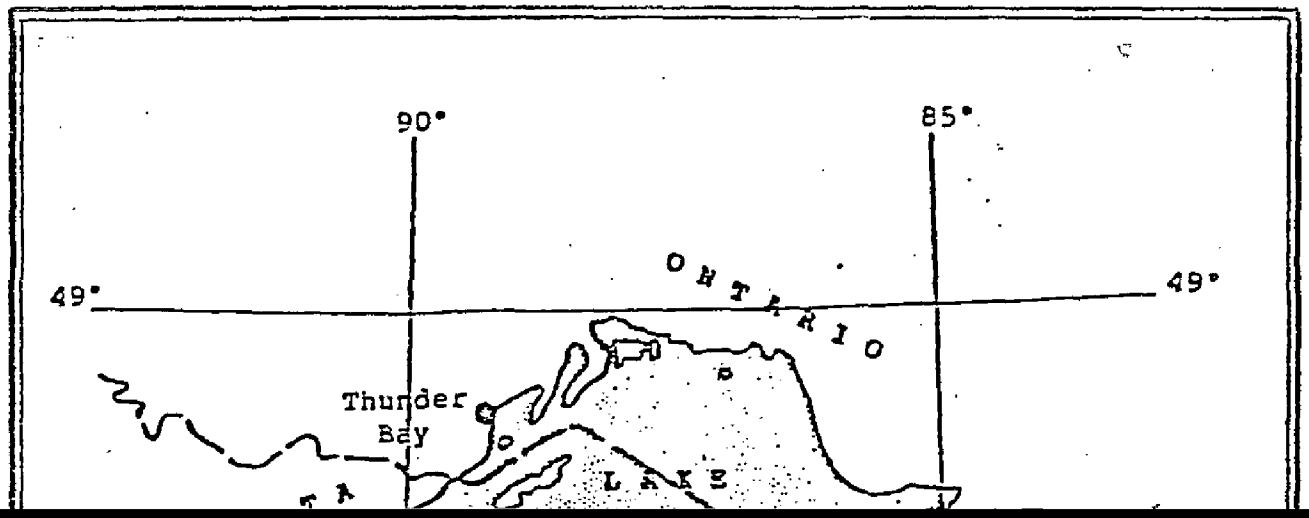
Planning

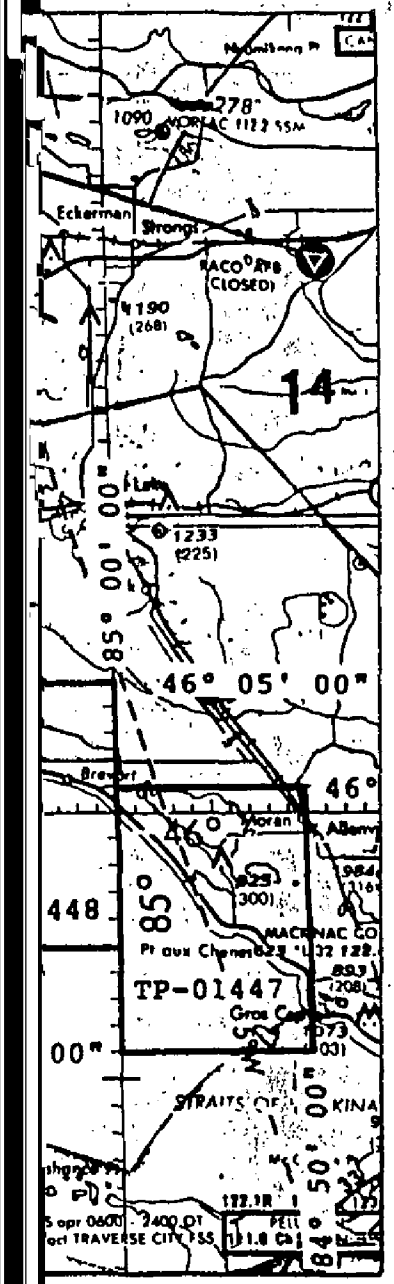
The Coastal Planning Unit, headquarters office, initiated the planning phase for this project in March 1986. The Atlantic Marine Center Coastal Surveys Unit was assigned all horizontal control activities. Aerial photography was the responsibility of the Flight Operations Unit, headquarters office. Field instructions were issued on May 12, 1987. A copy of these instructions are bound in Appendix A.

Field Operations

Field operations were conducted between May 11 and June 11, 1987 and consisted of aerial photography and the recovery, establishment and identification (premarking) of horizontal control necessary for aerotriangulation. Field operations were summarized by the Chief of Party in a report bound in Appendix B. Refer to Appendix B for information on the horizontal control related to this project.

A Turbo Commander aircraft (N57074) was used for the photographic operations. Photographs utilized for this project were taken in June 1987. Natural color photographs were acquired for aerotriangulation and map compilation at 1:50,000 and 1:30,000 scales using a Wild RC-8 camera with the "E" cone which has a


90°
85°
49°
49°
ONTARIO
Thunder
Bay
LAKE


1090
278
Eckerman
Strongs
RACO RPB
(CLOSED)
1190
(268)
14
1233
(225)
85° 00'
46° 05' 00"
46°
448
85°
TP-01447
00"
50°
84°

of the project site. The photographs were examined in June 1987 by the Quality Control Unit, headquarters office, for proper qualities required for mapping photographs as defined in the quality assurance program.

Aerotriangulation

The aerotriangulation phase was completed in July 1988 by the Aerotriangulation Unit, headquarters office. The Aerotriangulation Report is bound in Appendix C 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 June 12, 1989 and are bound in Appendix D. 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 July 1989 and completed in September 1989 by Compilation Section B, headquarters office. The photogrammetric work stations utilized in data acquisition were Wild B-8's (S/N's: 1132, 1167, 5597). Compilation was accomplished through the application of standard analog compilation techniques.

For information on the photographs used in the compilation phase, refer to the control 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 E.

The final maps were smooth drafted except for the application of annotation which was accomplished by 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 from the NOS Staff Geographer. The Final Geographic Names listings are bound in this report as Appendix F.

Office review of the project products was conducted in September 1989 by Compilation Section B, headquarters office. The results of a comparison against the NOS nautical charts of the area were annotated on the Chart Maintenance Print and Notes to Hydrographer Print for each map.

Comparisons were made against the following NOS nautical charts:

14881, 25th Edition (Dec.28, 1985), 1:80,000 scale
14911, 16th Edition (May 3, 1986), 1:80,000 scale

Final Review

The final review phase was initiated in September 1989 by the Compilation Unit B, 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 G 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 and a Notes to Hydrographer Print was generated for each map within the project.

This project completion report is the authoritative summary for project CM-8604 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 Administration
- **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
  - One copy of the project diagram (page size)
  - One copy of the Aerotriangulation Report
  - One copy of the Cartographic Features of Charting Interest listing

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.

APPENDIX A

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

May 12, 1987 N/CG2312:JDM

Chief, Photogrammetry Branch
Atlantic Marine Center

PROJECT INSTRUCTIONS: FIELD - Job CM-8604, Lake Michigan, Gros Cap to Point Patterson, Michigan, Shoreline Mapping

1.0. PURPOSE

These instructions provide specifications and a schedule for placing targets on horizontal control stations required for aerotriangulation.

2.0. AREA

Mapping at 1:20,000 scale will cover the shoreline from Gros Cap to Point Patterson. Also included are Naubinway, Little Hog, Epoufette and St. Helena Islands.

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. If target configuration and placement necessitate it, target identification photography may be obtained at 1:15,000 scale and 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. The horizontal datum for this project is NAD 83.

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

5.3. 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.

5.4. New control stations, where needed, shall be established by triangulation, trilateration, traverse, satellite positioning, or a combination of the four methods, in accordance with Third-Order, Class I specifications provided in Standards and Specifications for Geodetic Control Networks, dated September 1984.

5.5. New stations will be monumented if they are required for future work in the area needing geodetic control.

5.6. Notify 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

6.1. As soon as possible after all control stations have been paneled, the field party will forward to 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.

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

6.2. Aerotriangulation Control

6.2.1. Panel each station selected to meet horizontal control requirements in accordance with specifications given on the attached sheet for 1:50,000-scale photography.

6.2.2. 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.

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

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

6.2.5. Panel substitute stations wherever shadows or relief displacement will obscure the control stations. Monumented stations (reference marks, azimuth marks) are preferred substitute stations.

6.2.6. Substitute stations will be positioned to the specifications stated in Photogrammetric Instruction No. 22, Revised September 30, 1965, section 4.02.2.

6.2.7. 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

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.

c. In the space provided for a sketch of Substitute Station B, make a smaller scale sketch that shows the relationship of the target to the surrounding terrain. Include one or more salient features to assist office personnel in locating the target on the photographs.

d. Indicate on suitable chart bases the approximate locations of all targets placed.

8.0. SCHEDULE

All stations shall be premarked and ready for photography by June 8, 1987. If premarking is not completed by this date, inform N/CG2313 so this information can be relayed to the air photo mission.

9.0. REPORT

A field operations report covering all pertinent field work performed is required upon completion of the field phase of this project.

10.0. RECORDS

All field records will be sent through N/MOA2222 for review prior to being forwarded to 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.

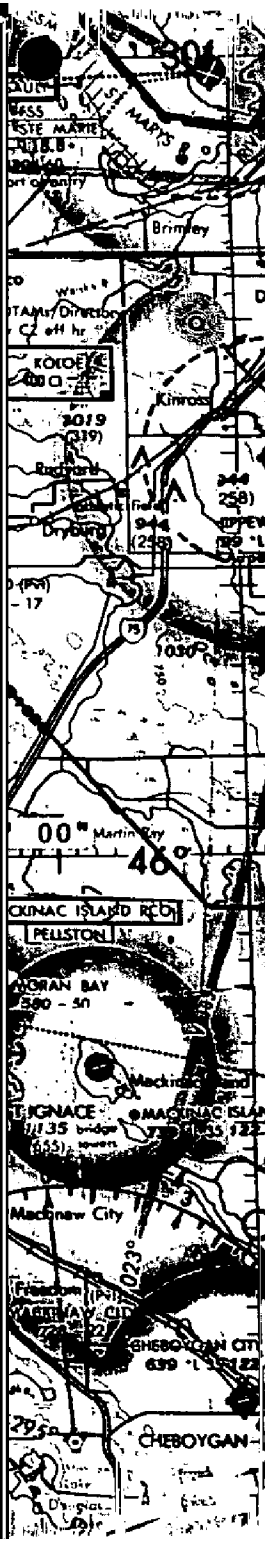
13.0. RECEIPT

Acknowledge receipt of these instructions.

Christian Andreasen

Ray E. Moses
Director
Atlantic Marine Center

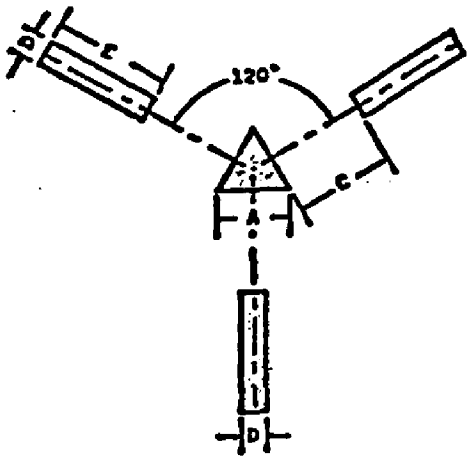
Christian Andreasen
Chief, Nautical Charting Division
Charting and Geodetic Services


Brimley
Kinross
Dryburg
Martin City
MACKINAC ISLAND RCD
PELLSTON
MORAN BAY
Mackinaw City
CHEBOYGAN

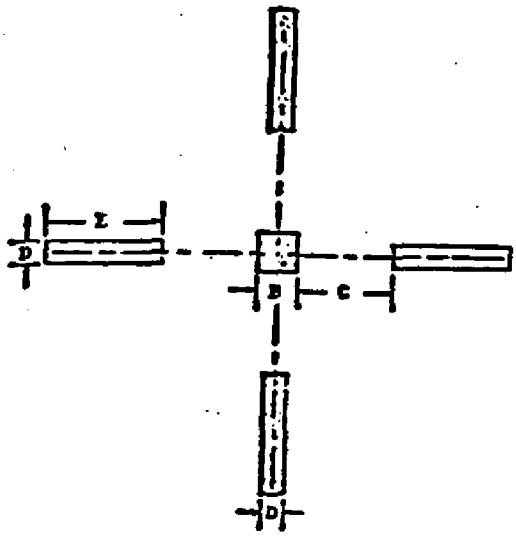
SPECIFICATIONS FOR PREMARKING CONTROL STATIONS

Revised November 23, 1976

ARRAY NO. 1



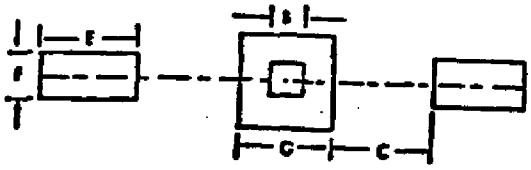
ARRAY NO. 2



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) A	B	C	D	E	F	G
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

APPENDIX B

LAKE MICHIGAN,GROS CAP TO POINT PATTERSON

MICHIGAN

PROJECT REPORT

SHORELINE MAPPING - PHOTO CONTROL

CM-8604

1.0 PURPOSE:

This project was accomplished to provide targets for horizontal control stations required for aerotriangulation according to PROJECT INSTRUCTIONS: FIELD - Job CM-8604, Lake Michigan, Gros Cap to Point Patterson, Michigan dated May 12, 1987.

2.0 AREA:

Shoreline and waterways mapping will cover from Gros Cap to Point Patterson Michigan.

3.0 PARTICIPATION:

3.1 Personnel:

Party Chief	M. Johnson	J. Dunford
Assistants	P. Walbolt	J. Koster
	G. Vose	C. Brown

3.2 Equipment:

3 4x4 Carry-all Trucks
2 Wild T-2 Theodolites
2 EDMI HP-3810B
4 MX 350 Radios
3 MX 1502 Satellite Receiver

4.0 FIELD ACTIVITY:

4.1 FIELD METHODS:

Eight (8) targets were located for aerotriangulation photography. Recovery notes were submitted for each horizontal control station used on this project.

4.2 CONTROL:

The North American Datum of 1983 was the controlling horizontal datum.

4.3 DISCUSSION OF RESULTS:

Panels were located using the following methods:

Circle #1. Station SCOTT POINT USLS 1917 paneled direct.

Panel. #1 LAT 45-57-32.10461 LON 85-41-29.24103

Circle #2. Located direct from station BIG KNOB, using reverse Solar for Azimuth.

Panel. #2 LAT 46-03-56.6055 LON 85-34-41.2467

Circle #3. Located direct from station ENGADINE, using Solar for Azimuth.

Panel. #3 LAT 46-07-23.8163 LON 85-34-23.6228

Circle #4. Located direct from station MILLE COQUINS USLS, NAUBINWAY ISLAND LIGHT for Azimuth.

Panel. #4 LAT 46-05-12.6368 LON 85-26-39.5143

Circle #5. New station NELSON established by Magnavox 1502 Satellite Receiver, Station translocated from Station ST. IGNACE E BASE.

Panel. #5 LAT 46-04-08.429 LON 85-16-27.823

Circle #6. Located direct from station FH4MI78, using Azimuth from WHITE SHOALS LH.

Panel. #6 LAT 46-01-54.5519 LON 85-06-05.2378

Circle #7. Located direct from station BREVORT RESET 1985 with Azimuth from WHITE SHOALS LH.

Panel. #7 LAT 45-59-20.7025 LON 84-58-39.5783

Circle #8. Located direct from station GOUDREAU,with Azimuth from WHITE SHOALS LH.

Panel. #8 LAT 45-52-18.5813 LON 84-48-51.0465

5.0 SCHEDULE:

The field party departed Norfolk Va. May 11 1987 and returned June 11 1987. There were many delays do to weather (heavy rain and fog).

6.0 STATISTICS:

Number of targets	8
Number of stations recovered	10
Number of stations established	1

7.0 RECORDS:

All original records will be forwarded to Rockville, Md. N/CG2313. A copy of all field data and this report will be maintained at Atlantic Marine Center's Coastal Surveys Unit, N/MOA2222.

June 30, 1987
Submitted by:
Michael W. Johnson

Approved:
Jim D. Shea
Chief, Coastal Surveys

APPENDIX C

Aerotriangulation Report
CM-8604
Gros Cap To Point Patterson, Michigan
July 1988

Area Covered

This report covers the area from Point Patterson to Gros Cap, Lake Michigan . The project consists of five 1:20,000-scale sheets; TP-01447 through TP-01451.

Method

Three strips of 1:50,000-scale color photographs were bridged by analytical aerotriangulation methods using the STK comparator. The bridging strips were adjusted to ground using the General Integrated Analytical Triangulation Program (GIANT). Pre-marked control stations were used as horizontal control. Common points were transferred between strips to insure adequate junctioning.

Ratio values were determined for the bridging photographs in this project. A copy of the ratio values is attached to this report.

The base manuscripts were plotted on the Kongsberg plotter. The positions are in the Michigan state plane coordinate system, north zone. This is a Lambert conformal conic projection. All positions are based on NAD 1983. In addition, 10mm ticks depicting NAD 1927 projection intersections were plotted at twice the interval of the NAD 1983 projection intersections.

Adequacy of Control

The control was adequate and meets the National Ocean Service requirements. A listing of closures to control is attached.

Supplemental Data

USGS topographic quadrangles were used to obtain vertical control for bridging. NOS Nautical Charts were used to locate aids and landmarks within the project area.

Photography

The coverage,overlap,and quality of the photographs were adequate for the job. The color bridging photographs used in this project are:

87 EC 1507 thru 1512
87 EC 1518 thru 1529
87 EC 1533 thru 1540

Submitted by,

Brian Thornton

Brian Thornton

Approved and Forwarded:

Don O. Norman

Don O. Norman
Chief,Aerotriangulation Unit

Fit To Control

Station Names	Point No.	Values In Feet X	Y
Scott Point USLS,1917	507100	-0.1	-0.3
Big Knob,1965 sub pt.	510101	-0.1	+1.7
Engadine,1965 sub pt.	512101	+1.2	-1.7
Brevort Reset,1985 sub pt.	518101	+1.8	0.0
FH4M178 sub pt.	521101	-0.8	0.3
Nelson,1987	524100	-0.2	+1.6
Mille Coquins USLS,1911 sub pt.	527101	-1.2	-0.6
Goudreau USLS,1902 sub pt.	540101	-0.8	-0.2

CM-8604

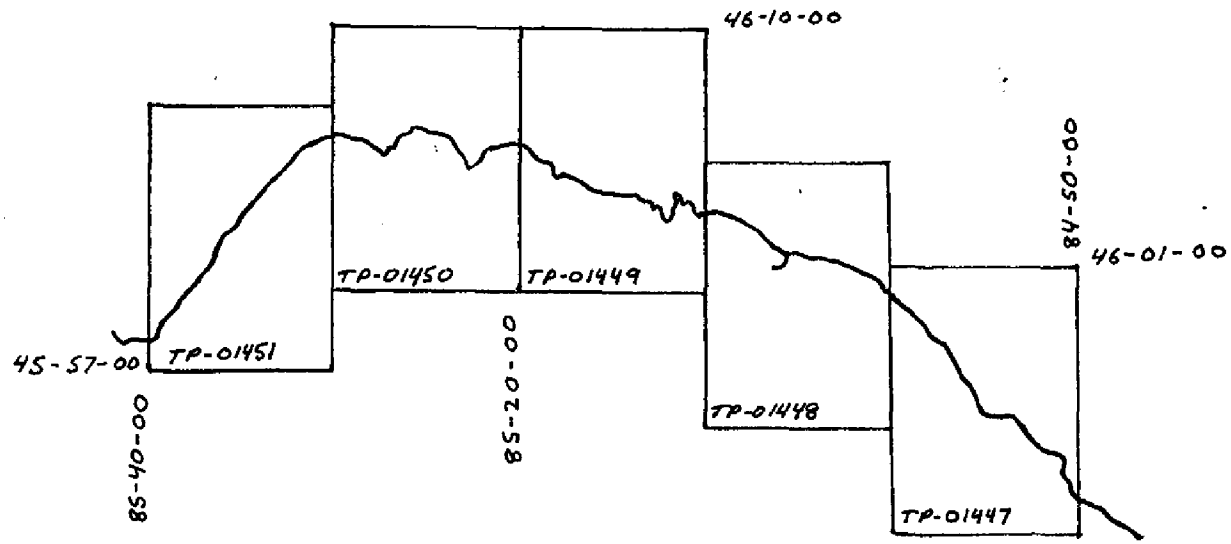
Ratio Values

Color Bridging Photographs:

[redacted]

87 EC 1518 thru 1529	Ratio	2.53
87 EC 1533 thru 1540	Ratio	2.53

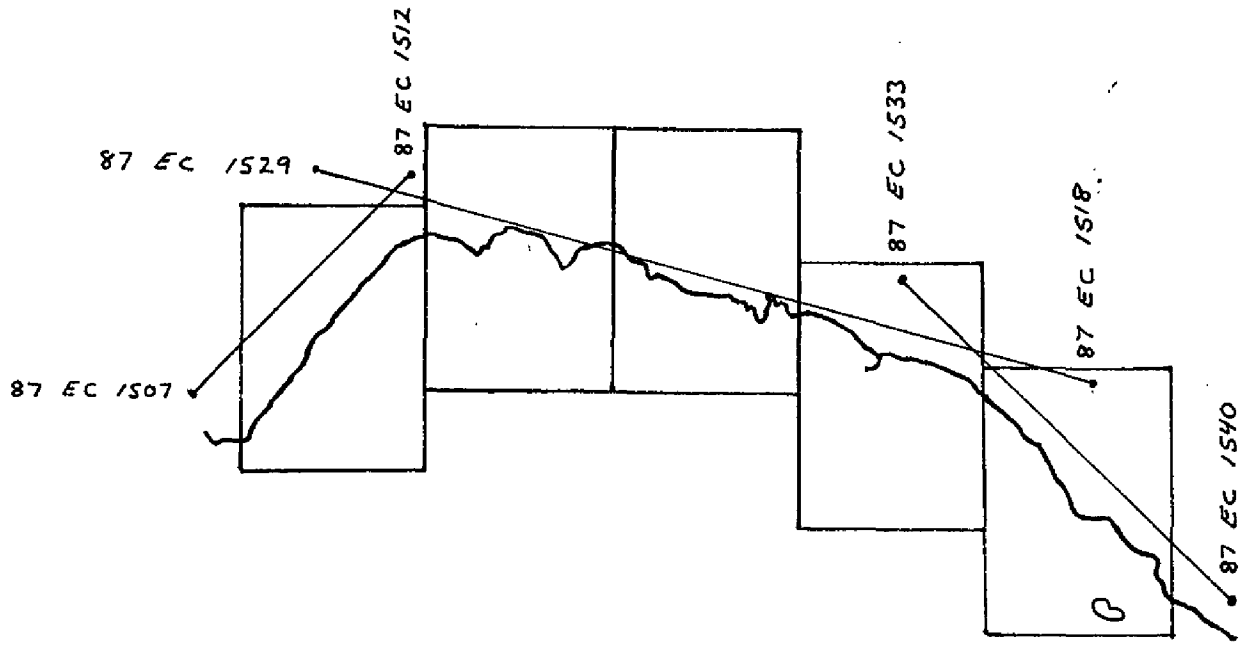
JOB CM-8604
LAKE MICHIGAN
GROS CAP TO POINT PATTERSON
MICHIGAN
SHORELINE MAPPING
SCALE = 1:20,000



JOB CM-8604
LAKE MICHIGAN
GROS CAP TO POINT PATTERSON
MICHIGAN
SHORELINE MAPPING
SCALE = 1:20,000

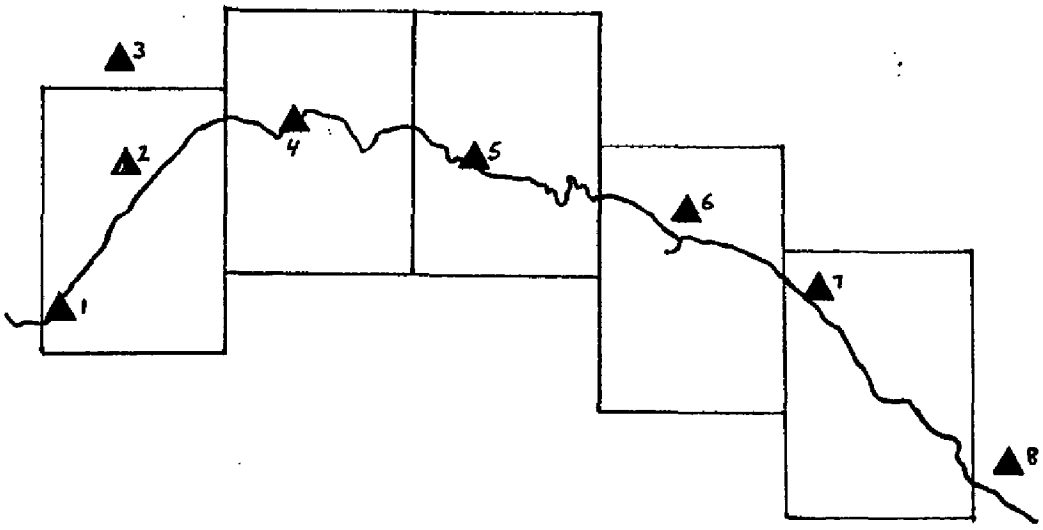
BRIDGING PHOTOGRAPHS

SCALE 1:50,000



JOB CM-8604
LAKE MICHIGAN
GROS CAP TO POINT PATTERSON
MICHIGAN
SHORELINE MAPPING
SCALE = 1:20,000

HORIZONTAL CONTROL



1 SCOTT POINT USLS, 1917
2 BIG KNOB, 1965
3 ENGADINE, 1965
4 MILLE COQUINS USLS, 1911
5 NELSON, 1987
6 FH4 M178
7 BREVORT RESET, 1985
8 GOUDREAU USLS, 1902

NOAA FORM 76-41
(6-75)

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

DESCRIPTIVE REPORT CONTROL RECORD

MAP NO.	JOB NO.	GEODETIC DATUM	ORIGINATING ACTIVITY
	CM-8604	1983 DATUM	1 of 2 pgs.

	STATION NAME	SOURCE OF INFORMATION (Index)	AEROTRIANGULATION POINT NUMBER	COORDINATES IN FEET STATE MICHIGAN ZONE NORTH	GEOGRAPHIC POSITION φ LATITUDE λ LONGITUDE	REMARKS
1	SCOTT POINT USLS, 1917	FIELD CONTROL BOOK	507100	x= 26579429.501 ✓ y= 431418.140 ✓	φ 45° 57' 32.10461" ✓ λ 85° 41' 29.24103" ✓	off sheet
	BIG KNOB, 1965	"	510100	x= 26606779.370 ✓ y= 470300.206 ✓	φ 46° 03' 51.2771" ✓ λ 85° 34' 52.2907" ✓	TP-01451
2	BIG KNOB SUB STATION	"	510101	x= 26607548.250 ✓ y= 470853.738 ✓	φ 46° 03' 56.6055" ✓ λ 85° 34' 41.2467" ✓	
	ENGADINE, 1965	"	512100	x= 26608331.967 ✓ y= 491833.031 ✓	φ 46° 07' 23.5549" ✓ λ 85° 34' 24.7790" ✓	off sheet
3	ENGADINE SUB STATION	"	512101	x= 26608412.898 ✓ y= 491860.928 ✓	φ 46° 07' 23.8163" ✓ λ 85° 34' 23.6228" ✓	
	NAUBINWAY ISLAND LIGHT, 1965	GEO. DATA BOOK SAULT SAINTE MARIE Pg 6	17	x= 26641217.754 ✓ y= 475020.879 ✓	φ 46° 04' 31.49795" ✓ λ 85° 26' 42.63637" ✓	TP-01450 ✓
4	MILLE COQUINS USLS, 1911	" Pg. 6	527100	x= 26640893.595 ✓ y= 478626.580 ✓	φ 46° 05' 07.1520" ✓ λ 85° 26' 46.2307" ✓	TP-01450
	MILLE COQUINS SUB-STATION	"	527101	x= 26641356.026 ✓ y= 479191.330 ✓	φ 46° 05' 12.6368" ✓ λ 85° 26' 39.5143" ✓	
5	NELSON, 1987	"	524100	x= 26684599.497 ✓ y= 473581.500 ✓	φ 46° 04' 08.429" ✓ λ 85° 16' 27.823" ✓	TP-01449
	WHITE SHOALS LIGHTHOUSE USLS, 1913	GEO. DATA BOOK CHEBOYGAN " Pg. 7		x= 26721703.937 ✓ y= 391486.173 ✓	φ 45° 50' 29.82903" ✓ λ 85° 08' 09.05621" ✓	off sheet

COMPUTED BY	DATE	COMPUTATION CHECKED BY	DATE
LISTED BY J. Taylor	DATE 10/16/87	LISTING CHECKED BY B. Thornton	DATE 10-21-87
HAND PLOTTING BY	DATE	HAND PLOTTING CHECKED BY	DATE

SUPERSEDES NOAA FORM 76-41, 2-71 EDITION WHICH IS OBSOLETE.

NOAA FORM 76-41
(6-75)

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

DESCRIPTIVE REPORT CONTROL RECORD

MAP NO.	JOB NO.	GEODETIC DATUM	ORIGINATING ACTIVITY
	CM-8604	1983 DATUM	2 of 2 pgs.

	STATION NAME	SOURCE OF INFORMATION (Index)	AEROTRIANGULATION POINT NUMBER	COORDINATES IN FEET STATE MICHIGAN ZONE NORTH	GEOGRAPHIC POSITION φ LATITUDE λ LONGITUDE	REMARKS
?	FH4M178	FIELD CONTROL BOOK	521100	x= 26728581.834 ✓ y= 459484.250 ✓	φ 46° 01' 39.36400" ✓ λ 85° 06' 08.93700" ✓	TP-01448
6	FH4M178 SUB STATION	"	521101	x= 26728805.899 ✓ y= 461028.429 ✓	φ 46° 01' 54.5519" ✓ λ 85° 06' 05.2378" ✓	
?	BREVORT RESET, 1985	"	518100	x= 26760670.174 ✓ y= 446224.818 ✓	φ 45° 59' 20.6636" ✓ λ 84° 58' 39.0757" ✓	TP-01447
7	BREVORT RESET SUB STATION	"	518101	x= 26760634.645 ✓ y= 446227.761 ✓	φ 45° 59' 20.7025" ✓ λ 84° 58' 39.5783" ✓	
	GOUDREAU (USLS), 1902	"	540100	x= 26803430.867 ✓ y= 404435.540 ✓	φ 45° 52' 17.02376" ✓ λ 84° 48' 49.98157" ✓	off sheet
8	GOUDREAU SUB STATION	"	540101	x= 26803351.265 ✓ y= 404591.109 ✓	φ 45° 52' 18.5813" ✓ λ 84° 48' 51.0465" ✓	
✓	GILCHRIST LOOKOUT TOWER, 1965	GEODETIC CONTROL DIAGRAM B.4 SAULT SAINTE MARIE	18	x= 26648791.126 ✓ y= 497219.009 ✓	φ 46° 08' 09.12877" ✓ λ 85° 24' 48.92246" ✓	TP-01450 X
	REXTON MICROWAVE RELAY MAST, 1965	" Pg. 8	22	x= 26698143.823 ✓ y= 507519.606 ✓	φ 46° 09' 40.44920" ✓ λ 85° 13' 04.93704" ✓	TP-01449 X
	ST. HELENA LIGHTHOUSE (USLS), 1902	CHEBOYGAN " B.6	539141	x= 26790920.893 ✓ y= 398116.509 ✓	φ 45° 51' 18.02665" ✓ λ 84° 51' 49.13455" ✓	KEY TO PROJECT INDEX NUMBER 41 TP-01441
				x= y=	φ λ	

COMPUTED BY	DATE	COMPUTATION CHECKED BY	DATE
LISTED BY J. Taylor	DATE 10/16/87	LISTING CHECKED BY B. Thornton	DATE 10-21-87
HAND PLOTTING BY	DATE	HAND PLOTTING CHECKED BY	DATE

SUPERSEDES NOAA FORM 76-41, 2-71 EDITION WHICH IS OBSOLETE.

APPENDIX D

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

June 12, 1989

Chief, Special Projects Unit
Photogrammetry Branch
Rockville, Maryland 20852

SUBJECT: Instructions - OFFICE - Project CM-8604, Gros Cap to Point Patterson, Lake Michigan, 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 and approved sections of the new Coastal Mapping Program Operations Manual (CMP-OM).

2.0. GENERAL

2.1. Scope. Five 1:20,000-scale shoreline maps will be produced; TP-01447 through TP-01451. These maps will depict the northeastern shore of Lake Michigan. 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 83.

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

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

Type	Scale	Camera	Date
Color/MS	1:50,000	Wild RC-8 (E)	6/4/87

2.4. Aerotriangulation. Three strips of color photographs were bridged using analytical aerotriangulation methods. Geodetic control used was premarked. Common image points between

overlapping strips were established to augment the datum tie and ensure that a sufficient control network was used for the analytical adjustment. Elevations from U.S. Geological Survey quadrangles were used as vertical control. The amount of aerotriangulated control proved adequate for map production and meets the NOS accuracy requirements and National Standards of Map Accuracy. Aerotriangulated control is based on NAD 83.

2.5. Charts Affected. Charts 14860, 14880, 14881, 14901, 14902, and 14911 depict areas that are common this survey.

2.6. Miscellaneous. The eastern limits of this survey adjoin project CM-8603, which is presently in production. The western limits conincide with project CM-8606, which will not enter production before FY 90.

3.0. DATA FURNISHED

a. Control data
b. USGS quadrangles and nautical charts
c. Bridging data
d. Project diagrams
e. Color contact prints and film positives
f. Field data
g. Base manuscripts
h. Aerotriangulation Report

4.0. ASSIGNMENT

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

5.0. COMPILATION

5.1. Limits. Standard shoreline maps are required. The offshore limit of compilation is directly related to the extension and placement of the photogrammetrically established horizontal control. Compilation of interior features will be generally consistent with the limits indicated under section 5.9.

5.2. Delineation

5.2.1. Delineation will be accomplished using analytical and/or analog 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 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 features. Instead, a representative pattern of the symbol or

area outline is to be shown, augmented by an explanatory note. Small features (e.g., bare rock, islet), especially when dangerous to navigation, may be slightly exaggerated in size, closely resembling their true shape.

5.2.3. Final map manuscripts, based on NAD 1983, will depict the Lambert Conformal Conic Projection (full line); NAD 27 offset ticks (unlabeled) are required. Refer to Photogrammetry memorandum instruction, "Implementation of the NAD 83 in the Coastal Mapping Program," dated October 2, 1987. A plotting adjustment note for NAD 27 will be added to each map; this information will be provided by N/CG2321.

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 open-water features shown as bare or uncovering are investigated and (2) will complement the interpretation of detail and/or identification of conflicts. Questionable 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 each final map 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 average water level taken at the Port Inland, Michigan, gage was 580.2 feet. Low Water Datum for Lake Michigan is 576.8 feet."

5.7. Geodetic Control. Refer to Photogrammetry 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 confirm aerotriangulated and geodetic positions of visible charted landmarks, fixed aids to navigation, and/or cartographic features that have possible landmark value using analytical and/or analog methods.

5.8.2. Refer to Photogrammetric Instruction No. 78 for symbolization and labeling. Map 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. The listing shall also contain features of possible landmark value. The listing shall indicate:

a. Map and project 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
i. Nautical chart(s) affected

The assignment of feature codes shall be in compliance with the specifications set forth in section 10 of the CMP-OM. Refer to Nautical Charting Division Standard Digital Data Exchange Format (NCD SDDEF), Version 1 documentation dated April 1, 1985, for clarification of NCD quality codes. 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. The requirements for the selection of roads outlined in Photogrammetric Instruction No. 56, Revision 1, are modified; the minimum requirement is (1) to show the first road, street, or highway paralleling the shoreline or coastal areas not subject to inundation and (2) all those providing access to the shore area or between this paralleling feature and the shoreline. 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. Drafting. The map 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.

5.12. Geographic and Object Names

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

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

5.13. Reports. Refer to sections 1.2 and 7.2. Information required for inclusion in the Project Completion Report (PCR) will be provided by N/CG2321. Include in the PCR a detailed discussion of the compilation methods and sources used for feature delineation and a brief statement, when applicable, about the selectivity of detail as indicated in section 5.2.2.

5.14. 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 therepresentation 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.

5.15. Support Data. Supplemental survey data required to support charting and hydrographic activities are indicated below. Coordinate the processing and distribution of these data with N/CG2321. Refer to sections 2.1, 5.3, 5.8.3, and 5.14.

Types of Data	Distribution
Chart Maintenance Prints Listings of navigational aids	N/CG2211
* Notes to Hydrographer Prints Listings of navigational aids	N/CG241

* 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.

5.16. Communication

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

5.16.2. 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.

5.16.3. Approved maps, reports, and materials to be archived shall be routed to N/CG2311 for distribution.

6.0. SCHEDULE

Schedule completion by December 31, 1989. If this schedule cannot be met, inform N/CG2321 immediately.

7.0. MODIFICATIONS OF INSTRUCTIONS

7.1. If changes in procedures and/or 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; e.g., feature symbolization.

8.0. COST

Charge all costs to 8K6C01.

9.0. RECEIPT

Acknowledge receipt of these instructions.

C. N. Bodnar

Commander A. Nicholas Bodnar, NOAA
Chief, Photogrammetry Branch
Nautical Charting Division

APPENDIX E

MAP COMPILATION SOURCES for CM-8604

MAP NUMBER[1]	PHOTOGRAPHY[2]	DATE	TIME[3]	SCALE	LAKE LEVEL[4] /	GAGE
TP-01447	87 E(C) 1535-1540	06/04/87	12:35	1:50,000	+3.4 FEET LWD /	Port Inland
TP-01448	87 E(C) 1519-1522	" " "	12:14	" " "	" " " /	" "
TP-01449	87 E(C) 1522-1525	" " "	12:18	" " "	" " " /	" "
TP-01450	87 E(C) 1525-1528	" " "	12:22	" " "	" " " /	" "
TP-01451	87 E(C) 1507-1511	" " "	11:56	" " "	" " " /	" "

REMARKS:

1. All Maps were compiled at a scale of 1:20,000
2. Photography type (C) denotes Natural Color
3. Standard Time, referenced to Eastern Time Zone (Meridian = 075°)
4. Referenced to Low Water Datum (LWD). LWD for Lake Michigan is 576.8 feet.

Final Reviewer - James E Schad

1/25/90
Date

APPENDIX F

OCT 4 1989

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GEOGRAPHIC NAMES

CM-8604 (GROS CAP TO POINT PATTERSON, MICHIGAN)

TP-01447

Brevoort Lake
Brevoort River
Chenes, Pointe aux
Kitchens Creek
Michigan, Lake
Pointe aux Chenes Bay
Pointe Aux Chenes Marshes
Pointe aux Chenes River
Poupard Bay
Round Lake
Saint Helens Island
Sprinkler Lake

TP-01448

Brevort
Cut River
Epoufette
Little Brevoort Lake
Little Brevoort River
Manitou Payment Point
Michigan, Lake

TP-01449

Davenport Creek
Epoufette Bay
Epoufette Island
Epoufette, Point
Gravel Island
Hog Island Point
Kenyon Bay
Little Hog Island
Michigan, Lake
Paquin Creek
Pelkie Reef
Sand Lake
West Harbor

TP-01450

Biddle Point
Black River
Lower Millecoquins River
Mattix Creek
Michigan, Lake
Millecoquins Point
Naubinway
Naubinway Island

TP-01451

Amadon Pond
Browns Lake
Burns Pond
Catarack River
Cranberry Shoal
Crow Lake
Crow River
Dry Lake
Duel Lake
Fox Point
Grants Point
Knob Lake
Lower Millecoquins River
McNeil Creek
Michigan, Lake
Miller Lake
Mud Lake (1)
Mud Lake (2)
Needle Point
Patterson, Point
Point Patterson Creek
Rock River
Sherman Pond
Stone Lake
Turtle Lake

Approved:

Charles E. Harrington

Charles E. Harrington
Chief Geographer, Nautical
Charting Division

APPENDIX G

CARTOGRAPHIC FEATURES OF CHARTING INTEREST

COASTAL MAPPING PROGRAM: CM-8604

NOS NAUTICAL CHART COVERAGE: 14881 and 14911

GEODETIC DATUM: NAD 83

The following features are recommended for charting based on field and photogrammetric observations. Refer to Nautical Charting Division Standard Digital Data Exchange Format documentation for quality code (QC) criteria and clarification of cartographic codes (CC). Please note that cartographic code 993 is a photogrammetric source code for cartographic features of possible landmark value.

FEATURE DESCRIPTION	NCD CC	GEOGRAPHICAL POSITION LATITUDE	LONGITUDE	NCD QC	DATE OF SOURCE
- TP-01447 ST HELENA LIGHT (ST HELENA LIGHT-HOUSE (USLS) 1902)	020	45-51-18.027	84-51-49.135	2	155/987
- TP-01448 Spire	993	46-01-13.77	85-02-36.70	6	155/987
- TP-01449	N/A				
- TP-01450 NAUBINWAY ISLAND LIGHT 1965	020	40-04-31.498	85-26-42.363	3	155/987
- TP-01451	N/A				

Listing approved by: James E Schad 11/30/89
Date