

NOAA COASTAL MAPPING PROGRAM PROJECT COMPLETION REPORT

PROJECT WI1001I-CM-N

Lake Butte des Morts to Lake Poygan, Wisconsin

Introduction

NOAA Coastal Mapping Program (CMP) Project WI1001I-CM-N provides a highly accurate database of new digital shoreline data for Lake Butte des Morts, Lake Winneconne, and Lake Poygan, including the Wolf and Fox Rivers in Wisconsin. Project WI1001I-CM-N is a sub-project of a larger project, WI1001-CM-N, which includes shoreline mapping from Burns Waterway Harbor, at the southern end of Lake Michigan to Little Bay de Noc, including Green Bay and Door Peninsula. The Geographic Cell (GC) may be used in support of the NOAA Nautical Charting Program (NCP) as well as geographic information systems (GIS) for a variety of coastal zone management applications.

Project Design

The Requirements Branch (RB) of the Remote Sensing Division (RSD) formulated the Project Instructions for this project following the guidelines of the Photo Mission Standard Operating Procedures. The instructions discussed the project's purpose, geographic area of coverage, scope and priority, image requirements, Global Positioning System (GPS) and Inertial Measurement Unit (IMU) data collection procedures and guidelines, instructions for data recording and handling, and mission communication protocols. RB created a project layout diagram, flight maps and input files for the aircraft's flight management system.

Field Operations

The field operations consisted of the collection of static and kinematic GPS/IMU data and the acquisition of digital aerial imagery. Aerial survey operations were conducted with the NOAA King Air (N68RF) aircraft from August 6th, 2010 through September 30th, 2010. All imagery was flown at a nominal altitude of 10,000 feet resulting in an approximate ground sample distance (GSD) of 0.35 meters. The overall acquisition project included 151 flight lines of natural color (RGB) and near-infrared (NIR) imagery acquired concurrently using an Applanix DSS-439 dual camera system. Of these, 9 flight lines were used for sub-project WI1001I-CM-N.

AeroMetric, Inc. was contracted by RSD to locate new photo control and check points within the project area. The control points and check points were photo-identifiable features located at well-defined locations. Refer to the Ground Survey Report for a listing of final coordinates, elevations, descriptions and a site map of the points.

GPS Data Reduction

GPS and IMU data was collected and processed by RSD personnel to yield precise positions and orientations of camera centers for application as photogrammetric control in the aerotriangulation

phase of project completion. A local GPS base station was established for use as a reference station for kinematic GPS processing operations. The position of the base station was determined using the NGS Online Processing User Service (OPUS), which computed fixed baseline solutions from nearby CORS stations. The airborne kinematic data was processed using POSPAC version 5.4.0 GPS and IMU processing software. For further information refer to the Airborne Positioning and Orientation Reports (APOR) that are on file with other project data within the Remote Sensing Division Electronic Data Library.

Aerotriangulation

The softcopy analytical aerotriangulation was accomplished by AeroMetric personnel using the Zeiss Image Station Automatic Triangulation (ISAT) program. The ISAT program includes automatic point matching (measuring) and the PhotoT least-squares-simultaneous-robust bundle-block adjustment. The point matching and bundle adjustment were done as one block. The automatic point matching was done in photos along a strip and in photos of overlapping strips. The photo coordinates from point matching are used with the ABGPS exposure stations and ground-surveyed control in the robust bundle-block adjustment, which automatically detects and removes any large point-matching errors. The RGB images and the NIR images were auto-measured in separate sub-blocks, then each sub-block was checked for completeness and errors were corrected.

Points were measured manually in weak areas and in models with little land area (mostly water). The two sub-blocks were then merged into one block and all ground-surveyed control points and checkpoints were manually measured. A pattern of tie points was manually measured to tie the RGB and NIR together. The RGB aerotriangulation was used to obtain computed coordinates for the tie points between the RGB and the NIR, and these points were used as ground control for the NIR. The root mean square (RMS) of the standard deviations of the residuals for each aerotriangulated ground point were used to compute a predicted horizontal circular error of 0.4 meters based on a 95% confidence level. An Aerotriangulation Report was completed and is on file with other project data within the RSD Electronic Data Library. Positional data is referenced to the North American Datum of 1983 (NAD 83).

Compilation

The data compilation phase of the project was completed by AeroMetric, Inc. in July 2012. Digital feature extraction was conducted in a softcopy stereo environment using DAT/EM Systems International Summit Evolution software (ver. 5.5), and Bentley Systems MicroStation V8. All coding and classification of features occurred within the MicroStation environment as features were collected, and was based on interpretation of the project imagery and on information extracted from the appropriate NOAA nautical charts and other ancillary sources. Feature attribution was assigned in compliance with the Coastal Cartographic Object Attribute Source Table (C-COAST), which provides the definition and attribution scheme for the full range of cartographic features pertinent to the CMP. Selected features were further modified with additional descriptive information to refine general classification.

Spatial data accuracies for Project WI1001I-CM-N were determined according to standard Federal Geographic Data Committee (FGDC) practices. Cartographic features were compiled to

meet a horizontal accuracy of 0.8 meters at the 95% confidence level. The predicted accuracy of compiled, well defined points is calculated by doubling the circular error derived from the aerotriangulation statistics.

The table below provides information on aerial photographs used in the project completion:

Date	Time (UTC)	Strip	Color Imagery		Infrared Imagery		Lake Level*
			Roll	Images	Roll	Images	
9/09/2010	14:07 – 14:10	50-096	10NC18	7182 – 7203	10NR18	8042 – 8063	N/A
9/09/2010	14:17 – 14:20	50-099	10NC18	7204 – 7228	10NR18	8064 – 8088	N/A
9/09/2010	14:24 – 14:27	50-093	10NC18	7229 – 7252	10NR18	8089 – 8112	N/A
9/09/2010	14:38 – 14:40	50-092	10NC18	7279 – 7296	10NR18	8139 – 8156	N/A
9/09/2010	14:46 – 14:49	50-095	10NC18	7297 – 7322	10NR18	8157 – 8182	N/A
9/09/2010	14:54 – 14:57	50-094	10NC18	7323 – 7347	10NR18	8183 – 8207	N/A
9/09/2010	15:59 – 16:01	50-149	10NC18	7508 – 7520	10NR18	8368 – 8380	N/A
9/09/2010	16:05 – 16:07	50-097	10NC18	7521 – 7535	10NR18	8381 – 8395	N/A
9/09/2010	16:18 – 16:20	50-098	10NC18	7581 – 7595	10NR18	8441 – 8455	N/A

Quality Control / Final Review

Quality control tasks were conducted during all phases of project completion. The final QC review was completed in January 2018. The review process included analysis of aerotriangulation results and assessment of the identification and attribution of digital feature data within the GC according to image analysis and criteria defined in C-COAST. The quality control process concluded with an inspection of topological connectivity within the GC using ArcGIS 10.5 software. All project data was evaluated for compliance to CMP requirements.

Comparisons of the largest scale NOAA nautical charts with project imagery and compiled project data resulted in creation of the Chart Evaluation File (CEF). The following nautical charts were used in the comparison process:

- 14500, 1:1,500,000 scale, 28th Ed., Oct. 2016
- 14901, 1:500,000 scale, 15th Ed., Aug. 2006
- 14916, 1:20,000 scale, 10th Ed., Jul. 2002

End Products and Deliverables

The following specifies the location and identification of the products generated during the completion of this project:

Remote Sensing Division Electronic Data Library

- Ground Survey Report
- Airborne Positioning and Orientation Reports (APOR)
- Aerotriangulation Report

- Project database
- GC10926 in shapefile format
- Project Completion Report (PCR)
- CEF in shapefile format

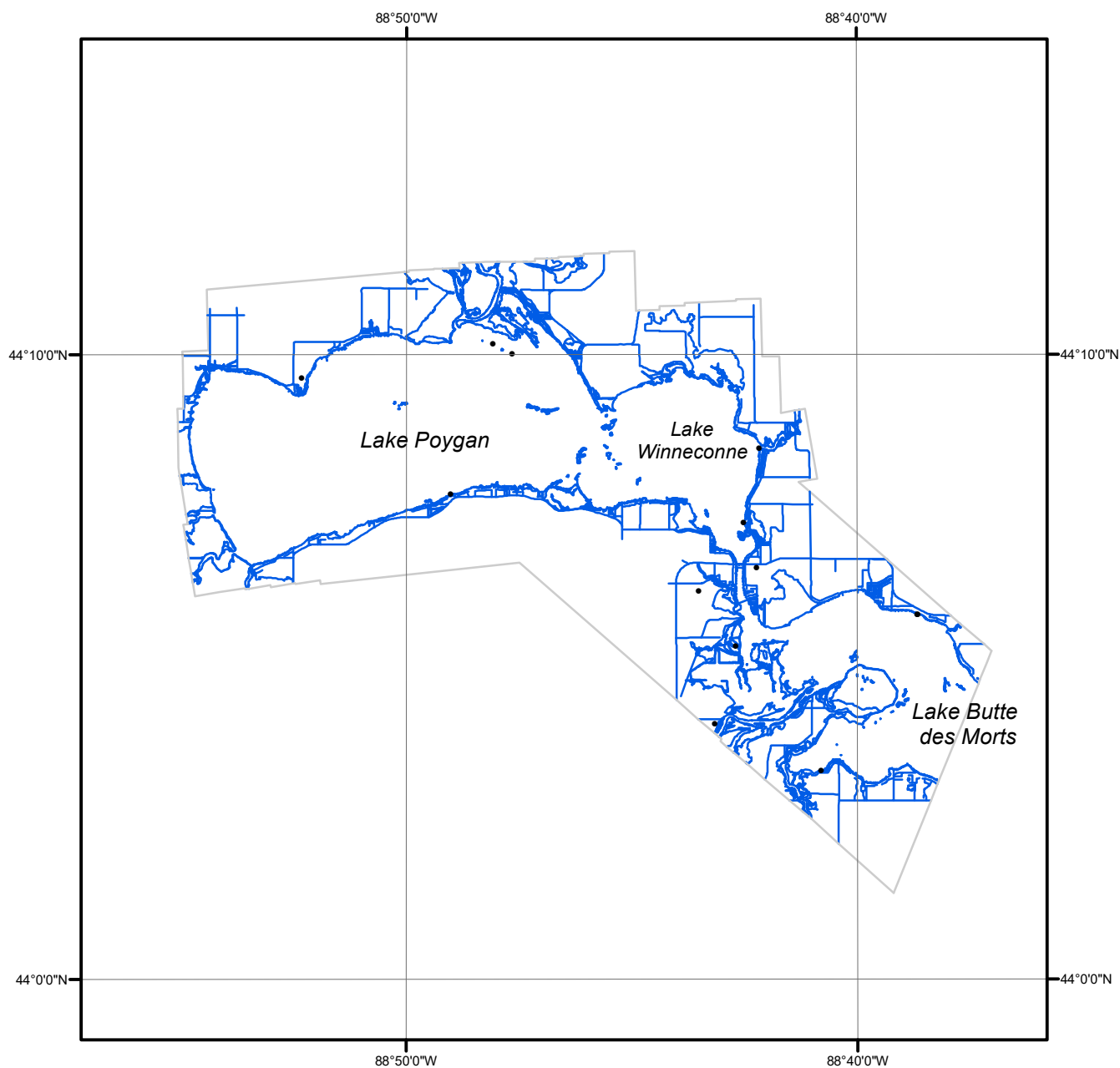
NOAA Shoreline Data Explorer

- GC10926 in shapefile format
- Metadata file for GC10926
- PCR in Adobe PDF format

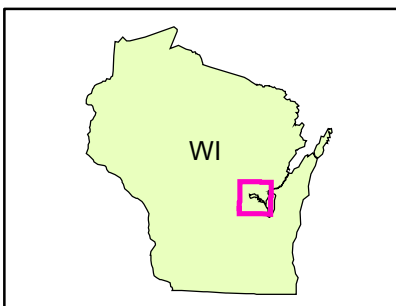
End of Report

LAKE BUTTE DES MORTS TO LAKE POYGAN

WISCONSIN



Overview



WI1001I-CM-N

GC10926