

NOAA COASTAL MAPPING PROGRAM PROJECT COMPLETION REPORT

PROJECT WI1001F-CM-N

Fox River, De Pere to Lake Butte des Morts, Wisconsin

Introduction

NOAA Coastal Mapping Program (CMP) Project WI1001F-CM-N provides a highly accurate database of new shoreline data for a portion of the Fox River, in Wisconsin, including Lake Winnebago. Project WI1001F-CM-N is a sub-project of a larger project, WI1001-CM-N, which covers the western shore of Lake Michigan from Burns International Harbor, Indiana to Little Bay De Noc, Michigan. 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 photographic mission 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 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, a subset of 23 flight lines was used for sub-project WI1001F-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 were 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 RSD Electronic Data Library.

Aerotriangulation

The aerotriangulation phase was completed by Aerometric, Inc. in February, 2012 using a softcopy photogrammetric system. Routine softcopy aerotriangulation methods were applied to establish the network of precise camera positions and other control for mapping and to provide model parameters and orientation elements required for digital compilation. The RGB and NIR images were auto-measured in two separate sub-blocks using the Zeiss Image Station Automatic Triangulation (ISAT) program. Points were measured manually in weak areas and in models with little land area (mostly water). The sub-blocks were then merged into one block and all ground-surveyed control points and check points were manually measured. A pattern of tie points was manually measured to tie the RGB and NIR images 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.

The project database consists of project parameters and options, camera calibration data, ground control parameters, adjusted exterior orientation parameters, and a positional listing of all measured points. Positional data is referenced to the North American Datum of 1983 (NAD 83).

Compilation

The data compilation phase of the project was initiated by AeroMetric, Inc. in March 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 WI1001F-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. This predicted accuracy of compiled, well defined points is calculated by doubling the circular error derived from the aerotriangulation statistics.

The following table provides information on the imagery used to complete this project:

Date	Time (UTC)	Strip	Color Imagery		Infrared Imagery		Lake Level*
			Roll	Images	Roll	Images	
9/9/2010	13:53 – 13:57	50-106	10NC18	7127 – 7153	10NR18	7987 – 8013	N/A
9/9/2010	14:02 – 14:07	50-096	10NC18	7154 – 7183	10NR18	8014 – 8043	N/A
9/9/2010	15:08 – 15:11	50-090	10NC18	7348 – 7370	10NR18	8208 – 8230	N/A
9/9/2010	15:45 – 15:46	50-102	10NC18	7452 – 7462	10NR18	8312 – 8322	N/A
9/9/2010	15:51 – 15:55	50-103	10NC18	7463 – 7489	10NR18	8323 – 8349	N/A
9/9/2010	15:57 – 16:00	50-149	10NC18	7490 – 7509	10NR18	8350 – 8369	N/A
9/9/2010	16:07 – 16:11	50-097	10NC18	7534 – 7562	10NR18	8394 – 8422	N/A
9/9/2010	16:16 – 16:19	50-098	10NC18	7563 – 7582	10NR18	8423 – 8442	N/A
9/9/2010	16:25 – 16:27	50-150	10NC18	7596 – 7613	10NR18	8456 – 8473	N/A
9/9/2010	16:29 – 16:33	50-104	10NC18	7614 – 7641	10NR18	8474 – 8501	N/A
9/10/2010	14:03 – 14:05	50-107	10NC19	7815 – 7835	10NR39	16399 – 16419	N/A
9/10/2010	14:13 – 14:17	50-109	10NC19	7836 – 7868	10NR39	16420 – 16452	N/A
9/10/2010	14:28 – 14:30	50-089	10NC19	7869 – 7881	10NR39	16453 – 16465	N/A
9/12/2010	13:53 – 13:58	50-148	10NC20	7937 – 7967	10NR19	8675 – 8705	N/A
9/12/2010	14:05 – 14:06	50-088	10NC20	7968 – 7977	10NR19	8706 – 8715	N/A
9/12/2010	14:11 – 14:14	50-087	10NC20	7978 – 8002	10NR19	8716 – 8740	N/A
9/12/2010	14:19 – 14:22	50-076	10NC20	8003 – 8024	10NR19	8741 – 8762	N/A
9/12/2010	14:35 – 14:39	50-079	10NC20	8080 – 8101	10NR19	8818 – 8839	N/A
9/22/2010	16:15 – 16:19	50-105	10NC22	10024 – 10049	10NR15	6322 – 6347	N/A
9/22/2010	16:29 – 16:31	50-091	10NC22	10050 – 10063	10NR15	6348 – 6361	N/A
9/22/2010	16:37 – 16:40	50-086	10NC22	10064 – 10083	10NR15	6362 – 6381	N/A
9/22/2010	16:44 – 16:47	50-085	10NC22	10084 – 10104	10NR15	6382 – 6402	N/A

Quality Control / Final Review

Quality control tasks were conducted during all phases of project completion by a senior member of Aerometric, Inc. The final QC review was completed in August 2012. 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:

- 14901, Lake Michigan, 16th Ed., Jun. 2016
- 14916, Lake Winnebago/Lower Fox River book chart, 11th Ed., Mar. 2016

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
- GC10923 in shapefile format
- Project Completion Report (PCR)
- CEF in shapefile format

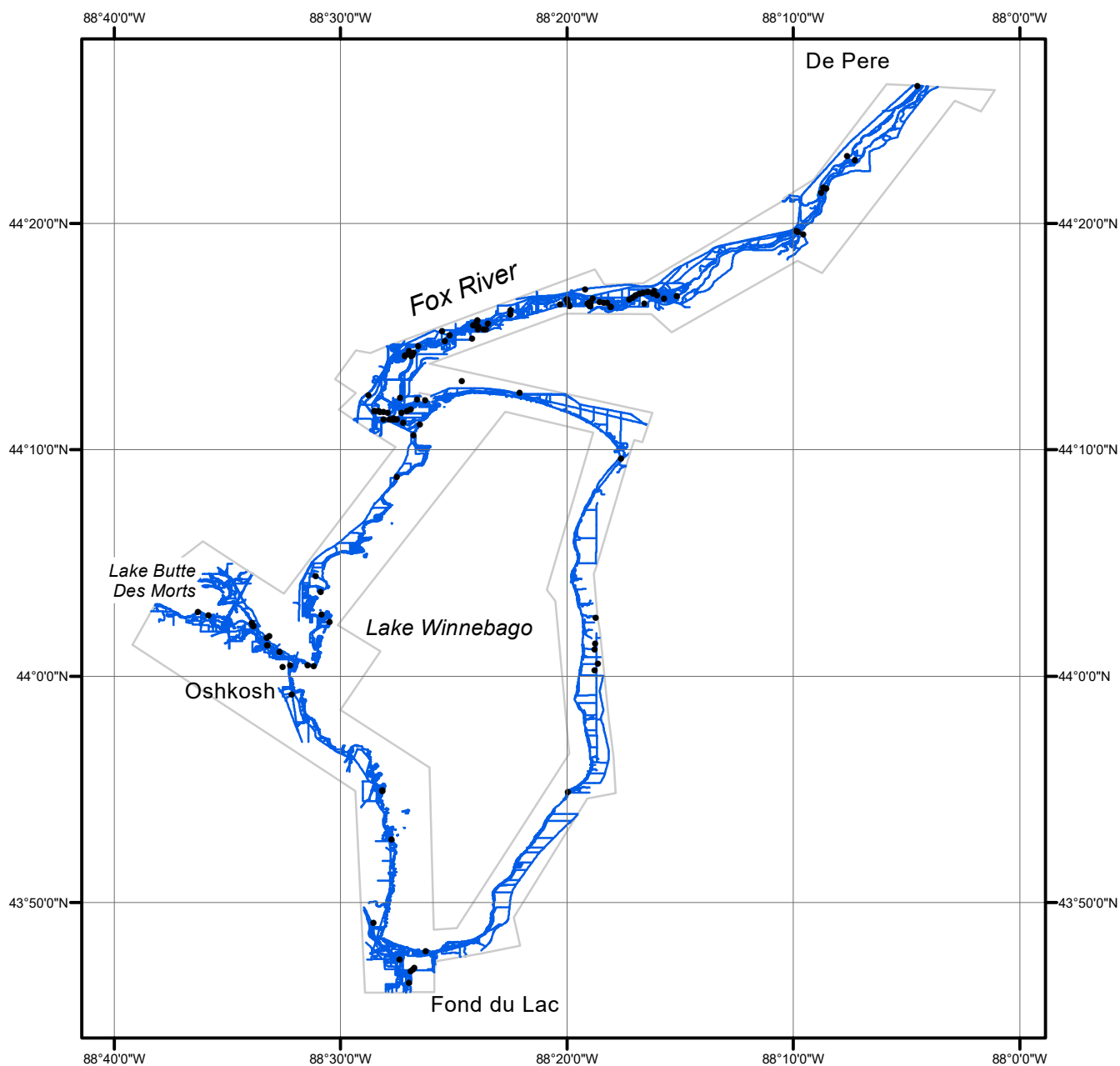
NOAA Shoreline Data Explorer

- GC10923 in shapefile format
- Metadata file for GC10923
- PCR in Adobe PDF format

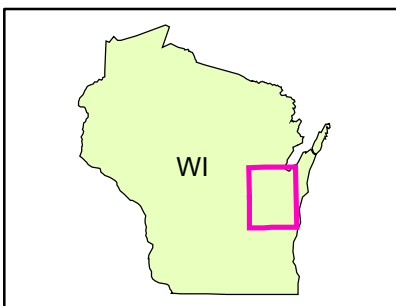
End of Report

FOX RIVER, DE PERE TO LAKE BUTTE DES MORTS

WISCONSIN



Overview



WI1001F-CM-N

GC10923