NOAA COASTAL MAPPING PROGRAM
PROJECT COMPLETION REPORT

PROJECT OH0602

Port of Lorain, Ohio

Introduction

NOAA Coastal Mapping Program (CMP) Project OH0602 provides a highly accurate database of new digital shoreline data for the port of Lorain, Ohio, including portions of the Black River within the port. 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 initial design of Project OH0602 was accomplished by the Requirements Branch (RB) of the Remote Sensing Division (RSD) in response to the need for timely updates to NOAA's Electronic Navigational Chart series. Project requirements were formulated as a result of analysis conducted within the Coast and Shoreline Change Analysis Program (CSCAP), in which NOAA nautical chart products are compared to contemporary high resolution satellite imagery in order to ascertain the need for more current shoreline data. Refer to RB analysis memorandum, "Results of CSCAP Change Analysis for Lorain Harbor, Ohio (OH0602)", for details regarding the chart comparison process.

Upon completion of the CSCAP analysis, the project was forwarded to the Applications Branch (AB) of RSD for compilation of features to address the problems within the ENC identified by the RB analyst. Digital scans of GPS-controlled metric quality aerial photographs acquired in 2000 as part of CMP project OH0001 were ordered by AB, initially solely as a means of establishing a controlled image base (CIB) to which the commercial satellite image for OH0602 could be georeferenced. More information on these photographs can be found in the OH0001C Port of Lorain, OH Aerotriangulation Report.

Once the CIB was established and all georeferencing of imagery completed, comparisons were performed between the photographs, satellite image, and ENC. The absolute positioning of ENC feature data was observed to be offset to a significant degree from the controlled imagery, to the extent that it was believed safe navigation could be threatened. Furthermore, it was determined that temporal changes between the photographs and satellite image were negligible. Therefore, the decision was made to fully recompile all charted features within the port using the original aerotriangulated photographs as the primary source of newly compiled feature data. This represented a significant departure from the original project design.

Field Operations

Routine CMP field operations did not apply for this project based on the origin of the project source data. Existing sources of horizontal control were used for the georeferencing process. See the "OH0001C Port of Lorain, OH Aerotriangulation Report" for information regarding the photographic mission operations. For information on the GPS survey operations, see the "Airborne Positioning and Orientation Report, 00BKL238, Burke Lakefront Airport".

Aerotriangulation

Aerotriangulation was accomplished utilizing a subset of the OH0001 photographs, in order to establish the aforementioned CIB. This work was completed by AB personnel in March 2007 utilizing a Digital Photogrammetric Workstation (DPW). Two strips of twelve natural color photographs were measured using BAE Systems' SOCET SET (version 5.3) photogrammetric software. Details of this phase of project completion can be found in the "OH0001C Port of Lorain, OH Aerotriangulation Report". Upon successful completion of the aerotriangulation process, the aerotriangulation software module provided the RMS of the standard deviations of the residuals for each aerotriangulated ground point which were used to compute a predicted horizontal circular error of 1.1 meters for the entire block based on a 95% confidence level (CE95). This CE value is doubled to yield a conservative predictor of the accuracy of well defined points measured during feature compilation using this imagery.

Georeferencing

One QuickBird non-orthorectified color satellite image with a spatial resolution of 61 centimeters, acquired from DigitalGlobe, Inc., was georeferenced using Erdas IMAGINE 9.0 software on a Windows platform. Ground control points (GCPs) were photogrammetrically measured from the CIB described above, then imported into IMAGINE and used to georeference the satellite imagery. Within IMAGINE the Raster Geometric Correction tool was used with a 1st order polynomial model. The imagery was resampled using the Nearest Neighbor sampling method. The RMS of the residuals for measured check points was used to compute a CE95 of 0.5 meters for the satellite image. This CE value was tripled and then added to the CE95 of the source imagery given above, in order to conservatively predict the accuracy of well-defined points measured during the compilation process. A Georeferencing Report was written and is on file with other project data within the AB Project Archive.

Compilation

The data compilation phase of OH0602 was initiated by a member of AB in March 2007. Digital feature data was primarily compiled from the OH0001 aerial photography, using a DPW in conjunction with the SOCET SET Feature Extraction software module. Additional feature data was added from the 2006 satellite image using ESRI's ArcGIS® version 9.1 desktop GIS software. Feature attributes were established using 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 cartographic features were further modified with additional descriptive information to refine general classification.

Spatial data accuracies for Project OH0602 were determined according to standard Federal Geographic Data Committee (FGDC) practices. Both the aerotriangulated photographs and the commercial satellite image were utilized for feature compilation, the former being used for the vast majority of this task. Features extracted from the photographs were compiled to meet a horizontal accuracy of 2.2 meters, while the limited feature data extracted from the georeferenced commercial satellite image were tested to have a horizontal accuracy of 2.6 meters. Both accuracies were computed at the 95% confidence level. At least twenty (20) check points were compared to an independent source of higher accuracy in order to derive a predicted accuracy of well-defined points measured in the satellite image.

The following table provides information on the imagery used in the compilation of feature data for this project:

Date	**Time (UTC)**	**Image ID(s)**		**Scale (Nominal)**	**Tide Level***
QuickBird Satellite Image		(Source ID/File Name)			
8/17/2006	16:39	06AUG17163944-S2AS-005563560010_01_P001		N/A	174.2
Aerial Photographs		(Roll Number)	(Photo Numbers)		
8/25/2000	17:23-17:24	00ACN18	3516-3521	1:30,000	174.2
8/25/2000	17:29-17:30	00ACN18	3522-3527	1:30,000	174.2

*****NOTE: Tide levels are given in meters above the IGLD and are based on actual observations recorded by the NOS gauge at Cleveland, OH.

Quality Control / Final Review

Quality control tasks were conducted during all phases of project completion by a senior member of AB. The final QC review was completed in December 2007. The review process included analysis of the aerotriangulation, georeferencing 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 9.1. The entire suite of project products was evaluated for compliance to CMP requirements.

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

14841, Lorain Harbor, OH, 1:10,000 Scale, 28th Edition
14826, Moss Point to Vermilion, OH, 1:80,000 Scale, 27th Edition

End Products and Deliverables

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

RSD Applications Branch Archive

- Hardcopy of the Airborne Positioning and Orientation Report
- Hardcopy of the Aerotriangulation Report
- Hardcopy of the Georeferencing Report
- Hardcopy of the Project Completion Report (PCR)
- Page size graphic plot of GC10655 file contents, attached to PCR
- Hardcopy of the CSCAP evaluation memorandum

Remote Sensing Division Electronic Data Library

- GC10655 in shapefile format
- Digital copy of the PCR in Adobe PDF format
- CEF in shapefile format

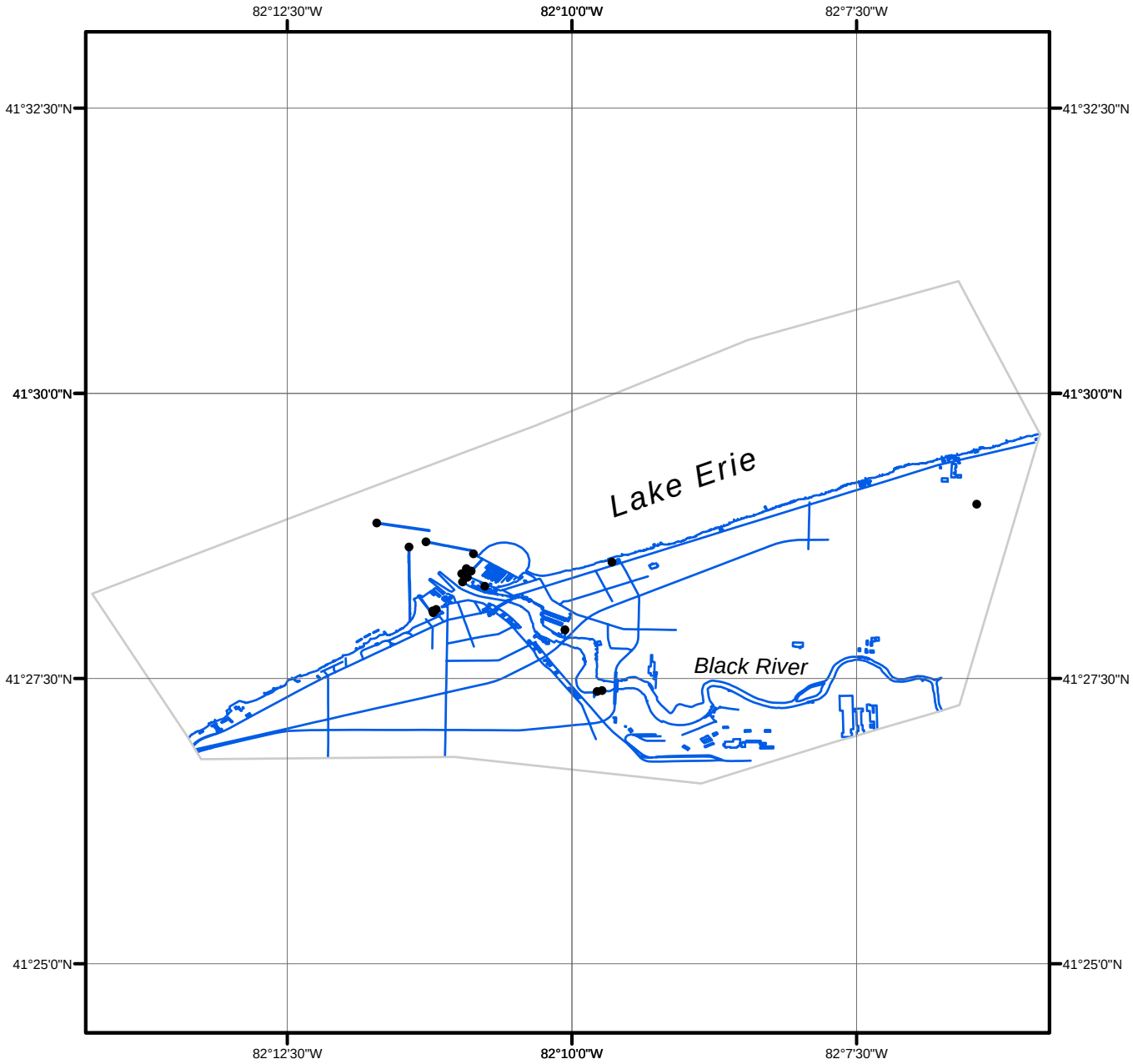
NOAA Shoreline Data Explorer

- GC10655 in shapefile format
- Metadata file for GC10655
- Digital copy of the PCR in Adobe PDF format

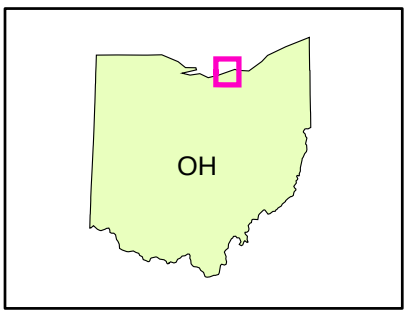
End of Report

PORT OF LORAIN

OHIO



Overview



OH0602

GC10655