

NOAA COASTAL MAPPING PROGRAM PROJECT COMPLETION REPORT

PROJECT NY0901A

Lake Champlain, Crown Point to Whitehall, New York and Vermont

Introduction

NOAA Coastal Mapping Program (CMP) Project NY0901A provides a highly accurate database of new digital shoreline data for Lake Champlain and the Hudson River in New York and Vermont. Project NY0901A is a sub-project of a larger project, NY0901, which includes shoreline mapping from Crown Point, Vermont, to Waterford, New York.

Successful completion of this project resulted in a densification of the National Spatial Reference System (NSRS), a set of controlled metric-quality aerial photographs, and digital feature data of the coastal zone which complements the Nautical Charting Program (NCP) as well as geographic information systems (GIS) for a variety of coastal zone management applications.

The project database consists of information measured and extracted from aerial photographs and metadata related to photogrammetric compilation. Base mapping was conducted in a digital environment using stereo softcopy photogrammetry and associated cartographic practices.

Project Design

The NOAA National Geodetic Survey (NGS) formulated the Project Instructions for this project following the guidelines of the “Scope of Work, Shoreline Mapping for the Coastal Mapping Program” (SOW), Version 13B, dated January 2008. The instructions discussed the project’s purpose, geographic area of coverage, scope and priority; data acquisition, processing, accuracy, and compilation requirements; product delivery and reporting instructions; and contact and communication information.

All project imagery was acquired by the Remote Sensing Division of NGS and forwarded to AeroMetric, Inc. in order to support photogrammetric processing and feature compilation. NOAA also provided shapefiles depicting the shoreline to be mapped, the boundaries of the main project and sub-project compilation areas, and flight lines and exposure centers of the imagery to be used for compilation.

Field Operations

The field operations consisted of the collection of static and kinematic GPS data and the acquisition of aerial photographs. The photographic mission operations were conducted on June 21-22, 2010 using the NOAA King Air (N68RF) aircraft. Twenty-five strips of Natural Color (NC) and Black and White Infrared (B&W IR) digital photographs were acquired through use of an Applanix DSS 439 Dual camera with a 40 mm lens at a nominal

altitude of 8,700 feet above lake level, resulting in an approximate image resolution of 0.35 meters. Although NC and B&W IR imagery were acquired simultaneously, the B&W IR imagery was not used in this project.

Airborne GPS and Inertial Measurement Unit (IMU) data were collected during the image acquisition flights. AeroMetric, Inc acquired aerial photographic control along the Lake Champlain Shoreline area in the States of New York and Vermont. The area covered Lake Champlain, the Champlain Canal, and Hudson River, in New York and Vermont, from Crown Point to Waterford, New York. In addition, eight ground points were surveyed by AeroMetric using static GPS observations. Four ground points were used as check points and four were used as control in the aerotriangulation. Geodetic Survey Monument "BBCL94" was also used for independent verification as a vertical check point.

GPS Data Reduction

Airborne GPS/IMU data was 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 were initially processed in July 2010 using Applanix POSPAC ver. 4.4.0 and were re-processed in December 2012 using POSPAC ver. 5.4.0 to achieve a tightly coupled solution. For further information refer to the Airborne Positioning and Orientation Reports (APOR) that are on file with other project data within the RSD Applications Branch (AB) Project Archive.

Aerotriangulation

The softcopy analytical aerotriangulation was done 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 measured and adjusted as one block of photos. 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. Points were measured manually in weak areas and in models with small land area within the water. Corrections for atmospheric refraction and earth curvature were enabled in the adjustment.

Upon successful completion of the aerotriangulation process, the software 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 0.77 meters based on a 95% confidence level. An Aerotriangulation Report was written and is on file with other project data within the RSD Project Archive.

Compilation

The data compilation phase of the project was initiated by AeroMetric, Inc. in December

2012. Digital feature extraction was completed in a softcopy stereo environment using DAT/EM Systems International Summit Evolution software (ver. 5.5), and Bentley Systems MicroStation (v8). Feature identification and attribution within the Geographic Cell (GC) were based on analysis of natural color project imagery, and on information extracted from the appropriate NOAA nautical charts, US Coast Guard Light List 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 NY0901A were determined according to standard Federal Geographic Data Committee (FGDC) practices. Cartographic features were compiled to meet a horizontal accuracy of 1.5 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)	Roll	Line	Photo Numbers	Water Level
06/21/2010	20:58 – 21:00	10NC34	150025	14625 – 14634	29.3
06/21/2010	21:04 – 21:05	10NC34	150024	14635 – 14645	29.3
06/21/2010	21:08 – 21:13	10NC34	150023	14646 – 14679	29.3
06/21/2010	21:18 – 21:25	10NC34	150022	14680 – 14722	29.3
06/21/2010	21:29 – 21:33	10NC34	150021	14723 – 14748	29.3
06/21/2010	21:36 – 21:43	10NC34	150019	14749 – 14793	29.3
06/21/2010	21:48 – 21:55	10NC34	150018	14794 – 14839	29.3
06/22/2010	15:07 – 15:09	10NC47	150016	19762 – 19774	29.2
06/22/2010	15:17 – 15:18	10NC47	150017	19796 – 19806	29.2
06/22/2010	15:23 – 15:24	10NC47	150020	19807 – 19814	29.2

* Lake water levels are given in NGVD88 meters and are based on verified observations at the U.S. Coast Guard navigation structure No. 26 on Lake Champlain.

Quality Control / Final Review

Quality control tasks were conducted during all phases of project completion. The final QC review was completed in January 2014. 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 MicroStation software. All project data 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 charts were used in the comparison process:

- 14786, New York State Canal System, 1:20,000, 14th Ed., Oct/08
- 14784, Barber Point to Whitehall, 1:40,000, 20th Ed., Jul/04

End Products and Deliverables

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

RSD Applications Branch Archive

- Hardcopy of the NY0901 Data Acquisition Summary
- Hardcopy of the Airborne Positioning and Orientation Report (APOR)
- Hardcopy of the Aerotriangulation Report
- Hardcopy of the Project Completion Report (PCR)
- Page-size graphic plot of GC10957 file contents, attached to PCR

Remote Sensing Division Electronic Data Library

- Project database
- GC10957 in shapefile format
- Digital copy of the PCR in Adobe PDF format
- CEF in shapefile format

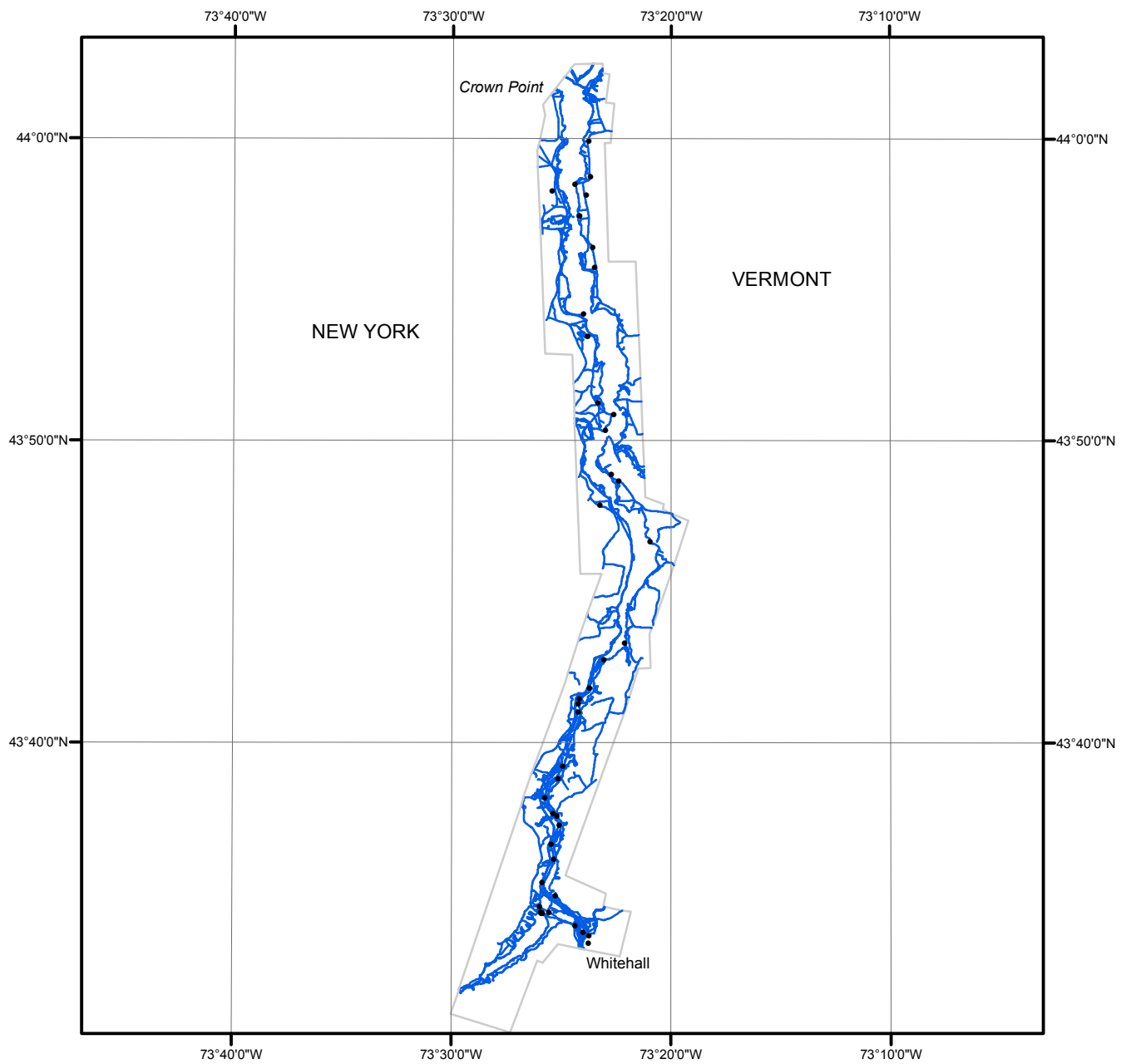
NOAA Shoreline Data Explorer

- GC10957 in shapefile format
- Metadata file for GC10957
- Digital copy of the PCR in Adobe PDF format

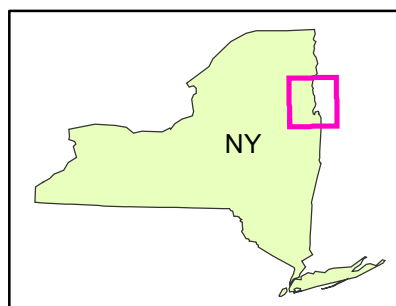
End of Report

LAKE CHAMPLAIN, CROWN POINT TO WHITEHALL

NEW YORK AND VERMONT



Overview



NY0901A

GC10957