

NOAA COASTAL MAPPING PROGRAM PROJECT COMPLETION REPORT

PROJECT CT0401D

Housatonic River, Connecticut

Introduction

NOAA Coastal Mapping Program (CMP) Project CT0401D provides a highly accurate database covering the Housatonic River, from Fowler Island to Lake Zoar as well as a portion of the Far Mill River and Naugatuck River. Project CT0401D is a sub-project of a larger project CT0401, which includes the entire coast of Connecticut, and parts of New York and Long Island Sound.

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 Requirements Branch (RB) of the Remote Sensing Division (RSD) formulated the CT0401 project instructions for this project. The instructions discussed the project's purpose, geographic area of coverage, scope and priority; photographic requirements; flight line priority; GPS data collection procedures and guidelines for both kinematic and static surveys; data recording and handling instructions; and contact and communication information. RB created a Project Layout Diagram and created flight maps. NOVA Digital Systems, Inc. and Sanborn Inc., a contractor for NOVA Digital Systems Inc., created the input files for the aircraft's flight management system and provided copies of the descriptions of potential geodetic control stations at the bases of operation.

Field Operations

The field operations consisted of the collection of static and kinematic GPS data and the acquisition of aerial photographs. The first photographic mission operation was conducted from September 5 to September 7, 2005 with Sanborn Inc.'s Piper PA31 Navajo aircraft. Sixteen strips of natural color photographs and sixteen strips of black and white infrared photographs were acquired through use of a Leica RC-30 aerial camera at a nominal scale of 1:30,000. The collection of MHW B&W Infrared photographs from this mission was coordinated with the MHW tide level, based on

predicted tides at the Bridgeport, CT gauge (#8467150).

The second photographic mission was conducted from May 22 to August 12, 2006 with Sanborn Inc.'s Cessna 206 aircraft. Eight strips of black and white infrared photographs were acquired through the use of a Leica RC-30 aerial camera at a nominal scale of 1:30,000. The collection of MLLW B&W Infrared photographs from this mission was coordinated with the MLLW tide level, based on predicted tides at the Bridgeport, CT gauge (#8467150).

A base station was established at the Groton Municipal Airport using static GPS. Airborne kinematic GPS data was collected to determine precise camera positions in order to establish a control network necessary for aerotriangulation. GPS data collection operations were conducted by NOVA and Sanborn in accordance with the NGS Shoreline Mapping Statement of Work (SOW v. 12). Photo-identifiable ground control was collected to supplement the airborne kinematic GPS.

GPS Data Reduction

Global Positioning System (GPS) data was collected and processed to provide precise positions of camera centers for application as photogrammetric control in the aerotriangulation phase of project completion. The airborne kinematic data was processed using NovAtel's GrafNav (v.7.50) software. For further information, please refer to the Airborne GPS Report and Ground Control Report on file with other project data within the RSD Applications Branch (AB) Project Archive.

Aerotriangulation

The aerotriangulation phase was initiated by NOVA Digital Systems Inc. and completed in February 2007. All photographs of the project were bridged using a softcopy stereo photogrammetric system to establish the network of control required for the compilation phase. The photogrammetric measurements were made using the aerotriangulation module within Z/I Imaging software version 2.0.2.16 and processed using the software AeroSys-AT version 7.2, both in a Windows XP environment. After the final analytical adjustment was performed, the RMS of the standard deviations for each triangulated ground point was computed using the AeroSys-AT Software. These values were then used to compute a predicted Horizontal Circular Error (R) based upon a 95% confidence level with the following results (all values are in meters):

Sub-Block	RMS (x)	RMS (y)	R
NATURAL COLOR Photographs	0.234	0.260	0.6
MHW B+W IR Photographs	0.341	0.380	0.9
MLLW B+W IR Photographs	0.317	0.359	0.8

An Aerotriangulation Report was written and is on file with other project data within the RSD Project Archive.

The project database consists of project parameters and options, camera calibration data, interior orientation parameters, ground control parameters, adjusted exterior orientation parameters, and 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 this subproject was initiated by RSD in April 2010. Digital mapping was performed using a DPW in conjunction with the SOCET SET Feature Extraction software module. Feature identification and attribution within the Geographic Cell (GC) were based on image analysis of 1:30,000 scale photographs and 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. The MHW IR imagery was not used in the compilation phase.

Spatial data accuracies for Project CT0401D were determined according to standard Federal Geographic Data Committee (FGDC) practices. For the color negative photographs, cartographic features were compiled to meet a horizontal accuracy of 1.2 meters at the 95% confidence level, for the MLLW B&W IR photographs features were compiled to meet a horizontal accuracy of 1.6 meters at the 95% confidence level. The predicted accuracy of compiled, well defined points is derived by doubling the circular error derived from aerotriangulation statistics.

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

Date	Time (UTC)	Roll Number	Photo Numbers	Scale (nominal)	Tide Level*
9-06-05	16:48-16:51	0526CN02	0304-0308	1:30,000	1.9 m
9-06-05	16:51-16:57	0526CN02	0309-0316	1:30,000	Non-tidal
9-06-05	17:41-17:42	0526CN03	0367-0369	1:30,000	2.2 m
6-18-06	16:03-16:04	0626R02	0240-0242	1:30,000	Non-tidal
6-18-06	16:05-16:07	0626R02	0243-0247	1:30,000	0.1 m
6-18-06	16:13-16:16	0626R02	0251-0255	1:30,000	Non-tidal
8-12-06	13:00-13:02	0626R03	0310-0312	1:30,000	-0.2 m

NOTE: Tide levels are given in meters above MLLW and are based on actual observations at the Bridgeport station, with corrections applied to CO-OPS tide zones LIS27 and LIS28 in the south part of the project area, and to the Long Hill and Shelton tidal sub-stations in the north. The elevation of the MHW datum varies from 2.1 meters in the south, to 2.2 meters up to the Lake Housatonic Dam on the Housatonic River. The Naugatuck River is only tidal within about a mile up from its confluence with the Housatonic.

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 July 2010. 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 9.3 software. All project data was evaluated for compliance to CMP requirements.

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

- 12354, Long Island Sound-Eastern Part, CT-NY, 1:80,000 scale, 42nd Ed.
- 12370, North Shore of Long Island Sound, CT, 1:20,000 scale, 20th Ed.

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 Airborne GPS Report
- Hardcopy of the Aerotriangulation Report
- Hardcopy of the Project Completion Report (PCR)
- Page-size graphic plot of GC10808 file contents, attached to PCR

Remote Sensing Division Electronic Data Library

- Project database
- GC10808 in shapefile format
- Digital copy of the PCR in Adobe PDF format
- CEF in shapefile format

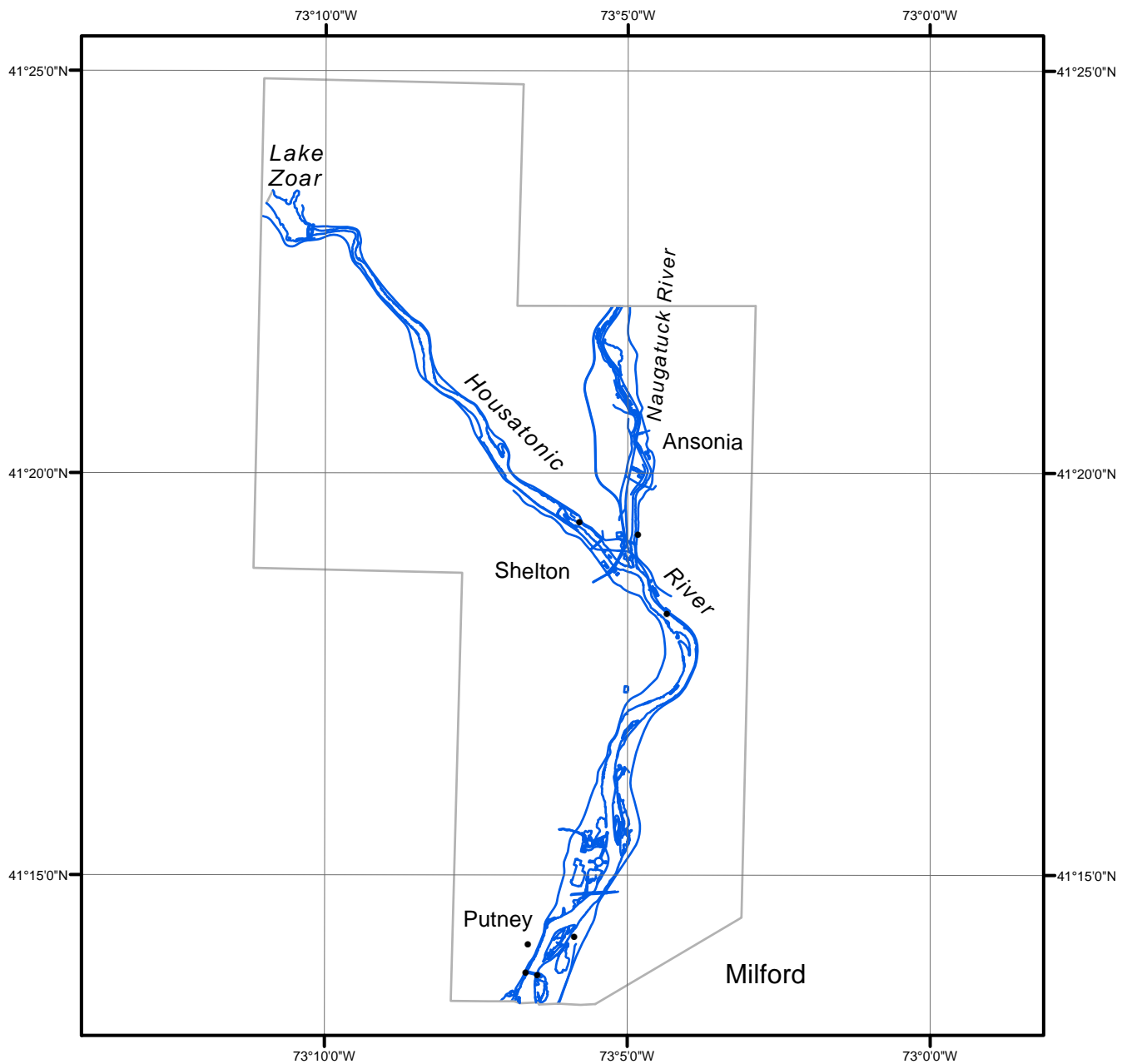
NOAA Shoreline Data Explorer

- GC10808 in shapefile format
- Metadata file for GC10808
- Digital copy of the PCR in Adobe PDF format

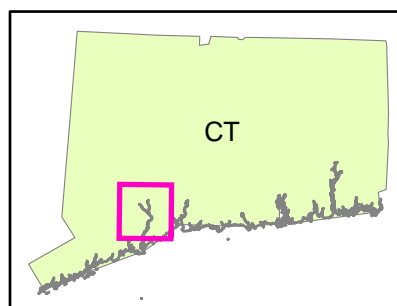
End of Report

HOUSATONIC RIVER

CONNECTICUT



Overview



CT0401D

GC10808