NOAA COASTAL MAPPING PROGRAM
PROJECT COMPLETION REPORT

PROJECT CT0801A

Block Island, Rhode Island

Introduction

NOAA Coastal Mapping Program (CMP) Project CT0801A provides a highly accurate database of new digital shoreline data for Block Island, in the state of Rhode Island. Block Island is located approximately 13 miles south of the mainland, at 40° 10' N latitude and 71° 35' W longitude. Project CT0801A is part of a larger acquisition project, CT0801, which also includes several rocks and islands off the Connecticut coast.

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 photographic mission instructions for this project following the guidelines of the Photo Mission Standard Operating Procedure Version II (7/1/93). The instructions discussed the project's purpose, geographic area of coverage, scope and priority; photographic requirements; flight line priority; Global Positioning System (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, flight maps and input files for the aircraft's flight management system.

Field Operations

The field operations consisted of acquiring digital aerial imagery, static and kinematic Global Positioning System (GPS) data, and Inertial Measurement Unit (IMU) data. The airborne photogrammetric survey mission operations were conducted on May 11 and May 23, 2008 with the NOAA Cessna Citation II aircraft (N52RF) utilizing the Applanix Digital Sensor System (DSS-439 DualCam). A total of twelve strips of natural color and of black and white infrared (B&W IR) imagery were acquired in tandem tide-coordinated imagery at a nominal scale of 1:50,000 (0.34 meters GSD).

A base station was established at the Quonset State Airport, Quonset, Rhode Island 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 in accordance with the GPS Controlled Photogrammetry Field Operations Manual (10/25/99).

GPS Data Reduction

Global Positioning System (GPS) data was collected and processed in conjunction with Inertial Measurement Unit (IMU) data 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 POSPAC 5.3.0 GPS/IMU processing software on February, 25, 2011. An Airborne Positioning and Orientation Report (APOR) contains further information on this phase of project execution and is on file with other project data within the RSD Applications Branch (AB) Project Archive.

Aerotriangulation

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. This work was initiated by RSD personnel in May 2011 utilizing a Digital Photogrammetric Workstation (DPW) which is a configuration of computer hardware, modular software components and other associated peripheral devices. The three strips of color and B&W IR images over Block Island were adjusted as one block. Image measurements and block adjustments were performed using BAE Systems' SOCET SET (version 5.5) photogrammetric software. AT procedures were accomplished using the Multi-Sensor Triangulation (MST) module of SOCET SET. The Automatic Point Measurement (APM) algorithm, within MST, was used to collect tie points, and a simultaneous solve adjustment was then performed. The predicted horizontal circular error, using all measured image points, was computed to be 0.6 meters at the 95% confidence level (CE95). 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, 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 project was initiated by RSD in August 2011. 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 the project 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.

Spatial data accuracies for Project CT0801A were determined according to standard Federal Geographic Data Committee (FGDC) practices. Cartographic features were compiled to meet a horizontal accuracy of 1.2 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 the imagery used in the project completion:

Date	Time (UTC)	Roll Number	Photo Numbers	GSD (Nominal)	Tide Level*
5-11-08	14:59-15:00	08NC18	3470-3484	0.34	0.7
5-11-08	15:05-15:06	08NC18	3485-3492	0.34	0.8
5-11-08	15:10-15:12	08NC18	3493-3505	0.34	0.8
5-11-08	14:59-15:00	08NR34	15185-15199	0.34	0.7
5-11-08	15:05-15:06	08NR34	15200-15207	0.34	0.8
5-11-08	15:10-15:12	08NR34	15208-15221	0.34	0.8

* Tide levels are given in meters above MLLW and are based on actual observations at the Newport, RI station, with corrections applied to two substations, Block Island (Old Harbor) and Southwest Point Block Island. The elevation of MHW at Southwest Point is 0.8 meters above MLLW, and the elevation of MHW at Old Harbor is 0.9 meters.

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 January 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 9.3 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 chart was used in the comparison process:

13217, Block Island, RI, 1:15,000 scale, 16th edition

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 Positioning and Orientation Report (APOR)
- Hardcopy of the Aerotriangulation Report
- Hardcopy of the Accuracy Assessment

- Hardcopy of the Project Completion Report (PCR)
- Page-size graphic plot of GC10920 file contents, attached to PCR

Remote Sensing Division Electronic Data Library

- Project database
- GC10920 in shapefile format
- Digital copy of the PCR in Adobe PDF format
- Chart Evaluation File in shapefile format

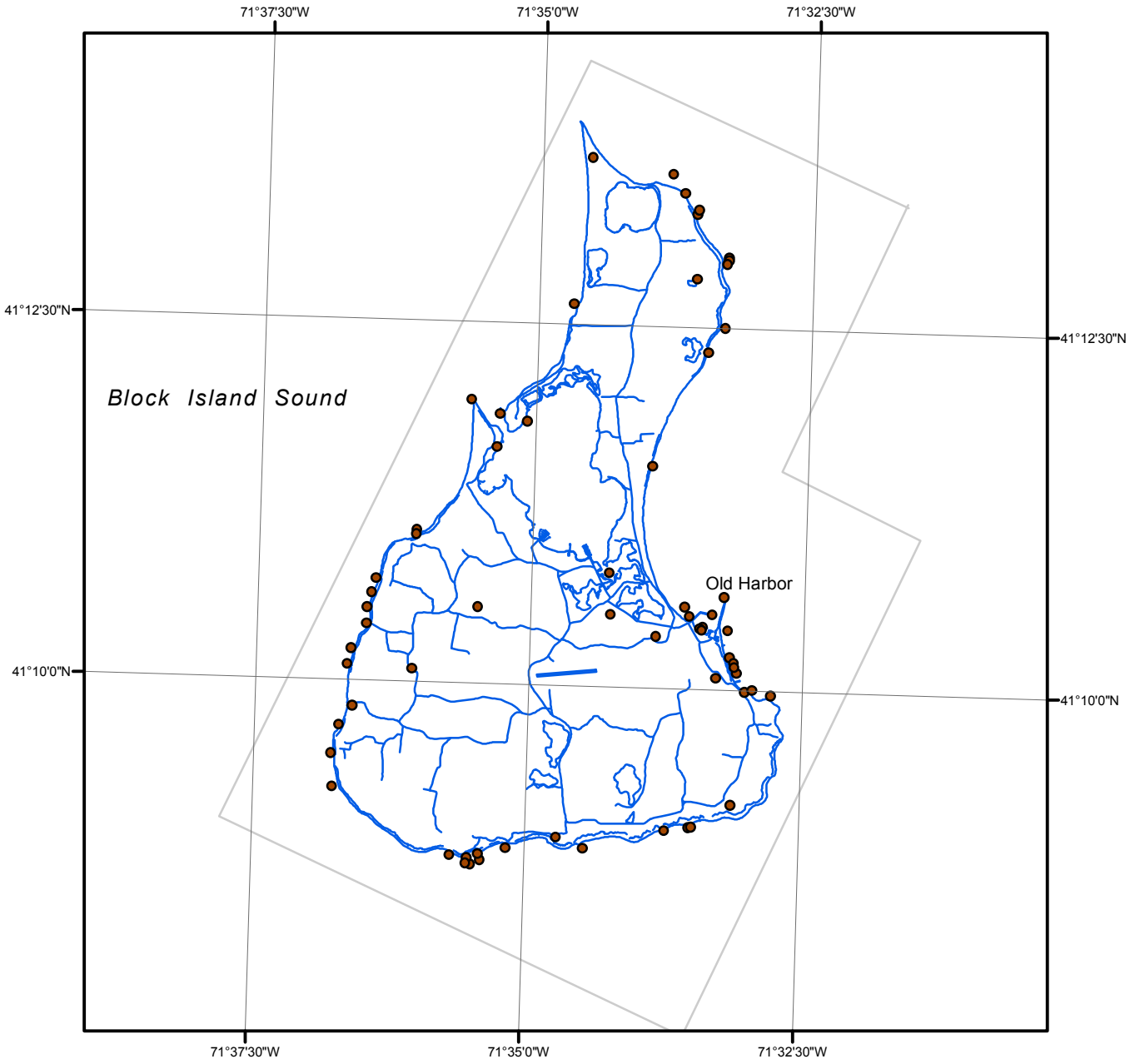
NOAA Shoreline Data Explorer

- GC10920 in shapefile format
- Metadata file for GC10920
- Digital copy of the PCR in Adobe PDF format

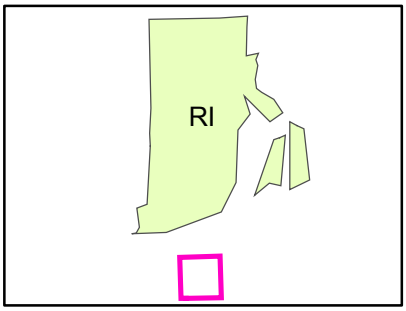
End of Report

BLOCK ISLAND

RHODE ISLAND



Overview



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GC10920