

NOAA COASTAL MAPPING PROGRAM PROJECT COMPLETION REPORT

PROJECT MA1101A

Nauset Harbor, Massachusetts

Introduction

NOAA Coastal Mapping Program (CMP) Project MA1101A provides a highly accurate database of new digital shoreline data for Nauset Harbor and the immediate vicinity, in the state of Massachusetts. Project MA1101A is a subproject of a larger project, MA1101, which covers Cape Cod and Cape Cod Bay. 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

Project MA1101A was designed in response to a request for shoreline data from the Marine Chart Division (MCD) of NOAA's Office of Coast Survey. The Requirements Branch (RB) of the Remote Sensing Division (RSD) formulated the photographic mission instructions for MA1101 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) 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 data and Inertial Measurement Unit (IMU) data, and the acquisition of digital aerial imagery. Aerial survey operations for Project MA1101 were conducted on dates ranging from June 2011 through October 2014 with the NOAA Hawker Beechcraft King Air B300CER aircraft (N68RF). Project imagery used for subproject MA1101A included portions of four flight lines, including natural color and near-infrared (NIR) imagery acquired concurrently using an Applanix DSS-439 dual head digital camera system (two 60 mm lenses). All imagery was acquired at a nominal altitude of 10,000 feet, resulting in an approximate ground sample distance (GSD) of 0.35 meters. All project imagery was acquired in coordination with local tides.

Direct Georeferencing Data Processing

GPS/IMU data were processed by RSD personnel to yield precise camera positions and orientations for direct georeferencing (DG) of the imagery. 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.

Airborne kinematic data for subproject MA1101A was processed using Applanix POSPAC (ver. 5.3) software in June 2011 and Applanix POSPAC (ver. 6.1.0) software in August 2012. For further information refer to the Airborne Positioning and Orientation Reports (APOR) on file with other project data within the RSD Applications Branch (AB) Project Archive.

The processed GPS/IMU data were used to derive precise exterior orientation (EO) values of the camera centers required for digital feature extraction. The predicted horizontal accuracy of the imagery was calculated by the EO TPU Tool (ver. 2.1). Using this tool, the predicted horizontal uncertainty at the 95% confidence level was calculated to be 1.4 meters.

Compilation

The data compilation phase of this project was accomplished by RSD AB personnel in November 2014. Digital mapping was performed using the Feature Extraction software module within SOCET SET (ver. 5.6). Feature identification and attribution within the GC were based on image analysis of the aerial imagery and information extracted from the largest scale 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 MA1101A were determined according to standard Federal Geographic Data Committee (FGDC) practices. Cartographic features were compiled to meet a horizontal accuracy of 2.8 meters. This predicted accuracy of well-defined points measured during the compilation phase was derived by doubling the imagery accuracy computed from the EO-TPU tool.

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

Date	Time (UTC)	Roll #	Strip / Photo #s	Tide Level*
6/16/2011	18:35 – 18:36	11NR21	50-015 / 4763 – 4765	2.0 m
6/16/2011	18:35 – 18:36	11NC39	50-015 / 07794 – 07796	2.0 m
7/21/2012	17:02 – 17:03	12NR34	50-037 / 7876 – 7883	1.9 m
7/21/2012	17:02 – 17:03	12NC48	50-037 / 12439 – 12446	1.9 m
7/21/2012	17:08 – 17:10	12NR34	50-038 / 7884 – 7894	2.0 m
7/21/2012	17:08 – 17:10	12NC48	50-038 / 12447 – 12457	2.0 m
7/21/2012	17:16 – 17:17	12NR34	50-039 / 7906 – 7914	2.0 m
7/21/2012	17:16 – 17:17	12NC48	50-039 / 12469 – 12477	2.0 m
7/22/2012	12:28 – 12:30	12NR35	50-038 / 8217 – 8227	0.0 m
7/22/2012	12:28 – 12:30	12NC49	50-038 / 12780 – 12790	0.0 m
7/22/2012	12:34 – 12:35	12NR35	50-037 / 8228 – 8236	0.0 m
7/22/2012	12:34 – 12:35	12NC49	50-037 / 12791 – 12798	0.0 m

7/22/2012	13:22 – 13:23	12NR35	50-039 / 8392 – 8401	0.1 m
7/22/2012	13:22 – 13:23	12NC49	50-039 / 12955 – 12964	0.1 m
7/22/2012	13:28 – 13:29	12NR35	50-015 / 8402 – 8404	0.1 m
7/22/2012	13:28 – 13:29	12NC49	50-015 / 12965 – 12968	0.1 m

* Tide levels are given in meters above MLLW and were calculated using the Pydro software tool with a TCARI grid referenced to verified water level observations at the time of photography from various NOS gauges in the vicinity of the project. The elevation of the MHW tidal datum in the project area varies between 2.0 – 2.1 meters above MLLW.

Quality Control / Final Review

Quality control tasks were conducted during all phases of project completion by a member of the Applications Branch. The final QC review was completed in December 2014. The review process included analysis of the DG 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 10.2.2 software. All project data was evaluated for compliance to CMP requirements.

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

- 13246, Cape Cod Bay, MA, 1:80,000, 40th Ed., Oct./13
- 13250, Wellfleet Harbor, MA, 1:40,000, 9th Ed., Dec./10

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 MA1101 Data Acquisition Summary
- Hardcopy of the Airborne Positioning and Orientation Report (APOR)
- Hardcopy of the Project Completion Report (PCR)
- Page-size graphic plot of GC11111 file contents, attached to PCR

Remote Sensing Division Electronic Data Library

- Project database
- GC11111 in shapefile format
- Digital copy of the PCR in Adobe PDF format
- CEF in shapefile format

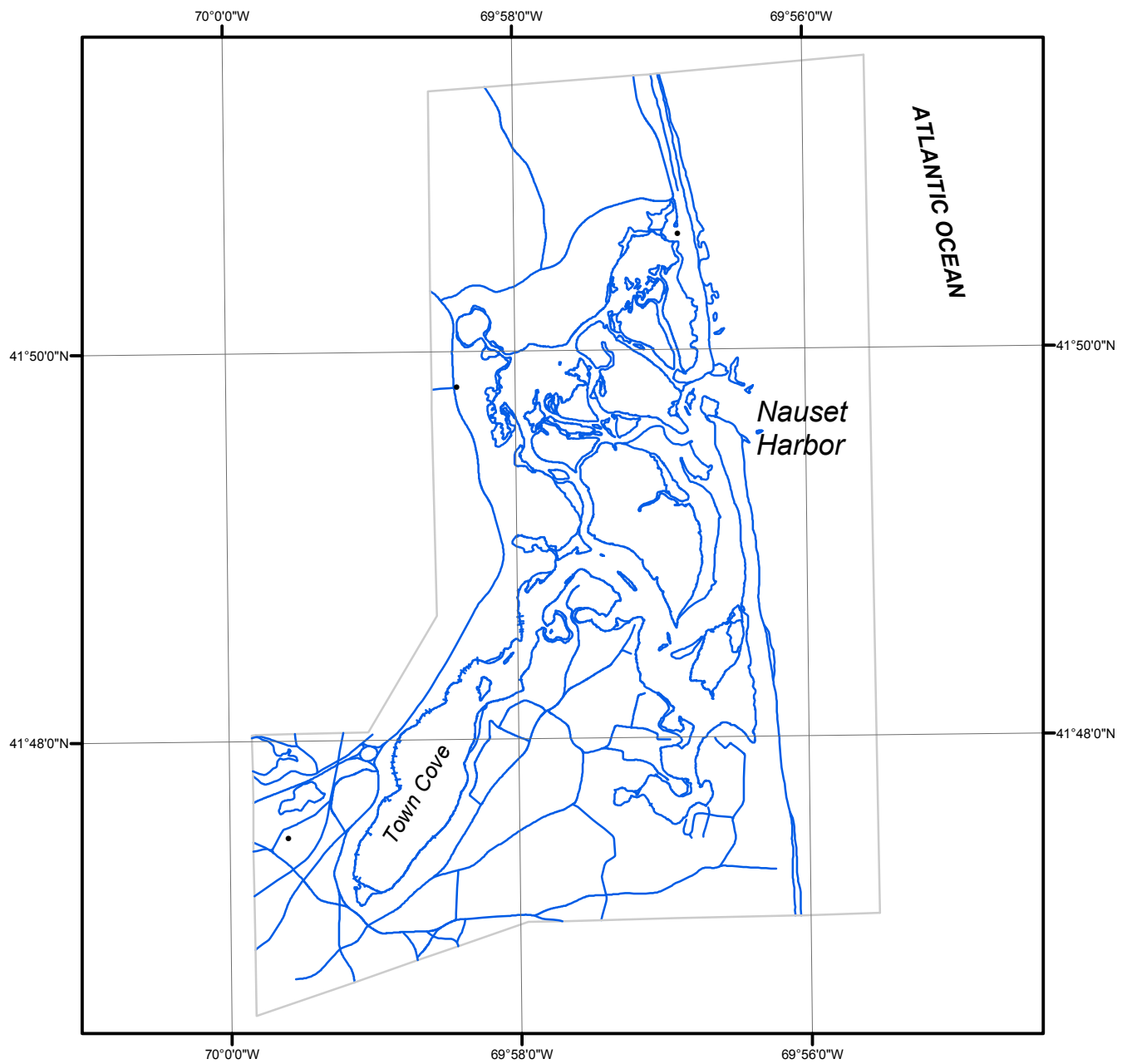
NOAA Shoreline Data Explorer

- GC11111 in shapefile format
- Metadata file for GC11111
- Digital copy of the PCR in Adobe PDF format

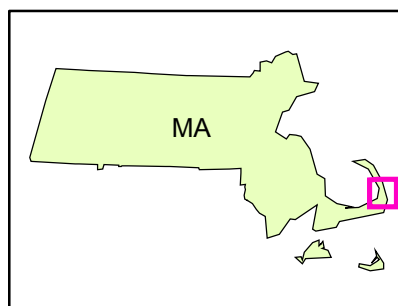
End of Report

NAUSET HARBOR

MASSACHUSETTS



Overview



MA1101A

GC11111