

NOAA COASTAL MAPPING PROGRAM PROJECT COMPLETION REPORT

PROJECT MA0901A-CM-N

Northern Buzzards Bay, Massachusetts

Introduction

NOAA Coastal Mapping Program (CMP) Project MA0901A-CM-N provides a highly accurate database of new digital shoreline data for a portion of the coastline along the Northern Buzzard Bay area beginning with Westport Harbor near the Massachusetts and Rhode Island border and extending northeast to Wareham River. The project area also includes Smith Neck, New Bedford Harbor, Nasketucket Bay, Mattapoissett Harbor, Sippican Harbor, and the Weweantic River. Project MA0901A-CM-N is a subproject of a larger project, MA0901-CM-N, which covers Buzzards Bay in its entirety, extending from Westport River to Waquoit Bay, Massachusetts. 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 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 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 were conducted using the NOAA King Air (N68RF) aircraft in August 2009, and the NOAA Citation II (N52RF) aircraft in October 2009. Nine lines of natural color and near infrared (NIR) imagery were acquired in tandem at the Mean High Water (MHW) tide stage using an Applanix DSS-439 dual camera system. In addition, six lines of color and NIR imagery were acquired near the Mean Lower Low Water (MLLW) tide stage. All imagery was collected at a nominal altitude of 10,000 feet resulting in an approximate ground sample distance (GSD) of 0.35 meters.

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. The airborne kinematic data was processed using Applanix POSPAC (v. 5.3.0) software in May 2011, then most of the data was reprocessed using POSPAC (v. 6.1.0) in September 2013 to achieve a tightly coupled solution. 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 determined by propagating sensor EO and image measurement uncertainties through the photogrammetric collinearity equations using an Excel spreadsheet based Exterior Orientation Total Propagated Uncertainty (EO-TPU) tool developed by NGS. Using this tool the predicted horizontal uncertainty at the 95% confidence level was calculated to be 1.5 meters for both the color and NIR images. In addition, a full aerotriangulation (AT) was performed for the New Bedford Harbor area. From the New Bedford Harbor AT results, the 95% confidence circle was calculated as 0.8 meters. This was derived by using the root mean square (RMS) of all the standard deviations of the measured adjusted ground points. Refer to the MA0901 AT Report on file in the AB Project Archive for further details.

Several third order geodetic control points were used to verify the horizontal integrity of the DG and AT results. All stereo models were examined and found to have acceptable levels of parallax for mapping purposes.

Compilation

The data compilation phase of this project was accomplished by RSD AB personnel in March 2015. 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 MA0901A-CM-N were determined according to standard Federal Geographic Data Committee (FGDC) practices. Most cartographic features were compiled to meet a horizontal accuracy of 3.0 meters with the exception of the New Bedford Harbor area which was compiled to meet a horizontal accuracy of 1.6 meters. These predicted accuracies of well-defined points measured during the compilation phase were derived by doubling the imagery accuracy computed from the EO-TPU tool and from the New Bedford AT results.

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

Date	Time (UTC)	Roll #	Photo #s	~ GSD	Tide Level*
08/10/2009	14:21 – 14:34	09NC05	1169 – 1210	0.35 m	1.1
08/10/2009	16:09 – 16:16	09NC05	1407 – 1463	0.35 m	1.2 – 1.3
08/10/2009	14:21 – 14:34	09NR04	1055 – 1095	0.35 m	1.1
08/10/2009	14:52 – 14:53	09NR04	1136 – 1140	0.35 m	1.2
08/10/2009	15:09 – 15:09	09NR04	1163 – 1167	0.35 m	1.2
08/10/2009	16:09 – 16:10	09NR04	1299 – 1303	0.35 m	1.2
08/14/2009	18:19 – 18:27	09NC06	1473 – 1530	0.35 m	1.0 – 1.3
08/14/2009	19:44 – 19:47	09NC06	1658 – 1678	0.35 m	1.2
08/14/2009	18:08 – 18:09	09NR05	1350 – 1351	0.35 m	1.1
08/14/2009	18:19 – 18:27	09NR05	1360 – 1408	0.35 m	1.0 – 1.3
10/12/2009	18:37 – 18:38	09NR07	1677 – 1683	0.35 m	1.2
10/12/2009	18:44 – 19:00	09NR07	1726 – 1751	0.35 m	1.0
10/12/2009	19:06 – 19:28	09NR08	1813 – 1877	0.35 m	1.0 – 1.2
10/12/2009	19:38 – 19:47	09NR08	1899 – 1954	0.35 m	1.2 – 1.0
10/14/2009	14:36 – 14:38	09NC09	2102 – 2120	0.35 m	0.2
10/14/2009	14:51 – 15:01	09NC09	2146 – 2187	0.35 m	0.2
10/14/2009	15:59 – 16:05	09NC09	2298 – 2343	0.35 m	0.2
10/14/2009	16:24 – 16:31	09NC09	2391 – 2436	0.35 m	0.2
10/21/2009	15:19 – 15:26	09NC16	4710 – 4766	0.35 m	1.2 – 1.4
10/21/2009	15:34 – 15:42	09NC16	4793 – 4850	0.35 m	1.4 – 1.1
10/21/2009	15:46 – 16:08	09NC16	4851 – 4980	0.35 m	1.1 – 1.2
10/21/2009	15:19 – 15:25	09NR17	4554 – 4602	0.35 m	1.2 – 1.4
10/21/2009	15:35 – 15:42	09NR17	4639 – 4693	0.35 m	1.4 – 1.1
10/21/2009	15:46 – 15:48	09NR17	4695 – 4709	0.35 m	1.1
10/21/2009	15:54 – 16:01	09NR17	4752 – 4773	0.35 m	1.3 – 1.2
10/21/2009	16:03 – 16:08	09NR17	4790 – 4824	0.35 m	1.1 – 1.0

*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 NOS tide stations in the vicinity. The elevation of the MHW tidal datum in the project area varies between 1.0 – 1.3 m. above MLLW.

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 May 2015. 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:

- 13228, Westport River and Approaches, 1:20,000, 12th Ed., Nov. 2009
- 13229, Inset, New Bedford, 1:20,000, 32nd Ed., Jun. 2013
- 13232, New Bedford Harbor and Approaches, 1:20,000, 5th Ed., Nov. 2009
- 13236, Cape Cod Canal and Approaches, 1:20,000, 31st Ed., Apr. 2012

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 project Data Acquisition Summary
- Hardcopy of the Airborne Positioning and Orientation Reports (APOR)
- Hardcopy of the Aerotriangulation Report
- Hardcopy of the Project Completion Report (PCR)
- Page-size graphic plot of GC11102 file contents, attached to PCR

Remote Sensing Division Electronic Data Library

- Project database
- GC11102 in shapefile format
- Digital copy of the PCR in Adobe PDF format
- CEF in shapefile format

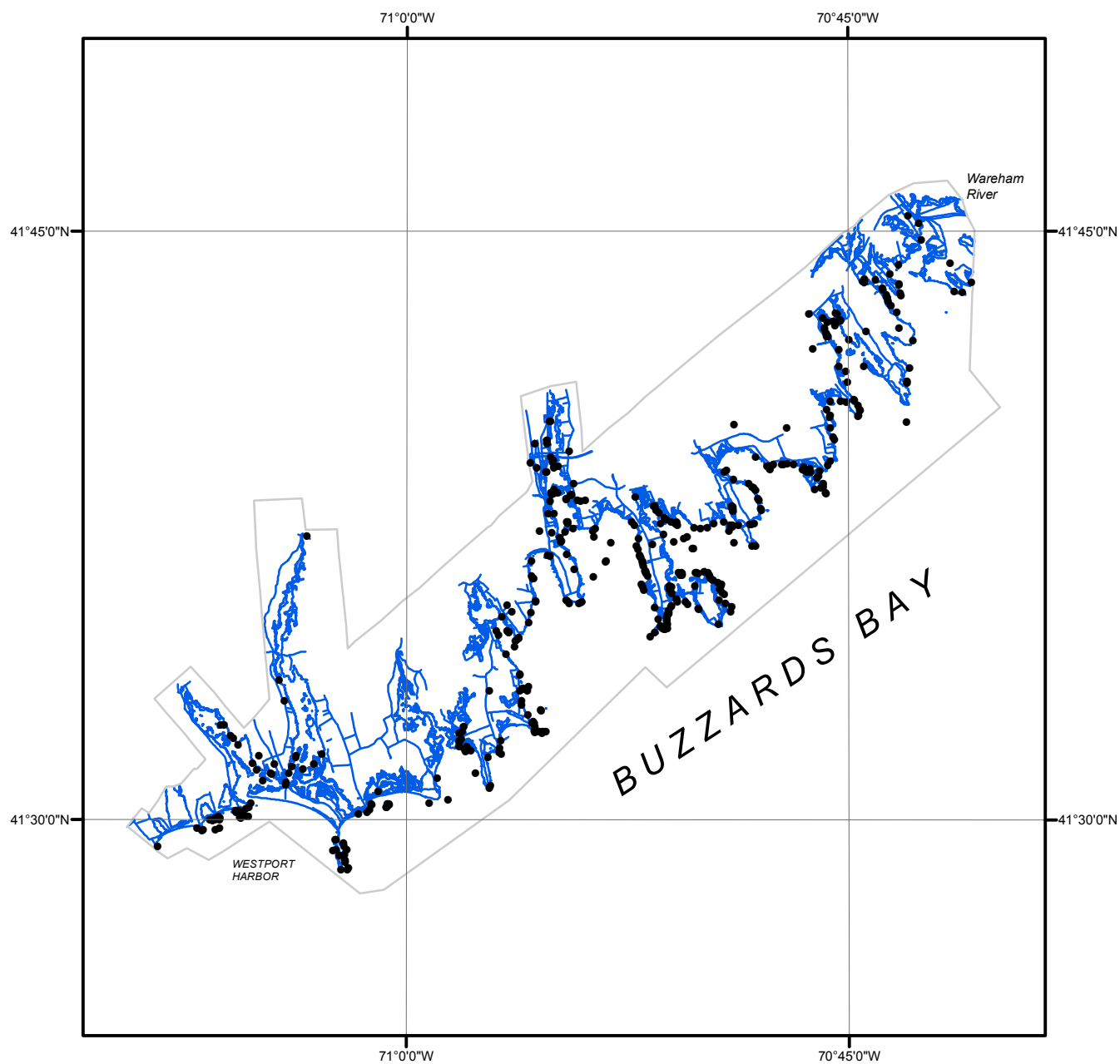
NOAA Shoreline Data Explorer

- GC11102 in shapefile format
- Metadata file for GC11102
- Digital copy of the PCR in Adobe PDF format

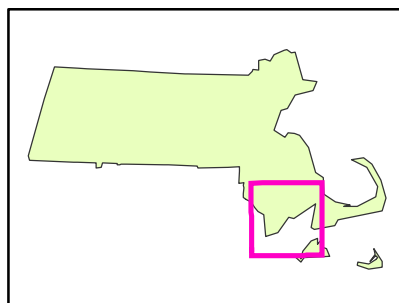
End of Report

NORTHERN BUZZARDS BAY

MASSACHUSETTS



Overview



MA0901A-CM-N

GC11102