NOAA COASTAL MAPPING PROGRAM
PROJECT COMPLETION REPORT

PROJECT ME1301D-CM-N

Whiting and Dennys Bays, Maine

Introduction

NOAA Coastal Mapping Program (CMP) Project ME1301D-CM-N provides a highly accurate database of new digital shoreline data for portions of the coastline in Whiting and Dennys Bays, Maine. Project ME1301D-CM-N is a subproject of a larger project ME1301-CM-N, which extends from St. Croix River southward along Grand Manan Channel to Little Machias 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

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. 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 the collection of static and kinematic GPS data and Inertial Measurement Unit (IMU) data, and the acquisition of digital aerial imagery. The photographic mission operations were conducted over the course of two years, from August 2013 through June 2014, with the NOAA King Air (N68RF) aircraft. Project imagery included natural color (RGB) and near-infrared (NIR) imagery acquired concurrently using an Applanix DSS-439 dual head digital camera system (two 60 mm lenses) in coordination with both MLLW and MHW tide levels.

Sixteen (16) flight lines with 2479 RGB and NIR images were acquired for ME1301-CM-N, though only three (3) flight lines with 356 images were used in the completion of subproject ME1301D-CM-N. All imagery was acquired 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 for project ME1301-CM-N 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 in August and November 2013, and July 2014 using POSPac MMS GPS/IMU software (v. 6.1, 6.2). For further information refer to the Airborne Positioning and Orientation Reports (APOR) on file with other project data within the RSD Applications Branch (AB) Electronic Data Library.

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 1.55 meters for the imagery used to compile data for ME1301D-CM-N. NGS third order geodetic control points were used to test the horizontal integrity of the DG data. 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 a member of AB in December 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 chart 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 ME1301D-CM-N were determined according to standard Federal Geographic Data Committee (FGDC) practices. Cartographic features were compiled to meet a horizontal accuracy of 3.1 meters at the 95% confidence level. This predicted accuracy of compiled well-defined points is derived by doubling the horizontal uncertainty calculated from the EO-TPU tool.

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

Date	Time (UTC)	Roll #	Photo #s	~ GSD	Tide Level*
8/18/2013	13:11 – 13:15	13NC51	11085 – 11112	0.35 m	5.3 – 4.4 m
8/18/2013	13:11 – 13:15	13NR46	09760 – 09787	0.35 m	5.3 – 4.4 m
8/18/2013	13:22 – 13:27	13NC51	11127 – 11157	0.35 m	4.4 – 5.4 m
8/18/2013	13:22 – 13:27	13NR46	09802 – 09832	0.35 m	4.4 – 5.4 m
8/19/2013	14:12 – 14:17	13NC52	11166– 11195	0.35 m	4.7 – 5.6 m
8/19/2013	14:12 – 14:17	13NR47	09841– 09870	0.35 m	4.7 – 5.6 m

5/29/2014	11:31 – 11:36	14NC51	11205 – 11232	0.35 m	0.4 – 0.0 m
5/29/2014	11:31 – 11:36	14NR43	08092 – 08119	0.35 m	0.4 – 0.0 m
6/01/2014	12:36 – 12:40	14NC53	11271 – 11300	0.35 m	0.1 – 0.4 m
6/01/2014	12:36 – 12:40	14NR45	08158 – 08187	0.35 m	0.1 – 0.4 m
6/01/2014	12:48 – 12:52	14NC53	11316 – 11346	0.35 m	0.3 – 0.1 m
6/01/2014	12:48 – 12:52	14NR45	08203 – 08233	0.35 m	0.3 – 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 4.5 – 6.0 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 January 2016. 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 10.1 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 chart was used in the comparison process:

13394, Grand Manan Channel Northern Part, 1:50,000, 5th Ed., Aug. 2013

End Products and Deliverables

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

Remote Sensing Division Electronic Data Library
- Airborne Positioning and Orientation Reports (APORs)
- Project database
- GC11138 in shapefile format
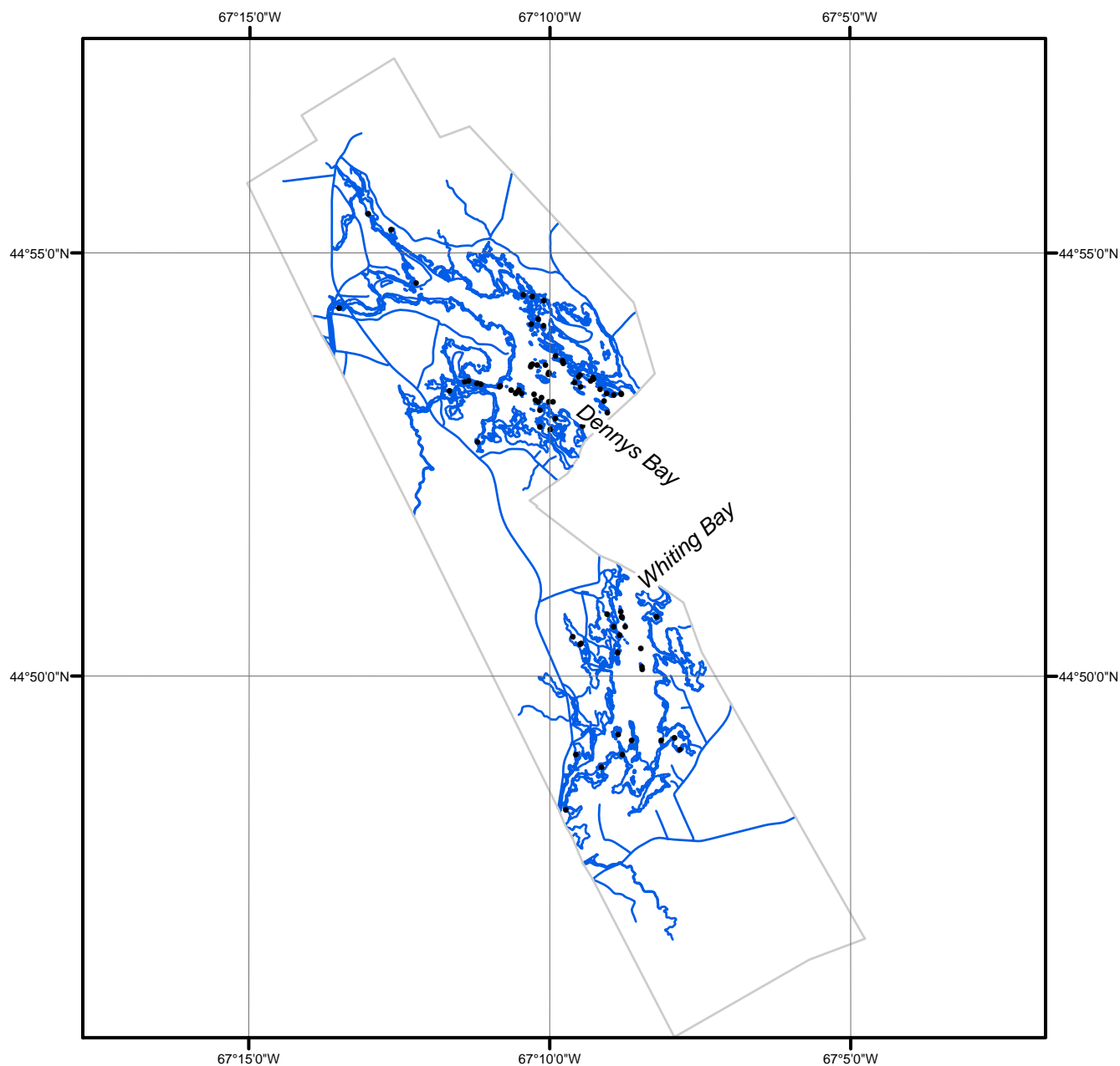- Project Completion Report (PCR)
- CEF in shapefile format

NOAA Shoreline Data Explorer
- GC11138 in shapefile format
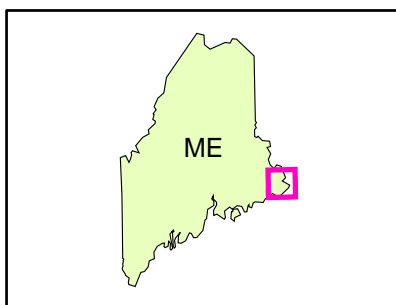- Metadata file for GC11138
- PCR in Adobe PDF format

End of Report

WHITING AND DENNYS BAYS

MAINE

67°15'0"W 67°10'0"W 67°5'0"W

44°55'0"N 44°55'0"N

Dennys Bay

Whiting Bay

44°50'0"N 44°50'0"N

67°15'0"W 67°10'0"W 67°5'0"W

Overview

ME

ME1301D-CM-N

GC11138