

NOAA COASTAL MAPPING PROGRAM PROJECT COMPLETION REPORT

PROJECT ME1301C-CM-N

Grand Manan Channel, Hamilton Cove to Bog Brook Cove, Maine

Introduction

NOAA Coastal Mapping Program (CMP) Project ME1301C-CM-N provides a highly accurate database of new digital shoreline data for a portion of the coastline for Grand Manan Channel from Hamilton Cove to Bog Brook Cove, Maine. Project ME1301C-CM-N is a subproject of a larger project ME1301-CM-N, which covers St. Croix River, Oak Bay, Grand Manan Channel, Whiting Bay, Dennys Bay and other small islands. 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 during eight (8) flights over the course of two years, from July 21, 2013 through June 01, 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 project ME1301, though only eight (8) flight lines with 292 images were used in the completion of subproject ME1301C-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 August 13 - 14 & November 6 – 8, 2013 & July 28 – 29, 2014 using various versions of POSpac MMS GPS/IMU software. 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 1.48 meters for the imagery used to compile data for ME1301C-CM-N. 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 November 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 ME1301C-CM-N were determined according to standard Federal Geographic Data Committee (FGDC) practices. Cartographic features were compiled to meet a horizontal accuracy of 3.0 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*
7/21/2013	19:11 – 19:11	13NC43	09754 – 09758	0.35 m	0.2 – 0.3 m
7/21/2013	19:11 – 19:11	13NR38	08429 – 08433	0.35 m	0.2 – 0.3 m
7/21/2013	19:18 – 19:19	13NC43	09759 – 09764	0.35 m	0.2 m
7/21/2013	19:18 – 19:19	13NR38	08434 – 08439	0.35 m	0.2 m
7/22/2013	13:34 – 13:34	13NC45	09884 – 09888	0.35 m	4.3 – 4.6 m
7/22/2013	13:34 – 13:34	13NR40	08559 – 08563	0.35 m	4.3 – 4.6 m

7/22/2013	13:39 – 13:40	13NC45	09889 – 09894	0.35 m	4.7 m
7/22/2013	13:39 – 13:40	13NR40	08564 – 08569	0.35 m	4.7 m
8/12/2013	13:07 – 13:09	13NC48	10725 – 10736	0.35 m	0.2 – 0.3 m
8/12/2013	13:07 – 13:09	13NR43	09400 – 09411	0.35 m	0.2 – 0.3 m
8/12/2013	13:24 – 13:25	13NC48	10789 – 10799	0.35 m	0.2 m
8/12/2013	13:24 – 13:25	13NR43	09464 – 09474	0.35 m	0.2 m
8/12/2013	13:30 – 13:32	13NC48	10800 – 10809	0.35 m	0.3 m
8/12/2013	13:30 – 13:32	13NR43	09575 – 09474	0.35 m	0.3 m
8/17/2013	12:12 – 12:14	13NC50	10951 – 10961	0.35 m	4.6 m
8/17/2013	12:12 – 12:14	13NR45	09626 – 09636	0.35 m	4.6 m
8/17/2013	12:26 – 12:28	13NC50	11014 – 11025	0.35 m	5.5 – 4.5 m
8/17/2013	12:26 – 12:28	13NR45	09689 – 09700	0.35 m	5.5 – 4.5 m
8/18/2013	12:56 – 12:57	13NC51	11047 – 11056	0.35 m	4.9 m
8/18/2013	12:56 – 12:57	13NR46	09722 – 09731	0.35 m	4.9 m
8/18/2013	13:15 – 13:16	13NC51	11110 – 11119	0.35 m	4.8 m
8/18/2013	13:15 – 13:16	13NR46	09785 – 09794	0.35 m	4.8 m
8/18/2013	13:21 – 13:22	13NC51	11120 – 11128	0.35 m	4.7 – 4.4 m
8/18/2013	13:21 – 13:22	13NR46	09795 – 09803	0.35 m	4.7 – 4.4 m
8/19/2013	14:11 – 14:12	13NC52	11158 – 11167	0.35 m	5.1 – 4.8 m
8/19/2013	14:11 – 14:12	13NR47	09833 – 09842	0.35 m	5.1 – 4.8 m
5/29/2014	11:30 – 11:31	14NC51	11198 – 11207	0.35 m	0.4 m
5/29/2014	11:30 – 11:31	14NR43	08085 – 08094	0.35 m	0.4 m
6/01/2014	12:40 – 12:41	14NC53	11299 – 11308	0.35 m	0.1 m
6/01/2014	12:40 – 12:41	14NR45	08186 – 08195	0.35 m	0.1 m
6/01/2014	12:47 – 12:48	14NC53	11309 – 11317	0.35 m	0.2 m
6/01/2014	12:47 – 12:48	14NR45	08196 – 08204	0.35 m	0.2 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 4.6 – 5.0 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 December 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 10.1 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 charts were used in the comparison process:

13392, Grand Manan Channel Southern Part, 1:50,000, 3rd Ed., Feb. 2011

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
- GC11137 in shapefile format
- Project Completion Report (PCR)
- CEF in shapefile format

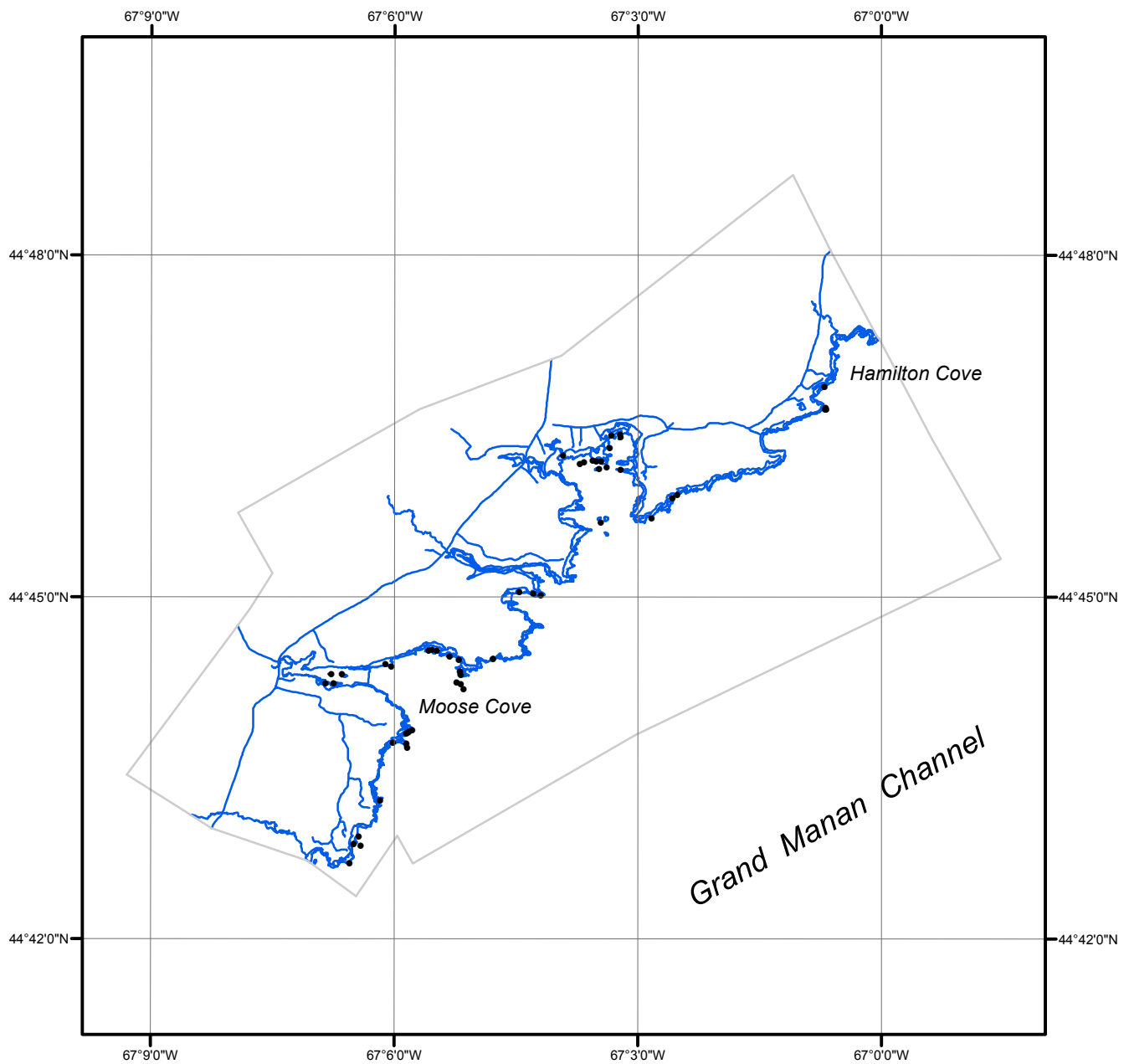
NOAA Shoreline Data Explorer

- GC11137 in shapefile format
- Metadata file for GC11137
- PCR in Adobe PDF format

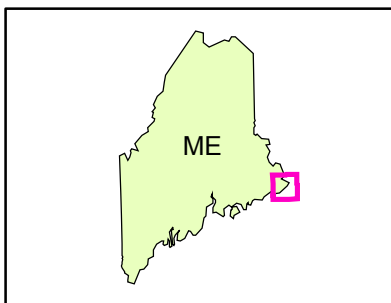
End of Report

GRAND MANAN CHANNEL, HAMILTON COVE TO BOG BROOK COVE

MAINE



Overview



ME1301C-CM-N

GC11137