NOAA COASTAL MAPPING PROGRAM
PROJECT COMPLETION REPORT

PROJECT ME1502B-CM-N

Kennebec River, Parker Head to Thorne Head, Maine

Introduction

NOAA Coastal Mapping Program (CMP) Project ME1502B-CM-N provides a highly accurate database of new digital shoreline data for a portion of Maine coastline centering on Kennebec River, from Parker Head northward to Thorne Head; including portions of New Meadows River, Back River, and Sasanoa River. Project ME1502B-CM-N is a subproject of a larger project ME1502-CM-N, which includes the tidal river areas from Augusta in the north to Georgetown in the south, and from Brunswick in the west to Damariscotta in the east. 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 for ME1502-CM-N 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 in July 2015 with the NOAA King Air (N68RF) aircraft. Project imagery included natural color (RGB) and near-infrared (NIR) imagery acquired concurrently using an Applanix DSS-580/560 dual-head digital camera system (two 60 mm lenses) in coordination with both MLLW and MHW tide levels. Seventeen flight lines, consisting of 2,232 RGB and NIR images, were acquired, though only nine flight lines and 653 images were utilized in the completion of subproject ME1502B-CM-N. All imagery was acquired at a nominal altitude of 10,500 feet, resulting in approximate ground sample distances (GSD) of 0.33 meters for the RGB imagery and 0.35 meters for the NIR imagery.

Direct Georeferencing Data Processing

GPS/IMU data for project ME1502B-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 station at Brunswick Executive Airport (KBXM), Brunswick, Maine. The airborne kinematic data were processed in July 2015 using POSPac MMS (ver. 7.1) software. For further information refer to the Airborne Positioning and Orientation Reports (APOR) on file with other project data within the RSD 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 the 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 0.9 to 1.0 meters for all imagery used to compile data for ME1502B-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 completed by a member of the RSD Applications Branch in October 2018. Digital mapping was performed using the Feature Extraction software module within BAE's SOCET SET (ver. 5.6) photogrammetric software. 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 ME1502B-CM-N were determined according to standard Federal Geographic Data Committee (FGDC) practices. Cartographic features were compiled to meet a horizontal accuracy of 1.8 to 2.0 meters at the 95% confidence level. These predicted accuracies of compiled well-defined points are derived by doubling the horizontal uncertainties calculated from the EO-TPU tool.

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

Date	Time (UTC)	Strip	Color Imagery		NIR Imagery		Tide Level*
			Roll	Images	Roll	Images	
07/06/2015	12:01 – 12:03	64-014	15VC02	0127 – 0133	15VR02	0128 – 0134	0.0
07/06/2015	12:23 – 12:25	64-012	15VC02	0178 – 0190	15VR02	0179 – 0191	-0.2 – 0.1
07/06/2015	14:13 – 14:16	64-007	15VC03	0211 – 0226	15VR03	0212 – 0227	-0.1
07/06/2015	20:23 – 20:25	64-014	15VC04	0334 – 0340	15VR04	0335 – 0341	2.9
07/06/2015	20:36 – 20:39	64-013	15VC04	0362 – 0377	15VR04	0363 – 0378	2.8 – 3.0
07/06/2015	20:57 – 20:59	64-012	15VC04	0422 – 0434	15VR04	0423 – 0435	2.7 – 2.8

07/06/2015	21:06 – 21:10	64-010	15VC04	0435 – 0457	15VR04	0436 – 0458	2.1 – 2.6**
07/07/2015	15:09 – 15:12	64-013	15VC05	0520 – 0535	15VR05	0521 – 0536	0.0 – 0.1
07/09/2015	16:21 – 16:24	64-008	15VC07	0560 – 0576	15VR07	0561 – 0577	-0.1 – 0.2
07/09/2015	16:29 – 16:34	64-011	15VC07	0578 – 0599	15VR07	0579 – 0600	-0.1 – 0.0
07/09/2015	16:34 – 16:35	64-011	15VC07	0600 – 0604	15VR07	0601 – 0605	0.2 – 0.4**
07/09/2015	16:40 – 16:44	64-009	15VC07	0609 – 0628	15VR07	0610 – 0629	-0.1 – 0.1
07/09/2015	16:49 – 16:53	64-010	15VC07	0629 – 0650	15VR07	0630 – 0651	-0.1 – 0.1
07/09/2015	17:04 – 17:06	64-006	15VC07	0671 – 0682	15VR07	0672 – 0683	0.0 – 0.3
07/11/2015	12:31 – 12:34	64-007	15VC08	0923 – 0938	15VR08	0924 – 0939	1.8 – 2.7
07/11/2015	12:39 – 12:43	64-008	15VC08	0939 – 0955	15VR08	0940 – 0956	2.3 – 2.7
07/11/2015	12:49 – 12:52	64-009	15VC08	0961 – 0980	15VR08	0962 – 0981	2.1 – 2.6
07/12/2015	13:20 – 13:24	64-011	15VC09	1058 – 1079	15VR09	1059 – 1080	2.4 – 2.9
07/12/2015	13:42 – 13:43	64-006	15VC09	1113 – 1116	15VR09	1114 – 1117	2.7
07/12/2015	15:01 – 15:02	64-006	15VC09	1165 – 1172	15VR09	1166 – 1173	1.9
07/12/2015	15:10 – 15:11	64-011	15VC09	1190 – 1194	15VR09	1191 – 1195	1.8 – 1.9

* Tide levels are given in meters above MLLW and were calculated using Pydro software with a TCARI grid referenced to verified water level observations at the time of photography from NOS gauges in the vicinity of the project. The elevation of the MHW tidal datum in the project area varies between 1.77 – 3.00 m. above MLLW.

** Some images within the strip were collected outside of normal tide tolerance.

Quality Control / Final Review

Quality control tasks were conducted during all phases of project completion by senior CMP personnel. The final QC review was completed in November 2018. 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 Esri's ArcGIS (ver. 10.5) desktop GIS 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:

13290, Casco Bay, 40th Ed., Feb. 2016
13293, Damariscotta, Sheepscot and Kennebec Rivers, 36th Ed., Mar. 2016
13295, Kennebec and Sheepscot River Entrances, 12th Ed., May 2013
13296, Boothbay Harbor to Bath - Kennebec River, 26th Ed., Jan. 2012
13298, Kennebec River, Bath to Courthouse Point, 11th Ed., Jun. 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 (APOR)
- Project database
- GC11357 in shapefile format
- Project Completion Report (PCR)
- CEF in shapefile format

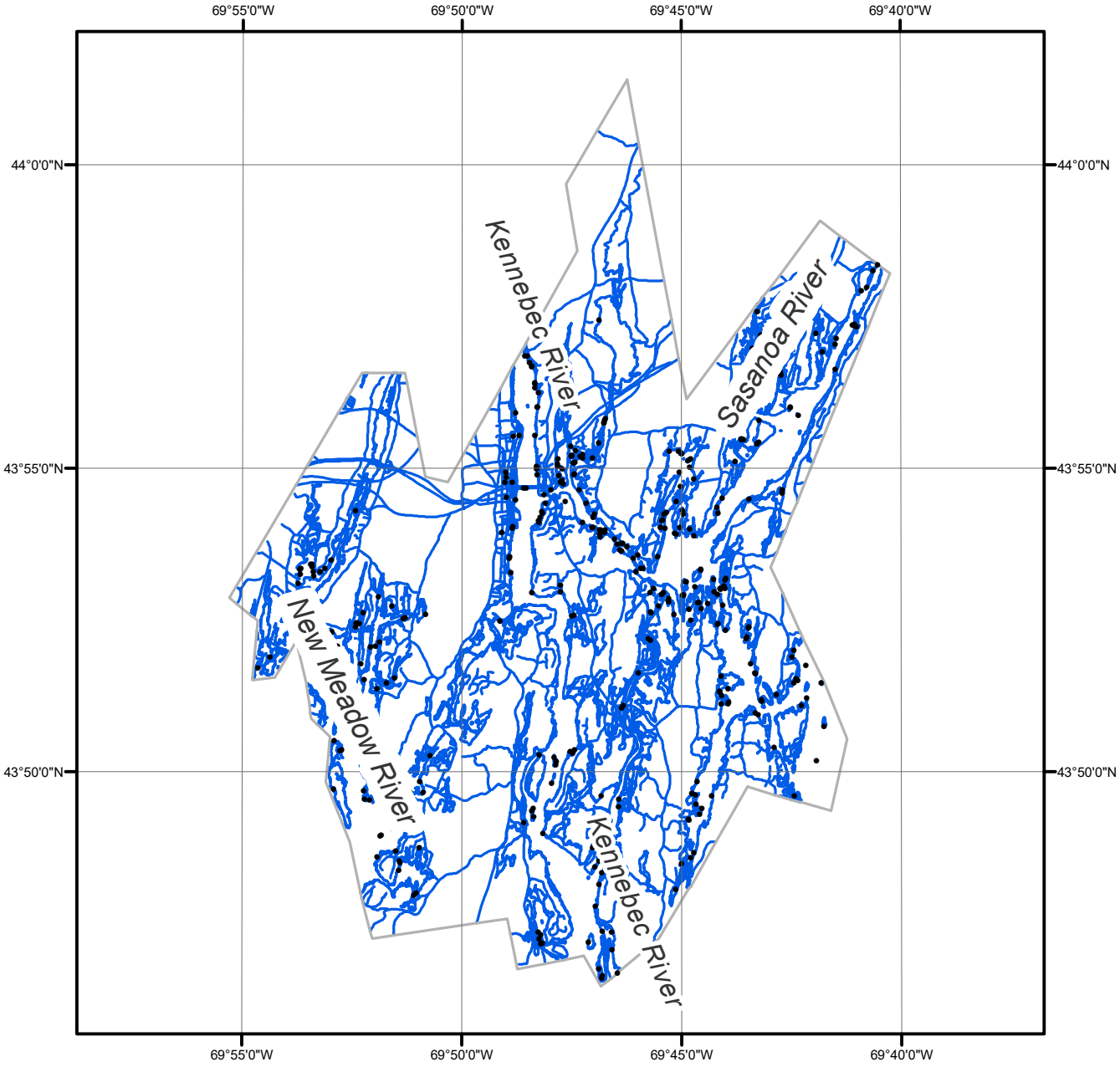
NOAA Shoreline Data Explorer

- GC11357 in shapefile format
- Metadata file for GC11357
- PCR in Adobe PDF format

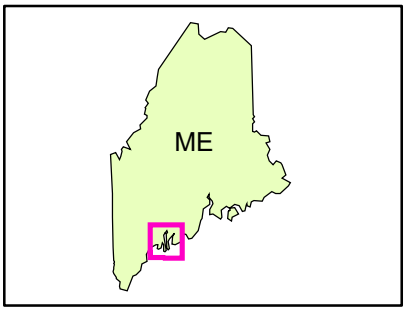
End of Report

KENNEBEC RIVER, PARKER HEAD TO THORNE HEAD

MAINE



Overview



ME1502B-CM-N

GC11357