NOAA COASTAL MAPPING PROGRAM PROJECT COMPLETION REPORT

PROJECT NC0901-CM-N

Newport River and North River, North Carolina

Introduction

NOAA Coastal Mapping Program (CMP) Project NC0901-CM-N provides a highly accurate database of new digital shoreline data for Newport River and North River, including Morehead City, in North Carolina. 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, flight line priority, Global Positioning System (GPS) and Inertial Measurement Unit (IMU) data collection procedures and guidelines, instructions for data recording and handling, and contact and communication information. 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 and IMU data, and the acquisition of digital aerial imagery. Aerial survey operations were conducted from November 02, 2011 through April 12, 2014, with the NOAA King Air aircraft (N68RF). The full project imagery includes 12 flight lines of 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 flight lines were acquired twice, one near MHW and the second coordinated with MLLW.

The project area for NC0901-CM-N was reduced to use only a portion of the collected imagery for the inner coastal area (7 flight lines, 832 images) due to overlapping coverage within an adjacent project (NC1408-TB-C).

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 (ver. 5.4.0) software in Nov. 2011, POSPAC (ver. 6.1.0) software in Dec. 2013, and POSPAC (ver. 6.2.4) software in Dec. 2014. For further information refer to the Airborne Positioning and Orientation Reports (APOR) that are on file with other project data within the Remote Sensing Division 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 (CE95) was calculated to be 1.4 meters.

NGS third order geodetic control points were used to test the horizontal integrity of the DG data. A comparison between image measurements and the published coordinates for these points revealed offsets in the 0.3 to 1.0 meter range. 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 AB personnel in September 2015. Digital mapping was performed using the Feature Extraction software module within SOCET SET (ver. 5.6). Feature identification and attribution within the GC was 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 NC0901-CM-N were determined according to standard Federal Geographic Data Committee (FGDC) practices. Cartographic features were compiled to meet a horizontal accuracy of 2.8 meters CE95. This predicted accuracy of well-defined points measured during the compilation phase was derived by doubling the image accuracy computed from the EO-TPU tool.

Date	Time (UTC)	Roll #s	Strip / Frame #s	Tide Level*
11-02-2011	16:06 – 16:08	11NC84	550006 / 26244 - 26265	1.1 – 1.0
11-02-2011	16:20 - 16:25	11NC84	550010 / 26295 - 26323	0.7 – 1.1
09-24-2013	13:38 - 13:43	13NC68	550007 / 18542 – 18577	1.0 - 0.6
09-24-2013	13:47 – 13:53	13NC68	550008 / 18578 - 18613	0.6 – 1.0

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

09-24-2013	14:08 - 14:10	13NC68	550011 / 18649 - 18662	1.3 – 1.1
11-25-2013	15:39 – 15:44	13NC86	550009 / 27209 - 27243	0.5 - 0.9
11-25-2013	15:58 - 15:59	13NC86	550012 / 27280 - 27289	0.4 - 0.6
11-02-2011	16:06 - 16:08	11NR49	250006 / 15133 - 15154	1.1 – 1.0
11-02-2011	16:20 - 16:25	11NR49	250010 / 15184 - 15212	0.7 – 1.1
09-24-2013	13:38 - 13:43	13NR58	250007 / 11879 - 11914	1.0 - 0.6
09-24-2013	13:47 - 13:53	13NR58	250008 / 11915 - 11950	0.6 - 1.0
09-24-2013	14:08 - 14:10	13NR58	250011 / 11986 - 11999	1.3 – 1.1
11-25-2013	15:39 - 15:44	13NR62	250009 / 12644 - 12678	0.5 – 0.9
11-25-2013	15:58 - 15:59	13NR62	250012 / 12715 - 12724	0.4 - 0.6
04-11-2014	15:10 - 15:13	14NC32	650006 / 7792 – 7813	0.0
04-11-2014	15:21 – 15:26	14NC32	650007 / 7830 – 7865	-0.1 - 0.0
04-11-2014	15:30 - 15:35	14NC32	650008 / 7866 – 7901	0.0
04-11-2014	15:40 - 15:46	14NC32	650009 / 7902 – 7936	0.0
04-11-2014	15:50 - 15:54	14NC32	650010 / 7937 – 7965	0.0 - (-0.1)
04-11-2014	16:01 – 16:03	14NC32	650011 / 7966 – 7979	0.1 - 0.0
04-12-2014	15:35 – 15:36	14NC33	650012 / 7990 – 7999	-0.1 - 0.1
04-11-2014	15:10 - 15:13	14NR25	350006 / 4872 - 4893	0.0
04-11-2014	15:21 – 15:26	14NR25	350007 / 4910 - 4945	-0.1 - 0.0
04-11-2014	15:30 - 15:35	14NR25	350008 / 4946 - 4981	0.0
04-11-2014	15:40 - 15:46	14NR25	350009 / 4982 - 5016	0.0
04-11-2014	15:50 - 15:54	14NR25	350010 / 5017 - 5045	0.0 - (-0.1)
04-11-2014	16:01 - 16:03	14NR25	350011 / 5046 - 5059	0.1 – 0.0
04-12-2014	15:35 - 15:36	14NR26	350012 / 5070 - 5079	-0.1 - 0.1

* 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 0.50 - 1.16 meters above MLLW.

Quality Control / Final Review

Quality control tasks were conducted during all phases of project completion by a member of AB. The final QC review was completed in November 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:

- 11541, Neuse River to Myrtle Grove Sound, Scale 1:40,000, 40th Ed., Feb. 2013
- 11543, Cape Lookout to New River, Scale 80,000, 24th Ed., Oct. 2012
- 11545, Beaufort Inlet and par of Core Sound, Scale 1:40,000, 65th Ed., May 2013
- 11547, Morehead City Harbor, Scale 1:15,000, 39th Ed., Dec. 2015

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 Report (APOR)
- Project Completion Report (PCR)
- Project database
- GC11117 in shapefile format
- CEF in shapefile format

NOAA Shoreline Data Explorer

- GC11117 in shapefile format
- Metadata file for GC11117
- Digital copy of the PCR in Adobe PDF format

End of Report

NEWPORT RIVER AND NORTH RIVER

NORTH CAROLINA

