

NOAA COASTAL MAPPING PROGRAM PROJECT COMPLETION REPORT

PROJECT PR1502-CS-N

Port of Ponce, Puerto Rico

Introduction

Coastal Mapping Program (CMP) Project PR1502-CS-N provides highly accurate digital shoreline data for key areas of change in the Port of Ponce, Puerto Rico. 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 design of Project PR1502-CS-N was accomplished by the Requirements Branch (RB) of the Remote Sensing Division (RSD) in response to the need for timely updates to the NOAA chart suite within key U.S. ports. Project requirements were formulated as a result of analysis conducted within the Coast and Shoreline Change Analysis Program (CSCAP), in which NOAA nautical chart products are compared to contemporary high resolution imagery to ascertain the need for more current shoreline data. A Chart Evaluation File (CEF) was created and forwarded to the Applications Branch (AB) of RSD once a change analysis was completed. Refer to the CSCAP memorandum for Project PR1505-CS-T dated August 25, 2015 for details of the chart comparison process.

Field Operations

The field operations consisted of the collection of static and kinematic Global Positioning System (GPS) data and Inertial Measurement Unit (IMU) data and the acquisition of aerial imagery. The photographic mission operations were conducted on February 29, 2016 with the NOAA King Air (N68RF) aircraft. Imagery acquired included three flight lines of natural color and near-infrared (NIR) imagery acquired concurrently using an Applanix DSS 580/560 dual camera system at a nominal altitude of 7,500 feet, resulting in approximate ground sample distances (GSD) of 0.24 and 0.27 meters. The NIR images were not used for compilation. Although imagery was not acquired in strict coordination with local tides, the goal was to collect all imagery below Mean High Water (MHW).

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 MMS 7.1 software in July 2016. For further information refer to the Airborne Positioning and Orientation Report (APOR) that is 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 an 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 0.7 meters.

Compilation

The data compilation phase of this project was accomplished by a member of RSD in October 2017. Digital feature data was compiled using the Feature Extraction module of BAE's SOCET SET (ver. 5.6) photogrammetric software. 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 PR1502-CS-N were determined according to standard Federal Geographic Data Committee (FGDC) practices. Cartographic features were compiled to meet a horizontal accuracy of 1.4 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 Number	Photo Numbers	GSD (nominal)	Tide Level*
29-FEB-2016	12:54 – 12:55	16VC21	6417 – 6431	0.24 m	0.2
29-FEB-2016	13:00 – 13:02	16VC21	6432 – 6447	0.24 m	0.2
29-FEB-2016	13:07 – 13:08	16VC21	6448 – 6462	0.24 m	0.2

* 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 is approximately 0.21 meters above MLLW.

Quality Control / Final Review

The final review of the project was completed by a senior member of RSD in December 2017, and included analysis of 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 10.5 software. All project data was evaluated for compliance to CMP requirements.

End Products and Deliverables

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

Remote Sensing Division Electronic Data Library

- CSCAP evaluation memorandum
- Airborne Positioning and Orientation Report (APOR)
- Project database
- Project Completion Report (PCR)
- GC11362 in shapefile format
- Chart Evaluation File in shapefile format

NOAA Shoreline Data Explorer

- GC11362 in shapefile format
- Metadata file for GC11362
- Digital copy of the PCR

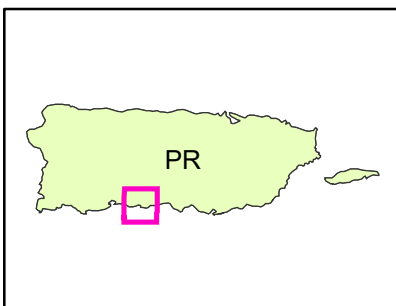
End of Report

PORT OF PONCE

PUERTO RICO



Overview



PR1502-CS-N

GC11362