NOAA COASTAL MAPPING PROGRAM
PROJECT COMPLETION REPORT

PROJECT PR1101

Port of Mayaguez, Puerto Rico

Introduction

Coastal Mapping Program (CMP) Project PR1101 provides highly accurate digital shoreline data for key areas of change on the western coast of Puerto Rico for the Port of Mayaguez. 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

This project was designed per a request from the NOAA Hydrographic Surveys Division (HSD) of the Office of Coast Survey, NOAA, for cartographic data in support of HSD operations. Based on an analysis of project requirements and results of a source data search, it was determined that CMP procedures for multiple source projects would apply for this project. Available source data deemed adequate for successful completion of this project included sources acquired in March of 2011.

Field Operations

The field operations consisted of the collection of static and kinematic Global Positioning System (GPS) data and the acquisition of aerial imagery. One photographic mission operation was conducted on March 25th, 2011 with the NOAA King Air 350ER (N68RF) aircraft. Two strips of natural color digital imagery were acquired, with an approximate ground sample distance of 15 cm, through use of an Applanix Digital Sensor System (DSS) 439 Dual Cam digital camera.

A base station was established for the photographic mission using static GPS. Airborne kinematic GPS data was collected in conjunction with Inertial Measurement Unit (IMU) data to determine precise camera positions and orientations.

GPS Data Reduction

GPS and IMU data was collected and processed by Remote Sensing Division (RSD) personnel to yield precise positions and orientations of camera centers as a means of rendering accurately georeferenced digital images. The static GPS base station data was processed in March 2011 using the NGS Online Processing User Service (OPUS) software to compute fixed baseline solutions from the three nearest CORS stations. The airborne kinematic data was processed using Applanix POSGPS (ver. 5.1) software in April 2011. An Airborne Positioning and Orientation Report was written for this mission and is on file with other project data within the Applications Branch (AB) archive.

Aerotriangulation

Routine softcopy aerotriangulation methods were applied to establish a network of precise camera positions and other control for mapping, and to provide model parameters and orientation elements required for digital compilation. This work was initiated by RSD personnel in April 2012 utilizing a Digital Photogrammetric Workstation (DPW), which is a configuration of computer hardware, modular software components, and other associated peripheral devices. The digital images were measured and adjusted as a single block using BAE Systems SOCET SET® v. 5.5.0 Multi-Sensor Triangulation module (MST). Upon successful completion of the aerotriangulation process, the simultaneous solve tool within the MST module provided the standard deviations for each aerotriangulated ground point, which were used to compute a predicted horizontal circular error of 0.3 meters based on a 95% confidence level. An Aerotriangulation Report was written and is on file with other project data within the RSD project archive.

The project database consists of project parameters and options, camera calibration data, adjusted exterior orientation parameters, and positional listing of all measured points. Positional data is referenced to the North American Datum of 1983 (NAD83).

Compilation

The data compilation phase of the project was initiated by RSD personnel in April 2012. Digital mapping was performed using a DPW in conjunction with the SOCET SET Feature Extraction software module. Feature identification and attribution within the Geographic Cell (GC) were based on image analysis of the digital images and information extracted from the appropriate NOAA Nautical Charts, U.S. Coast Guard Light List and other ancillary sources. Feature attribution was assigned in compliance with the Coastal Cartographic Object Attribute Source Table (C-COAST). Selected features were further modified with additional descriptive information to refine general classification.

Spatial data accuracies for Project PR1101 were determined according to standard Federal Geographic Data Committee (FGDC) practices. Cartographic features were compiled to meet a horizontal accuracy of 0.6 meters at the 95% confidence level. The predicted accuracy of compiled, well defined points is derived by doubling the circular error computed from aerotriangulation statistics.

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

Date	Time (UTC)	Roll Number	Photo Numbers	GSD (nominal)	Tide Level*
3-25-2011	13:18 – 13:19	11NC14	2522 – 2537	0.5 m	0.0 m
3-25-2011	13:23 – 13:24	11NC14	2538 – 2553	0.5 m	0.0 m

* Tide levels are given in meters above MLLW and are based on actual observations recorded by the NOS gauge at Mayaguez, PR at the time of photography. The elevation of MHW at Mayaguez is equal to 0.3 meters above MLLW.

Quality Control / Final Review

Quality control tasks were conducted during all phases of project completion by a senior member of AB. The final QC review was completed in July 2012. The review process included analysis of aerotriangulation 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 9.3 software. All project data was evaluated for compliance to CMP requirements.

A comparison of the largest scale NOAA nautical chart with natural color images and compiled project data resulted in creation of the Chart Evaluation File (CEF). The following nautical chart was used in the comparison process:

25673, Bahia de Mayaguez and Approaches, 1:15,000 scale, 16th edition

End Products and Deliverables

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

RSD Applications Branch Archive

- Hardcopy of the Airborne Positioning and Orientation Report (APOR)
- Hardcopy of the Aerotriangulation Report
- Hardcopy of the Project Completion Report (PCR)
- Page-size graphic plot of GC10934 file contents, attached to PCR

Remote Sensing Division Electronic Data Library

- Project database
- GC10934 in shapefile format
- Digital copy of the PCR in Adobe PDF format
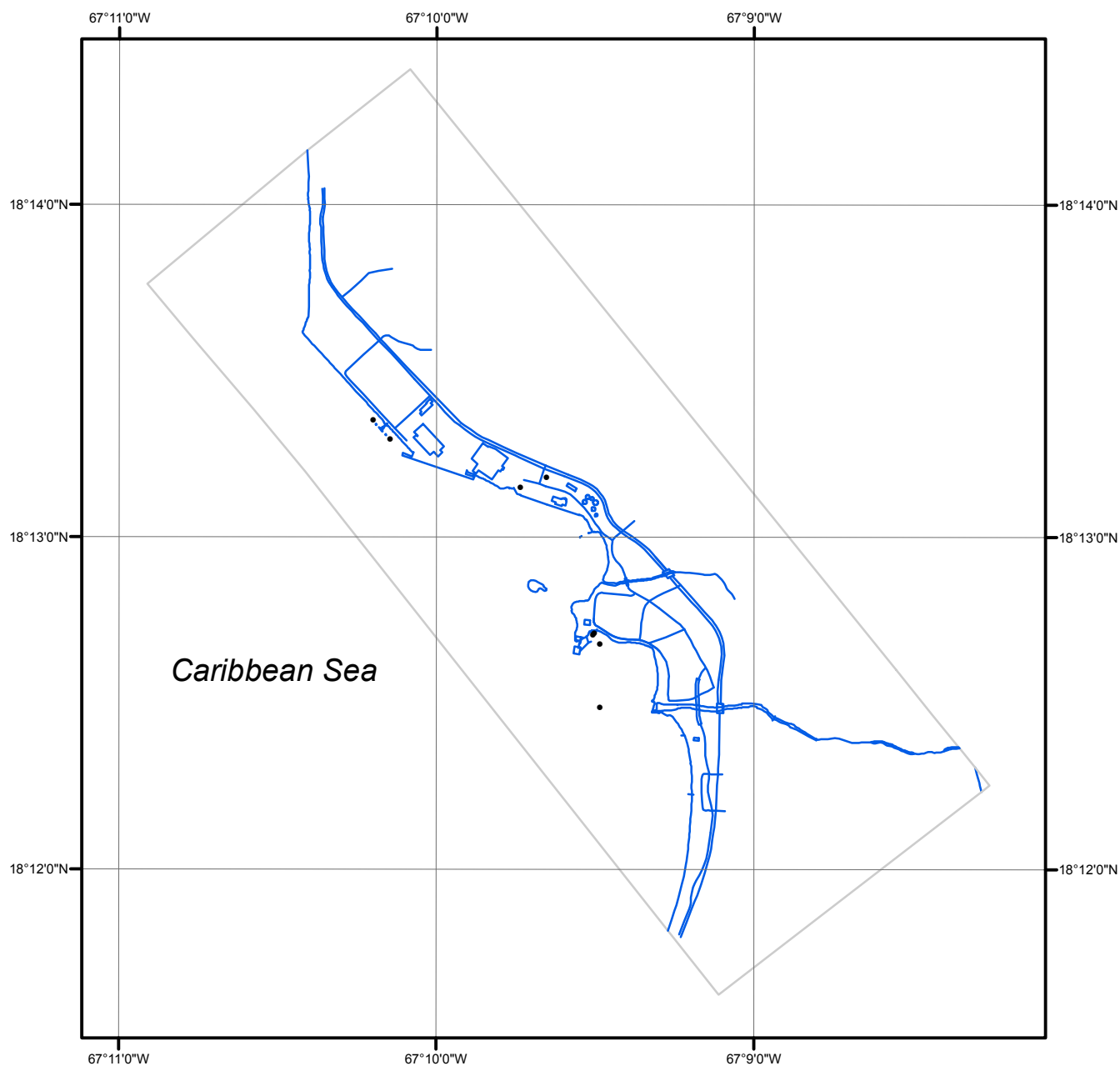- Chart Evaluation File in shapefile format

NOAA Shoreline Data Explorer

- GC10934 in shapefile format
- Metadata file for GC10934
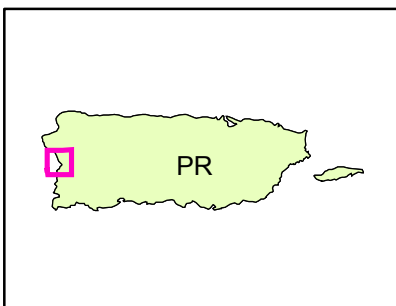- Digital copy of the PCR in Adobe PDF format

End of Report

PORT OF MAYAGUEZ

PUERTO RICO

67°11'0"W 67°10'0"W 67°9'0"W

18°14'0"N

18°13'0"N

Caribbean Sea

18°12'0"N

67°11'0"W 67°10'0"W 67°9'0"W

Overview

PR

PR1101

GC10934