

NOAA COASTAL MAPPING PROGRAM PROJECT COMPLETION REPORT

PROJECT PR1103

Puerto Yabucoa, Puerto Rico

Introduction

NOAA Coastal Mapping Program (CMP) Project PR1103 provides a highly accurate database of new digital shoreline data for Puerto Yabucoa and vicinity, in 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

This project was designed per a request from the NOAA Hydrographic Surveys Division (HSD) for shoreline data in support of HSD operations. 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 ver. II. The instructions discussed the project's purpose, geographic area of coverage, scope and priority, image requirements, Global Positioning System (GPS) data collection guidelines, instructions for data recording and handling, and field communication protocols. RB created a Project Layout Diagram, flight maps and input files for the aircraft flight management system. Note that the flight lines were re-planned in the field to accommodate a different camera and lens configuration than was originally intended in the project instructions.

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 digital aerial imagery. A reference point was established at the Henry W. Rohlsen Airport (STX) in Christiansted, St Croix for use as a base station for airborne kinematic GPS survey operations. The aerial survey flight was conducted on 4/3/2011 with the NOAA King Air aircraft (N68RF). All imagery was acquired using an Applanix DSS-439 dual camera system (RGB & IR) with 60 mm lenses. The five flight lines of imagery were acquired at a nominal altitude of 4,500 feet resulting in a Ground Sample Distance (GSD) of 0.51 feet (0.155 meter).

GPS Data Reduction

The GPS/IMU data were processed by RSD personnel to yield precise camera positions and orientations for use as control in the aerotriangulation phase of the project. The static GPS base station data was processed in May 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 POSPAC (ver. 5.x) software in May 2011. For further information refer to the Airborne Positioning and Orientation Reports (APOR) on file with other project data within the RSD Applications Branch (AB) Project 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 June 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 (version 5.6.0) photogrammetric suite in conjunction with the Multi-Sensor Triangulation (MST) software module and Bingo (version 5.6) program. Bingo was used to perform the bundle adjustment, and analysis tools within Bingo were used to refine the aerotriangulation solution and to evaluate the accuracy of the block adjustment. Upon successful completion of the aerotriangulation process, the Bingo software provided the standard deviations for all aerotriangulated ground points, which were used to compute a predicted horizontal circular error of 0.15 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. Positional data is referenced to the North American Datum of 1983 (NAD 83).

Compilation

The data compilation phase of this project was initiated by RSD in July 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 aerial photographs and information extracted from the largest scale NOAA nautical charts, the 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), 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 PR1103 were determined according to standard Federal Geographic Data Committee (FGDC) practices. Cartographic features were compiled to meet a horizontal accuracy of 0.3 meters at the 95% confidence level. This 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 ID	Photo Numbers	GSD (Nominal)	Tide Level*
4/03/2011	17:57 – 17:58	11NC23	3347 – 3364	0.16 m.	-0.01
4/03/2011	18:10 – 18:11	11NC23	3368 – 3375	0.16 m.	0.0
4/03/2011	18:16 – 18:17	11NC23	3376 – 3385	0.16 m.	-0.01
4/03/2011	18:17 – 18:22	11NC23	3387 – 3398	0.16 m.	-0.01
4/03/2011	18:26 – 18:28	11NC23	3399 – 3416	0.16 m.	-0.01

*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 NOS gauges. The height of Mean High Water above the MLLW datum at the Yabucoa Harbor gauge is 0.214 meters.

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 August 2012. The review process included analysis of the 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.

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:

Chart 25650, Virgin Passage & Sonda De Vieques, 36th Ed., Dec/11, Scale 1:100,000
Chart 25659, Puerto Maunabo, 9th Ed., Mar/03, Scale 1:20,000
Chart 25661, Puerto Yabucoa, 12th Ed., Jul/04, Scale 1:10,000

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 GC10940 file contents, attached to PCR

Remote Sensing Division Electronic Data Library

- Project database
- GC10940 in shapefile format
- Digital copy of the PCR in Adobe PDF format
- Chart Evaluation File in shapefile format

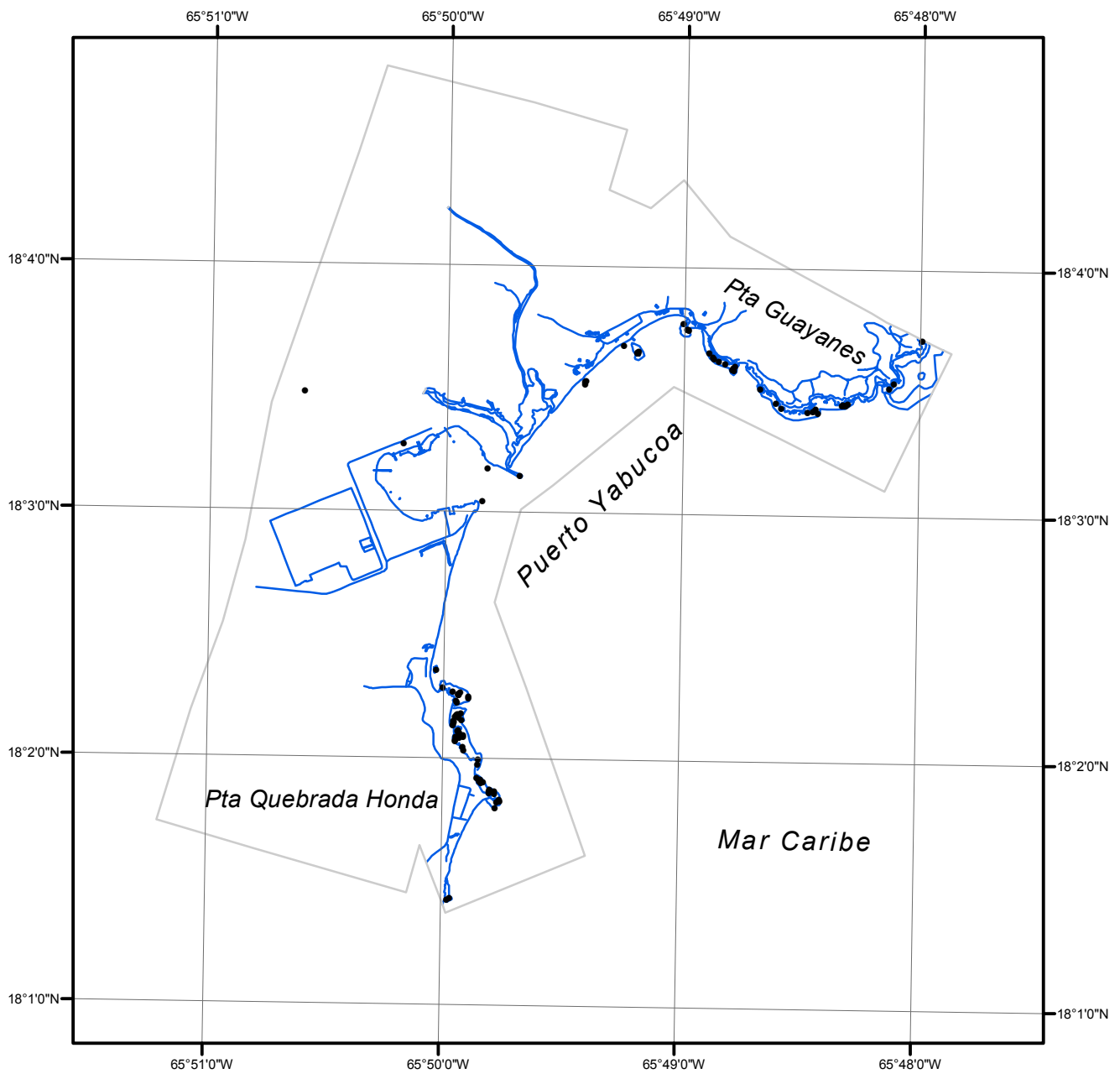
NOAA Shoreline Data Explorer

- GC10940 in shapefile format
- Metadata file for GC10940
- Digital copy of the PCR in Adobe PDF format

End of Report

PUERTO YABUCOA

PUERTO RICO



Overview



PR1103

GC10940