

NOAA COASTAL MAPPING PROGRAM PROJECT COMPLETION REPORT

PROJECT VI1102

Christiansted to Southgate Lagoon, St. Croix, U.S. Virgin Islands

Introduction

NOAA Coastal Mapping Program (CMP) Project VI1102 provides a highly accurate database of new digital shoreline data for a portion of St. Croix, U.S. Virgin Islands, from Christiansted Harbor to Southgate Lagoon, including Altona Lagoon. 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, flight line priority, Global Positioning System (GPS) 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 data and the acquisition of aerial imagery. The photographic mission operations were conducted on April 2, 2011 and February 16, 2012, with the NOAA King Air (N68RF) aircraft. The images acquired on the April 2, 2011 mission were not used in this project. Three strips of natural color (RGB) digital images were acquired using an Applanix DSS-439 camera, flown at an approximate altitude of 4,500 ft. resulting in a ground sample distance (GSD) of 0.5 ft. (0.16 meters). All images were acquired at a stage of tide below MHW.

A base station was established at Henry E. Rohlsen Airport (TISX), on St. Croix, U.S. Virgin Islands, using static GPS. Airborne kinematic GPS data was collected in conjunction with an Inertial Measurement Unit (IMU) to yield precise camera positions and orientations.

GPS Data Reduction

GPS and IMU data was processed by RSD personnel to yield precise positions and orientations of camera centers as a means of rendering accurately georeferenced digital images. The GPS base station data was processed using the NGS Online Processing User Service (OPUS) software in order to compute the fixed baseline solutions from the three nearest CORS stations. The final NAD83 position reported by OPUS was the average of these three baseline solutions. The

airborne kinematic data was processed using the Applanix POSGPS (ver. 5.4) software on March 9, 2012. For additional information, refer to the Airborne Positioning and Orientation Report (APOR) written to document this phase of the project.

Georeferencing

Direct Georeferencing (DG) methods were evaluated using the processed kinematic GPS/IMU data that established precise exterior orientation (EO) values of the camera centers. This work was accomplished by RSD Applications Branch (AB) personnel in May 2012 using an Excel spreadsheet based Exterior Orientation Total Propagated Uncertainty (EO-TPU) tool, developed by NGS, to determine the horizontal accuracy (at the 95% confidence level) of well-defined image features by propagating sensor EO and image measurement uncertainties through the photogrammetric collinearity equations. The resulting horizontal uncertainty of the directly georeferenced images was determined to be 0.6 meters. As an additional check of the DG results, eight NGS photo-identifiable ground survey points were measured and compared to their published positions, with an average offset of 0.4 meters.

Despite the very good DG results, routine softcopy aerotriangulation (AT) methods were applied to establish the 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 completed by AB personnel in May 2012 using the Multi-Sensor Triangulation (MST) module of BAE Systems SOCET SET® v. 5.6 softcopy photogrammetry suite. Upon successful completion of the aerotriangulation process, the MST software provided the standard deviations of the residuals for each aerotriangulated ground point, which were used to compute an overall predicted horizontal circular error of 0.4 meters based on a 95% confidence level for the final adjusted block of all images. 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.

Compilation

The data compilation phase of the project was initiated by AB personnel in May 2012. This work was accomplished using the Feature Extraction module within BAE Systems' SOCET SET (v. 5.6) software. Feature identification and the assignment of cartographic codes were based on image analysis of the project 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 VII102 were determined according to standard Federal Geographic Data Committee (FGDC) practices. Cartographic features were compiled to meet a horizontal accuracy of 0.8 meters at the 95% confidence level. The predicted accuracy of compiled, well-defined points is derived by doubling the circular error derived from aerotriangulation statistics.

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

Date	Time (UTC)	Roll Number	Line Number	Photo Numbers	GSD (nominal)	Tide Level*
2/16/2012	20:33 – 20:34	12NC11	22-003	2732 – 2738	0.16 m	0.0 m
2/16/2012	21:16 – 21:17	12NC11	22-002	2771 – 2786	0.16 m	0.0 m
2/16/2012	21:24 – 21:25	12NC11	22-001	2787 – 2802	0.16 m	0.0 m

* Tide levels 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 the MHW tidal datum in the project area varies between 0.21 - 0.22 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 June 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 9.3.1 software. All project data was evaluated for compliance to CMP requirements.

Comparisons of the largest scale NOAA nautical charts 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:

25645, Christiansted Harbor, VI, 1:10,000 scale, 19th 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 and Accuracy Assessment
- Hardcopy of the Project Completion Report (PCR)
- Page-size graphic plot of GC10936 file contents, attached to PCR

Remote Sensing Division Electronic Data Library

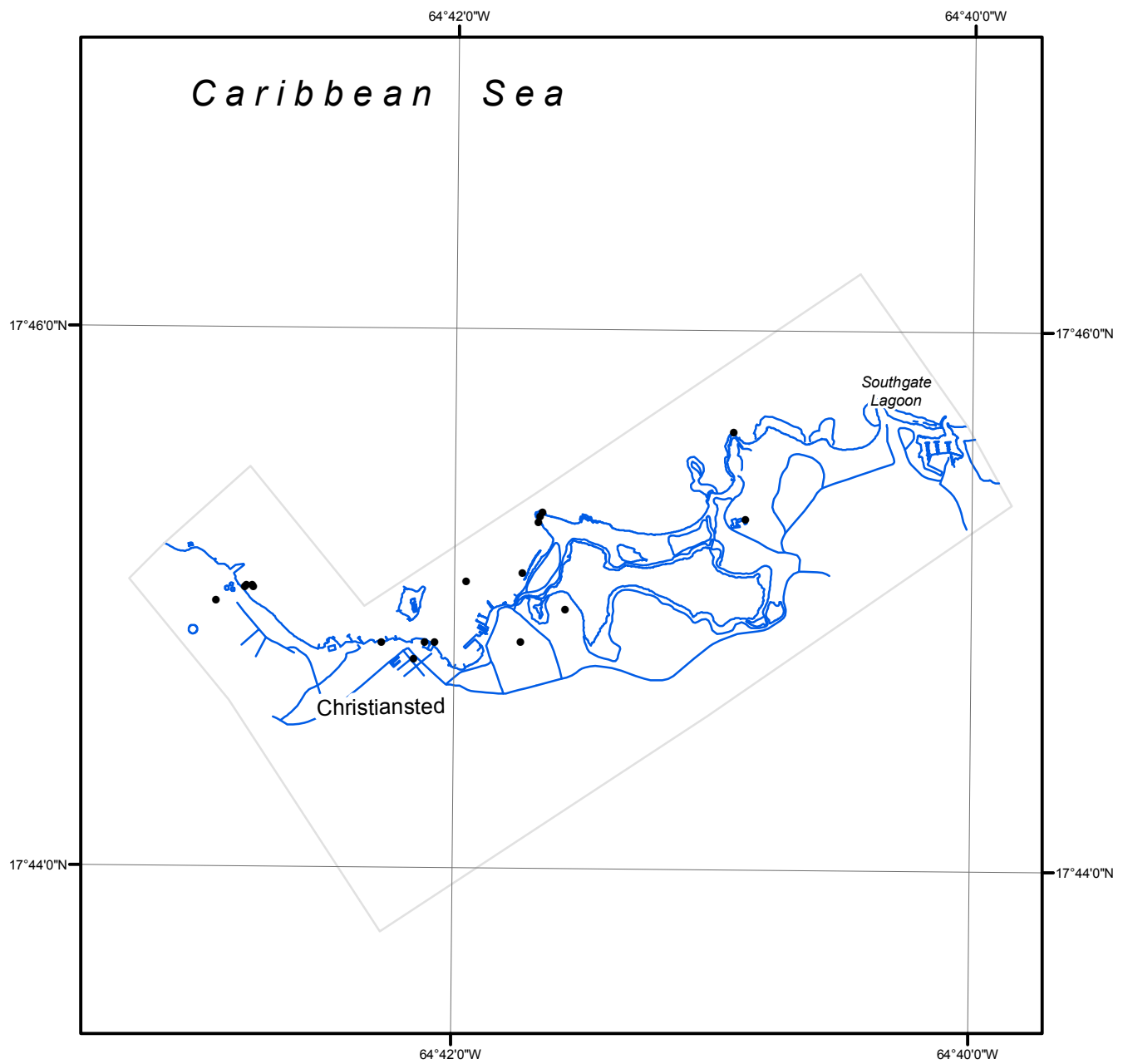
- Project database
- GC10936 in shapefile format
- Digital copy of the PCR in Adobe PDF format
- Chart Evaluation File in shapefile format

NOAA Shoreline Data Explorer

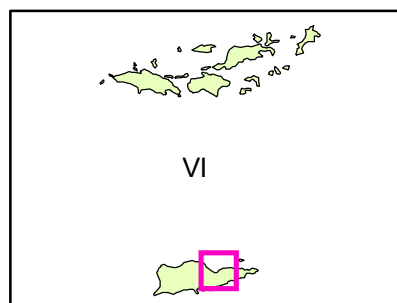
- GC10936 in shapefile format
- Metadata file for GC10936
- Digital copy of the PCR in Adobe PDF format

End of Report

CHRISTIANSTED TO SOUTHGATE LAGOON, ST. CROIX U.S. VIRGIN ISLANDS



Overview



VI1102

GC10936