

NOAA COASTAL MAPPING PROGRAM PROJECT COMPLETION REPORT

PROJECT FL0601B

Indian Rocks Beach to Egmont Key, Florida

Introduction

NOAA Coastal Mapping Program (CMP) Project FL0601B provides a highly accurate database of new digital shoreline data for the coast of the Gulf of Mexico in Florida, extending from Indian Rocks Beach to Egmont Key, and including Boca Ciega Bay. Project FL0601B is a subproject of a larger project, FL0601, which extends from Clearwater to Sarasota Bay and includes the entirety of Tampa Bay.

Successful completion of this project resulted in a densification of the National Spatial Reference System (NSRS), a set of controlled metric-quality aerial photographs, and digital feature data of the coastal zone which complements the Nautical Charting Program (NCP) as well as geographic information systems (GIS) for a variety of coastal zone management applications.

The project database consists of information measured and extracted from aerial photographs and metadata related to photogrammetric compilation. Base mapping was conducted in a digital environment using stereo softcopy photogrammetry and associated cartographic practices.

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; photographic requirements; flight line priority; Global Positioning System (GPS) data collection procedures and guidelines for both kinematic and static surveys; data recording and handling instructions; 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, Inertial Measurement Unit (IMU) data, and the acquisition of aerial photographs. The photo mission operations covering this sub-project area were conducted between 3/13/2006 – 11/15/2006, and on 1/9/2008 with the NOAA Cessna Citation II (N52RF) aircraft. Five strips of natural color photographs, and two sets of black and white infrared (B&W IR) photographs, consisting of five strips each taken in coordination with MHW and MLLW tide levels, were acquired through use of a Wild RC-30 camera with the NOS "A" lens cone at a nominal scale of 1:30,000. Two additional strips of each type (color, MHW-IR, MLLW-IR) were acquired using the RC-30 camera at a lower altitude (1:15,000 scale) over Egmont Key. Note that for many of the above

photographs the attempt to coordinate collection with the MHW or MLLW tide stages was not successful, as the actual water levels were outside of the RSD standard acceptable tolerances (± 0.3 ft.) for tide coordination. Finally, two strips of natural color digital imagery were collected in January 2008 using the Applanix DSS-439 digital camera with a 60 mm VIS lens. The digital images were specifically collected to provide photographic coverage of the Sunshine Skyway Bridge and were not tide-coordinated.

Temporary GPS base stations were established at area airports for each photo mission using static GPS positioning techniques. Airborne kinematic GPS/IMU data was collected to determine precise camera positions and orientations in order to establish a control network necessary for aerotriangulation. Data collection operations were conducted in accordance with the GPS Controlled Photogrammetry Field Operations Manual. No ground control survey operations were required for this project.

GPS Data Reduction

The GPS/IMU data was processed to provide precise positions of camera centers for application as photogrammetric control in the aerotriangulation phase of project completion. The static GPS base station data for each mission day was processed in March and November 2006, and January 2008 using the NGS Online Processing User Service (OPUS) software to compute fixed baseline solutions from three CORS stations. The final NAD83 position reported by OPUS was the average of these three baseline solutions. The airborne kinematic data for the 2006 flights were processed using Applanix POSPac (ver. 4.3) software in May 2006 and August 2007, with some additional processing done in November 2007 to correct for a systematic vertical error in the camera station positions. The data for the January 2008 flight was processed in February 2008. An Airborne Positioning and Orientation Report was written and is on file with other project data within the RSD Applications Branch (AB) Project Archive.

Aerotriangulation

Routine softcopy aerotriangulation 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 initiated by RSD personnel in February 2008 utilizing a Digital Photogrammetric Workstation (DPW), which is a configuration of computer hardware, modular software components and other associated peripheral devices. The color photographs and MHW and MLLW infrared photographs were measured and adjusted as three separate blocks using BAE Systems SOCET SET (v. 5.3) photogrammetric software, and then a final bundle adjustment was performed to tie the separate blocks together. All image points as well as the digital image data were tied into a single block adjustment. The Multi-Sensor Triangulation (MST) module, within SOCET SET, was used for the aerotriangulation portion of the project. Using the root mean square (RMS) of the standard deviations of all adjusted image points, the horizontal circular error at the 95% confidence level was calculated to be 0.6 meters for the combined image block. Photo-identifiable check points, extracted from the NGS geodetic control and airport obstruction chart databases, were then compared to the imagery to further validate the accuracy of the triangulation solution. 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, interior orientation parameters, ground control parameters, adjusted exterior orientation parameters, and positional listing of all measured points. 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 March 2010. 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 project photographs and information extracted from NOAA nautical charts, US Coast Guard Light List and other 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 FL0601B were determined according to standard Federal Geographic Data Committee (FGDC) practices. Cartographic features were compiled to meet a horizontal accuracy of 1.2 meters at the 95% confidence level. This predicted accuracy of compiled, well defined points is derived by doubling the circular error calculated from the aerotriangulation statistics.

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

Date	Time (UTC)	Roll #	Strip #	Photo #s	Scale (nominal)	Tide Level*
3-13-06	14:14-14:15	06ACN03	15-002	0044-0052	1:15,000	0.4
3-15-06	17:09-17:12	06ACN03	30-003	0336-0344	1:30,000	0.3
3-15-06	20:03-20:09	06ACN04	30-005	0421-0432	1:30,000	0.2
3-15-06	20:15-20:20	06ACN04	30-004	0441-0453	1:30,000	0.2
3-25-06	16:02-16:06	06AR02	30-005	0140-0151	1:30,000	0.1 – 0.4 †
3-25-06	16:11-16:16	06AR02	30-004	0152-0164	1:30,000	0.1 – 0.2 †
10-24-06	14:31-14:35	06AR11	30-005	2030-2042	1:30,000	(-0.3) – (-0.1) †
10-24-06	14:42-14:45	06AR11	30-004	2048-2061	1:30,000	(-0.0) – (-0.2) †
10-25-06	13:49-13:50	06AR11	30-002	2125-2129	1:30,000	0.0
10-25-06	13:54-13:55	06AR11	30-001	2130-2133	1:30,000	0.0
11-15-06	14:52-14:53	06AR13	30-002	2932-2936	1:30,000	0.5
11-15-06	14:57-14:58	06AR13	30-001	2937-2940	1:30,000	0.6
01-09-08	18:43-18:44	08NC01	38-001	0247-0257	1:38,000	0.4

* Tide levels are given in meters above MLLW and are based on Pydro (ver. 9.6) calculations using the Tampa Bay TCARI model. The elevation of the MHW tidal datum in the project area varies between 0.6 – 0.7 meters above MLLW.

† Tide levels for most photos in these flight lines are outside of acceptable tolerances for tide coordination.

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 December 2011. 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.

Comparisons of the largest scale NOAA nautical charts with project images and compiled project data resulted in creation of the Chart Evaluation File (CEF). The following nautical charts were used in the comparison process:

- 11411, Tampa Bay to Port Richey, FL, 1:40,000 scale, 17th Ed.
- 11412, Tampa Bay and St. Joseph Sound, FL, 1:80,000 scale, 44th Ed.
- 11415, Tampa Bay Entrance, FL, 1:40,000 scale, 8th Ed.

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 GC10764 file contents, attached to PCR

Remote Sensing Division Electronic Data Library

- Project database
- GC10764 in shapefile format
- Digital copy of the PCR in Adobe PDF format
- Chart Evaluation File in shapefile format

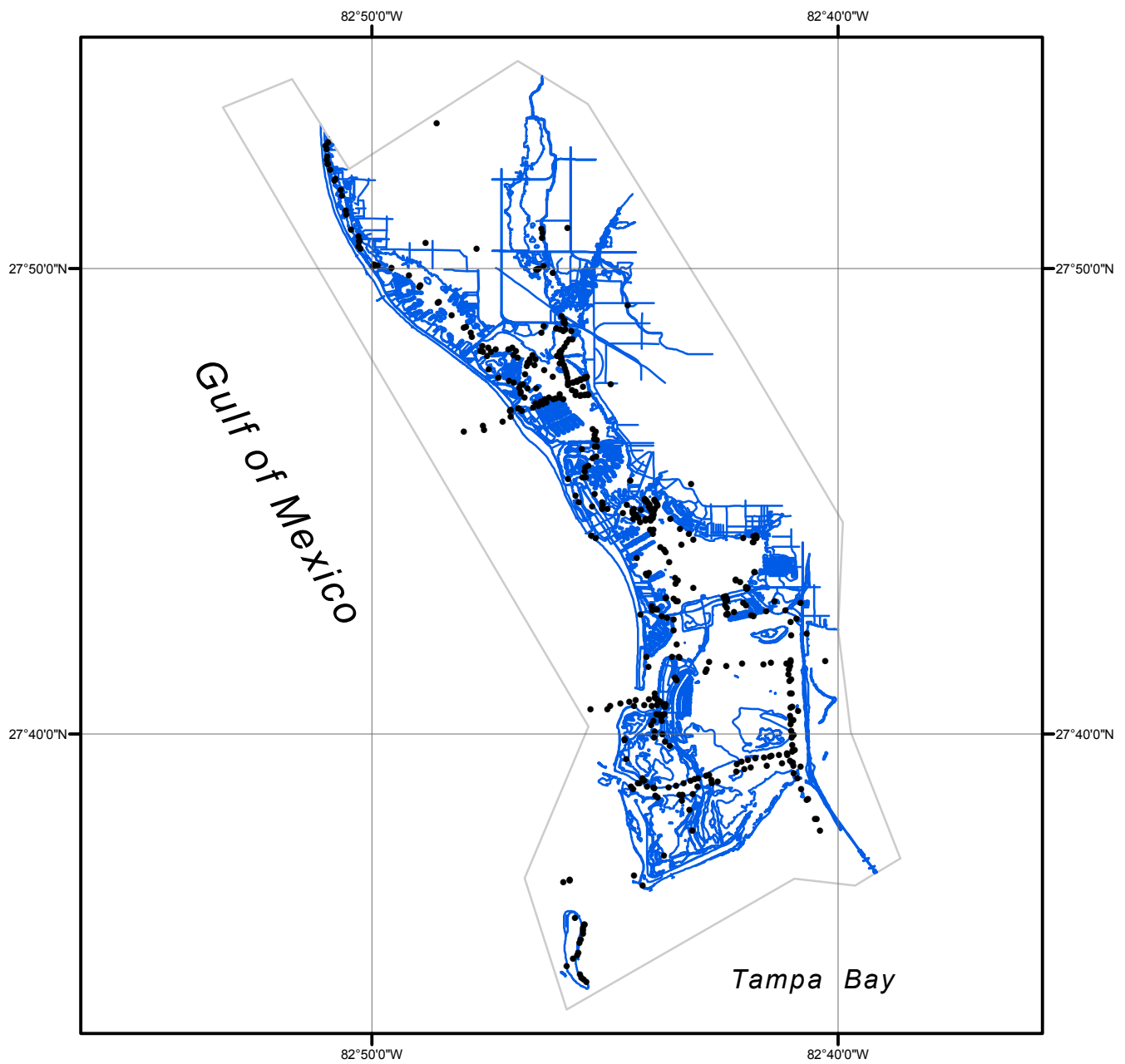
NOAA Shoreline Data Explorer

- GC10764 in shapefile format
- Metadata file for GC10764
- Digital copy of the PCR in Adobe PDF format

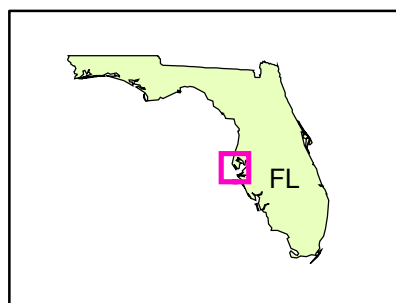
End of Report

INDIAN ROCKS BEACH TO EGMONT KEY

FLORIDA



Overview



FL0601B

GC10764