

NOAA COASTAL MAPPING PROGRAM PROJECT COMPLETION REPORT

PROJECT FL0601F

Hillsborough Bay, Florida

Introduction

NOAA Coastal Mapping Program (CMP) subproject FL0601F provides a highly accurate database of new digital shoreline data for Hillsborough Bay, Florida, from Gadsden Point to Apollo Beach, including the city of Tampa. Project FL0601F is a subproject of a larger project, FL0601, which extends from Clearwater to Sarasota Bay, and includes all 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 Procedure Version II. 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's flight management system.

Field Operations

The field operations consisted of the collection of static and kinematic GPS and Inertial Measurement Unit (IMU) data and the acquisition of aerial photographs. Mission operations were conducted on four separate days between March and October 2006 with the NOAA Cessna Citation II (N52RF) aircraft. Five strips of natural color photographs, and two sets of black and white infrared (IR) photographs, including 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 the nominal scale of 1:30,000. All exposures attempted at the MHW tide level for this project, and two of five strips attempted at the MLLW level, were

unsuccessful and were not used for feature compilation.

A temporary GPS base station was established at the St. Petersburg Airport (KPIE) 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 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 each flight was processed using Applanix POSPac (ver. 4.3) software in May 2006 and August 2007. Some additional processing was done in November 2007 on all four mission datasets to correct for a systematic vertical error in the camera station positions. 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 November 2007 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. 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 meter 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 February 2009. 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 1:30,000 scale photographs and information extracted from the appropriate NOAA nautical charts, US 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 FL0601F 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 photographs used in project completion:

Date	Time (UTC)	Roll #	Strip #	Photo #s	Scale (nominal)	Tide Level*
3-15-06	15:17-15:23	06ACN03	30-18	0165-0181	1:30,000	0.0 – 0.1
3-15-06	15:28-15:35	06ACN03	30-21	0183-0197	1:30,000	0.0 – 0.2
3-15-06	15:38-15:44	06ACN03	30-22	0199-0213	1:30,000	0.1 – 0.2
3-15-06	15:54-16:04	06ACN03	30-14	0215-0239	1:30,000	0.1 – 0.3
3-15-06	16:08-16:18	06ACN03	30-15	0242-0267	1:30,000	0.2 – 0.3
3-25-06	16:34-16:44	06AR02	30-14	0176-0200	1:30,000	0.1 – 0.2 **
3-25-06	16:50-17:03	06AR02	30-15	0201-0226	1:30,000	0.0 – 0.2 **
3-25-06	17:27-17:33	06AR03	30-22	0250-0264	1:30,000	0.2 – 0.3 **
3-25-06	17:38-17:44	06AR03	30-21	0265-0279	1:30,000	0.2 – 0.3 **
3-25-06	17:49-17:56	06AR03	30-18	0280-0296	1:30,000	0.0 – 0.3 **
3-26-06	14:17-14:22	06AR03	30-22	0364-0378	1:30,000	0.0 – (-0.1)
3-26-06	14:27-14:32	06AR03	30-21	0379-0393	1:30,000	0.0
3-26-06	14:37-14:42	06AR03	30-18	0394-0410	1:30,000	0.0 – 0.1
10-24-06	13:59-14:05	06AR11	30-14	1972-1994	1:30,000	(-0.2) – (-0.4) **
10-24-06	14:10-14:18	06AR11	30-15	1995-2020	1:30,000	(-0.4) – (-0.2) **

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

** Tide levels at time of photography deemed outside of acceptable tolerances for successful tide coord.

Quality Control / Final Review

Quality control tasks were conducted during all phases of project completion by a senior member of AB. Final QC review was completed in July 2009, including 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 9.2 software. All project data was evaluated for compliance to CMP requirements.

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

11416, Tampa Bay, FL, 1:40,000 scale, 10th edition
and Tampa Inset, 1:20,000 scale

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 GC10768 file contents, attached to PCR

Remote Sensing Division Electronic Data Library

- Project database
- GC10768 in shapefile format
- Digital copy of the PCR in Adobe PDF format
- CEF in shapefile format

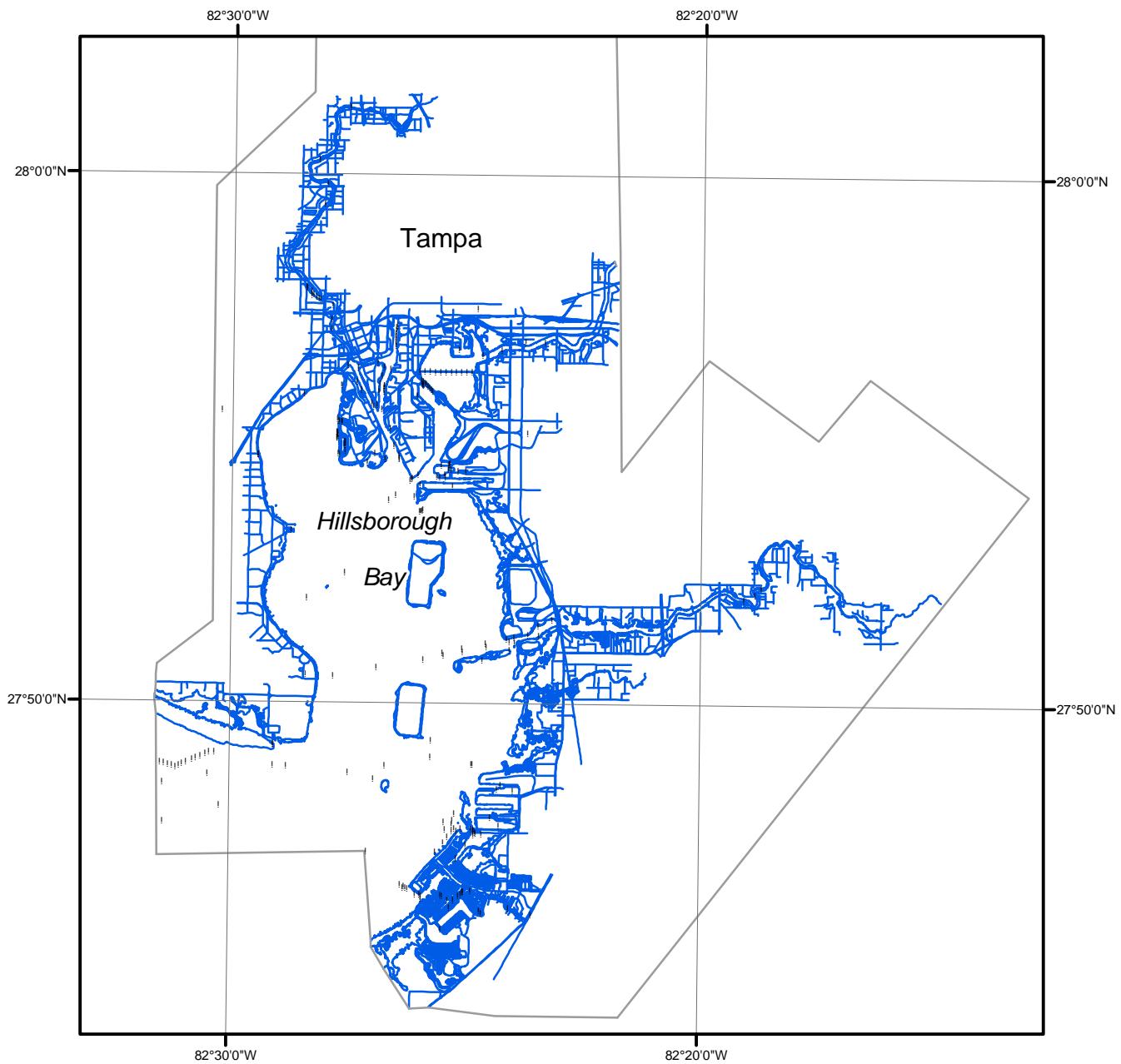
NOAA Shoreline Data Explorer

- GC10768 in shapefile format
- Metadata file for GC10768
- Digital copy of the PCR in Adobe PDF format

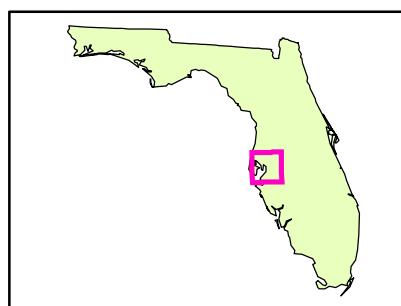
End of Report

HILLSBOROUGH BAY

FLORIDA



Overview



FL0601F

GC10768