NOAA COASTAL MAPPING PROGRAM
PROJECT COMPLETION REPORT

PROJECT FL0804

Fort Pierce Inlet and Harbor, Florida

Introduction

NOAA Coastal Mapping Program (CMP) Project FL0804 provides a highly accurate database of new digital shoreline data for Fort Pierce, Florida, and the surrounding coastal areas. The project extends from Bear Point and the city of Fort Pierce in the south, northwards to Indrio, and Garfield Point, and includes a small stretch of the Indian River. 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

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 data and the acquisition of aerial imagery. The photographic mission operations were conducted on May 6th and 7th, 2008, with the NOAA Cessna Citation II aircraft. Three strips of natural color digital images were acquired, along with three strips of digital MHW infrared photographs, and three strips of digital MLLW infrared photographs. The images have an approximate ground sample distance of 34 cm, and were acquired through the use of an Applanix Digital Sensor System (DSS) digital camera.

A base station was established at St. Lucie County International Airport, Fort Pierce, Florida using static GPS. Airborne kinematic GPS data was collected in conjunction with an Inertial Measurement Unit (IMU) to determine precise camera positions and orientations.

GPS Data Reduction

The GPS and IMU data was 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 May 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 was processed using Applanix POSGPS (ver. 4.4) software in November 2008.

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 Applications Branch (AB) personnel in November 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, MHW Infrared photographs, and MLLW Infrared photographs were each measured and adjusted as separate blocks using BAE Systems' SOCET SET (version 5.3) photogrammetric software in conjunction with the Multi-Sensor Triangulation (MST) aerotriangulation module. 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 0.5 meters for each block based on a 95% confidence level. An Aerotriangulation Report and accuracy assessment were written and are 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 based on the UTM Coordinate System (Zone 17) and referenced to NAD 83.

Compilation

The data compilation phase of the project was initiated by RSD personnel in November 2008. Digital mapping was performed using a DPW in conjunction with the SOCET SET (version 5.4.1) Feature Extraction software module. Feature identification and attribution within the GC 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 FL0804 were determined according to standard Federal Geographic Data Committee (FGDC) practices. Cartographic features were compiled to meet a horizontal accuracy of 1.0 meters at the 95% confidence level from the color imagery and 0.9 meters from the infrared imagery. These predicted accuracies of compiled, well defined points were derived by doubling the circular error determined 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*
5-06-08	17:52-17:55	08NC12	2963 - 2980	0.34 m	0 – (-0.1) m
5-06-08	18:44-18:46	08NC12	3035 - 3052	0.34 m	0 – (-0.1) m
5-06-08	18:53-18:55	08NC12	3053 - 3070	0.34 m	0 – (-0.1) m
5-06-08	17:52-17:55	08NR14	2918 - 2935	0.34 m	0 – (-0.1) m
5-06-08	18:44-18:46	08NR14	2990 - 3007	0.34 m	0 – (-0.1) m
5-06-08	18:53-18:55	08NR14	3008 - 3025	0.34 m	0 – (-0.1) m
5-07-08	16:03-16:05	08NR15	3027 - 3044	0.34 m	0.4 – 0.6 m
5-07-08	16:17-16:19	08NR15	3063 - 3080	0.34 m	0.4 – 0.7 m
5-07-08	16:24-16:27	08NR15	3081 - 3098	0.34 m	0.4 – 0.7 m

* Tide levels are given in meters above MLLW and are based on actual observations recorded by the NOS gauge at Virginia Key Station (ID:8723214) at the time of photography, with offsets applied to substations within the Project Area (Fort Pierce, St. Lucie, South Jetty, & Binney Dock) that lie within the project area. The elevation of MHW at the various substations ranges between (0.4m - 0.8m) 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 January 2009. 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 9.2 software. All project data was evaluated for compliance to CMP requirements.

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

> 11474, Bethel Shoal to Jupiter Inlet, FL, 1:80,000 scale, 10th edition
> 11475, Fort Pierce Harbor, FL, 1:10,000, 18th 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 (AT)
- Hardcopy of the Project Completion Report (PCR)
- Page-size graphic plot of GC10750 file contents, attached to PCR

Remote Sensing Division Electronic Data Library
- Project database
- GC10750 in shapefile format
- Digital copy of the PCR in Adobe PDF format
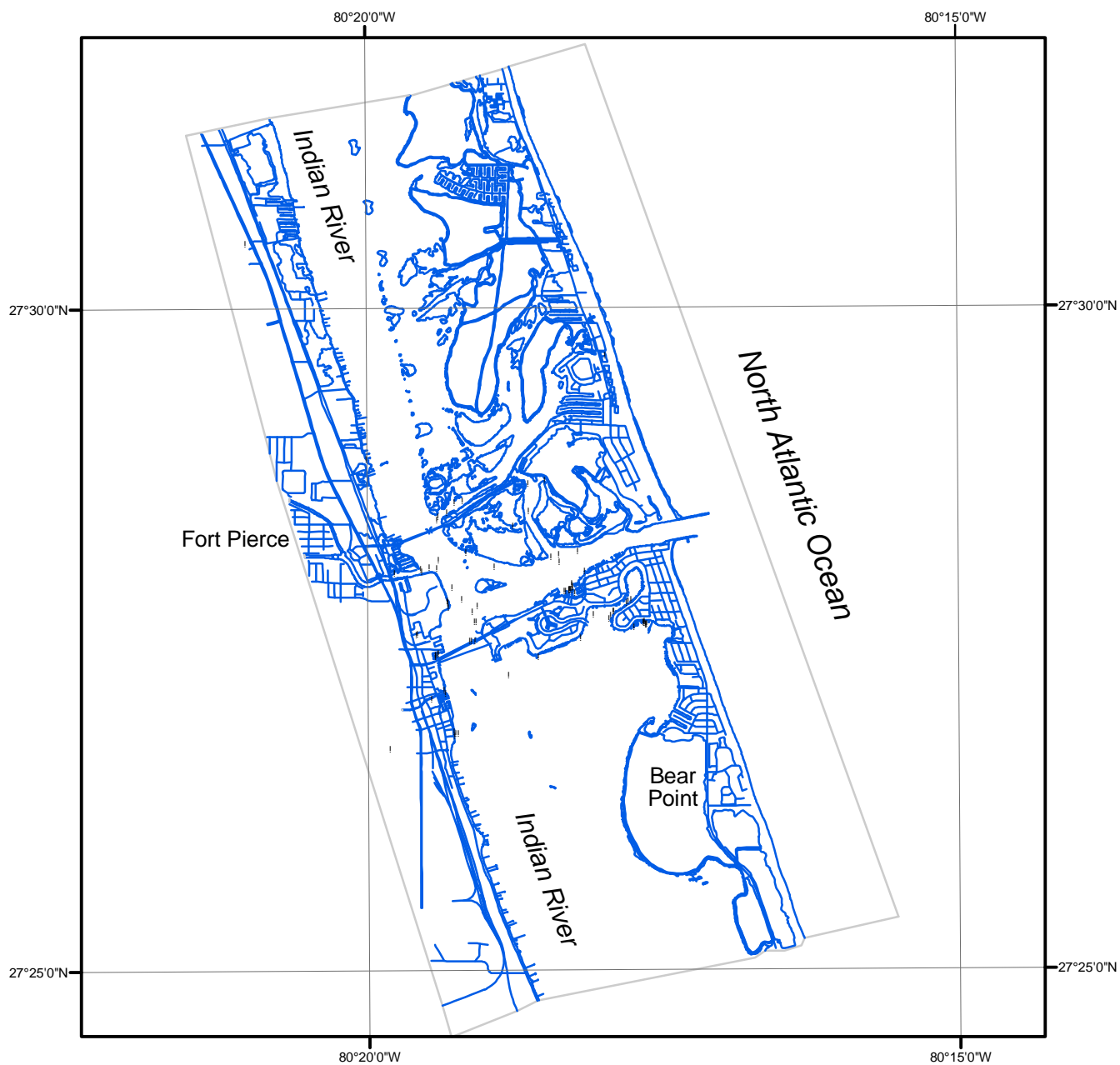- Chart Evaluation File in shapefile format

NOAA Shoreline Data Explorer
- GC10750 in shapefile format
- Metadata file for GC10750
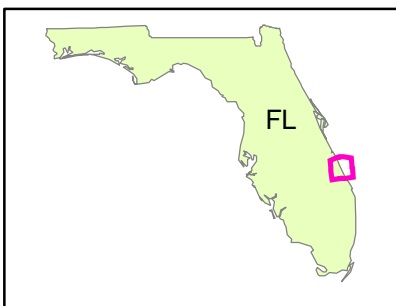- Digital copy of the PCR in Adobe PDF format

End of Report

FORT PIERCE INLET AND HARBOR

FLORIDA

80°20'0"W

80°15'0"W

Indian River

27°30'0"N

North Atlantic Ocean

Fort Pierce

Indian River

Bear Point

27°25'0"N

27°30'0"N

27°25'0"N

80°20'0"W

80°15'0"W

Overview

FL

FL0804

GC10750