

NOAA COASTAL MAPPING PROGRAM PROJECT COMPLETION REPORT

PROJECT TX1001

Port of Freeport, Texas

Introduction

NOAA Coastal Mapping Program (CMP) Project TX1001 provides highly accurate digital shoreline data for key areas of change within the port of Freeport, Texas, and surrounding coastal areas. The project extends along the Old Brazos River from Freeport and Brazos Harbor to the Freeport Harbor Entrance, including the Dow Barge Canal and a portion of the Intracoastal Waterway. 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

Project TX1001 was designed per a request from the Navigation Services Division (NSD) of the Office of Coast Survey (OCS) to provide expedited compilation of new port infrastructure for chart update. Reconnaissance imagery, flown by RSD personnel in response to Hurricane Ike in 2008, was evaluated for use in the project; however, some of the requested infrastructure was still under construction at the time this imagery was acquired. Therefore a GeoEye-1 non-orthorectified color image with a spatial resolution of 0.41 meters, acquired in 2009, was obtained from the National Geospatial-Intelligence Agency (NGA) via the unclassified Web-Based Access and Retrieval Portal (WARP). The combination of satellite (pan-sharpened) and aerial images were deemed sufficient to meet all project requirements.

Field Operations

The field operations consisted of the acquisition of aerial imagery and collection of Global Positioning System (GPS) and Inertial Measurement Unit (IMU) data. The hurricane response photographic mission was conducted on September 17, 2008, with the NOAA Cessna Citation II (N52RF) aircraft. Natural color digital images were acquired, with an approximate ground sample distance of 39 cm, through use of an Applanix Digital Sensor System (DSS-439) digital camera. A total of 137 flight lines were acquired during the mission, although only three lines (51 photographs) were used for this project.

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 airborne kinematic data was processed in the field using Applanix POSPAC (ver. 4.4) software in September 17, 2008. The ZHU1 CORS station in Houston was used as a reference base station for processing the kinematic GPS data. See the Airborne Positioning and Orientation Report (APOR) for more details.

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 December 2009 utilizing a Digital Photogrammetric Workstation (DPW), which is a configuration of computer hardware, modular software components and other associated peripheral devices. All three strips of color aerial imagery, as well as the GeoEye-1 satellite image, were measured and adjusted as a single block using BAE Systems SOCET SET (version 5.4.1) photogrammetric software in conjunction with the Multi-Sensor Triangulation (MST) aerotriangulation module. Upon successful completion of the aerotriangulation process, the RMS of the standard deviations of the residuals for each aerotriangulated ground point was calculated using a full covariance solve strategy within the MST aerotriangulation module. These values were used to compute a predicted horizontal circular error of 0.4 meters based on a 95% confidence level. An Aerotriangulation Report, on file with other project data within the RSD Applications Branch (AB) Project Archive, offers additional information on the aerotriangulation process.

The project database consists of project parameters and options, camera calibration data, 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 the project was initiated by RSD personnel in December 2009. This work was accomplished using a DPW, in conjunction with the Feature Extraction module within BAE Systems SOCET SET (version 5.4.1) photogrammetric 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. The existence and positioning of all features compiled from the aerial imagery was verified using the more recent satellite image.

Spatial data accuracies for Project TX1001 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 imagery sources used to complete this project:

Aerial Imagery					
Date	Time (UTC)	Roll Number	Photo Numbers	GSD	Tide Level*
9-17-08	22:27-22:29	08NC51	26184478-26184603	0.39 m	0.8 m
9-17-08	22:43-22:45	08NC51	26185469-26185574	0.39 m	0.8 m
9-17-08	22:53-22:54	08NC51	26186039-26186127	0.39 m	0.8 m
Satellite Imagery					
Date	Time (UTC)	Source ID	Source File Name	Resolution	Tide Level*
9-28-09	17:06	20090928T170628M	5V090826M0003469604B222000100252M_001548134	0.41 m	0.4 m

* Tide levels are given in meters above MLLW and are based on actual observations recorded by the NOS gauge at Freeport, TX. The elevation of MHW at Freeport is equal to 0.4 meters 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 2010. The review process included analysis of aerotriangulation results and assessment of the identification and attribution of digital feature data within the Geographic Cell (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 chart with the images and compiled project data resulted in creation of the Chart Evaluation File (CEF). The following nautical chart was used in the comparison process:

11322, Intracoastal Waterway Galveston Bay to Cedar Lakes, 1:40,000 scale, 32nd 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 GC10788 file contents, attached to PCR

Remote Sensing Division Electronic Data Library

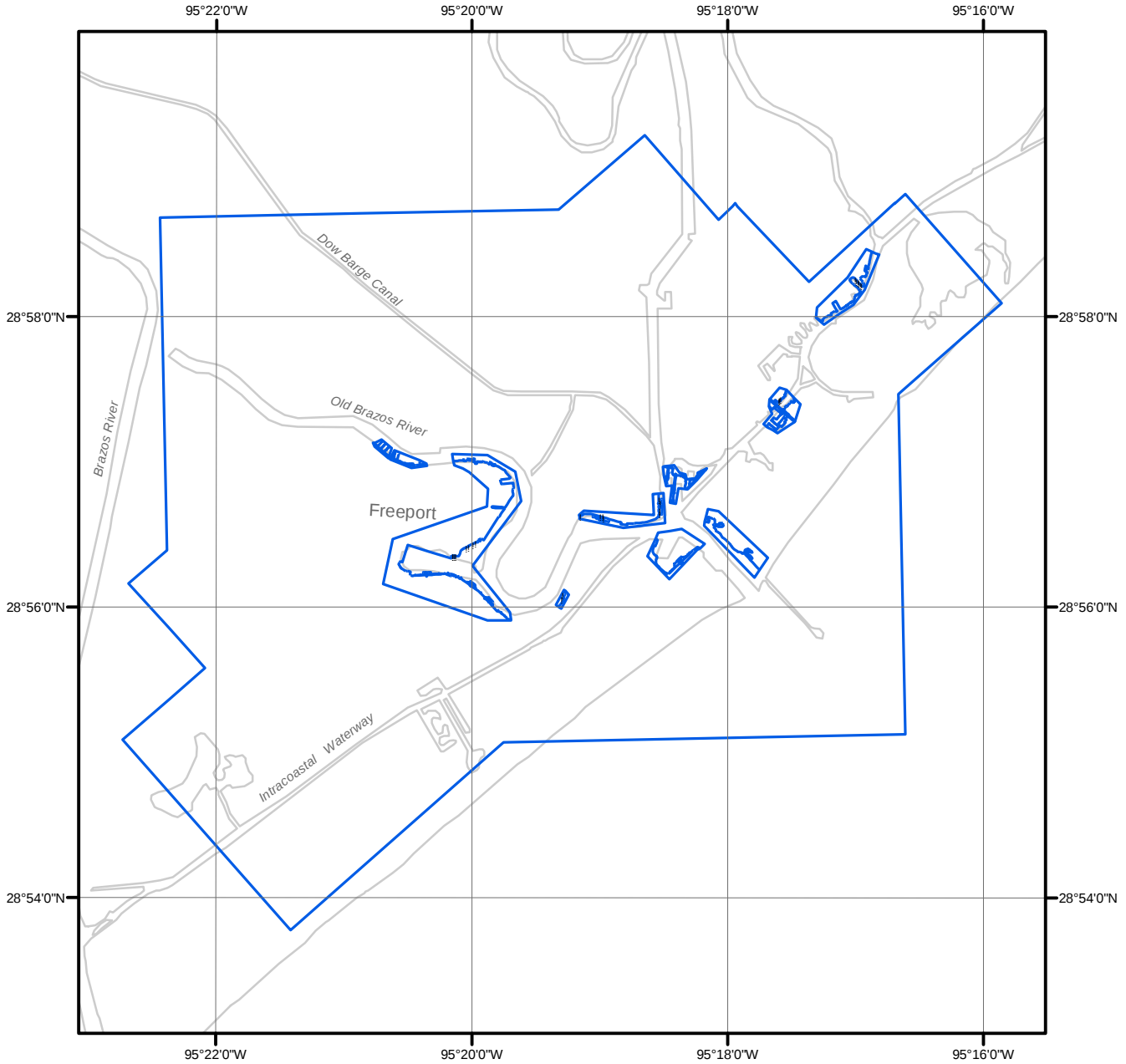
- Project database
- GC10788 in shapefile format
- Digital copy of the PCR in Adobe PDF format
- Chart Evaluation File (CEF) in shapefile format

NOAA Shoreline Data Explorer

- GC10788 in shapefile format
- Metadata file for GC10788
- Digital copy of the PCR in Adobe PDF format

End of Report

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Overview



TX1001

GC10788