

NOAA COASTAL MAPPING PROGRAM PROJECT COMPLETION REPORT

PROJECT TX1104

Colorado River to Bay City, Texas

Introduction

NOAA Coastal Mapping Program (CMP) Project TX1104 provides a highly accurate database of new digital shoreline data for the Colorado River, in Texas, from its mouth upriver to Bay City. 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 Procedures. 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.

Additionally, commercial satellite imagery was used to extend the coverage of this project after significant shoreline changes were observed just beyond the coverage of the aerial photography. One panchromatic WorldView-2 image, acquired by DigitalGlobe, Inc. in May 2013, was obtained for this purpose. The vendor's stated accuracy is 5.0 meters at the 90% confidence level (CE90), however the georeferencing of the image was refined to match the geolocation accuracy of the aerial imagery using Esri's ArcGIS 9.3 desktop GIS software.

Field Operations

The field operations consisted of the collection of static and kinematic GPS data and Inertial Measurement Unit (IMU) data, and the acquisition of digital aerial imagery. Aerial survey operations were conducted on March 11, 2011 with the NOAA King Air aircraft (N68RF). Four flight lines of natural color imagery was acquired using an Applanix DSS-439 digital camera system with a 60 mm lens. Imagery was acquired at a nominal altitude of 10,000 feet, resulting in an approximate ground sample distance (GSD) of 0.35 meters. Although imagery was not acquired in strict coordination with local tides, the goal was to collect all imagery below MHW.

Direct Georeferencing Data Processing

GPS/IMU data were processed by RSD personnel to yield precise camera positions and

orientations for direct georeferencing (DG) of the aerial imagery. A local GPS base station was established for use as a reference station for kinematic GPS processing operations. The position of the base station was determined using the NGS Online Processing User Service (OPUS), which computed fixed baseline solutions from nearby CORS stations. The airborne kinematic data was processed using Applanix POSPAC (ver. 5.3) software in April 2011. For further information refer to the Airborne Positioning and Orientation Reports (APOR) on file with other project data within the RSD Applications Branch (AB) Project Archive.

The processed GPS/IMU data were used to derive precise exterior orientation (EO) values of the camera centers required for feature extraction from the aerial imagery. The predicted horizontal accuracy of the imagery was determined by propagating sensor EO and image measurement uncertainties through the photogrammetric collinearity equations using an Excel spreadsheet based Exterior Orientation Total Propagated Uncertainty (EO-TPU) tool developed by NGS. Using this tool, the predicted horizontal uncertainty at the 95% confidence level (CE95) was calculated to be 1.4 meters.

NGS third order geodetic control points were used to test the horizontal integrity of the DG data. A comparison between image measurements and the published coordinates for these points revealed offsets in the 0.0 to 2.0 m range. All stereo-models were examined and found to have acceptable levels of parallax for mapping purposes.

Compilation

The data compilation phase of this project was accomplished by AB personnel in July 2013. Digital mapping was performed using the Feature Extraction software module within SOCET SET (ver. 5.6). Feature identification and attribution within the GC was based on image analysis of the project imagery and information extracted from the largest scale NOAA nautical chart 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 TX1104 were determined according to standard Federal Geographic Data Committee (FGDC) practices. Cartographic features were compiled to meet a horizontal accuracy of 2.8 meters CE95. This predicted accuracy of well-defined points measured during the compilation phase was derived by doubling the imagery accuracy computed from the EO-TPU tool.

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

Aerial Photographs					
Date	Time (UTC)	Roll #	Photo #s	~ GSD	Tide Stage*
3/11/2011	18:33 – 18:35	11NC06	1804 – 1821	0.35 m	0.0 m
3/11/2011	18:40 – 18:42	11NC06	1822 – 1836	0.35 m	0.0 m

3/11/2011	18:46 – 18:51	11NC06	1837 – 1869	0.35 m	0.0 m
3/11/2011	18:56 – 19:01	11NC06	1870 – 1907	0.35 m	0.0 m
Satellite Imagery					
Date	Time (UTC)	Source File Name		Resolution	Tide Stage*
5/5/2013	18:04	13MAY05171804-P1BS-00057600170_03_P003		0.5 m	0.0 m

* Tide levels are given in meters above MLLW and are based on actual observations recorded at the NOS reference station at Port O'Connor, TX. The height of the MHW tidal datum above MLLW in the project area is approximately 0.6 m.

Quality Control / Final Review

Quality control (QC) tasks were conducted during all phases of project completion by a member of AB. The final QC review was completed in August 2013. The review process included analysis of the DG 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 source imagery and compiled project data resulted in creation of the Chart Evaluation File (CEF). The following nautical chart was used in the comparison process:

11319, ICW - Cedar Lakes to Espiritu Santo Bay, 1:40,000, 34th Ed., Sep./12

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 TX1104 Data Acquisition Summary
- Hardcopy of the Airborne Positioning and Orientation Report (APOR)
- Hardcopy of the Project Completion Report (PCR)
- Page-size graphic plot of GC11010 file contents, attached to PCR

Remote Sensing Division Electronic Data Library

- Project database
- GC11010 in shapefile format
- Digital copy of the PCR in Adobe PDF format
- Chart Evaluation File in shapefile format

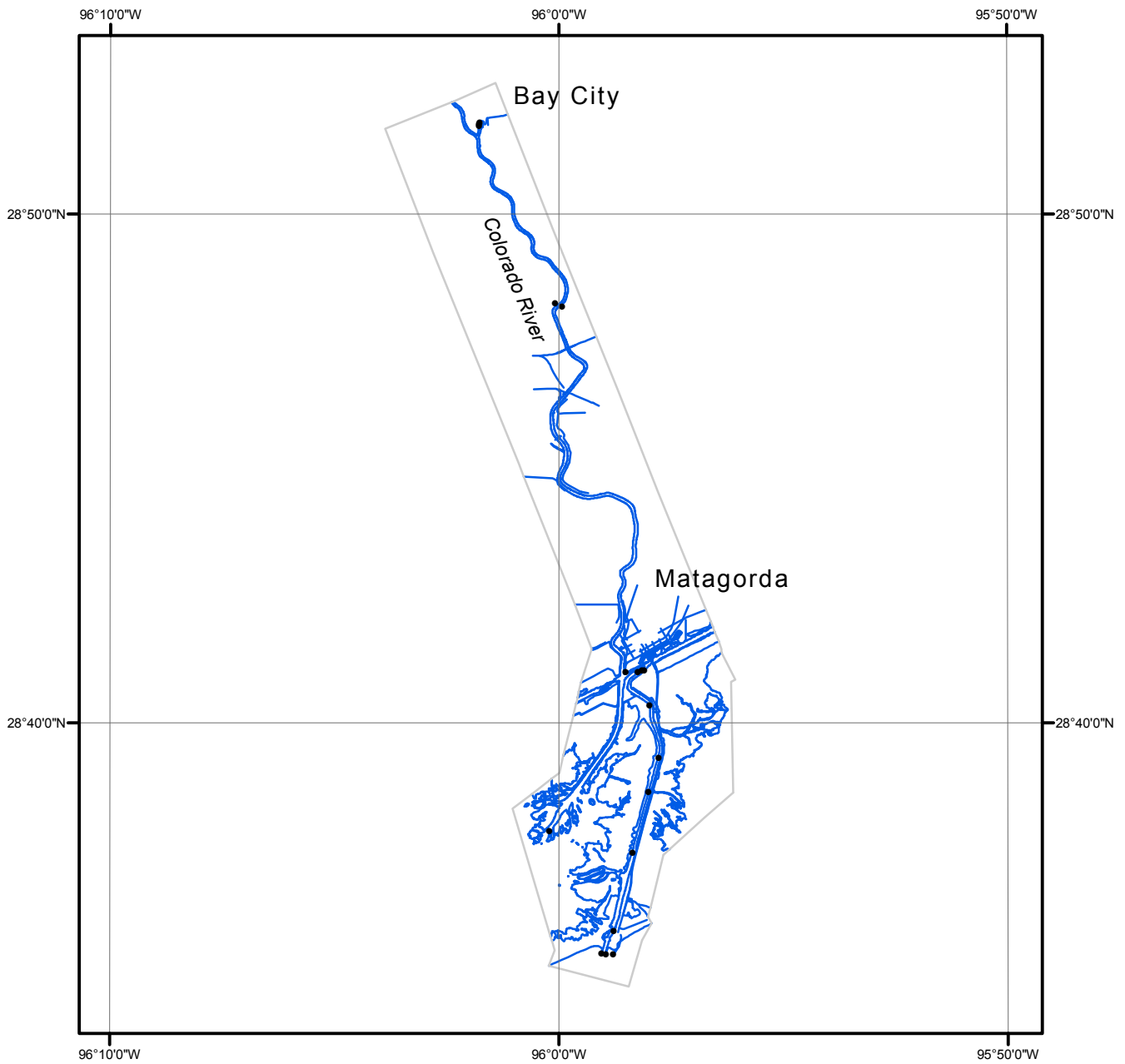
NOAA Shoreline Data Explorer

- GC11010 in shapefile format
- Metadata file for GC11010
- Digital copy of the PCR in Adobe PDF format

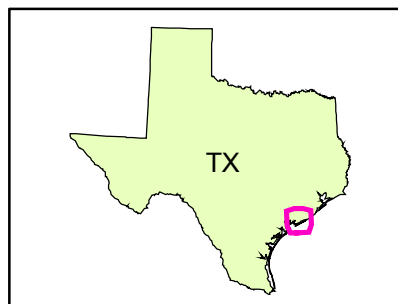
End of Report

COLORADO RIVER TO BAY CITY

TEXAS



Overview



TX1104

GC11010