NOAA COASTAL MAPPING PROGRAM
PROJECT COMPLETION REPORT

PROJECT TX1002A

Port of Beaumont, Texas

Introduction

Coastal Mapping Program (CMP) Project TX1002A provides highly accurate digital shoreline data for key areas of change in the port of Beaumont, Texas and vicinity. Project TX1002C is a subproject of a larger project, TX1002, which includes the ports of Beaumont, Orange, Port Arthur, and Sabine Pass. 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 design of Project TX1002A was accomplished by the Requirements Branch (RB) of the Remote Sensing Division (RSD) in response to the need for updates to the NOAA Electronic Navigational Chart (ENC) series. Project requirements were formulated as a result of analysis conducted within the Coast and Shoreline Change Analysis Program (CSCAP), in which NOAA nautical chart products are compared to contemporary high resolution imagery to ascertain the need for more current shoreline data. A Chart Evaluation File (CEF) was created and forwarded to the Applications Branch (AB) of RSD once a change analysis was completed. For details of the chart comparison process refer to the RB CSCAP memorandum of July 1, 2010.

Field Operations

The field operations consisted of the collection of static and kinematic Global Positioning System (GPS) data and Inertial Measurement Unit (IMU) data and the acquisition of aerial imagery. The photographic mission operations were conducted on March 12-13, 2010 with the NOAA King Air (N68RF) aircraft. Seventeen (17) lines of color (RGB) and black & white infrared (BWIR) digital images were acquired with an Applanix Digital Sensor System (DSS-439) aerial camera at a nominal altitude of 10,000 feet, resulting in an approximate ground sample distance (GSD) of 0.35 meters. For this subproject only eight of the RGB lines and none of the BWIR lines were used. Although imagery was not acquired in strict coordination with local tides, the goal was to collect all imagery below Mean High Water (MHW).

GPS Data Reduction

The GPS and IMU data were processed by RSD personnel to yield precise camera positions in order to provide a control network necessary for aerotriangulation. The base station's geodetic position was derived using the NGS Online Processing User Service (OPUS), which computed fixed baseline solutions from nearby CORS stations. The kinematic GPS data was processed using Applanix POSPac MMS 4.4 GPS/IMU software on May 28, 2010. For further information refer to the Airborne Positioning and Orientation Reports (APOR) on file with other project data within the AB Project Archive.

Aerotriangulation

Routine softcopy aerotriangulation methods were applied to establish a 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 AB personnel in March 2013 utilizing a Digital Photogrammetric Workstation (DPW), a configuration of computer hardware, modular software components, and other associated peripheral devices. The digital images were measured and adjusted as a single block using the triangulation software module of BAE Systems SOCET GXP (v 4.1) software. Upon successful completion of this process, the triangulation software provided the standard deviations for each aerotriangulated ground point, which were used to compute a predicted horizontal circular error of 0.3 meters based on a 95% confidence level (CE95). An Aerotriangulation Report was written and is on file with other project data within the RSD Project Archive. Positional data is referenced to the North American Datum of 1983 (NAD83).

Compilation

The data compilation phase of this project was initiated by a member of RSD in February 2014. Before compilation of features was begun, newer satellite imagery covering the entire project area was obtained to ensure the most recent delineation of changes identified during CSCAP analysis. Four commercial satellite images from DigitalGlobe, Inc. were obtained, including two orthorectified pan-sharpened natural color WorldView-2 images (acquired in December 2011 and January 2013) and two orthorectified panchromatic WorldView-1 images (acquired in January 2014). Esri's ArcGIS (v 10.2) desktop GIS software was used to enhance the georeferencing for the satellite images to be used to compile feature data.

Digital feature data was compiled using SOCET GXP (v 4.1) photogrammetric software. 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 TX1002A were determined according to standard Federal Geographic Data Committee (FGDC) practices. Cartographic features extracted from aerial photography were compiled to meet a horizontal accuracy of 0.6 meters CE95, a predicted accuracy of compiled well-defined points derived by doubling the circular error calculated from the aerotriangulation statistics. Cartographic features extracted from the WorldView images were compiled to meet a horizontal accuracy of 3.5 meters CE95, a predicted accuracy which is based on a comparison with check points measured from the aerotriangulated aerial photography.

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

Aerial Imagery					
Date	Time (UTC)	Roll #	Photo #s	~ GSD	Tide Level*
12-MAR-2010	15:55 – 15:56	10NC09	2239 – 2247	0.35 m	0.0 m
12-MAR-2010	16:28 – 16:29	10NC09	2320 – 2328	0.35 m	0.0 m
12-MAR-2010	16:51 – 16:56	10NC09	2374 – 2402	0.35 m	0.0 m

12-MAR-2010	17:02 – 17:07	10NC09	2407 – 2445	0.35 m	0.0 m
12-MAR-2010	17:11 – 17:13	10NC09	2446 – 2455	0.35 m	0.0 m
12-MAR-2010	17:23 – 17:25	10NC09	2457 – 2470	0.35 m	0.0 m
12-MAR-2010	17:29 – 17:33	10NC09	2471 – 2492	0.35 m	0.0 m
12-MAR-2010	17:34 – 17:37	10NC09	2496 – 2508	0.35 m	0.0 m
12-MAR-2010	17:41 – 17:43	10NC09	2509 – 2527	0.35 m	0.0 m
13-MAR-2010	15:21 – 15:22	10NC03	413 – 416	0.35 m	0.0 m
13-MAR-2010	15:28 – 15:29	10NC03	423 – 425	0.35 m	0.0 m
Satellite Imagery					
Date	**Time (UTC)**	**Source File Name**		**GSD**	**Tide Lev***
1-DEC-2011	17:11	20111201_171157_wv2_ori		0.5 m	0.1 m
3-JAN-2013	17:14	20130103_171407_wv2_ori		0.5 m	-0.1 m†
21-JAN-2014	16:49	20140121_164943_wv1_ori_a		0.5 m	-0.3 m
21-JAN-2014	16:49	20140121_164943_wv1_ori_b		0.5 m	-0.3 m

* Tide levels are given in meters above MLLW and are based on preliminary water level observations at the time of photography recorded by the TCOON gauge at Rainbow Bridge, TX (Station ID: 8770520). The elevation of the MHW tidal datum in the project area is 0.30 meters above MLLW.

† Reported tide level based on verified data.

Quality Control / Final Review

The final review of the project was completed by a senior member of RSD in March 2014, and 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 9.3.1 software. All project data was evaluated for compliance to CMP requirements.

End Products and Deliverables

The following specifies the location and identification of end products generated during the completion of this project:

RSD Applications Branch Archive

- Hardcopy of the CSCAP evaluation memorandum
- Hardcopy of the Airborne Positioning and Orientation Report (APOR)
- Hardcopy of the Aerotriangulation Report
- Hardcopy of the Project Completion Report (PCR)

Remote Sensing Division Electronic Data Library

- Project database
- GC10967 in shapefile format
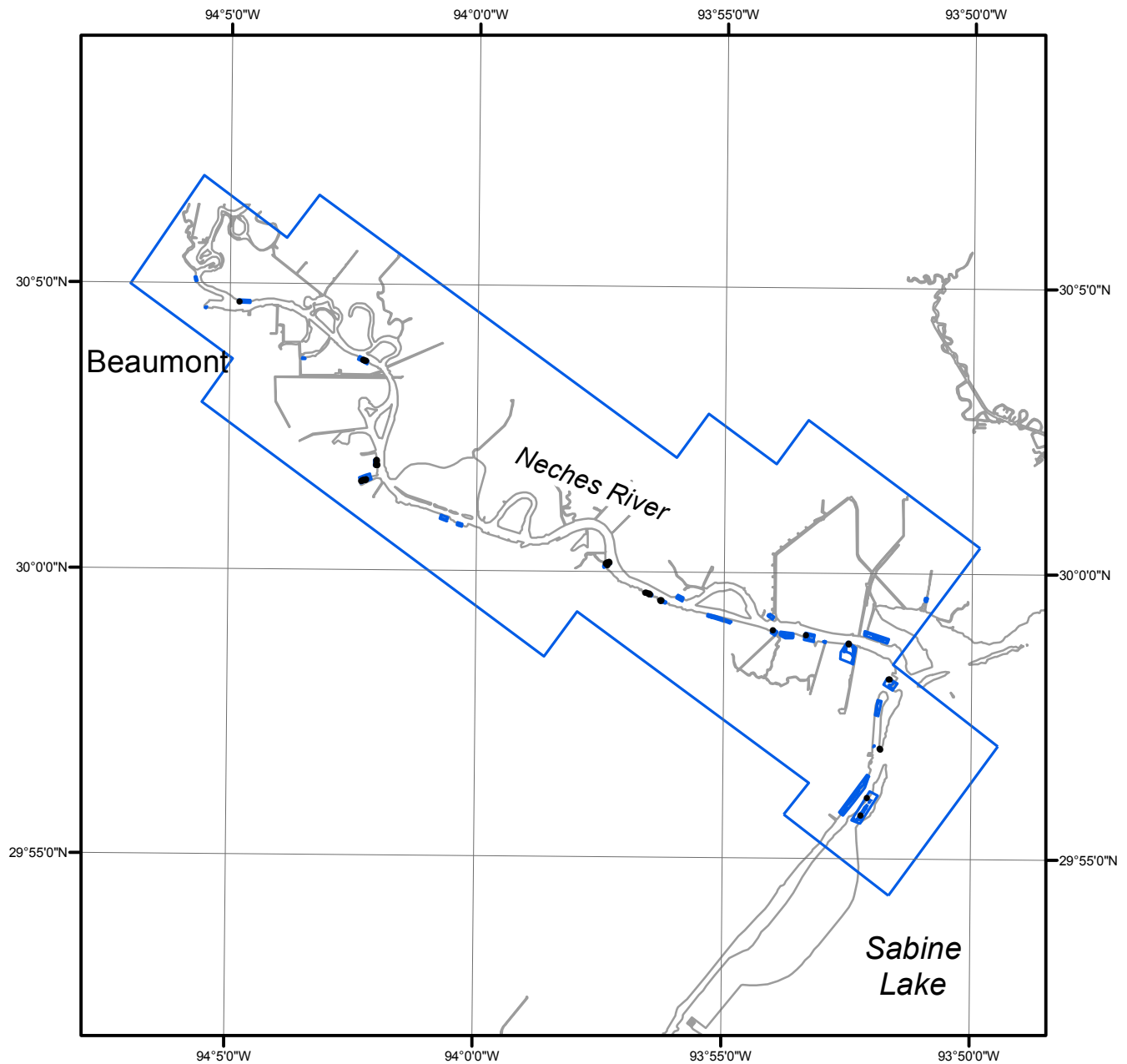- Digital copy of the PCR in Adobe PDF format
- CEF in shapefile format

NOAA Shoreline Data Explorer
- GC10967 in shapefile format
- Metadata file for GC10967
- Digital copy of the PCR in Adobe PDF format

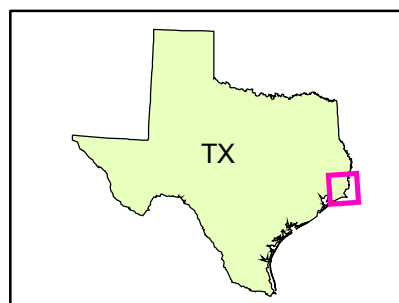## End of Report

PORT OF BEAUMONT

TEXAS

Beaumont

Neches River

Sabine Lake

94°5'0"W 94°0'0"W 93°55'0"W 93°50'0"W

30°5'0"N

30°0'0"N

29°55'0"N

Overview

TX

TX1002A

GC10967