

NOAA COASTAL MAPPING PROGRAM PROJECT COMPLETION REPORT

PROJECT TX1002C

Port Arthur, Texas

Introduction

Coastal Mapping Program (CMP) Project TX1002C provides highly accurate digital shoreline data for key areas of change in the vicinity of Port Arthur, Texas, including Port Arthur Ship Channel, Sabine-Neches Canal, and Taylor Bayou. 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 coastal zone management applications.

Project Design

The design of Project TX1002C 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 initially 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 in order to ascertain the need for more current shoreline data. Aerial photography, described below, was utilized for the CSCAP analysis. A Chart Evaluation File (CEF) was forwarded to the Applications Branch (AB) of RSD once the change analysis was complete. Refer to the CSCAP memorandum of July 27, 2010 for details of the chart comparison process. Additionally, pan-sharpened natural color WorldView-2 commercial satellite imagery from DigitalGlobe, Inc., with a spatial resolution of 0.5 meters, was obtained to cover an area of change identified after completion of CSCAP analysis.

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. Photographic mission operations were conducted on March 12, 2010 with the NOAA King Air aircraft (N68RF). All photography was acquired using an Applanix Digital Sensor System (DSS-439) dual head camera. Seventeen strips of natural color digital images were acquired with an approximate ground sample distance of 0.35 meters, although only five strips (89 images) were used for this subproject.

GPS Data Reduction

A base station was established at Chennault International Airport in Louisiana using static GPS. GPS and IMU data were processed by RSD personnel to yield precise positions and orientations of camera centers as a means of rendering accurately positioned digital images. The static GPS base station data was processed in May of 2010 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 POSPac (ver. 4.4) software in July 2010. For further information refer to the Airborne Positioning and Orientation Report (APOR) on file with other project data within the AB Project Archive.

Aerotriangulation

Routine softcopy aerotriangulation (AT) 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 softcopy photogrammetric workstation. The digital images were measured and adjusted as a single block using BAE Systems SOCET GXP (ver. 4.0) photogrammetric suite in conjunction with the Multi-Sensor Triangulation (MST) software module. Upon successful completion of the AT process, the MST software provided the standard deviations of the residuals 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 AT Report was written and is on file with other project data within the RSD Project Archive.

The commercial satellite imagery was not included in the aerotriangulation described above. It was determined that refinement georeferenced imagery was not necessary since the imagery compared favorably spatially with sources of control used to check its geolocation, and since the vendor provided an acceptable accuracy assessment for their imagery. The RMSE accuracy reported by the vendor is 3.9 meters. 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 AB in July 2013. Digital mapping was performed using the SOCET SET (ver. 5.6) Feature Extraction software module. Feature identification and attribution within the Geographic Cell (GC) were based on image analysis of the digital photographs, satellite image, and information extracted from the appropriate NOAA nautical charts 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 TX1002C were determined according to standard Federal Geographic Data Committee (FGDC) practices. Feature data extracted from the aerial photography was compiled to meet a horizontal accuracy of 0.6 meters CE95. This predicted accuracy of compiled, well defined points was derived by doubling the circular error computed from AT statistics. Features extracted from satellite imagery were compiled to meet a horizontal accuracy of 6.8 meters, based on the vendor reported RMSE accuracy converted to the 95% confidence level (CE95). The accuracy of the satellite imagery was further tested by comparing positions of features also visible in the aerial imagery, with observed measured differences not exceeding 2 meters.

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

Aerial Imagery					
Date	Time (UTC)	Roll Number	Photo Numbers	GSD (nominal)	Tide Level*
3/12/2010	15:56 – 15:58	10NC09	2247 – 2262	0.35 m	0.1
3/12/2010	16:25 – 16:27	10NC09	2305 – 2320	0.35 m	0.1
3/12/2010	17:50 – 17:52	10NC09	2528 – 2541	0.35 m	0.3
3/12/2010	18:03 – 18:07	10NC09	2582 – 2603	0.35 m	0.3
3/12/2010	18:11 – 18:13	10NC09	2605 – 2621	0.35 m	0.3
Satellite Imagery					
Date	Time (UTC)	Source File Name		Resolution	Tide Level
9/23/2013	17:21:59	WV0213SEP23172159-PSORI-1030010027171400-r5c1.tif		0.5 m	n/a

* Tide levels are given in meters above MLLW and are based on actual observations recorded by the NOS gage at Sabine Pass North. The elevation of MHW at Sabine Pass North is 0.5 meters above MLLW.

Quality Control / Final Review

The final review of the project was completed by a senior member of AB in October 2013, and included analysis of AT 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.

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)
- Hardcopy of the CSCAP evaluation memorandum

Remote Sensing Division Electronic Data Library

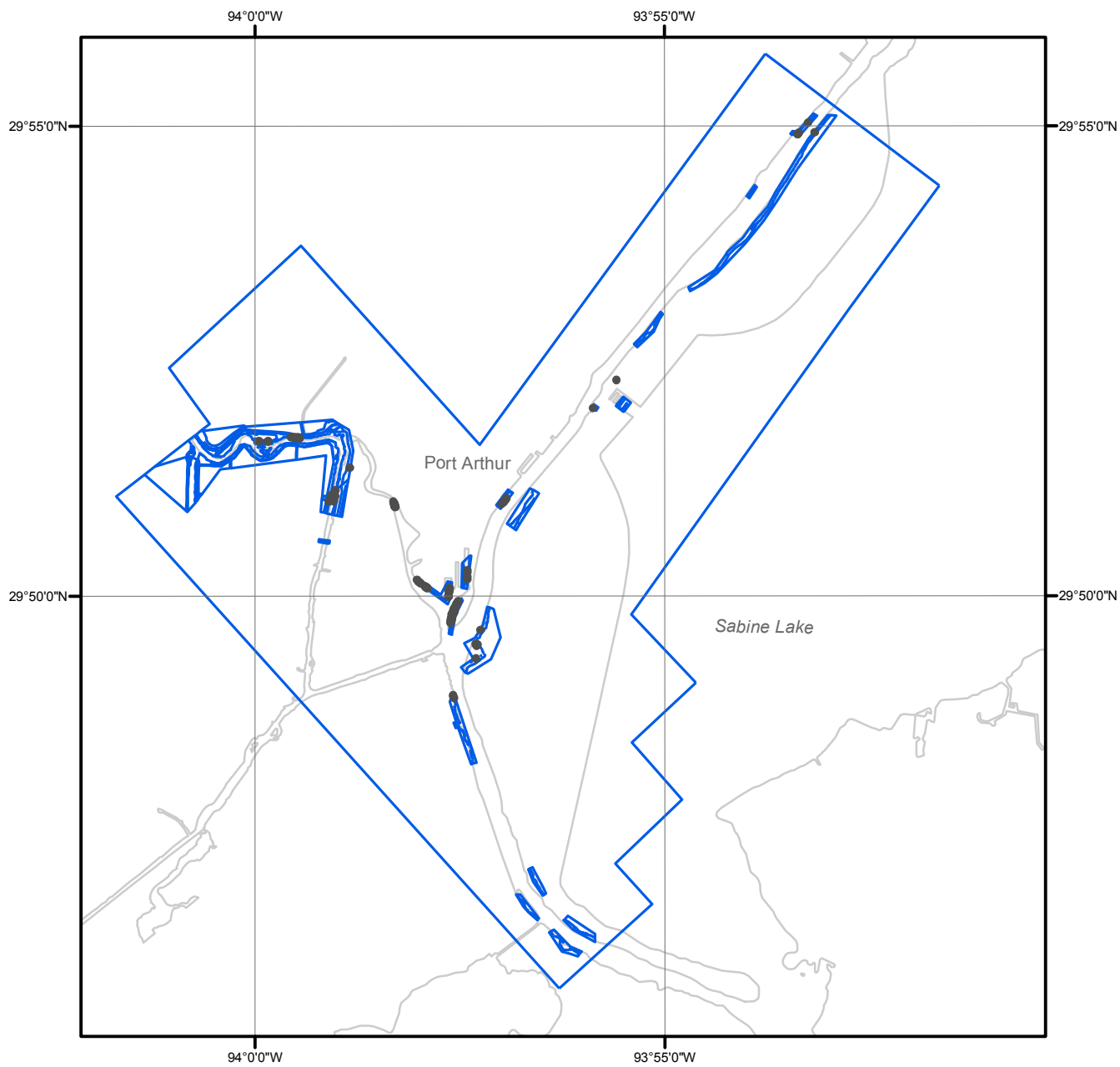
- Project database
- GC10969 in shapefile format
- Digital copy of the PCR in Adobe PDF format
- CEF in shapefile format

NOAA Shoreline Data Explorer

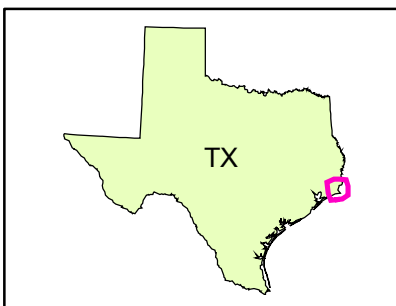
- GC10969 in shapefile format
- Metadata file for GC10969
- Digital copy of the PCR in Adobe PDF format

End of Report

PORT ARTHUR TEXAS



Overview



TX1002C

GC10969