

NOAA COASTAL MAPPING PROGRAM PROJECT COMPLETION REPORT

PROJECT TX1504A-CM-N

Shamrock Island, Texas

Introduction

NOAA Coastal Mapping Program (CMP) Project TX1504A-CM-N provides highly accurate digital shoreline data for Shamrock Island, Texas. This is a subproject of a larger acquisition project, TX1504-CS-N, covering the Port of Corpus Christi/Port Ingleside. 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 TX1504-CS-N was planned by the Requirements Branch (RB) of the Remote Sensing Division (RSD) in response to the need for timely updates to the NOAA chart suite within key U.S. ports. Subproject TX1504A-CM-N was subsequently planned in order to expedite data delivery in response to a specific request from the Marine Chart Division (MCD) of NOAA's Office of Coast Survey. Project imagery for TX1504-CS-N predated construction of several coastal features requested by MCD, therefore commercial satellite imagery was used to supplement the project. Available source data deemed adequate for successful completion of this project included one orthorectified, pan-sharpened natural color WorldView-3 image from DigitalGlobe, Inc. with a spatial resolution of 0.3 meters.

Field Operations

Field operations for Project TX1504-CS-N consisted of the collection of static and kinematic GPS data and Inertial Measurement Unit (IMU) data, and the acquisition of aerial imagery. Aerial survey operations were conducted in March, 2016 with the NOAA King Air aircraft (N68RF). Nineteen flight lines of natural color (RGB) imagery were acquired using an Applanix DSS dual camera system, although only seven individual RGB images were used for this subproject. Near-infrared (NIR) imagery was also acquired concurrently but was not used. Imagery was acquired at a nominal altitude of 10,500 feet, resulting in an approximate ground sample distance (GSD) of 0.33 meters for the RGB images. Although imagery was not acquired in strict coordination with local tides, the goal was to collect all imagery below Mean High Water (MHW).

Aerial Imagery Direct Georeferencing

GPS/IMU data were processed by RSD personnel to yield precise camera positions and orientations for direct georeferencing (DG) of the 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 in April 2016 using POSPac MMS GPS/IMU software (v. 7.1). For further

information refer to Airborne Positioning and Orientation Reports (APORs) on file with other project data within the RSD Electronic Data Library. All positional data for this project is referenced to the North American Datum of 1983 (NAD 83).

The processed GPS/IMU data were used to derive precise exterior orientation (EO) values of the camera centers required for digital feature extraction. The predicted horizontal accuracy of the imagery was determined by propagating sensor EO and image measurement uncertainties through the photogrammetric collinearity equations using the Exterior Orientation Total Propagated Uncertainty (EO-TPU) tool developed by NGS. Using this tool, the predicted horizontal uncertainty at the 95% confidence level was calculated to be 0.9 meters. NGS third order geodetic control points were used to verify the horizontal integrity of the DG data. All stereo-models were examined and found to have acceptable levels of parallax for mapping purposes.

Satellite Imagery Georeferencing

Georeferencing tasks were conducted using Esri's ArcGIS® (v10.4.1) desktop GIS software by a member of the Applications Branch (AB) of RSD in July 2017. Ground control points were extracted from the aerial images described above. Within ArcGIS, the Georeferencing toolset was used, and the georeferenced image was resampled using the Nearest Neighbor method with a 1st order polynomial model. The RMS of the residuals for measured check points was used to compute a horizontal accuracy at the 95% confidence level (CE95) of 0.8 meters. This value was doubled and added to the CE95 of the aerial images from which check points were measured in order to conservatively predict the accuracy of well-defined points measured during the compilation process.

Compilation

Feature data compilation for TX1504A-CM-N was accomplished by a member of RSD AB in July 2017. This work was performed using the Feature Extraction software module within SOCET SET (ver. 5.6). Feature identification and attribution within the GC were based on image analysis 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 were determined according to standard Federal Geographic Data Committee (FGDC) practices. Cartographic features from aerial imagery were compiled to meet a horizontal accuracy (CE95) of 1.8 meters, a predicted accuracy of compiled well-defined points derived by doubling the horizontal uncertainty calculated using the EO-TPU tool. Features from satellite imagery were tested to have an accuracy of 2.5 meters CE95 based on comparison of at least twenty (20) check points to an independent source of higher accuracy.

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

Aerial Imagery				
Date	Time (GMT)	Roll	Strip / Images	Tide Level*
3/21/2016	18:07 – 18:09	16VC34	53-006 / 8161 – 8167	0.1 m
Satellite Imagery				
Date	Time (GMT)	Derivative Image ID		Tide Level†
2/23/2017	17:36	20170223_1736_WV03_ORI_MOS.jp2		0.0 m

* Tide level is given in meters above MLLW and calculated using the Pydro software tool with a TCARI grid referenced to verified water level observations at the time of photography from various NOS gauges in the vicinity of the project. The elevation of the MHW tidal datum in the project is approximately 0.2 meters above MLLW.

† Tide level is given in meters above MLLW and based on observations recorded by NOS gauges at USS Lexington (#8775296) and Packery Channel (#8775792), TX at the time of image acquisition.

Quality Control / Final Review

Quality control tasks were conducted during all phases of project completion by senior members of the CMP. The final QC review was completed in July 2017. 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 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:

- 11312, Corpus Christi Bay, Port Aransas to Port Ingleside, 1:20,000 scale, 6th Ed., Aug 2015

End Products and Deliverables

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

Remote Sensing Division Electronic Data Library

- Airborne Positioning and Orientation Reports (APORs)
- Project database
- GC11342 in shapefile format
- Project Completion Report (PCR)
- CEF in shapefile format

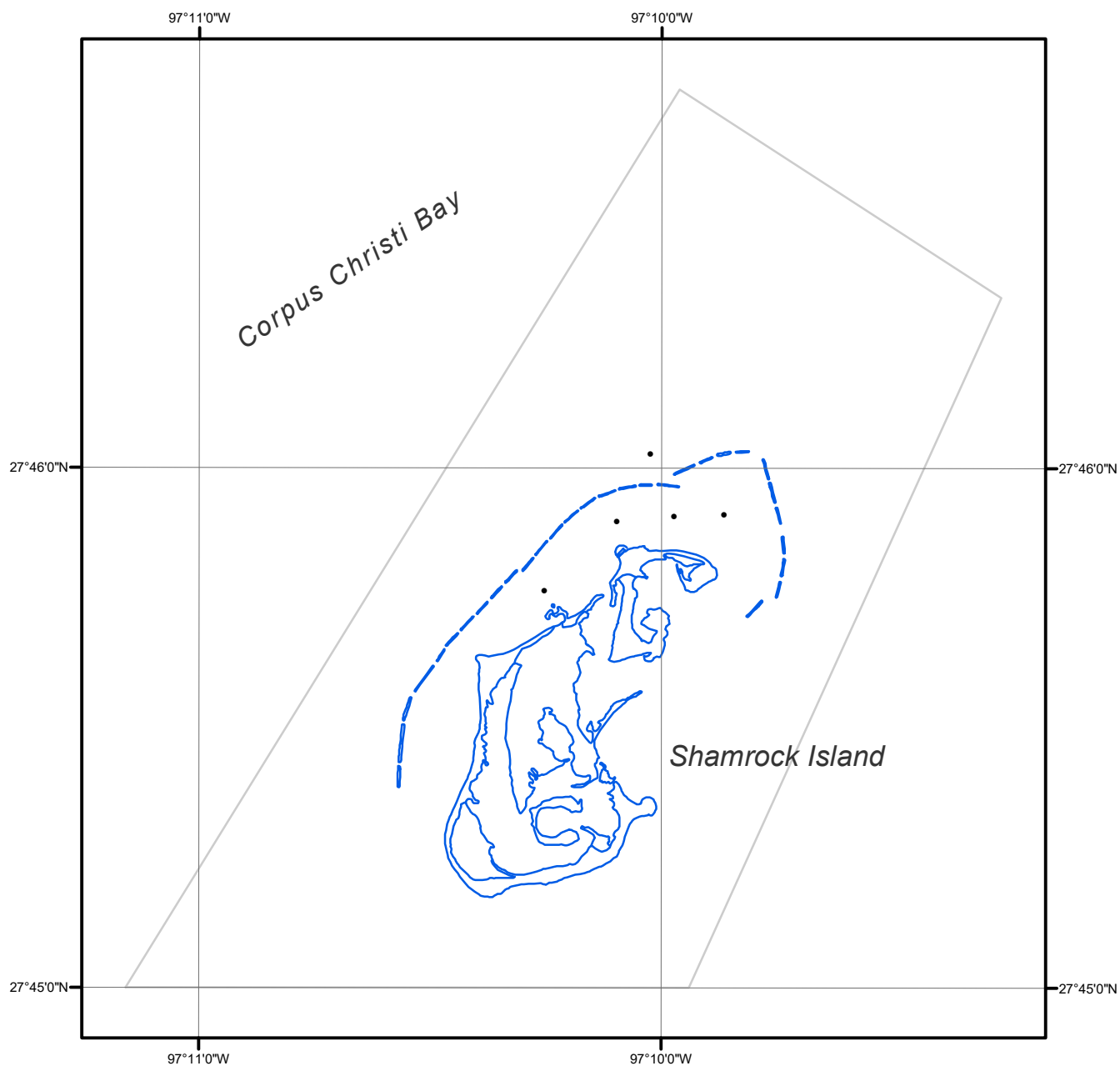
NOAA Shoreline Data Explorer

- GC11342 in shapefile format
- Metadata file for GC11342
- PCR in Adobe PDF format

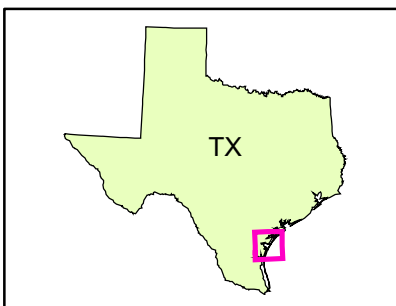
End of Report

SHAMROCK ISLAND

TEXAS



Overview



TX1504A-CM-N

GC11342