

# **NOAA COASTAL MAPPING PROGRAM PROJECT COMPLETION REPORT**

## ***PROJECT TX1505B-CM-N***

### ***Galveston Bay, Clear Lake to La Porte, Texas***

#### **Introduction**

NOAA Coastal Mapping Program (CMP) Project TX1505B-CM-N provides highly accurate digital shoreline data for a portion of Galveston Bay from Clear Lake, near Seabrook, to La Porte, Texas. This project is a subproject of a larger project, TX1505-CM-N, which covers the western part of Galveston Bay from Texas City to Baytown. 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**

Photographic mission instructions for TX1505-CM-N were formulated by the Requirements Branch (RB) of the Remote Sensing Division (RSD) following the guidelines of RSD's Photo Mission Standard Operating Procedures. The instructions discussed the project's purpose, geographic area of coverage, scope and priority, image requirements, Global Positioning System (GPS) data collection procedures and guidelines, instructions for data recording and handling, and mission communication protocols. RB created a Project Layout Diagram, flight maps and input files for the aircraft flight management system.

#### **Field Operations**

Field operations consisted of the collection of static and kinematic GPS data, Inertial Measurement Unit (IMU) data, and the acquisition of aerial imagery. The photographic mission operations were conducted in March 2016 and February 2017 and consisted of acquisition of Mean Lower Low Water (MLLW) tide-coordinated imagery with the NOAA King Air (N68RF) aircraft. Twelve strips of color (RGB) and near-infrared (NIR) digital images were acquired concurrently with an Applanix Digital Sensor System (DSS) dual camera at a nominal altitude of 10,500 feet, resulting in an approximate ground sample distance (GSD) of 0.32 – 0.37 meters.

#### **Direct Georeferencing Data Processing**

The 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 kinematic GPS data was processed in April 2016 and in March 2017 using Applanix POSPac MMS (ver. 7.1) software. For further information refer to the Airborne Positioning and Orientation Reports (APOR) on file with other project data within the RSD Electronic Data Library. All positional data 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 suitable 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 for all project imagery was calculated to be 0.9 meters. Several NGS third-order geodetic control points were used to verify the horizontal integrity of the DG data, and all stereo models were examined and found to have acceptable levels of parallax for mapping purposes.

## Compilation

A member of the RSD Applications Branch (AB) accomplished the data compilation phase of this project in July 2019 utilizing the Feature Extraction module of BAE's SOCET SET (ver. 5.6) photogrammetric software. Feature identification and the assignment of cartographic codes were based on image analysis of the project photography 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), 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 TX1505B-CM-N were determined according to standard Federal Geographic Data Committee (FGDC) practices. Cartographic features were compiled to meet a horizontal accuracy of 1.8 meters at the 95% confidence level. This predicted accuracy of compiled, well-defined points 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:

Date	Time (UTC)	Color Imagery		Infrared Imagery		Tide Level*
		Roll #	Frame #s	Roll #	Frame #s	
3-20-2016	16:56 – 17:00	16VC32	7871 – 7891	16VR32	7870 – 7890	0.1 – 0.0 m
3-20-2016	17:08 – 17:12	16VC32	7904 – 7922	16VR32	7903 – 7921	0.1 – 0.0 m
3-20-2016	17:16 – 17:20	16VC32	7923 – 7942	16VR32	7922 – 7941	0.1 – 0.0 m
3-20-2016	17:41 – 17:42	16VC32	7964 – 7968	16VR32	7963 – 7967	-0.1 m
2-25-2017	19:02 – 19:03	17VC16	2981 – 2985	17VR14	2387 – 2391	-0.1 m

\*Tide levels are given in meters above MLLW and were calculated using the Pydro software tool with a TCARI grid referenced to verified water level observations at NOS gauges. The height of the MHW tidal datum in the project area ranges between 0.34 – 0.38 meters above MLLW.

## Quality Control / Final Review

A senior member of AB conducted quality control tasks during all phases of project completion. The final QC review was completed in August 2019. 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 Esri's ArcGIS (ver. 10.7) desktop GIS software. All project data was evaluated for compliance to CMP requirements.

Comparisons of the largest scale NOAA nautical charts with project images and compiled project data resulted in creation of the Chart Evaluation File (CEF). The following nautical charts were used in the comparison process:

- 11326, Galveston Bay, 41<sup>st</sup> Ed., Apr. 2019
- 11327, Upper Galveston Bay, 38<sup>th</sup> Ed., Mar. 2017

## **End Products and Deliverables**

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

### **Remote Sensing Division Electronic Data Library**

- Project database
- Airborne Positioning and Orientation Reports (APOR)
- GC11493 in shapefile format
- Project Completion Report (PCR)
- CEF in shapefile format

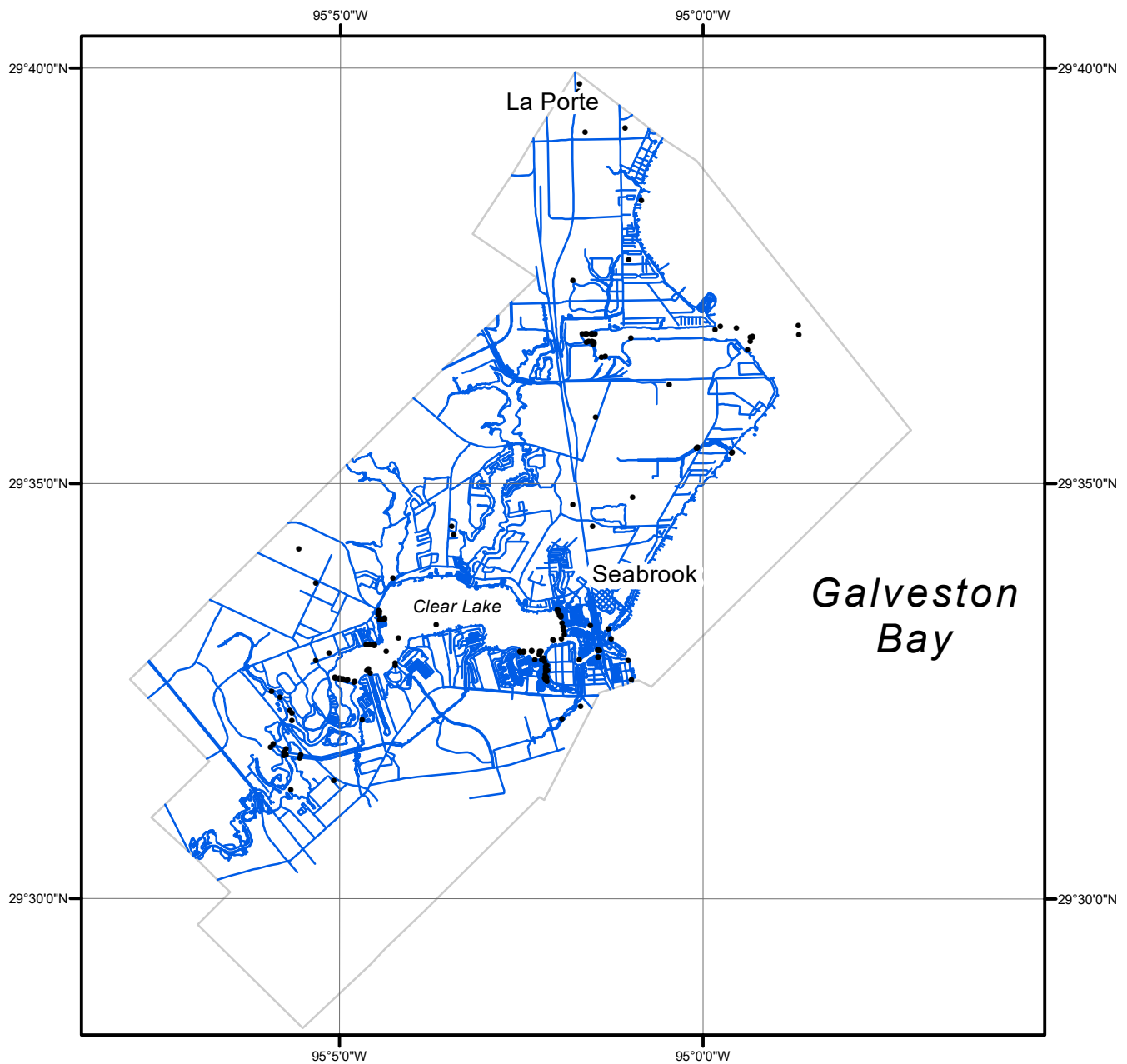
### **NOAA Shoreline Data Explorer**

- GC11493 in shapefile format
- Metadata file for GC11493
- PCR in Adobe PDF format

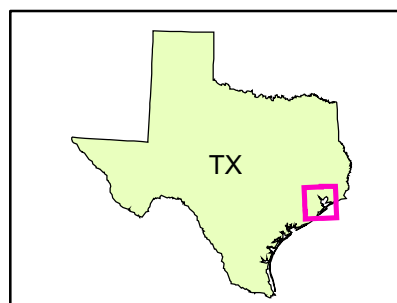
## **End of Report**

# GALVESTON BAY, CLEAR LAKE TO LA PORTE

## TEXAS



Overview



TX1505B-CM-N

GC11493