

NOAA COASTAL MAPPING PROGRAM PROJECT COMPLETION REPORT

PROJECT TX1505A-CM-N

Galveston Bay, Kemah to Eagle Point, Texas

Introduction

NOAA Coastal Mapping Program (CMP) Project TX1505A-CM-N provides highly accurate digital shoreline for a portion of Galveston Bay from Kemah to San Leon, 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 Global Positioning System (GPS) data, Inertial Measurement Unit (IMU) data, and the acquisition of aerial imagery. The photographic mission operations were conducted on March 20, 2016 and February 25, 2017 for the 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 on April 13, 2016 and on March 23, 2017 using Applanix POSPAC (ver. 6.2) software. For further information refer to the Airborne Positioning and Orientation Reports (APOR) on file with other project data within RSD's 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

The data compilation phase of this project was accomplished by a member of the RSD Applications Branch (AB) in May 2017. The Feature Extraction module was used within SOCET SET (v 5.6.0) 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 TX1505A-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	Images	Roll	Images	
3-20-2016	16:40 – 16:41	16VC32	07849 – 07853	16VR32	07848 – 07852	0.1 m
2-25-2017	19:00 – 19:02	17VC16	02970 – 02982	17VR14	02376 – 02388	-0.1 – 0 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 is 0.3 meters above MLLW.

Quality Control / Final Review

Quality control tasks were conducted during all phases of project completion by a senior member of AB. The final QC review was completed in May 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 10.4.1 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, 1:80,000 scale (w/1:25,000 scale inset), 40th Ed., Nov. 2016
- 11327, Upper Galveston Bay, 1:25,000 scale, 38th 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)
- GC11309 in shapefile format
- Project Completion Report (PCR)
- CEF in shapefile format

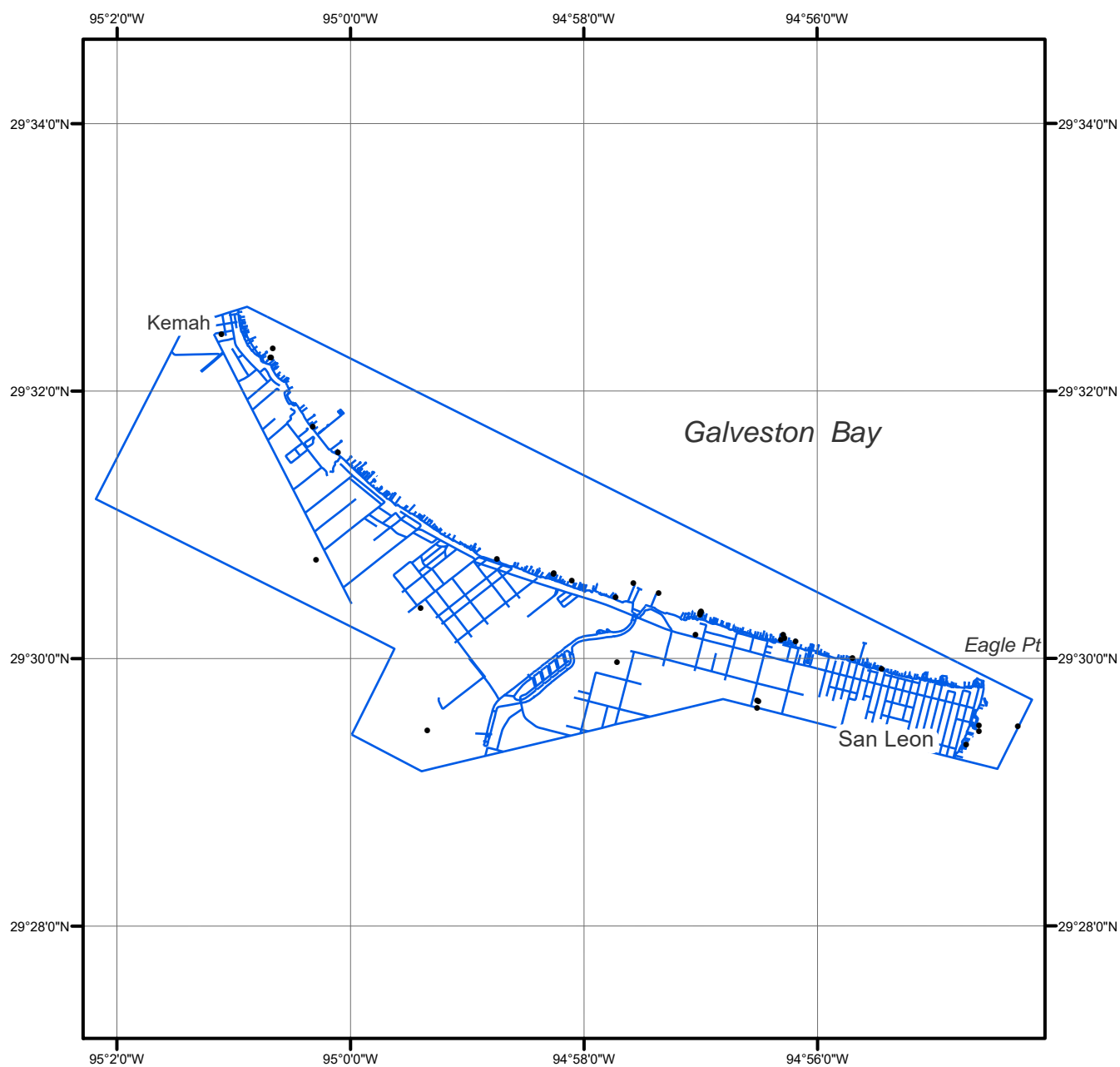
NOAA Shoreline Data Explorer

- GC11309 in shapefile format
- Metadata file for GC11309
- PCR in Adobe PDF format

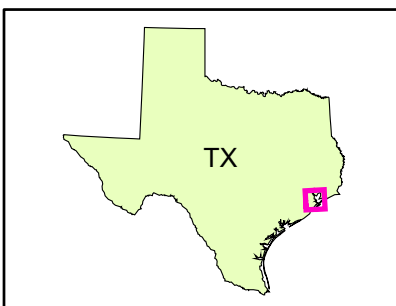
End of Report

GALVESTON BAY, KEMAH TO EAGLE POINT

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Overview



TX1505A-CM-N

GC11309