

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

## ***PROJECT TX1404D-CM-N***

### ***Laguna Madre, El Toro to Mesquite Rincon, Texas***

#### **Introduction**

NOAA Coastal Mapping Program (CMP) Project TX1404D-CM-N provides highly accurate digital shoreline data for a portion of the coast of Laguna Madre from El Toro to Mesquite Rincon, Texas. TX1404D-CM-N is a subproject of a larger acquisition project, TX1404-CU-N, which extends from the Port Mansfield to Rocky Slough, Texas. 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 Requirements Branch (RB) of the Remote Sensing Division (RSD) designed Project TX1404-CU-N to support the Continually Updated Shoreline Product (CUSP), a seamless shoreline database. Photographic mission instructions were formulated 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.

This project is located in a non-tidal area of Laguna Madre, where a Mean Water Level (MWL) datum and a Low Water Datum (LWD) are established in lieu of the standard Mean High Water and Mean Lower Low Water tidal datums, respectively. MWL is an adjusted average equivalent to Mean Sea Level (MSL), and LWD is determined by subtracting 0.5 ft. from the MWL datum.

#### **Field Operations**

The 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 October 2014 with the NOAA King Air aircraft. Natural color and near infrared (NIR) digital images were acquired with an Applanix Digital Sensor System (DSS) 439 aerial camera system. All images were acquired at a nominal altitude of 10,500 feet, resulting in an approximate ground sample distance (GSD) of 0.37 meters. Imagery acquisition was coordinated with the established Mean Water Level (MWL) datum.

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

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 using Applanix POSPac (ver. 6.2) software in November 2014. For further information refer to the Airborne Positioning and Orientation Report (APOR) that is on file with other project data within the RSD Electronic Data Library.

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 an 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 1.52 meters.

NGS third order control was 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. Positional data is referenced to the North American Datum of 1983 (NAD 83).

## Compilation

The data compilation phase of this project was completed in December 2018. The Feature Extraction module of BAE Systems' SOCET SET (ver. 5.6) photogrammetric software was used to compile feature data from imagery. Feature identification and the assignment of cartographic codes were based on image analysis of the project digital images 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 TX1404D-CM-N were determined according to standard Federal Geographic Data Committee (FGDC) practices. Cartographic features were compiled to meet a horizontal accuracy of 3.0 meters at the 95% confidence level. This predicted accuracy of compiled well-defined points measured during the compilation phase was derived by doubling the horizontal uncertainty calculated 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		Water Level*
		Roll	Strip/Images	Roll	Strip/Images	
14-OCT-2014	21:41 – 21:42	14NC90	53-022 / 20025 – 20034	14NR80	53-022 / 16555 – 16564	0.0 m
15-OCT-2014	15:17 – 15:19	14NC91	53-005 / 20228 – 20239	14NR81	53-005 / 16758 – 16769	0.1 m
15-OCT-2014	15:42 – 15:44	14NC91	53-006 / 20307 – 20319	14NR81	53-006 / 16837 – 16849	0.1 m
15-OCT-2014	15:51 – 15:53	14NC91	53-007 / 20332 – 20344	14NR81	53-007 / 16862 – 16874	0.1 m
15-OCT-2014	16:05 – 16:07	14NC91	53-008 / 20395 – 20409	14NR81	53-008 / 16925 – 16939	0.1 m
15-OCT-2014	16:12 – 16:14	14NC91	53-009 / 20411 – 20425	14NR81	53-009 / 16941 – 16955	0.1 m

15-OCT-2014	16:22 – 16:24	14NC91	53-010 / 20448 – 20461	14NR81	53-010 / 16978 – 16991	0.1 m
15-OCT-2014	16:29 – 16:31	14NC91	53-011 / 20462 – 20474	14NR81	53-011 / 16992 – 17004	0.1 m
15-OCT-2014	16:39 – 16:40	14NC91	53-012 / 20494 – 20502	14NR81	53-012 / 17024 – 17032	0.1 m

\* Water levels are given in meters above MSL and are based on verified observations at the Texas Coastal Ocean Observation Network (TCOON) gauge at Rincon Del San Jose (station 8777812).

## 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 December 2018. 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 (ver. 10.5.1) software. All project data was evaluated for compliance to CMP requirements.

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

- 11304, Northern part of Laguna Madre, 14<sup>th</sup> Ed., Apr. 2012
- 11306, Intracoastal Waterway, Laguna Madre, Middle Ground to Chubby I., 22<sup>nd</sup> Ed., Oct./12

## 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 Report (APOR)
- GC11450 in shapefile format
- Project Completion Report (PCR)
- CEF in shapefile format

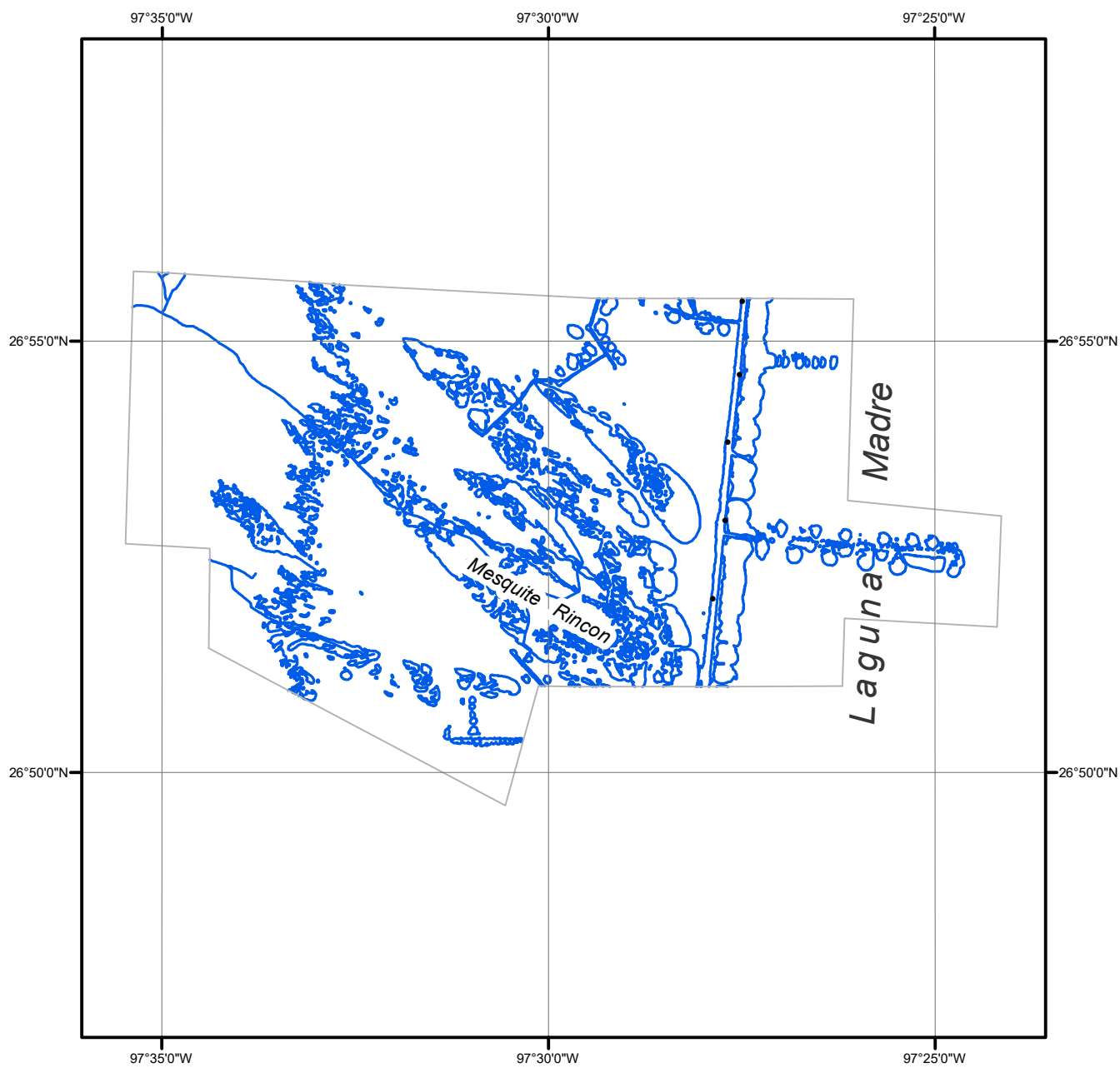
### NOAA Shoreline Data Explorer

- GC11450 in shapefile format
- Metadata file for GC11450
- PCR in Adobe PDF format

## End of Report

# LAGUNA MADRE, EL TORO TO MESQUITE RINCON

## TEXAS



Overview



TX1404D-CM-N

GC11450