

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

## ***PROJECT AL0901-CM-N***

### ***Mobile Bay, Bon Secour Bay to Fairhope, Alabama***

#### **Introduction**

NOAA Coastal Mapping Program (CMP) Project AL0901-CM-N provides a highly accurate database of new digital shoreline data for a portion of the coastline of Mobile Bay from Bon Secour Bay to Fairhope, including Weeks Bay, Alabama. 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) formulated the photographic mission instructions for this project following the guidelines of the Photo Mission Standard Operating Procedure. 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**

The field operations consisted of the collection of static and kinematic GPS data and Inertial Measurement Unit (IMU) data, and the acquisition of digital aerial imagery. The photographic mission operations were conducted during two flights over the course of two days, November 13, 2012 and November 14, 2012, with the NOAA King Air (N68RF) aircraft. Project imagery included thirteen flight lines with 746 natural color (RGB) and near-infrared (NIR) images acquired concurrently using an Applanix DSS-439 dual head digital camera system in coordination with the MLLW tide level. All imagery was acquired at a nominal altitude of 10,000 feet, resulting in an approximate ground sample distance (GSD) of 0.35 meters. Although NIR imagery was acquired, it was not used in the compilation of this project.

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

GPS/IMU data for project AL0901-CM-N was 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 December 3, 2012 using POSpac MMS ver. 5.4.4 GPS/IMU 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.

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 Excel spreadsheet based 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 1.4 meters for the imagery used to compile data for AL0901-CM-N.

Three NGS third-order geodetic control points were used to test the horizontal integrity of the DG data. The differences between positions measured in the imagery and the published coordinates for these points are less than 0.5 meters. 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 in October 2015. Digital mapping 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 of the aerial imagery and information extracted from the largest scale 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 AL0901-CM-N were determined according to standard Federal Geographic Data Committee (FGDC) practices. Cartographic features were compiled to meet a horizontal accuracy of 2.8 meters at the 95% confidence level. This predicted accuracy of compiled well-defined points is 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)	Roll #	Photo #s	~ GSD	Tide Level*
11/13/2012	16:58 – 17:05	12NC84	30032 – 30077	0.35 m	0.0 m
11/13/2012	18:12 – 18:15	12NC84	30283 – 30304	0.35 m	-0.1 m
11/14/2012	15:28 – 15:31	12NC85	30323 – 30342	0.35 m	-0.1 m
11/14/2012	15:38 – 15:40	12NC85	30343 – 30362	0.35 m	-0.1 to 0.0 m
11/14/2012	15:45 – 15:49	12NC85	30363 – 30386	0.35 m	0.0 m
11/14/2012	15:53 – 15:55	12NC85	30387 – 30404	0.35 m	-0.1 to 0.0 m
11/14/2012	16:00 – 16:04	12NC85	30405 – 30429	0.35 m	0.0 m
11/14/2012	16:08 – 16:11	12NC85	30430 – 30450	0.35 m	-0.1 to 0.0 m

11/14/2012	16:20 – 16:23	12NC85	30451 – 30474	0.35 m	0.0 m
11/14/2012	16:38 – 16:41	12NC85	30475 – 30498	0.35 m	0.0 m
11/14/2012	16:46 – 16:49	12NC85	30499 – 30521	0.35 m	0.0 m
11/14/2012	16:54 – 17:00	12NC85	30522 – 30569	0.35 m	0.0 m
11/14/2012	17:04 – 17:09	12NC85	30570 – 30609	0.35 m	0.0 m

\* Tide levels are given in meters above MLLW and were calculated using the Pydro software tool with a TCARI grid based on verified observations at NOS reference stations within the project vicinity. The height of the MHW tidal datum in the project area varies between 0.35 – 0.46 meters above MLLW.

## Quality Control / Final Review

Quality control tasks were conducted during all phases of project completion by a member of the Applications Branch. The final QC review was completed in October 2015. 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 10.2 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 charts were used in the comparison process:

11376, Mobile Bay, 1:80,000, 57<sup>th</sup> Ed., Jan. 2014

11377, Mobile Bay – Approaches & Lower Half, 1:40,000, 10<sup>th</sup> Ed., Jan. 2013

11378, ICW, Santa Rosa Sound to Dauphin Island, 1:40,000, 38<sup>th</sup> Ed., Apr. 2013

## 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

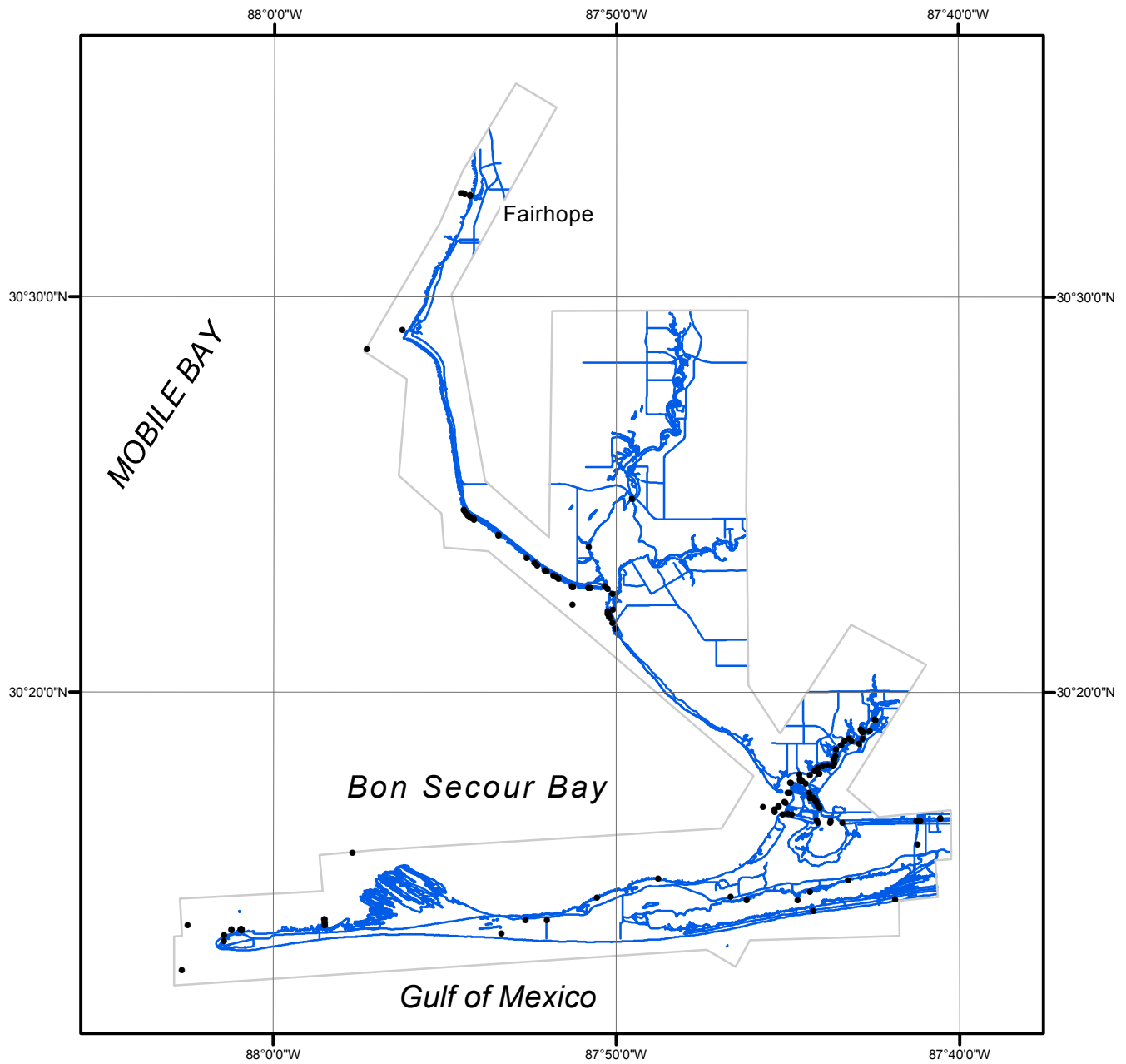
- Airborne Positioning and Orientation Report (APOR)
- Direct Georeferencing Report
- Project Completion Report (PCR)
- Project database
- GC11159 in shapefile format
- Chart Evaluation File in shapefile format

### NOAA Shoreline Data Explorer

- GC11159 in shapefile format
- Metadata file for GC11159
- Digital copy of the PCR

## End of Report

# MOBILE BAY, BON SECOUR BAY TO FAIRHOPE ALABAMA



Overview



AL0901-CM-N

GC11159