NOAA COASTAL MAPPING PROGRAM
PROJECT COMPLETION REPORT

PROJECT AL1103

Grand Bay and Point aux Chenes Bay, Alabama and Mississippi

Introduction

Coastal Mapping Program (CMP) Project AL1103 provides highly accurate digital shoreline data for a portion of the Alabama/Mississippi Gulf Coast, including Grand Bay and Point aux Chenes Bay. The Geographic Cell (GC) may be used in support of the NOAA Nautical Charting Program (NCP) as well as geographic information systems (GIS) for 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 Version II. The instructions discussed the project's purpose, geographic area of coverage, scope and priority, image requirements, flight line priority, Global Positioning System (GPS) data collection procedures and guidelines for both kinematic and static surveys, data recording and handling instructions and contact and communication information. RB created a Project Layout Diagram, flight maps and input files for the aircraft's flight management system.

Field Operations

The field operations consisted of the collection of static and kinematic Global Positioning System (GPS) data and Inertial Measurement Unit (IMU) data and the acquisition of aerial imagery. Aerial survey operations were originally designed and conducted on October 10, 2010, with the NOAA King Air aircraft, for analysis of the Deepwater Horizon Oil Spill (post-kill). For the Coastal Mapping project AL1103 a subset of eight strips of digital images were utilized. The data were acquired using an Applanix Digital Sensor System (DSS-439) Dual Cam digital camera at a flying height of 7,500 feet - approximate ground sample distance of 0.25 meters.

Airborne kinematic GPS data were collected in conjunction with an Inertial Measurement Unit (IMU) to determine precise camera positions and orientations.

GPS Data Reduction

GPS and IMU data were processed by Remote Sensing Division (RSD) personnel to yield precise camera positions and orientations for direct georeferencing of the imagery, and to provide a control network necessary for aerotriangulation. A local GPS base station was established for use as a reference station in kinematic GPS processing operations. The position of the base station was determined using the NGS Online Processing User Service (OPUS) software, which computed fixed baseline solutions from

nearby CORS stations. The airborne kinematic data was processed using Applanix POSPAC (ver. 5.3) software in November 2010.

Ortho-imagery

Ortho-images of the surrounding project area were created in October of 2010, by RSD personnel, in support of emergency operations for the Deep Water Horizon oil spill. The developed DSS imagery, along with Direct Geo-referencing data, were utilized within the APPLANIX Rapid Ortho software in order to produce ortho-images at a 0.35m ground sample distance (GSD). A constant elevation of zero meters was utilized to rectify the data. These ortho-images were used as base data in the automated feature extraction (AFE) process described below

Aerotriangulation

Routine softcopy aerotriangulation (AT) methods were applied to establish a network of precise camera positions and other control for mapping, and to provide model parameters and orientation elements required for digital compilation. This work was initiated by RSD personnel in May 2011, utilizing a Digital Photogrammetric Workstation (DPW). The digital images were measured and adjusted as a single block using BAE Systems SOCET SET (version 5.5.0) photogrammetric suite in conjunction with the Multi-Sensor Triangulation (MST) AT module. Upon successful completion of the AT process, the MST software provided the standard deviations for each aerotriangulated ground point, which were used to compute a predicted horizontal circular error of 0.46 meters based on a 95% confidence level. An AT Report was written and is on file with other project data within the RSD Project Archive.

The project database consists of project parameters and options, camera calibration data, adjusted exterior orientation parameters, and positional listing of all measured points. Positional data is referenced to the North American Datum of 1983 (NAD83).

Compilation

The digital compilation phase of this project was initiated by RSD in June 2011, and entailed a multi-step approach utilizing both automated and manual compilation methods, as reported below.

Automated Mapping Method

All Shoreline class features present in the database were compiled using this method. The AFE method was performed using the ortho-images, discussed above, in combination with an object-based image analysis (OBIA) approach from within the ENVI Feature Extraction (Fx) software. Fx allows the user to interactively create and classify objects, based on image rules that meet in-situ criteria, and then to run a raster-to-vector algorithm to convert the classified image to an ArcGIS polygon shapefile. Upon completion of the AFE process, the polygon shapefile was imported into ArcGIS and 1) aggregated to merge polygons separated by less than the standard minimum distance, 2) smoothed and simplified, 3) converted to a polyline format, and 4) edited to create attribute fields compatible with the RSD interim shapefile format. The interim shapefile was then imported into SOCET SET (SS) and a Feature Data Base (FDB) was

created. The FDB, consisting solely of Shoreline features, was then reviewed and edited within the SS Feature Extraction module, by the original compiler, using stereo-models derived from the AT solution.

Manual Mapping Method

All non-Shoreline class features present in the database (i.e., Alongshore Features, Obstructions, etc.) were compiled using this method. The manual data compilation phase of this project utilized the *traditional* RSD digital mapping approach of stereoscopic interpretation integrated with "heads-up" digitizing from within the SS Feature Extraction module. The FDB created in the automated mapping method, as described above, was subsequently populated with features derived from this manual method. This served to integrate all coastal features within a single FDB. Also, all Shoreline features compiled using the AFE method, were reviewed for accuracy within the stereo environment.

Feature identification and attribution within the Geographic Cell (GC) were based on image analysis of the digital photographs 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 AL1103 were determined according to standard Federal Geographic Data Committee (FGDC) practices. Cartographic features were compiled to meet a horizontal accuracy of 0.9 meters at the 95% confidence level. The predicted accuracy of compiled, well defined points is derived by doubling the circular error computed from AT statistics.

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

Date	~ Time (UTC)	Roll Number	Strip	Photo Numbers	GSD (nominal)	Tide Level*
10-10-2010	17:48	10NC35	138034	15638 - 15645	0.25 m	0.1m
10-10-2010	18:02	10NC35	138036	15677 - 15685	0.25 m	0.1m
10-10-2010	18:16	10NC35	138038	15733 – 15764	0.25 m	0.1m
10-10-2010	18:33	10NC35	138041	15813 – 15844	0.25 m	0.1m
10-10-2010	18:47	10NC35	138043	15897 - 15914	0.25 m	0.1m
10-10-2010	19:03	10NC35	138045	15981 - 15999	0.25 m	0.1m
10-10-2010	19:15	10NC35	138047	16032 - 16052	0.25 m	0.1m
10-10-2010	19:24	10NC35	138049	16054 - 16079	0.25 m	0.1m

* Tide levels are given in meters above MLLW and are based on actual observations recorded by the NOS gauge at Dauphin Island, AL (station ID: 8735180). The elevation of MHW at Dauphin Island is 0.36 meters above MLLW.

Final Review

The final review of the project was completed by a senior member of RSD in June 2011, and included analysis of the aerotriangulation 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 9.3 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:

Chart 11374, Dauphin I. to Dog Keys Pass, 1:40,000 scale, 35th Ed., Sep. 2009
Chart 11375, Pascagoula Harbor, MS, 1:20,000 scale, 37th Ed., Jun. 2010

End Products and Deliverables

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

RSD Applications Branch Archive
- Hardcopy of the Aerotriangulation Report
- Hardcopy of the Airborne Positioning and Orientation Report (APOR)
- Hardcopy of the Project Completion Report (PCR)
- Page-size graphic of GC10879 file contents, attached to PCR

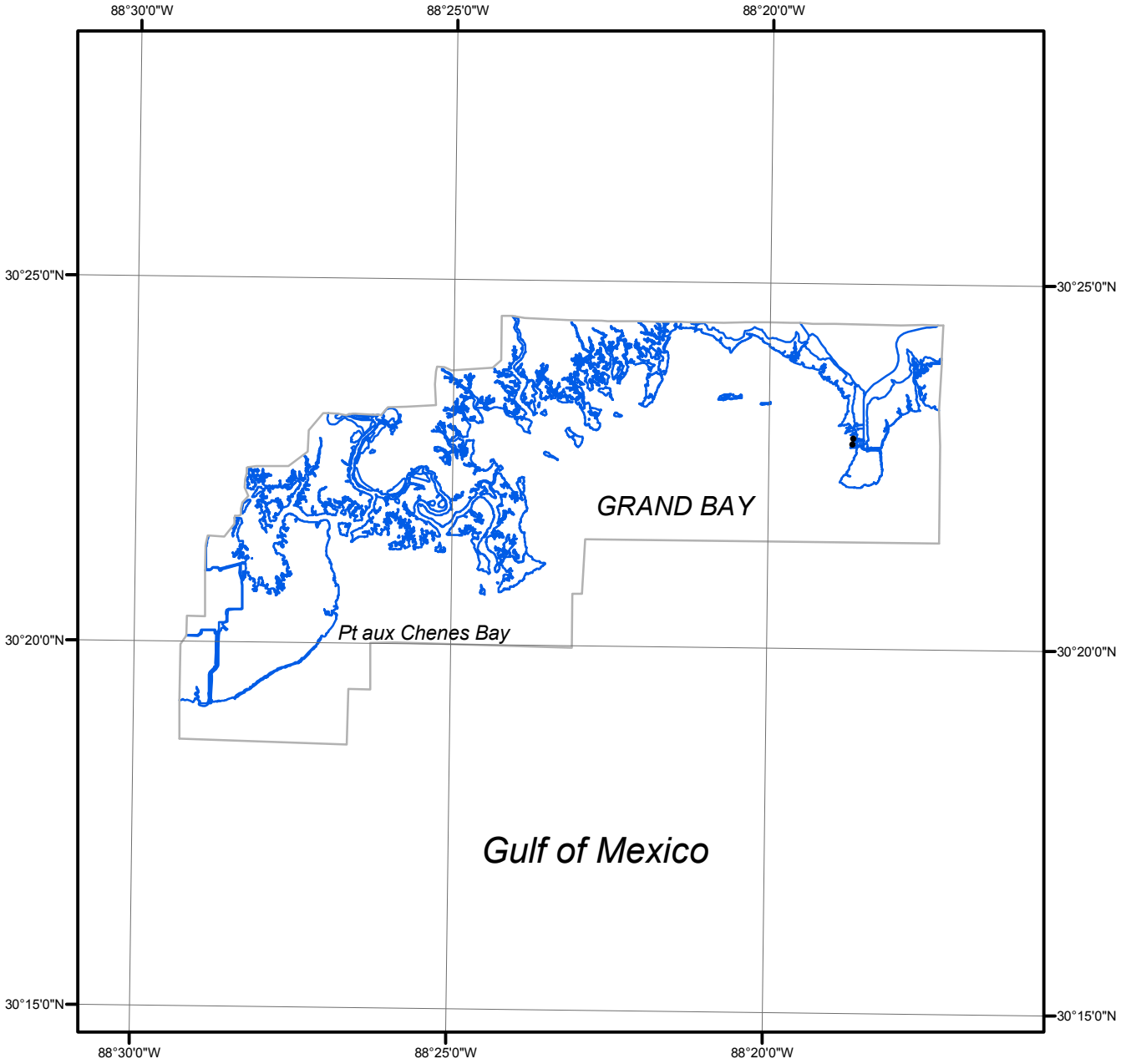
Remote Sensing Division Electronic Data Library
- Project database
- GC10879 in shapefile format
- Digital copy of the PCR in Adobe PDF format
- CEF in shapefile format

NOAA Shoreline Data Explorer
- GC10879 in shapefile format
- Metadata file for GC10879
- Digital copy of the PCR in Adobe PDF format

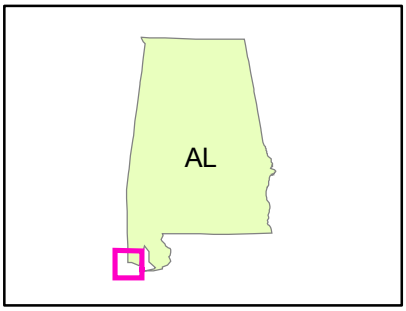
End of Report

GRAND BAY AND POINT AUX CHENES BAY

ALABAMA AND MISSISSIPPI



Overview



AL1103

GC10879