

NOAA COASTAL MAPPING PROGRAM PROJECT COMPLETION REPORT

PROJECT LA0501C

Northern Vermilion Bay, Louisiana

Introduction

NOAA Coastal Mapping Program (CMP) Project LA0501C provides a highly accurate database of new digital shoreline data for Northern Vermilion Bay, Louisiana; extending from Green Island Bayou in the west to West Cote Blanche Bay in the east, and the surrounding coastal areas. Project LA0501C is a subproject of a larger project, LA0501, which extends from Freshwater Bayou Canal eastward to Cypremort Point, and includes all of Vermilion Bay and Marsh Island.

Successful completion of this project resulted in a densification of the National Spatial Reference System (NSRS), a set of controlled metric-quality aerial photographs, and digital feature data of the coastal zone which complements the Nautical Charting Program (NCP) as well as geographic information systems (GIS) for a variety of coastal zone management applications.

The project database consists of information measured and extracted from aerial photographs and metadata related to photogrammetric compilation. Base mapping was conducted in a digital environment using stereo softcopy photogrammetry and associated cartographic practices.

Project Design

AERO-METRIC, INC. formulated the photographic missions for this project following the guidelines of the Coastal Mapping Program Specifications for Shoreline Mapping and the Project Instructions prepared by NOAA, February 22, 2005. The guidelines discussed the project's purpose, geographic area of coverage, scope and priority; photographic 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.

The project limits were provided by NOAA on hardcopy Nautical Charts 11345, 11349, and 11350, and also in digital ArcView Shapefile format. These sources were used to depict the approximate locations of the shoreline to be mapped. AERO-METRIC, INC. created a Project Layout Diagram, flight maps and input files for the aircraft's flight management system.

Field Operations

AERO-METRIC acquired imagery for LA0501 suite of subprojects on several dates between November 2006 and March 2008. All imagery was acquired with either a Piper Navajo PA31-310 or an Aero-Commander fixed wing aircraft using a Zeiss RMK TOP 15 camera equipped with Forward Motion Compensation. The current USGS calibration reports for the camera were submitted to NOAA.

Color (CN) and Black and White Infrared (BWIR) imagery was collected for this project with thirteen flight lines for each film medium at 1:30,000 scale, along with the simultaneous collection of kinematic GPS and IMU positioning and orientation data. CN film was acquired at tide stages at or below the MHW level. The BWIR film was acquired at tide stages at or below allowable tolerances of MLLW level

The airborne positioning was based on two NSRS (National Spatial Reference System) stations and one NGS CORS (Continually Operating Reference Stations) station. The NSRS stations were DATUM (PID AV0999) and L 044 (PID AU3429). The CORS station was KJUN CORS ARP (PID AJ7830). Two photo identifiable points were selected and surveyed as ground check points. Photo ground check points were established by GPS static observation methods and verified with OPUS derived solutions.

The two NGS differential base stations (Station DATUM and L 044) were deployed and used to capture simultaneous GPS data in the project area and were left running until the data was acquired for the two photo identifiable points. The shortest session of data acquisition was two hours. Data from each of these occupations were sent to OPUS and verified for quality. In addition, GPS data was downloaded from a nearby CORS station (KJUN) during the imagery acquisition. All base stations were observed with dual frequency GPS receivers.

See Aerial Photography Report for NOAA, Vermilion Bay LA, NGS Project No. LA0501, dated April 28, 2008.

See Ground Photo Control Report for NOAA, Vermilion Bay LA, NGS Project No. LA0501, dated February 5, 2007. (Revised April 24, 2007)

GPS Data Reduction

GPS data was processed to provide accurate positions of camera centers for application as photogrammetric control in the aerotriangulation phase of the project. All of the baselines were processed using LEICA Geo Office (LGO) version 4.0 on January 24, 2007. The processing of the airborne positioning data was carried out using Applanix POSPac version 4.31. The end result of the POSProc processing was an SBET (Smoothed Best Estimated Trajectory) file. This file contained x,y,z coordinates as well as roll, pitch and yaw orientation angles for every 0.005 seconds during the entire mission.

The final step in the data processing stream was to create x,y,z coordinates and roll, pitch and yaw orientation angles for the exact moment the camera shutter opened for each

image. This step was accomplished using POSEO. The undulations for each exposure station were calculated from Geoid03 and the final EO file was outputted with UTM Zone 18 coordinates in NAD83 and NAVD88 elevations. Coordinates and elevations were expressed in meters. The results of this step produced a text file which could be imported to a software package for the airborne triangulation process. The reformatted form of the POSEO is contained in the Aerotriangulation Report for LA0501.

See Airborne Positioning and Orientation for Aerial Photography Report for NOAA, Vermilion Bay LA, NGS Project No. LA0501, dated April 28, 2008.

See Ground Photo Control Report for NOAA, Vermilion Bay LA, NGS Project No. LA0501, dated February 5, 2007. (Revised April 24, 2007)

Aerotriangulation

Routine softcopy aerotriangulation methods were applied to establish the 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 AERO-METRIC, Inc. personnel in March 2007. The softcopy analytical aerotriangulation was done using the Zeiss Image Station Automatic Triangulation (ISAT) program installed on a Dell PWS670 workstation, running under Windows XP Professional, Version 2002 Service Pack 2. The ISAT program includes automatic point-matching (measuring) and the PhotoT least squares-simultaneous-robust bundle-block adjustment. The point matching and bundle adjustment were done as a block of photos. The photo coordinates from point matching were used with the ABGPS exposure stations and ground-surveyed control in the robust bundle-block adjustment, which automatically detected and removed any large point-matching errors. The total number of images provided by NOAA was 450, but 72 of these were photos covering only water. Points were measured manually in weak areas, in models with small land area or platforms within the water. Four ground-surveyed horizontal-and-vertical check points were also measured manually.

Since the color film was acquired nearly a year before the BWIR film, the color imagery was aerotriangulated and mapped separately. After the BWIR film was acquired, this imagery was added to the color aerotriangulation as a “combined” adjustment. One hundred eighty-three (183) color film image points were transferred to the BWIR imagery to tie the BWIR imagery to the color aerotriangulation solution. Randomly, thirteen (13) of these color image points along with the four (4) surveyed ground check points were left as check points in the final combined adjustment. Upon successful completion of the aerotriangulation process, the ISAT software provided the RMS of the standard deviations of the residuals for each aerotriangulated ground point which were used to compute a predicted horizontal circular error of 0.4 meters based on a 95% confidence level. An Aerotriangulation Report was written and is on file with other project data within the RSD Applications Branch (AB) Project Archive.

The project database consists of project parameters and options, camera calibration data, interior orientation parameters, ground control parameters, adjusted exterior orientation

parameters, and positional listing of all measured points. Positional data is referenced to the North American Datum of 1983 (NAD 83).

Compilation

Compilation of the LA0501C subproject was accomplished by the AEROMETRIC, INC. Geospatial Department during the period of June 2007 through March 2009. Digital mapping was accomplished using DAT/EM Summit Evolution digital photogrammetric workstations with DAT/EM Capture for MicroStation software. Feature identification and attribution within the Geographic Cell (GC) were based on image analysis of 1:30,000 scale photographs and information extracted from the appropriate NOAA nautical charts, US 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 LA0501C were determined according to standard Federal Geographic Data Committee (FGDC) practices. Cartographic features were compiled to meet a horizontal accuracy of 0.8 meters at the 95% confidence level. The predicted accuracy of compiled, well defined points is derived by doubling the circular error derived from aerotriangulation statistics.

The following table provides information on aerial photographs used in the completion of this project:

Date	Time (UTC)	Roll Number	Photo Numbers	Scale (nominal)	Tide Level*
11-04-06	15:39-15:47	0623CN03	348-363	1:30,000	0.2 m
11-04-06	16:05-16:11	0623CN03	385-398	1:30,000	0.1 m
11-04-06	16:15-16:22	0623CN03	399-411	1:30,000	0.1 m
11-08-06	15:46-15:51	0623R01	010-021	1:30,000	0.0 m
11-19-06	16:22-16:29	0623R01	147-160	1:30,000	0.0 m
11-19-06	17:07-17:13	0623CN04	431-446	1:30,000	-0.1 m
02-08-08	18:30-18:36	0823R01	025-036	1:30,000	-0.1 m
03-16-08	14:39-14:45	0823R02	147-162	1:30,000	0.0 m
03-16-08	14:59-15:04	0823R02	186-201	1:30,000	0.0 m
03-16-08	15:42-15:47	0823R02	227-240	1:30,000	0.0 m

* Tide levels are given in meters above MLLW and are based on actual observations at the Freshwater Canal station, at the Cyremort Point station and at various substations throughout the project area with corrections applied from the above mentioned reference stations. The mean tide range in the project area varied between 0.4m and 0.5m.

Quality Control / Final Review

The final review was initiated by senior members of the AERO-METRIC, INC. Geospatial and Imaging/Terrain Departments in May 2009. Data review consisted of on-line and off-line evaluations of digital compilation and hard-copy products. The on-line review was comprised of reviewing stereo models and digital images of the largest scale nautical charts available on SUMMIT Evolution stereoplotters for cartographic feature codes selection, positional accuracies of features, and nomenclature. The Geographic Cell (GC) was evaluated for completeness and accuracy. The review process included analysis of 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 off-line evaluation compared hardcopy plots of project data with the largest scale nautical charts available and the natural color photographs and the black and white infrared photographs. All project data was evaluated for compliance to CMP requirements.

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

- 11345 Intracoastal Waterway, New Orleans to Calcasieu R., 1:175,000 scale, 33rd Ed.
- 11349 Vermilion Bay and Approaches, 1:80,000 scale, 43rd Ed.
- 11350 Intracoastal Waterway, Wax Lake Outlet to Forked I., 1:40,000 scale, 26th Ed.

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 Airborne Positioning and Orientation Report (APOR)
- Hardcopy of the Aerotriangulation Report
- Hardcopy of the Project Completion Report (PCR)
- Page-size graphic plot of GC10679 file contents, attached to PCR

Remote Sensing Division Electronic Data Library

- Project database
- GC10679 in shapefile format
- Digital copy of the PCR in Adobe PDF format
- CEF in shapefile format

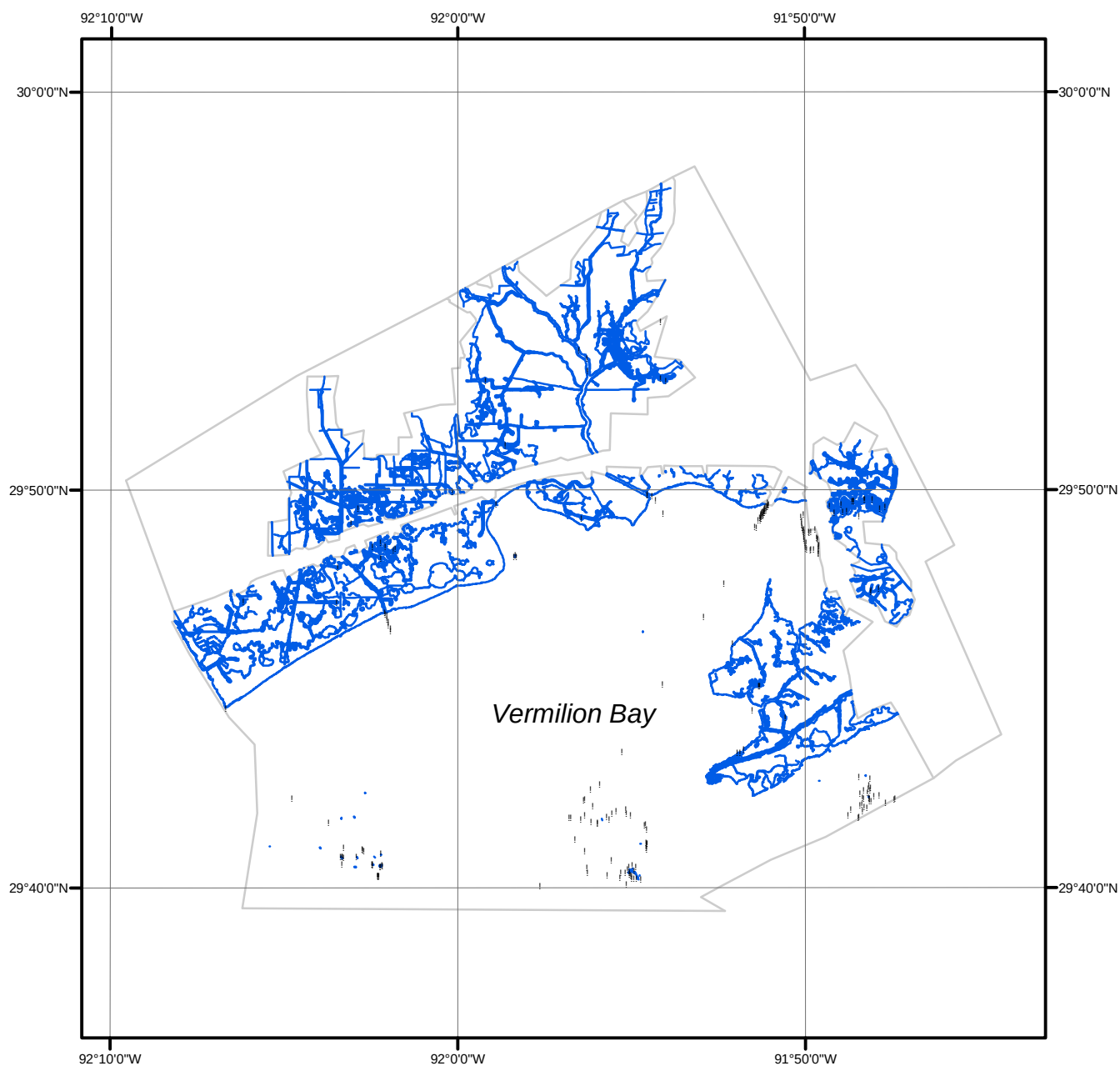
NOAA Shoreline Data Explorer

- GC10596 in shapefile format
- Metadata file for GC10679
- Digital copy of the PCR in Adobe PDF format

End of Report

NORTHERN VERMILION BAY

LOUISIANA



Overview



LA0501C

GC10679