

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

## ***PROJECT LA2206S-CM-C***

### ***Timbalier Island to Grand Isle, Louisiana***

#### **Introduction**

NOAA Coastal Mapping Program (CMP) Project LA2206S-CM-C provides a highly accurate database of new digital shoreline data for a portion of the Gulf Coast of Louisiana, from Timbalier Island to Grand Isle, including Port Fourchon. Project LA2206S-CM-C is a subproject of a larger acquisition project, LA2206-CM-C, which extends along the Gulf Coast from Timbalier Island eastward to Bay Joe Wise, and northwards, roughly bounded by Bayou Lafourche on the west and the Mississippi River on the east, to Lake Salvador, including all of Barataria Bay. Project LA2206-CM-C was completed to support areas determined to be impacted by Hurricane Ida. 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 and Planning**

The Requirements Branch (RB) of the NOAA National Geodetic Survey (NGS) Remote Sensing Division (RSD) designed Project LA2206-CM-C and formulated project instructions following the guidelines of the “Scope of Work, Shoreline Mapping for the Coastal Mapping Program” (SOW), Version 15. The instructions discussed the project’s purpose, geographic area of coverage, scope and priority; data acquisition, processing, accuracy, and compilation requirements; product delivery and reporting instructions; and contact and communication information. RSD provided a shapefile and maps of the project area, and tide coordination time windows for data acquisition.

NV5 Geospatial (NV5G) was contracted to provide the planning, acquisition, and post-processing of aerial imagery and ground surveys for aerial imagery checkpoints; aerotriangulation (AT); feature compilation and quality control.

#### **Field Operations**

The field operations for Project LA2206-CM-C consisted of the surveying of ground control and check points and the acquisition of digital aerial photographs. Ground control/check points were established in Project LA2206-CM-C using a combination of fast-static, real-time kinematic, and post-processed kinematic Global Positioning System (GPS) techniques. Survey field work was performed during September 2022. This phase of project completion is described in NV5G’s Ground Survey Report, on file in RSD’s Electronic Data Library with all of the other project reports.

Acquisition of digital imagery, kinematic GPS data, and Inertial Measurement Unit (IMU) data was performed during September 2022. Aerial survey operations included the acquisition of 25

lines of imagery at the Mean High Water (MHW) tide stage using a Leica ADS100 (RGB/NIR) 4-band camera system. A subset of 8 flight lines were used for Project LA2206S-CM-C. All aerial images were acquired at a nominal altitude of 10,000 feet, giving a ground sample distance (GSD) of 0.25 meters. For more information on imagery acquisition refer to NV5G's Hurricane Ida LA2206-CM-C Data Acquisition Summary Report.

## **GPS Data Processing**

GPS/IMU data were processed to yield precise sensor positions and orientations of the imagery as inputs for the AT phase. The aircraft used to acquire data was equipped with a Novatel SPAN IMU unit to collect ABGPS and IMU data and Novatel Inertial Explorer (ver. 8.9) software was used to process the data and obtain a tightly coupled GNSS/INS solution. For further information refer to the LA2206-CM-C Hurricane Ida Airborne Positioning and Orientation Report.

## **Aerotriangulation**

The AT phase of the project was performed using digital AT methods to establish the network of photogrammetric control required for the compilation phase. Leica's XPro AT software was used to perform automatic and interactive measurements of tie points. The final adjustment of the block was accomplished by using a rigorous simultaneous least squares bundle adjustment, and analysis tools within XPro were used to refine the AT solution and to evaluate the accuracy of the adjustment. The Root Mean Square (RMS) of the standard deviations in both X and Y directions was calculated and used to determine a predicted horizontal circular error at the 95% confidence level of 0.38 meters for the 4-band images.

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). An Aerotriangulation Report was completed and is on file with other project data within the RSD Electronic Data Library.

## **Shorelines Automation**

Since lidar acquisition was not within the scope of this project, two automation methods were tested against pre-existing data to generate base shorelines in preparation for the compilation phase. The first automated process that was tested used image classification to derive basic shoreline linework to begin an edit process. Using orthophotography and various combinations of image bands, an automated process was developed based on supervised image classification. This yielded the base linework to then be segmented, attributed, and edited. The second method tested used Structure from Motion (SfM) to derive basic shoreline linework to begin an edit process. Using stereo photography, an automated process was developed to yield a digital terrain model (DTM) from which a MHW contour would be created. This contour line would be a basis for further shoreline segmentation, attribution, and editing.

After testing the two automation methods, the image classification process was found to yield the best accuracy and was applied to Project LA2206S-CM-C. Following automation, the base linework was smoothed using GIS processes to remove jagged edges and reduce the vertex count. The linework was then visually scanned to omit areas of false positives. This produced the base linework for compilation.

## Compilation

The data compilation phase of the project was initiated by NV5G personnel in July 2023. This work was accomplished using a Digital Photogrammetric Workstation (DPW), which consists of a stereo-enabled PC-based graphics workstation running the Windows 2010 operating system and DAT/EM Summit Evolution (ver. 7.6) digital photogrammetric software. Feature identification, segmentation, and attribution within the GC were based on image analysis of the project imagery 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 LA2206S-CM-C were determined according to standard Federal Geographic Data Committee (FGDC) practices. Cartographic features compiled from the stereo imagery were compiled to meet a horizontal accuracy of 0.8 meters at the 95% confidence level, a predicted accuracy of compiled, well-defined points derived by doubling the circular error calculated from the AT statistics. Automated shorelines described in the preceding section were viewed in stereo and determined to meet the same accuracy or otherwise edited as appropriate. The table below provides information on the imagery used to complete this project.

| Date       | Time (UTC)    | Flight Line | Photo IDs   | Tide Level* |
|------------|---------------|-------------|-------------|-------------|
| 09/27/2022 | 14:12 – 14:18 | 25-004      | BL001/NL001 | 0.3 m       |
| 09/27/2022 | 14:23 – 14:30 | 25-005      | BL001/NL001 | 0.3 m       |
| 09/27/2022 | 14:34 – 14:43 | 25-006      | BL001/NL001 | 0.3 m       |
| 09/28/2022 | 14:07 – 14:11 | 25-001      | BL001/NL001 | 0.3 m       |
| 09/28/2022 | 14:16 – 14:25 | 25-002      | BL001/NL001 | 0.3 m       |
| 09/28/2022 | 14:29 – 14:38 | 25-003      | BL001/NL001 | 0.3 m       |
| 09/28/2022 | 14:43 – 14:54 | 25-007      | BL001/NL001 | 0.3 m       |
| 09/28/2022 | 14:58 – 15:08 | 25-008      | BL001/NL001 | 0.3 m       |

\* Tide levels are given in meters above MLLW and are based on verified observations recorded by NOAA gauge 8761724 at Grand Isle, Louisiana. The height of the MHW datum at the Grand Isle gauge is 0.321 meters above MLLW.

## Quality Control / Final Review

Quality control tasks were conducted during all phases of project completion by senior NV5G personnel. The final QC review was completed in December 2023. The review process included analysis of AT results and assessment of the identification and attribution of digital feature data within the subproject 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. 10.8.2) software. All project data was evaluated for compliance to CMP requirements.

Comparisons of the largest scale NOAA nautical charts with natural color images and compiled project data resulted in creation of the Chart Evaluation File (CEF). The following Electronic Navigational Charts (ENCs) were used in the comparison process:

- US4LA29M, 31<sup>st</sup> Ed., Sep. 2022
- US4LA31M, 39<sup>th</sup> Ed., Nov. 2023
- US5LA26M, 41<sup>st</sup> Ed., Sep. 2023
- US5LA38M, 26<sup>th</sup> Ed., Aug. 2022

## **End Products and Deliverables**

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

### **Remote Sensing Division Electronic Data Library**

- Ground Survey Report for Imagery
- Hurricane Ida Acquisition Summary Report
- Airborne Positioning and Orientation Report (APOR)
- Aerotriangulation Report
- Project database
- GC11852 in shapefile format
- Project Completion Report (PCR)
- CEF in shapefile format

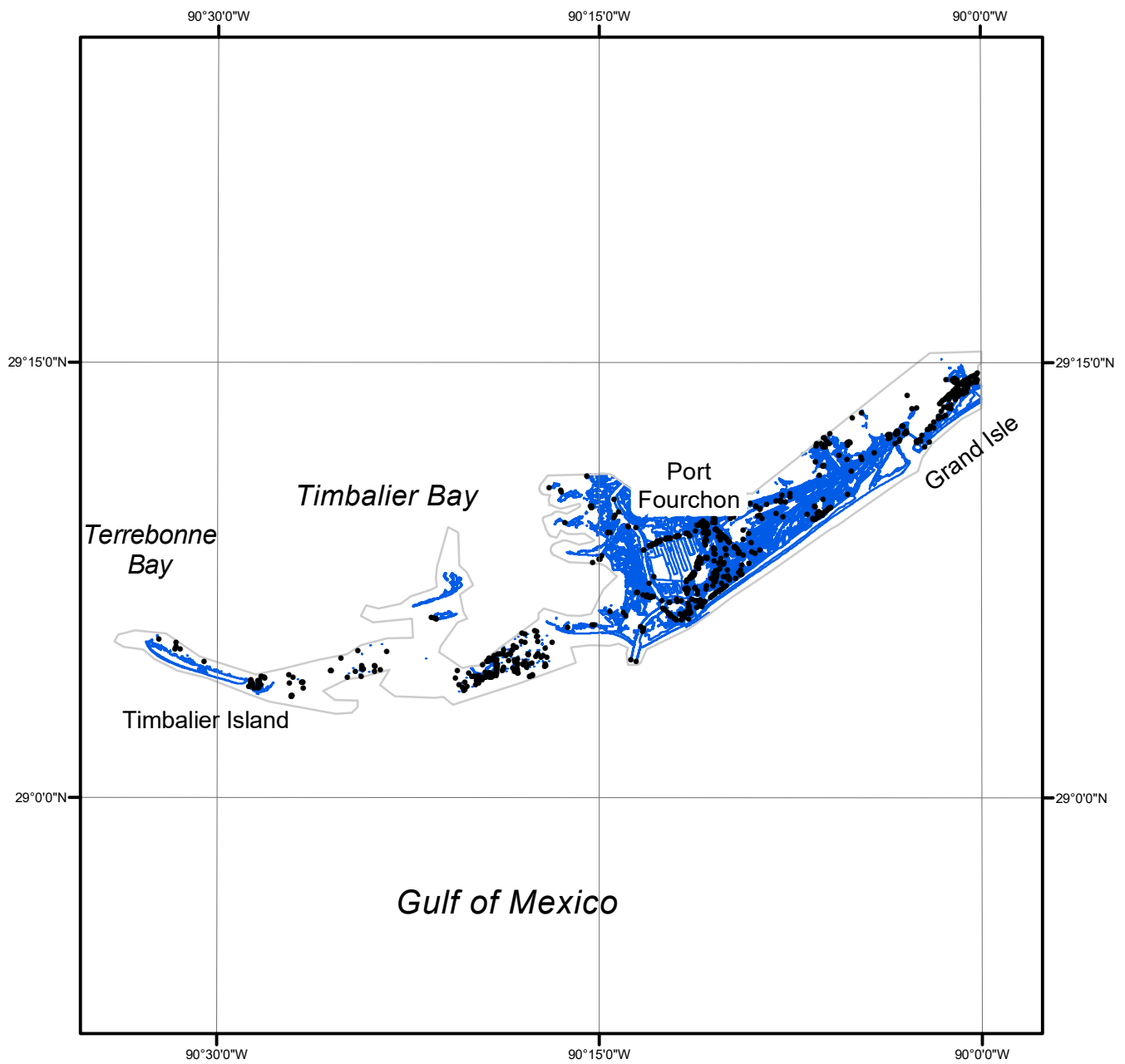
### **NOAA Shoreline Data Explorer**

- GC11852 in shapefile format
- Metadata file for GC11852
- PCR in Adobe PDF format

## **End of Report**

# TIMBALIER ISLAND TO GRAND ISLE

## LOUISIANA



Overview



LA2206S-CM-C

GC11852