

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

## ***PROJECT FL1305E-CM-N***

### ***Turtle Creek Bay to Crystal Reef, Florida***

#### **Introduction**

NOAA Coastal Mapping Program (CMP) Project FL1305E-CM-N provides a highly accurate database of new digital shoreline data for the coast of Florida from Turtle Creek Bay to Crystal Reef. Project FL1305E-CM-N is a subproject of a larger acquisition project, FL1305-CM-N, which extends from Tarpon Springs to Cedar Keys. 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**

Project FL1305-CM-N was designed in response to a request for shoreline data from the Marine Chart Division of NOAA's Office of Coast Survey. 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 Procedures. 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, instructions for data recording and handling, and contact and communication information. RB created a Project Layout Diagram, flight maps and input files for the aircraft flight management system.

#### **Field Operations**

The field operations for the FL1305-CM-N project consisted of the collection of static and kinematic GPS data and Inertial Measurement Unit (IMU) data, the acquisition of digital aerial imagery by NOAA, followed by ground surveys performed under contract with Fugro Geospatial, Inc. Aerial survey operations included the acquisition of 32 strips of natural color and NIR imagery at both the MLLW and MHW tidal stage. The images were acquired using either the DSS- 439/539 dual camera system in 2014 or the DSS 580/560 dual camera system in 2016. All aerial imagery acquisition was accomplished with NOAA's King Air aircraft (N68RF) flying at an altitude of 10,000 feet. Refer to the FL1305 Acquisition Summary report for additional information and specific dates concerning the aerial survey operations.

Fugro was contracted by NGS to perform field operations limited to the surveying of ground control points (GCPs) and check points (CPs). The National Spatial Reference System (NSRS) was used to provide control for the network. As a subcontractor to Fugro, TerraSurv Inc. established twenty-four (24) photo identifiable control points. Of the 24 collected control points, fourteen (14) were successfully located and used as ground control in the final block adjustments, and six (6) were successfully located and used as check points. Refer to Fugro's Florida Coastal FL1305 (A-F) Survey Report for more information on ground survey operations.

## **GPS Data Processing**

All GPS/IMU data processing tasks were completed by NGS and the final processed data was supplied to Fugro Geospatial, Inc. GPS and IMU data was collected and processed by Remote Sensing Division (RSD) personnel to yield precise positions and orientations of camera centers as a means of rendering accurately georeferenced digital images. For further information refer to the multiple Airborne Positioning and Orientation Reports (APOR) that are on file within the RSD Electronic Data Library.

## **Aerotriangulation**

Fugro Geospatial, Inc. performed routine softcopy aerotriangulation methods that 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. The RGB and NIR images were measured and adjusted as two separate blocks. This work was completed in December 2017 using a softcopy photogrammetric workstation. The softcopy system hardware consisted of a high-end Dell Precision™ Workstation with the Windows® 7 Professional operating system, and stereo viewing capability. SOCET SET v 5.6 was used for project setup and the mensuration phase. The adjustment solution phase was accomplished with the ORIMA v. 11.01 module.

Upon successful completion of the aerotriangulation process, the overall RMS data for all of the adjusted ground point standard deviations (both x & y) were used to compute a predicted horizontal circular error (95% confidence level) of 0.53 meters for the RGB adjusted block solution and 0.59 meters for the NIR solution.

The project database consists of project parameters and options, camera calibration data, 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, (NAD83). An Aerotriangulation Report was completed and is on file with other project data within the RSD Electronic Data Library

## **Compilation**

The compilation for FL1305E-CM-N was done by Fugro Geospatial, Inc., between June and July of 2018. Digital mapping was performed using SOCET SET (ver. 5.6) stereo softcopy workstations with the SOCET for ArcGIS module and Esri's ArcGIS (ver. 10.3) GIS software. Feature identification and attribution within the GC were based on image analysis of project imagery 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 FL1305E-CM-N were determined according to standard Federal Geographic Data Committee (FGDC) practices. Cartographic features were compiled to meet a horizontal accuracy of 1.1 meters from RGB imagery and 1.2 meters from the NIR

imagery, all at the 95% confidence level. The predicted accuracy of compiled, well defined points is derived by doubling the circular errors derived from aerotriangulation statistics.

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

Date	Time (UTC)	Flight Line	Color Imagery		Infrared Imagery		Tide Level*
			Roll	Images	Roll	Images	
2/19/2014	19:22 – 19:23	50-017	14NC21	5402 – 5408	14NR16	2561 – 2567	1.0
2/19/2014	19:28 – 19:29	50-018	14NC21	5409 – 5415	14NR16	2568 – 2574	1.0
2/19/2014	19:36 – 19:37	50-019	14NC21	5432 – 5439	14NR16	2591 – 2598	1.0
2/19/2014	19:43 – 19:45	50-015	14NC21	5440 – 5453	14NR16	2599 – 2612	0.9
2/19/2014	20:09 – 20:11	50-016	14NC21	5468 – 5481	14NR16	2627 – 2640	0.9 – 1.0
5/17/2014	19:45 – 19:50	50-020	14NC46	10473 – 10506	14NR39	7554 – 7587	0.9 – 1.0
5/17/2014	19:56 – 20:01	50-021	14NC46	10521 – 10555	14NR39	7602 – 7636	0.9 – 1.0
5/17/2014	20:07 – 20:12	50-022	14NC46	10575 – 10608	14NR39	7656 – 7689	0.9 – 1.0
5/17/2014	20:17 – 20:18	50-023	14NC46	10617 – 10624	14NR39	7698 – 7705	0.9 – 1.0
5/17/2014	20:20 – 20:22	50-023	14NC46	10634 – 10651	14NR39	7715 – 7732	1.0
5/17/2014	20:29 – 20:34	50-024	14NC46	10668 – 10701	14NR39	7749 – 7782	0.9 – 1.0
5/18/2014	19:09 – 19:10	50-023	14NC47	10893 – 10901	14NR40	7974 – 7982	0.9 – 1.0
10/9/2014	13:53 – 13:54	50-017	14NC87	19338 – 19344	14NR77	15868 – 15874	0.0 – 0.1
10/9/2014	14:00 – 14:01	50-018	14NC87	19345 – 19351	14NR77	15875 – 15881	0.1
10/9/2014	14:08 – 14:09	50-019	14NC87	19368 – 19375	14NR77	15898 – 15905	0.1
10/9/2014	14:14 – 14:16	50-015	14NC87	19376 – 19389	14NR77	15906 – 15919	0.1
10/9/2014	14:21 – 14:23	50-016	14NC87	19390 – 19403	14NR77	15920 – 15933	0.1
1/24/2016	16:00 – 16:05	50-020	16VC10	3333 – 3366	16VR10	3332 – 3365	-0.1 – 0.0
1/25/2016	14:58 – 15:03	50-024	16VC11	3389 – 3422	16VR11	3388 – 3421	-0.1 – 0.0
1/25/2016	15:09 – 15:14	50-021	16VC11	3440 – 3474	16VR11	3439 – 3473	-0.1 – 0.0
1/25/2016	15:19 – 15:24	50-023	16VC11	3482 – 3515	16VR11	3481 – 3514	-0.1 – 0.0
1/25/2016	15:31 – 15:36	50-022	16VC11	3535 – 3568	16VR11	3534 – 3567	0.0

\* Tide levels are given in meters above MLLW and were calculated using the Pydro software tool with a TCARI grid referenced to verified water level observations at the time of photography from various NOS gauges in the vicinity of the project. The elevation of the MHW tidal datum in the project area varies between 0.9 – 1.0 meters above MLLW.

## **Quality Control / Final Review**

Quality Control tasks were conducted during all phases of project completion by a senior member of the Fugro compilation team. The final QC review was completed in August 2018. 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 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 natural color photographs and compiled project data resulted in creation of the Chart Evaluation File (CEF). The following nautical charts were used in the comparison process for FL1305E-CM-N:

- 11408, Crystal River to Horseshoe Point, FL, 31st Ed., Jun. 2018
- 11409, Anclote Keys to Crystal River, FL, 31st Ed., Jan. 2017

## **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 Control Report
- Airborne Positioning and Orientation Reports (APOR)
- Aerotriangulation Report
- Project database
- GC11331 in shapefile format
- Project Completion Report (PCR)
- CEF in shapefile format

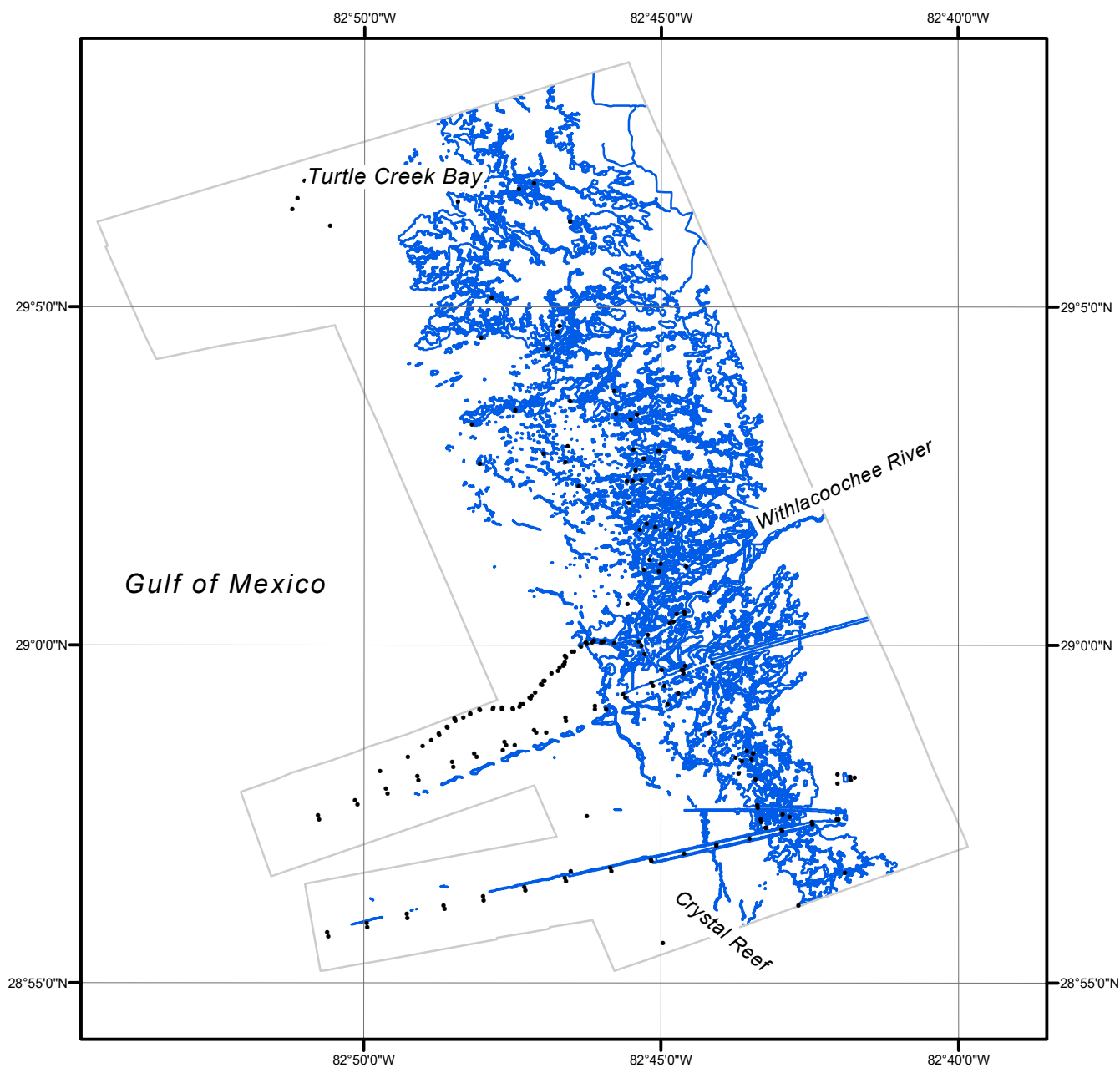
### **NOAA Shoreline Data Explorer**

- GC11331 in shapefile format
- Metadata file for GC11331
- PCR in Adobe PDF format

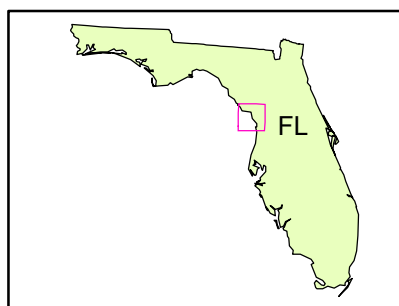
## **End of Report**

# TURTLE CREEK BAY TO CRYSTAL REEF

## FLORIDA



Overview



FL1305E-CM-N

GC11331