NOAA COASTAL MAPPING PROGRAM
PROJECT COMPLETION REPORT

PROJECT FL1305F-CM-N

Cedar Keys to Waccasassa Bay, Florida

Introduction

NOAA Coastal Mapping Program (CMP) Project FL1305F-CM-N provides a highly accurate database of new digital shoreline data for the coast of Florida from Cedar Keys to Waccasassa Bay. Project FL1305F-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 (ver. 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 FL1305F-CM-N was done by Fugro Geospatial, Inc., between July and August 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 FL1305F-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	
2/4/2014	20:20 – 20:25	50-032	14NC14	3792 – 3829	14NR23	4484 – 4521	1.0
2/4/2014	20:30 – 20:35	50-031	14NC14	3830 – 3865	14NR23	4522 – 4557	1.0 – 1.1
2/4/2014	20:41 – 20:45	50-030	14NC14	3866 – 3888	14NR23	4558 – 4580	1.1
2/4/2014	20:49 – 20:52	50-029	14NC14	3889 – 3909	14NR23	4581 – 4601	1.1
2/4/2014	20:57 – 20:59	50-028	14NC14	3910 – 3926	14NR23	4602 – 4618	1.1
2/4/2014	21:03 – 21:06	50-027	14NC14	3927 – 3942	14NR23	4619 – 4634	1.1 – 1.2
2/4/2014	21:10 – 21:12	50-026	14NC14	3943 – 3958	14NR23	4635 – 4650	1.1 – 1.2
2/4/2014	21:17 – 21:18	50-025	14NC14	3959 – 3971	14NR23	4651 – 4663	1.1
2/19/2014	19:21 – 19:23	50-017	14NC21	5393 – 5404	14NR16	2552 – 2563	1.0
2/19/2014	19:28 – 19:30	50-018	14NC21	5413 – 5423	14NR16	2572 – 2582	1.0
2/19/2014	19:35 – 19:37	50-019	14NC21	5424 – 5434	14NR16	2583 – 2593	1.0
5/17/2014	19:44 – 19:46	50-020	14NC46	10464 – 10475	14NR39	7545 – 7556	1.0
5/17/2014	20:00 – 20:02	50-021	14NC46	10553 – 10564	14NR39	7634 – 7645	1.0
5/17/2014	20:06 – 20:08	50-022	14NC46	10565 – 10577	14NR39	7646 – 7658	1.0
5/17/2014	20:22 – 20:23	50-023	14NC46	10649 – 10659	14NR39	7730 – 7740	1.0
5/17/2014	20:29	50-024	14NC46	10666 – 10669	14NR39	7747 – 7750	1.0
5/18/2014	19:02 – 19:03	50-024	14NC47	10887 – 10892	14NR40	7968 – 7973	1.0
10/9/2014	13:29 – 13:34	50-032	14NC87	19255 – 19292	14NR77	15785 – 15822	0.0
10/9/2014	13:40 – 13:45	50-031	14NC87	19293 – 19328	14NR77	15823 – 15858	0.0
10/9/2014	13:52 – 13:53	50-017	14NC87	19329 – 19340	14NR77	15859 – 15870	0.1
10/9/2014	14:00 – 14:02	50-018	14NC87	19349 – 19359	14NR77	15879 – 15889	0.1
10/9/2014	14:07 – 14:08	50-019	14NC87	19360 – 19370	14NR77	15890 – 15900	0.1
1/24/2016	15:13 – 15:17	50-030	16VC10	3218 – 3240	16VR10	3217 – 3239	-0.1
1/24/2016	15:21 – 15:24	50-029	16VC10	3241 – 3261	16VR10	3240 – 3260	-0.1
1/24/2016	15:30 – 15:32	50-028	16VC10	3262 – 3278	16VR10	3261 – 3277	-0.1
1/24/2016	15:36 – 15:39	50-027	16VC10	3279 – 3294	16VR10	3278 – 3293	0.0
1/24/2016	15:44 – 15:46	50-026	16VC10	3295 – 3310	16VR10	3294 – 3309	0.0
1/24/2016	15:51 – 15:53	50-025	16VC10	3311 – 3323	16VR10	3310 – 3322	0.0

1/24/2016	15:59 – 16:00	50-020	16VC10	3324 – 3335	16VR10	3323 – 3334	0.0
1/25/2016	15:02 – 15:04	50-024	16VC11	3420 – 3430	16VR11	3419 – 3429	0.0
1/25/2016	15:08 – 15:10	50-021	16VC11	3431 – 3443	16VR11	3430 – 3442	0.0
1/25/2016	15:24 – 15:25	50-023	16VC11	3513 – 3524	16VR11	3512 – 3523	0.0
1/25/2016	15:30 – 15:32	50-022	16VC11	3525 – 3537	16VR11	3524 – 3536	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 0.99 – 1.06 m. 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 September 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 chart was used in the comparison process for FL1305F-CM-N:

- 11408, Crystal River to Horseshoe Point, FL, 31st Ed., Jun. 2018

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
- GC11332 in shapefile format
- Project Completion Report (PCR)
- CEF in shapefile format

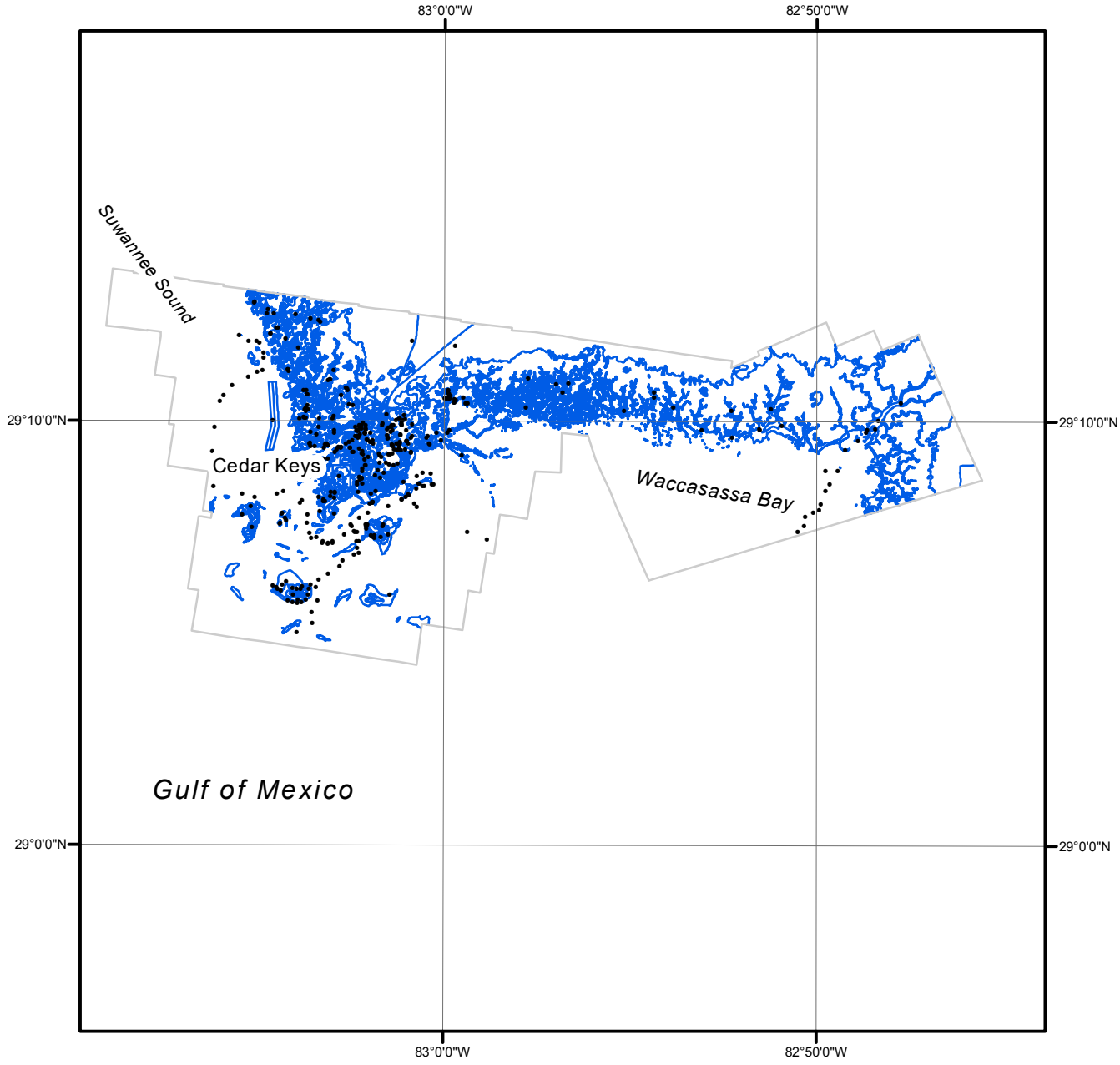
NOAA Shoreline Data Explorer

- GC11332 in shapefile format
- Metadata file for GC11332
- PCR in Adobe PDF format

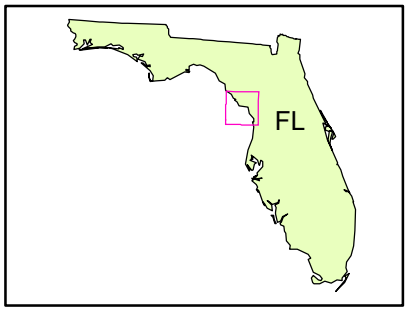
End of Report

CEDAR KEYS TO WACCASASSA BAY

FLORIDA



Overview



FL1305F-CM-N

GC11332