

NOAA COASTAL MAPPING PROGRAM PROJECT COMPLETION REPORT

PROJECT DE1101A

Middle Island, Delaware

Introduction

Coastal Mapping Program (CMP) Project DE1101A provides highly accurate digital shoreline data for Middle Island, located between Rehoboth Bay and Indian River Bay, in Delaware. DE1101A is a small subproject of a larger project, DE1101, which covers the Delaware shoreline in Delaware Bay from Appoquinimink River to Cape Henlopen, and thence along the Atlantic Coast to the Maryland state line. 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. The photographic mission operations were conducted on April 11, 2011 (MLLW) and June 8, 2011 (MHW) with the NOAA King Air aircraft and consisted of:

- 1) 4 Natural color (NC) images collected at a Mean Lower Low Water (MLLW) tide stage (4/21/11 at ~ 21:00 GMT)
- 2) 4 Near Infra-Red (IR) images collected, in tandem, at a Mean Lower Low Water (MLLW) tide stage (4/21/11 at ~ 21:00 GMT), and
- 3) 6 Near Infra-Red (IR) images collected at a Mean High Water (MHW) tide stage (6/08/11 at ~ 17:55 GMT).

In total, 14 images were used for the AT - see the attached AT diagram. All images were acquired at a flying height (FH) of 10,000 feet (~0.35 meter ground sample distance) using the 439DSS_60mm Dual Camera in the NOAA King Air aircraft.

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 in order to provide a control network necessary for aerotriangulation (AT). 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 April and June 2011.

Aerotriangulation

Routine softcopy 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 June 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 0.76 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 data compilation phase of this project was initiated by RSD in June 2011. Digital mapping was performed using a DPW in conjunction with the SOCET SET Feature Extraction software module. 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 DE1101A were determined according to standard Federal Geographic Data Committee (FGDC) practices. Cartographic features were compiled to meet a horizontal accuracy of 1.5 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, collected in tandem, used to complete this project:

Date	Time (UTC)	Roll Number	Photo Numbers	GSD (nominal)	Tide Level*
4-11-11	21:03:30	11NC19	03120 – 03123	0.35 m	0.0
4-11-11	21:03:30	11NR07	00692 – 00695	0.35 m	0.0
6-08-11	17:55:00	11NR16	02565 – 02570	0.35 m	0.7

* Tide levels are given in meters above MLLW and are based on actual observations recorded by the NOS gauge at Indian River Inlet, DE (station ID: 8558690). The elevation of MHW at Indian River Inlet is 0.8 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 AT 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.

A comparison of imagery and compiled feature data with the largest scale NOAA chart was attempted, however due to the extremely limited project size the Chart Evaluation File (CEF) contained no chart annotations. The following chart was used for comparison:

- 12216, Cape Henlopen to Indian River Inlet, 1:40,000 scale, 28th Ed., Apr. /08.

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 GC10883 file contents, attached to PCR

Remote Sensing Division Electronic Data Library

- Project database
- GC10883 in shapefile format
- Digital copy of the PCR in Adobe PDF format
- CEF in shapefile format

NOAA Shoreline Data Explorer

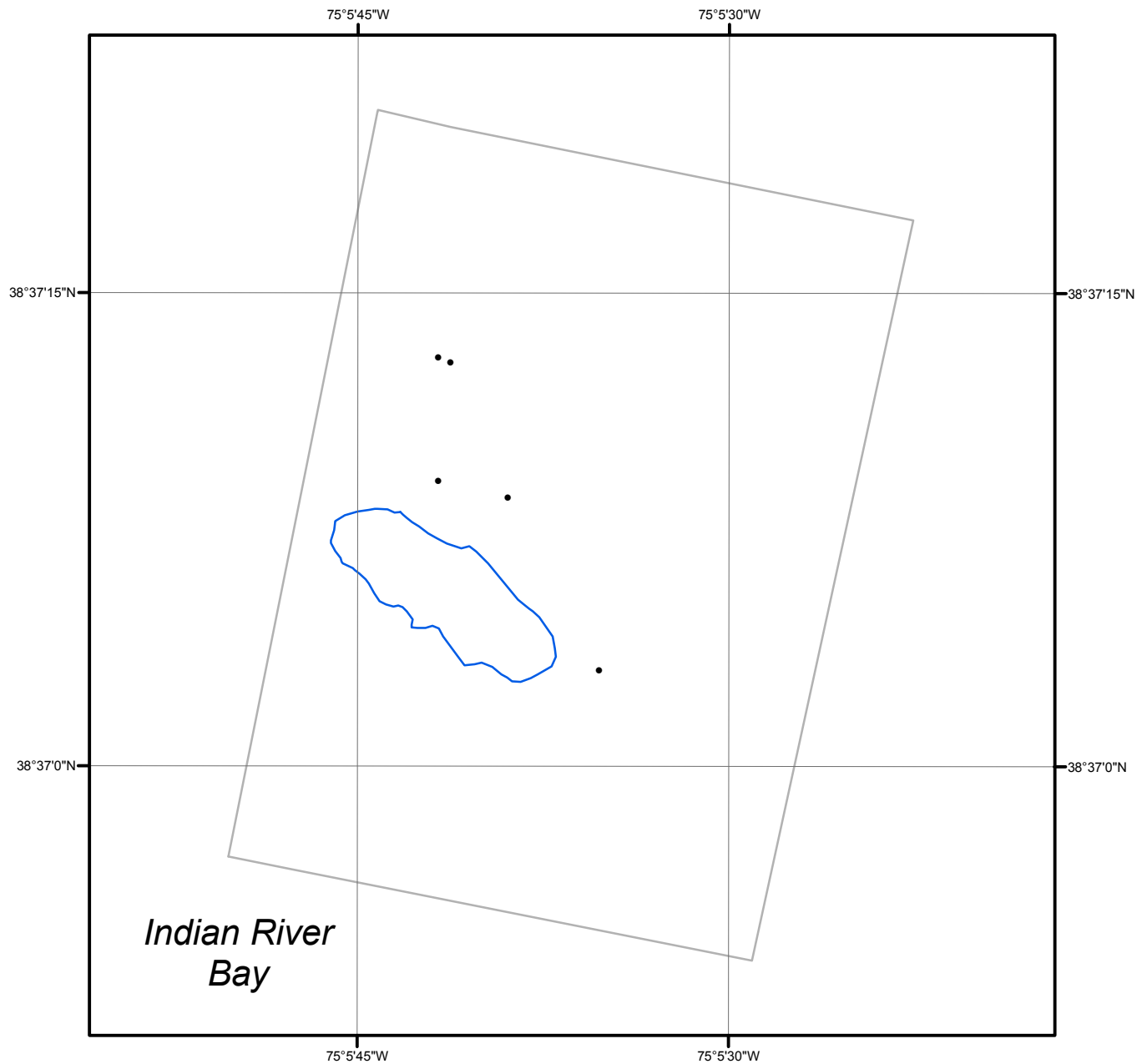
- GC10883 in shapefile format

- Metadata file for GC10883
- Digital copy of the PCR in Adobe PDF format

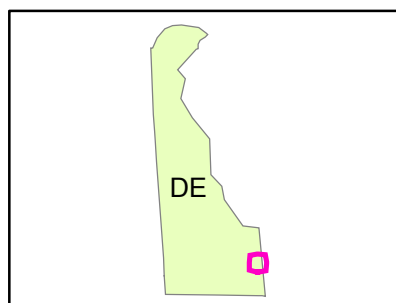
End of Report

MIDDLE ISLAND

DELAWARE



Overview



DE1101A

GC10883