

NOAA COASTAL MAPPING PROGRAM PROJECT COMPLETION REPORT

PROJECT NJ1801-CS-N

Ports of Trenton and Penn Manor, New Jersey and Pennsylvania

Introduction

NOAA Coastal Mapping Program (CMP) Project NJ1801-CS-N provides highly accurate digital shoreline data for key areas of change within the ports of Trenton and Penn Manor, in New Jersey and Pennsylvania. 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

The design of Project NJ1801-CS-N was accomplished by the Requirements Branch (RB) of the Remote Sensing Division (RSD) in response to the need for timely updates to the NOAA chart suite within key U.S. ports. Project requirements were formulated as a result of analysis conducted within the Coast and Shoreline Change Analysis Program (CSCAP), in which NOAA nautical chart products are compared to contemporary high resolution digital imagery in order to ascertain the need for more current shoreline data. A Chart Evaluation File (CEF) was forwarded to the Applications Branch (AB) of RSD once the change analysis was complete. One GeoEye-1 orthorectified pan-sharpened image with a spatial resolution of 0.50 meter, downloaded from the Enhanced View Web Hosting Site, was utilized for change analysis of the port areas. Refer to the CSCAP Memorandum of July 31, 2017 for Project NJ1702-CS-T for further details of the chart comparison process.

Field Operations

Field operations for Project NJ1801-CS-N consisted of the collection of static and kinematic GPS data and Inertial Measurement Unit (IMU) data, and the acquisition of aerial imagery. Aerial survey operations were conducted in November, 2018 with the NOAA King Air aircraft (N68RF). Three flight lines of natural color (RGB) imagery were acquired using an Applanix DSS dual camera system. Near-infrared (NIR) imagery was also acquired concurrently but was not used. Imagery was acquired at a nominal altitude of 10,500 feet, resulting in an approximate ground sample distance (GSD) of 0.32 meters for the RGB images. Although imagery was not acquired in strict coordination with local tides, the goal was to collect all imagery below Mean High Water (MHW) tide stage.

GPS Data Processing

The GPS/IMU data were processed by RSD personnel to yield precise camera positions in order to provide a control network necessary for aerotriangulation (AT). The base station's geodetic position was derived using the NGS Online Processing User Service (OPUS), which computed fixed baseline solutions from nearby CORS stations. The kinematic GPS data was processed using Applanix POSPac MMS (ver. 8.2) software in November 2018. For further information

refer to the Airborne Positioning and Orientation Reports (APOR) on file with other project data within the RSD Electronic Data Library.

Aerotriangulation/Georeferencing

The AT phase of project completion was accomplished in June 2019 by a member of AB. 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. The digital images were measured and adjusted as a single block using the Multi-Sensor Triangulation (MST) module of BAE Systems' SOCET SET (ver. 5.6) software on a Windows based photogrammetric workstation. Upon successful completion of this process, the triangulation software provided the standard deviations for each aerotriangulated ground point, which were used to compute a predicted horizontal circular error of 0.63 meters based on a 95% confidence level. An AT Report was written and is on file with other project data within the RSD Electronic Data Library.

In addition to the aerial imagery, commercial satellite imagery used in the CSCAP analysis was also incorporated into the project for compilation purposes. This imagery was georeferenced by a member of AB using Esri's ArcGIS (ver. 10.6.1) desktop GIS software. Within ArcGIS, the Georeferencing tool was used, and the imagery was re-sampled using the Nearest Neighbor sampling method with a 1st order polynomial model. Check points extracted from feature data compiled for a previous project (CMP Project NJ0301B) were used as control and to assess the accuracy of the resampled imagery. The RMS of the residuals for each measured check point was used to compute a predicted horizontal circular error of 1.6 meters based on a 95% confidence level (CE95). This value was doubled and added to the CE95 of the check points to conservatively predict the accuracy of well-defined points measured during compilation. Positional data is referenced to the North American Datum of 1983 (NAD 83).

Compilation

The data compilation phase of this project was accomplished by a member of RSD in June 2019. Digital feature data from aerial imagery was compiled using the Feature Extraction module of SOCET SET, whereas feature data from satellite imagery was compiled using Esri's ArcGIS. Feature identification and attribution within the GC were based on image analysis of the digital photographs and information extracted from the appropriate NOAA nautical charts 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.

Spatial data accuracies for Project NJ1801-CS-N were determined according to standard Federal Geographic Data Committee (FGDC) practices. Cartographic features extracted from aerial imagery were compiled to meet a horizontal accuracy of 1.3 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. Features extracted from the satellite imagery were tested to have a horizontal accuracy of 4.2 meters at the 95% confidence level based on a comparison of twenty or more check points to a source of higher accuracy.

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

Aerial Imagery - DSS				
Date	Time (UTC)	Roll #	Strip / Image #s	Tide Level*
8-NOV-2018	15:36 – 15:40	18VC76	64-003 / 21133 – 21148	0.4 m
8-NOV-2018	15:45 – 15:48	18VC76	64-002 / 21149 – 21164	0.4 m
8-NOV-2018	15:53 – 15:56	18VC76	64-001 / 21165 – 21174	0.5 m
Satellite Imagery – GeoEye-1				
Date	Time (UTC)	Source File Name		Tide Level**
29-JUN-2017	15:45	20170629_1545_GE01_ORI_MOS.jp2		0.9 – 1.1 m

* Tide levels are given in meters above MLLW and 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 ranges between 2.29 – 2.56 meters above MLLW.

** Tide level is given in meters above MLLW and is based on verified observations at the NOS gauges at Burlington, NJ and Newbold, PA at the time of image acquisition.

Quality Control / Final Review

The final review of the project was completed by a senior member of RSD in June 2019, 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 software. All project data was evaluated for compliance to CMP requirements.

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

- CSCAP evaluation memorandum
- Airborne Positioning and Orientation Report (APOR)
- Aerotriangulation Report
- Project Completion Report (PCR)
- Project database
- GC11535 in shapefile format
- CEF in shapefile format

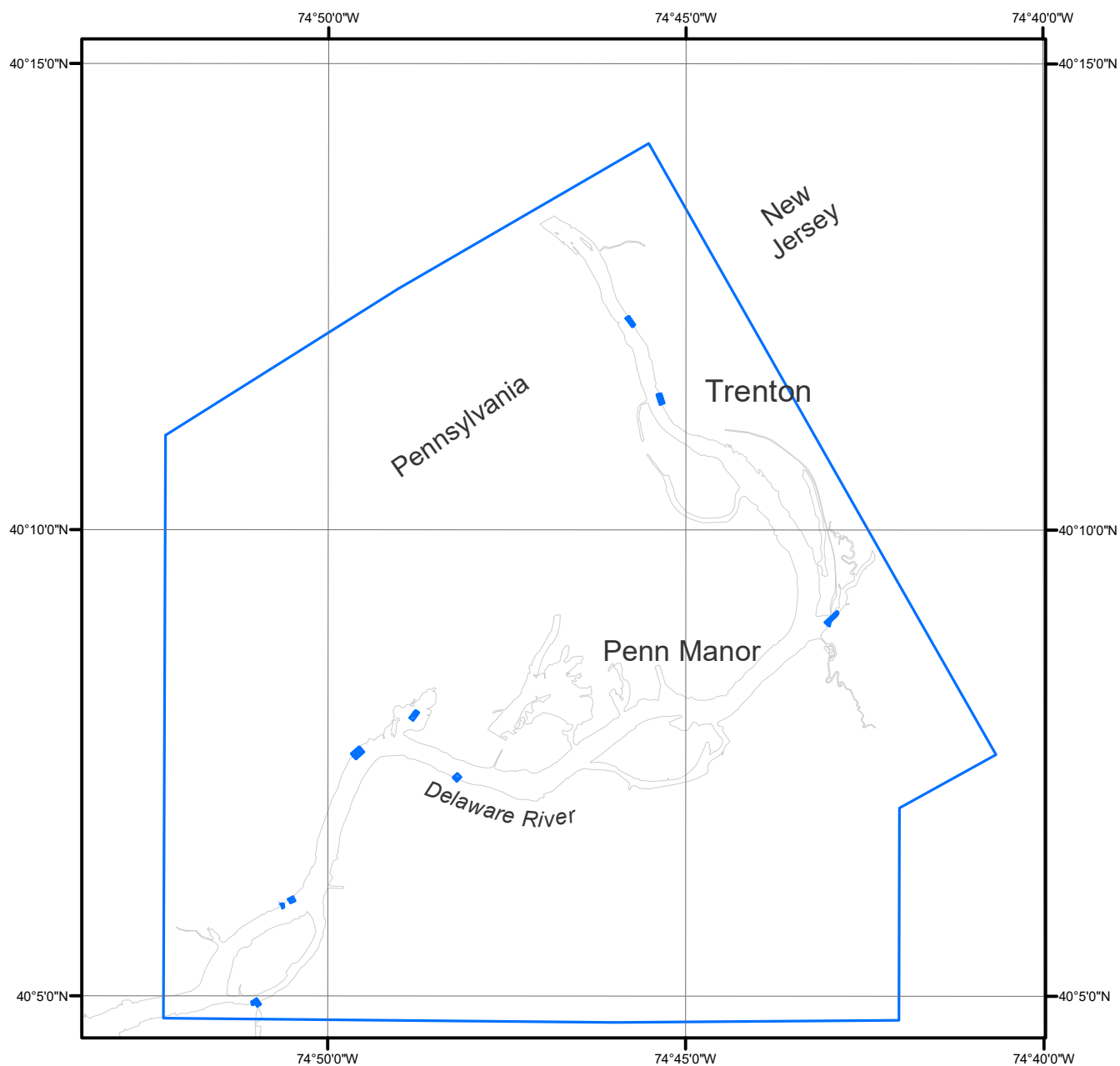
NOAA Shoreline Data Explorer

- GC11535 in shapefile format
- Metadata file for GC11535
- PCR in Adobe PDF format

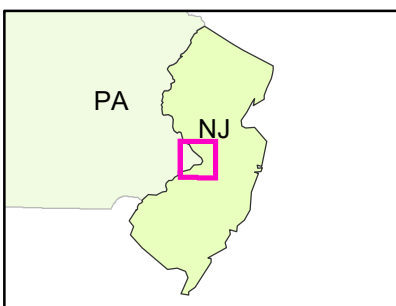
End of Report

PORTS OF TRENTON AND PENN MANOR

NEW JERSEY AND PENNSYLVANIA



Overview



NJ1801-CS-N

GC11535