NOAA COASTAL MAPPING PROGRAM
PROJECT COMPLETION REPORT

PROJECT NJ1102C-CM-N

Brigantine to Longport, New Jersey

Introduction

NOAA Coastal Mapping Program (CMP) Project NJ1102C-CM-N provides a highly accurate database of new digital shoreline data for the portion of New Jersey from Longport extending north to Brigantine. The project area also includes Great Egg Harbor Inlet, and Absecon Inlet. Project NJ1102C-CM-N is a subproject of the larger project NJ1102-CM-N, which extends from Cape May to Brigantine, New Jersey. 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 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 (7/1/93). The instructions discussed the project's purpose, geographic area of coverage, scope and priority; aerial photograph and LIDAR data acquisition requirements; orthophoto creation; tide-coordination; flight line priority; Global Positioning System (GPS) and Inertial Measurement Unit (IMU) data collection procedures and guidelines for both kinematic and static surveys; data recording and handling instructions; and contact and communication information. RB created Project Layout Diagrams for both the aerial photo and LIDAR missions, and input files for the aircraft's flight management system.

Field Operations

The field operations consisted of the collection of static and kinematic GPS data, the acquisition of digital imagery and collection of LIDAR data. The field mission operations were conducted July 16 and October 26, 2011 using the NOAA King Air aircraft (N68RF).

On July 16, 2011, both imagery and LIDAR were acquired in tandem for flight lines 25-001 to 25-014 at an altitude of 5,000 feet AGL. The data was acquired while the tide was below MHW using the DSS 439 camera and the Riegle Q680i LIDAR system. On October 26, 2011, coordinating with MLLW tide levels, RGB and NIR imagery was acquired in tandem for flight lines 50-001 to 50-008. The eight flight lines were flown at 10,000 Feet AGL with 60% end lap and 30% side lap.

For both acquisition dates, a base station was established at the Atlantic City airport using static GPS. Airborne kinematic GPS/IMU data was collected to determine precise camera positions in order to establish a control network necessary for aerotriangulation. GPS data collection operations were conducted in accordance with the GPS Controlled Photogrammetry Field Operations Manual (10/25/99).

GPS Data Reduction

Kinematic GPS data collected in July 2011 and October 2011 were processed on July 19, 2011 and November 14, 2011 respectively, using POSPAC 5.4.0 GPS/IMU software. The October data was reprocessed on June 1, 2012 using the same processing software to achieve a tightly coupled solution. The GPS data provides accurate positions of camera centers for application as photogrammetric control in the aerotriangulation phase of the project. For additional information on the GPS reduction phase see the Airborne Positioning and Orientation Report.

Aerotriangulation

Routine softcopy aerotriangulation methods were applied using the higher-altitude imagery acquired in October 2011 to establish a network of precise camera positions, model parameters, and orientation elements required for digital compilation. This work was completed by RSD personnel in March 2013 utilizing a softcopy photogrammetric workstation. The color and IR images were measured and adjusted as a single block using BAE Systems' SOCET SET (ver. 5.6) photogrammetric software in conjunction with the Multi-Sensor Triangulation (MST) module. Upon successful completion of the aerotriangulation process, the MST software provided the standard deviations of the residuals for each aerotriangulated ground point which were used to compute a predicted horizontal circular error of 0.7 meters at the 95% confidence level. The low-altitude imagery acquired in July 2011 was not included in the aerotriangulation phase for this project. For additional information, refer to the NJ1102-CM-N Aerotriangulation Report.

Ortho-image Processing

A tiled Orthomosaic image was created in July 2011 from the low-altitude DSS-439 imagery and associated image EO data using INPHO OrthoVista software. The United States Geological Survey (USGS) National Elevation Dataset (NED) was utilized to rectify the data.

LIDAR Data Processing

LIDAR point cloud data were processed in December 2011 using the following steps:

1) Riegl's *RiProcess* pre-processing software to place the raw LIDAR into a point cloud with respect to a mapping projection,
2) Terrasolid's suite of LIDAR calibration and editing software to correct alignment, remove erroneous returns, and classify bare earth points,
3) NOAA's VDatum software to convert the vertical datum of the bare earth points from ellipsoidal NAVD88 to local MHW, and
4) GeoCue LIDAR processing software to produce MHW digital elevation models (DEM) at 1 meter grid resolution.

The journal article "Lidar-Derived National Shoreline: Empirical and Stochastic Uncertainty Analyses" (2010), published in the *Journal of Coastal Research*, contains more detailed information, and is on file in the RSD Project Archive.

Compilation

The data compilation phase of this project was completed in March 2014 by RSD personnel and accomplished in two phases, automated extraction from LIDAR and manual extraction using digital stereo imagery.

During the automated extraction from LIDAR phase shoreline vectors were delineated for the outer coast portions of the project area only, using the MHW DEM and a contouring script implemented within ESRI's ArcGIS 9.3 software. The orthomosaic tiles were subsequently used to review, edit, and attribute the LIDAR shoreline vectors. Based on the study referenced in the LIDAR processing section above, the LIDAR derived shoreline vectors and features compiled from the orthoimagery, were compiled to meet a horizontal accuracy of 5.0 meters at the 95% confidence level.

Manual compilation was performed for the remaining portions of the project. The Feature Extraction software module within SOCET SET (ver. 5.6) was used in conjunction with the higher-altitude DSS source stereo-models for the majority of the back-bay areas. Features extracted from the stereo imagery were compiled to meet a horizontal accuracy of 1.4 meters at the 95% confidence level.

The following table provides information on the higher-altitude imagery used in the project completion:

Date	Time (UTC)	Roll Number	Flight Line	Photo Numbers	GSD (nominal)	Tide Level*
10/26/2011	17:30 – 17:31	11NC83	50-003	26009 – 26017	0.36 m	-0.1 to 0.0
10/26/2011	17:30 – 17:31	11NR48	50-003	14898 – 14906	0.36 m	-0.1 to 0.0
10/26/2011	17:36 – 17:37	11NC83	50-004	26018 – 26023	0.36 m	-0.1
10/26/2011	17:36 – 17:37	11NR48	50-004	14907 – 14912	0.36 m	-0.1
10/26/2011	17:49 – 17:52	11NC83	50-005	26062 – 26087	0.36 m	-0.1 to -0.2
10/26/2011	17:49 – 17:52	11NR48	50-005	14951 – 14976	0.36 m	-0.1 to -0.2
10/26/2011	17:58 – 18:02	11NC83	50-006	26088 – 26114	0.36 m	-0.2
10/26/2011	17:58 – 18:02	11NR48	50-006	14977 – 15003	0.36 m	-0.2
10/26/2011	18:07 – 18:08	11NC83	50-007	26125 – 26128	0.36 m	-0.2
10/26/2011	18:07 – 18:08	11NR48	50-007	15014 – 15017	0.36 m	-0.2

* Tide levels are given in meters above MLLW, and are based on verified water level observations at the Atlantic City station at the time of photography. For photographs covering the outer coast the tide levels were calculated using the Pydro software tool with discrete tidal zoning. For photographs covering the back bay areas, time/height corrections were applied at various substations throughout the project. The height of MHW in the project area varied between 1.0 to 1.3 meters above MLLW.

Quality Control / Final Review

Quality control tasks were conducted by RSD personnel and the final QC review was completed in June 2014. 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 9.3 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:

12316, Little Egg Harbor to Cape May, NJ, 1:40,000 scale, 35th Ed.
12318, Absecon Inlet inset, 1:20,000 scale, 45th Ed.

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 GC10976 file contents, attached to PCR

Remote Sensing Division Electronic Data Library

- Project database
- GC10976 in shapefile format
- Digital copy of the PCR in Adobe PDF format
- CEF in shapefile format

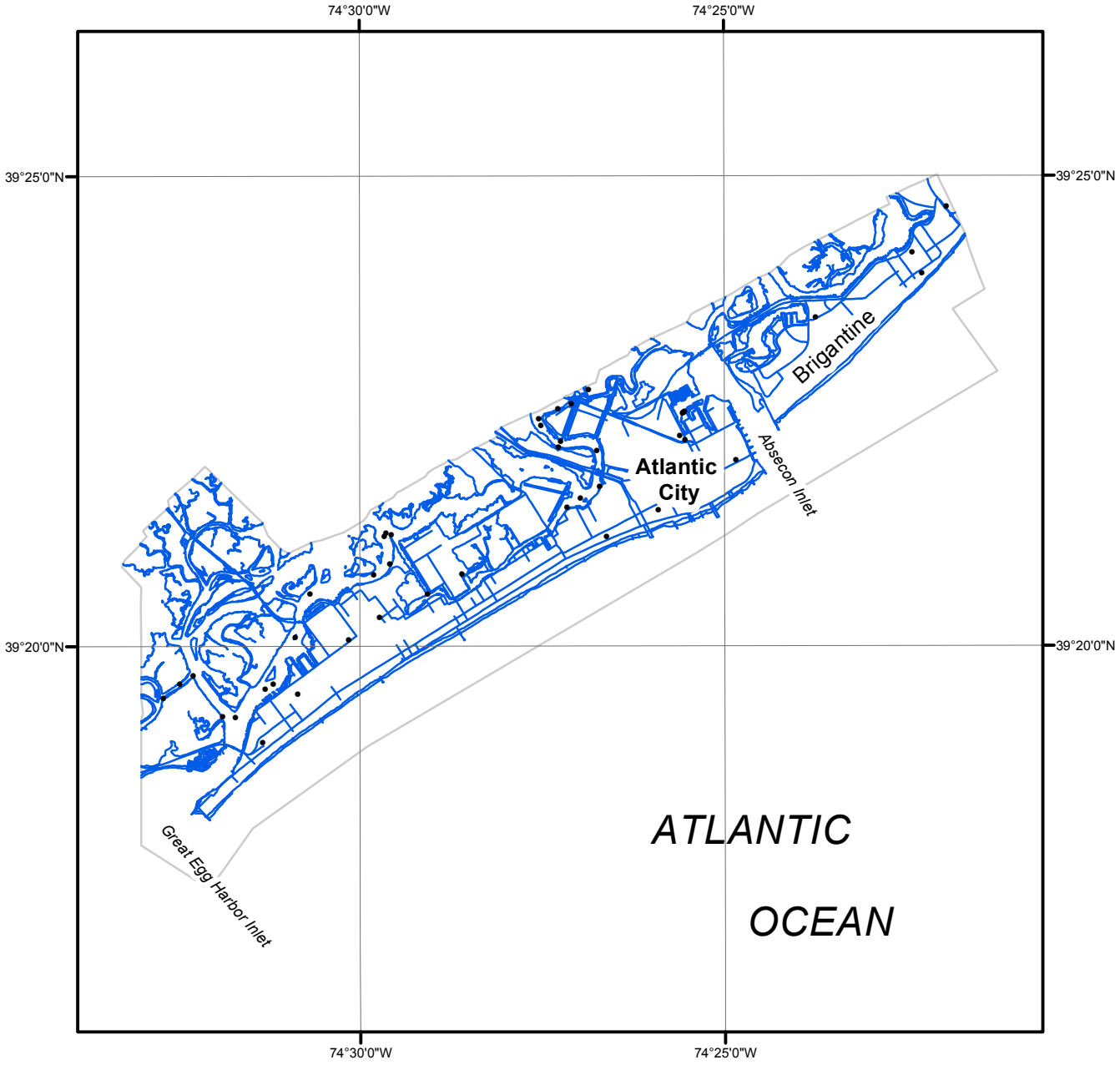
NOAA Shoreline Data Explorer

- GC10976 in shapefile format
- Metadata file for GC10976
- Digital copy of the PCR in Adobe PDF format

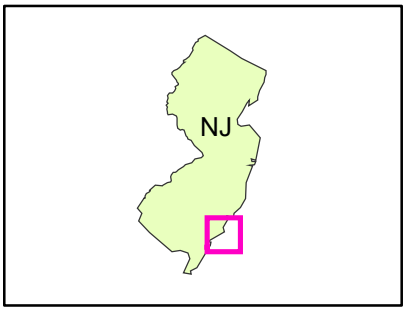
End of Report

BRIGANTINE TO LONGPORT

NEW JERSEY



Overview



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