

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

## ***PROJECT MD0701D***

### ***Potomac River, Washington, D.C. to Mason Neck, Maryland and Virginia***

#### **Introduction**

NOAA Coastal Mapping Program (CMP) Project MD0701D provides a highly accurate database of new digital shoreline data for a portion of the Potomac River. The project extends from Washington, D.C. southward to Mason Neck, Virginia as well as a portion of the Anacostia River. Project MD0701D is a sub-project of the project MD0701 which covers the Potomac River from Washington D.C. to Mob Neck.

Successful completion of this project resulted in a densification of the National Spatial Reference System (NSRS), a set of controlled metric-quality aerial photographs, and digital feature data of the coastal zone which complements the Nautical Charting Program (NCP) as well as geographic information systems (GIS) for a variety of coastal zone management applications.

The project database consists of information measured and extracted from aerial photographs and metadata related to photogrammetric compilation. Base mapping was conducted in a digital environment using stereo softcopy photogrammetry and associated cartographic practices.

#### **Project Design**

The NOAA National Geodetic Survey (NGS) formulated the Project Instructions for this project following the guidelines of the "Scope of Work, Shoreline Mapping for the Coastal Mapping Program" (SOW), Version 13A, dated July 2005. The instructions discussed the project's purpose, geographic area of coverage, scope and priority; data acquisition, processing, accuracy, and compilation requirements; product delivery and reporting instructions; and contact and communication information.

#### **Field Operations**

AERO-METRIC, INC. (AME) performed the field operations for project MD0701. Field operations included the surveying of ground control using static GPS data collection and the acquisition of aerial imagery with airborne GPS (ABGPS) data collection. Survey field work was performed between 12/09/2008 and 12/15/2008. AME collected fifty-six ground control points using GPS surveying techniques in conjunction with Continuously Operating Reference Stations (CORS). All of the control points were at photo identifiable locations throughout the project area. The CORS stations CORB, LOY8, MDSI, USNO and VIMS were used as controlled base stations. Two NSRS monuments (C 273 and JASON) were also occupied and used as control in the adjustment. A minimum of 15

minutes of data were collected at each point and OPUS-RS was used to verify the positions and elevations of all points.

All aerial photography was acquired using a Leica RC30 aerial camera at an altitude of 15,000 feet with a nominal scale of 1:30,000. The natural color photographs were acquired between July 15<sup>th</sup>, 2008 and February 24<sup>th</sup>, 2009. Black and White Infrared (B&W IR) photographs acquired at the mean high water (MHW) tide stage were acquired between August 20<sup>th</sup>, 2008 and September 2<sup>nd</sup>, 2010. Mean Lower Low Water (MLLW) B&W IR photographs were acquired between August 18<sup>th</sup>, 2008 and September 7<sup>th</sup>, 2010. Airborne GPS data were collected during the acquisition of all photography in order to determine precise camera positions.

### **GPS Data Reduction**

The airborne and ground base station GPS raw data were processed using the Applanix POSPAC (versions 4.31 and 4.4) software. At least two CORS stations were used to derive the solution in a forward and reverse mode independently, and then their results were compared as a quality control measure. Root mean square (RMS) residuals at each epoch were produced in the processing software. These residuals were used to evaluate the accuracy estimates of the positions.

### **Aerotriangulation**

AME completed the aerotriangulation phase for project MD0701 in May 2011. The softcopy analytical aerotriangulation was done using the Zeiss Image Station Automatic Triangulation (ISAT) program installed on a Dell PWS670 workstation, running under Windows XP Professional, Version 2002 Service Pack 2. The ISAT program includes automatic point matching capability and the PhotoT least-squares bundle-block adjustment.

Each of the three sets of photography were point matched, triangulated and debugged as individual blocks. These three blocks were then merged into one block. Ground survey points MD10, MD15, VA02, and VA28 were used as check points and the remaining fifty-two points were used as control points. Tie points were measured manually in weak areas and in models with small land area. All ground-surveyed horizontal-and-vertical control, check points and ties between the sets of photography were also measured manually. Upon successful completion of the aerotriangulation process, the ISAT software provided the RMS of the standard deviations of the residuals for each aerotriangulated ground point, which were used to compute a predicted horizontal circular error of 0.5 meters based on a 95% confidence level. An Aerotriangulation Report was written and is on file with other project data within the RSD Applications Branch (AB) Project Archive.

The project database consists of project parameters and options, camera calibration data, interior orientation parameters, 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 (NAD 83).

## Compilation

The data compilation phase of project MD0701D was initiated by AeroMetric, Inc. in September 2011. Digital feature extraction was completed in a softcopy stereo environment using DAT/EM Systems International Summit Evolution software (ver. 6.2), and Bentley Systems MicroStation V8. All coding and classification of features occurred within the MicroStation environment as features were collected, and was based on interpretation of the project imagery, and on 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. Selected features were further modified with additional descriptive information to refine general classification.

Spatial data accuracies for the Project MD0701D were determined according to standard Federal Geographic Data Committee (FGDC) practices. Cartographic features were compiled to meet a horizontal accuracy of 1.0 meter at the 95% confidence level. The predicted accuracy of compiled, well defined points is calculated by doubling the circular error derived from the aerotriangulation statistics.

The following table provides information on aerial photographs used in project MD0701D:

Date	Time (UTC)	Roll Number	Strip	Photo Numbers	Scale (nominal)	Tide Level*
7/15/08	14:40-14:45	0828CN01	30-010	0024-0026	1:30,000	0.2
7/15/08	15:04-15:08	0828CN01	30-008	0037-0042	1:30,000	0.1 – 0.2
9/02/08	14:26-14:33	0827R10	30-010	0973-0974	1:30,000	0.6
9/02/08	15:00-15:02	0827R10	30-008	0982-0983	1:30,000	0.6
9/02/08	20:56-21:00	0827R10	30-008	1115-1116	1:30,000	0.1
10/31/08	15:43-15:48	0827CN07	30-010	0611-0620	1:30,000	0.4 – 0.6
10/31/08	15:53-15:56	0827CN07	30-008	0622-0627	1:30,000	0.5
10/31/08	16:01-16:04	0827CN07	30-009	0628-0633	1:30,000	0.6
10/31/08	16:09-16:13	0827CN07	30-013	0639-0643	1:30,000	0.6
10/31/08	16:21-16:24	0827CN07	30-012	0646-0653	1:30,000	0.6 – 0.5
2/21/09	15:14-15:24	0927CN01	30-009	0003-0016	1:30,000	0.1 – (-0.1)
4/05/09	13:58-14:03	0927R04	30-010	0587-0591	1:30,000	0.1
4/05/09	14:38-14:44	0927R04	30-008	0616-0626	1:30,000	0.1 – 0.0
4/05/09	14:47-14:53	0927R04	30-009	0628-0642	1:30,000	0.0 – 0.1
4/27/09	20:04-20:07	0927R06	30-009	0901-0902	1:30,000	0.0
4/27/09	20:28-20:32	0927R06	30-010	0916-0920	1:30,000	0.1
4/27/09	20:51-20:55	0927R06	30-012	0936-0943	1:30,000	0.1
4/27/09	21:01-21:05	0927R06	30-013	0946-0951	1:30,000	0.1
5/05/10	17:20-17:28	1024R03	30-009	0075-0090	1:30,000	0.7 – 1.0

5/05/10	17:33-17:37	1024R03	30-013	0094-0099	1:30,000	1.0
5/05/10	17:45-17:49	1024R03	30-010	0102-0109	1:30,000	0.7 – 1.0
5/05/10	17:54-17:59	1024R03	30-012	0110-0117	1:30,000	1.0
5/05/10	18:08-18:13	1024R03	30-008	0119-0129	1:30,000	1.0 – 0.6
9/02/10	18:35-18:39	1027R04	30-101	0166-0167	1:30,000	1.0

\* Tide levels are given in meters above MLLW and are based on tidal zoning corrections applied from the Washington reference station. The height of the MHW tidal datum in the project area varies between 0.4 and 1.0 meters above MLLW.

## Quality Control / Final Review

Quality control tasks were conducted during all phases of project completion. The final QC review was completed in October 2011. The review process included analysis of aerotriangulation results and assessment of the identification and attribution of digital feature data within the Geographic Cell (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 MicroStation and ArcGIS software. All project data was evaluated for compliance to CMP requirements.

Comparisons of the largest scale NOAA nautical charts with project photography and compiled project data resulted in creation of the Chart Evaluation File (CEF). The following nautical charts were used in the comparison process:

- 12285, Potomac River, Smith Point to Breton Bay, 1:80,000 scale, 40<sup>th</sup> Ed.
- 12289, Potomac River, Mattawoman Creek to Georgetown, 1:40,000 scale, 50<sup>th</sup> 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 GC10896 file contents, attached to PCR

### Remote Sensing Division Electronic Data Library

- Project database
- GC10896 in shapefile format
- Digital copy of the PCR in Adobe PDF format
- CEF in shapefile format

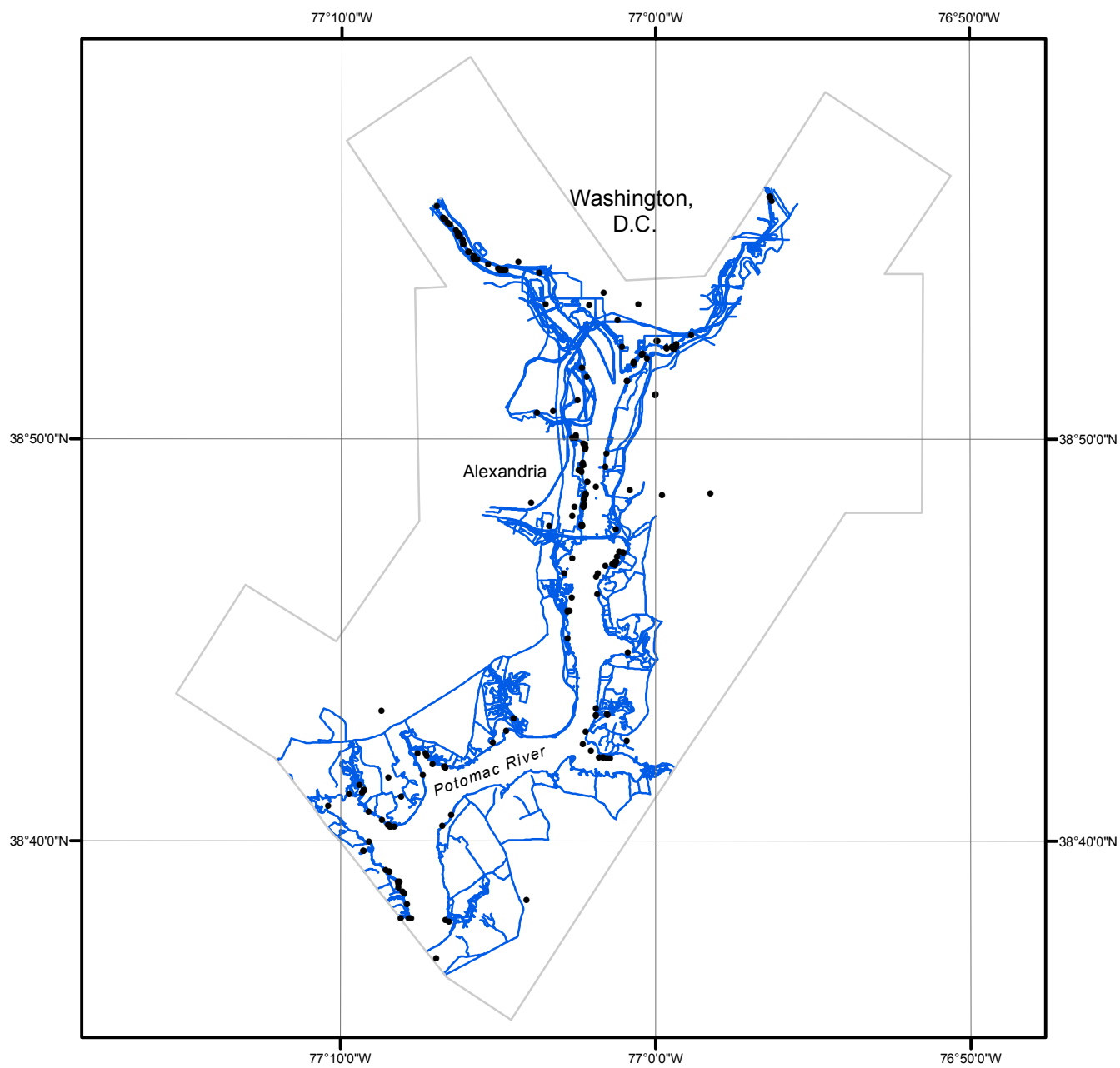
### NOAA Shoreline Data Explorer

- GC10896 in shapefile format
- Metadata file for GC10896
- Digital copy of the PCR in Adobe PDF format

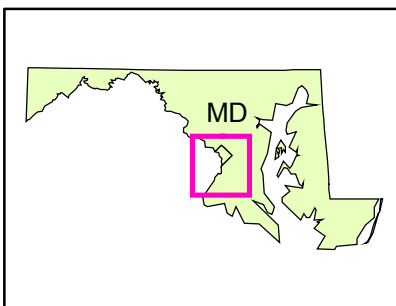
## End of Report

# POTOMAC RIVER, WASHINGTON DC TO MASON NECK

## MARYLAND AND VIRGINIA



Overview



MD0701D

GC10896