NOAA COASTAL MAPPING PROGRAM
PROJECT COMPLETION REPORT

PROJECT MD0701C

Potomac River, Mathias Point Neck to Mason Neck, Maryland and Virginia

Introduction

NOAA Coastal Mapping Program (CMP) Project MD0701C provides a highly accurate database of new digital shoreline data for a portion of the Potomac River from Mathias Point Neck to Mason Neck. Project MD0701C is a sub-project of 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 from 12/09/2008 to 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 15th, 2008 and February 24th, 2009. Black and White Infrared (B&W IR) photographs acquired at the mean high water (MHW) tide stage were acquired between August 20th, 2008 and September 2nd, 2010. Mean Lower Low Water (MLLW) B&W IR photographs were acquired between August 18th, 2008 and September 7th, 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 photographs 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 MD0701C was initiated by AeroMetric, Inc. in June 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 MD0701C 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 MD0701C:

Date	Time (UTC)	Roll Number	Strip	Photo Numbers	Scale (nominal)	Tide Level*
7/15/2008	14:27-14:32	0828CN01	30-001	0008-0011	1:30,000	0.1
7/15/2008	14:40-14:45	0828CN01	30-010	0015-0024	1:30,000	0.1 – 0.2
7/15/2008	14:52-14:54	0828CN01	30-007	0027-0030	1:30,000	0.2
7/15/2008	15:04-15:08	0828CN01	30-008	0033-0037	1:30,000	0.1
7/15/2008	15:33-15:37	0828CN01	30-009	0046-0053	1:30,000	0.1
8/20/2008	15:27-15:31	0827R09	30-007	0875-0879	1:30,000	0.1
8/20/2008	15:58-16:05	0827R09	30-005	0881-0888	1:30,000	0.1 – 0.0
8/20/2008	19:08-19:14	0827R10	30-003	0934-0944	1:30,000	0.1 – 0.0
8/20/2008	19:19-19:23	0827R10	30-002	0947-0955	1:30,000	0.0 – 0.1
9/02/2008	14:26-14:33	0827R10	30-010	0965-0974	1:30,000	0.5 – 0.6
9/02/2008	14:48-14:52	0827R10	30-011	0975-0980	1:30,000	0.6
9/02/2008	15:00-15:02	0827R10	30-008	0982-0985	1:30,000	0.6
9/02/2008	15:10-15:26	0827R10	30-006	0992-0995	1:30,000	0.1
9/02/2008	15:45-15:50	0827R10	30-004	1032-1039	1:30,000	0.0 – 0.1
9/02/2008	19:47-19:58	0827R10	30-001	1061-1065	1:30,000	0.1
9/02/2008	20:46-20:48	0827R10	30-007	1106-1110	1:30,000	0.5
9/02/2008	20:56-21:00	0827R10	30-008	1113-1116	1:30,000	0.1
9/05/2008	13:38-13:43	0828R02	30-001	0081-0085	1:30,000	0.5
9/18/2008	13:43-13:46	0828R02	30-005	0106-0110	1:30,000	0.6 – 0.5
10/20/2008	15:41-15:50	0828R03	30-003	0370-0373	1:30,000	0.6
10/31/2008	15:43-15:48	0827CN07	30-010	0610-0611	1:30,000	0.2 – 0.3
2/21/2009	15:14-15:24	0927CN01	30-009	0016-0018	1:30,000	-0.1 to -0.2
2/21/2009	15:46-15:47	0927CN01	30-011	0025-0029	1:30,000	-0.1 to -0.2
2/21/2009	15:52-15:55	0927CN01	30-006	0030-0037	1:30,000	-0.1 to +0.1

2/21/2009	16:16-16:24	0927CN01	30-005	0073-0085	1:30,000	+0.1 to -0.1
2/21/2009	16:30-16:35	0927CN01	30-004	0086-0098	1:30,000	-0.1 to +0.2
2/21/2009	16:55-17:03	0927CN01	30-003	0127-0139	1:30,000	0.2 – 0.0
2/21/2009	17:07-17:12	0927CN01	30-002	0140-0151	1:30,000	0.0 – 0.1
4/05/2009	13:31-13:34	0927R04	30-011	0567-0572	1:30,000	0.1 – 0.0
4/05/2009	13:39-13:41	0927R04	30-005	0575-0577	1:30,000	0.0
4/05/2009	13:58-14:03	0927R04	30-010	0579-0589	1:30,000	0.0
4/05/2009	14:38-14:44	0927R04	30-008	0625-0627	1:30,000	0.0
4/05/2009	14:47-14:53	0927R04	30-009	0628-0629	1:30,000	0.0
4/17/2009	14:17-14:18	0927R05	30-004	0688-0693	1:30,000	0.4 – 0.5
4/17/2009	14:33-14:39	0927R05	30-002	0707-0715	1:30,000	0.5
4/17/2009	15:38-15:49	0927R05	30-005	0745-0752	1:30,000	0.6
4/17/2009	15:54-16:06	0927R05	30-006	0791-0795	1:30,000	0.6 – 0.5
4/24/2009	13:32-13:34	0927R05	30-006	0798-0802	1:30,000	0.0
4/24/2009	13:56-13:58	0927R05	30-003	0836-0838	1:30,000	-0.1 to 0.0
4/27/2009	20:04-20:07	0927R06	30-009	0901-0909	1:30,000	-0.1 to 0.0
7/14/2009	13:41-13:48	0928R01	30-004	0007-0014	1:30,000	0.6
7/14/2009	14:00-14:05	0928R01	30-003	0015-0025	1:30,000	0.5
5/05/2010	17:08-17:12	1024R03	30-009	0066-0077	1:30,000	0.5 – 0.7
5/05/2010	17:45-17:49	1024R03	30-010	0101-0103	1:30,000	0.7
5/05/2010	18:08-18:13	1024R03	30-008	0128-0130	1:30,000	0.6
9/07/2010	15:10-15:12	1027R04	30-004	0170-0175	1:30,000	0.2

* Tide levels are given in meters above MLLW and are based on tidal zoning corrections applied from the Colonial Beach reference station. The height of the MHW tidal datum in the project area varies between 0.35 and 0.60 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 September 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 natural color photographs, black and white infrared photographs 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, St. Clements Bay to Mattawoman Creek, 1:80,000 scale, 41st Ed.
12288, Potomac River, Lower Cedar Point to Mattawoman Creek, 1:40,000 scale, 20th Ed.
12289, Potomac River, Mattawoman Creek to Georgetown, 1:40,000 scale, 50th Ed.

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

- Airborne Positioning Report
- Ground Photo Control Report
- Aerotriangulation Report
- Project Completion Report (PCR)
- Project database
- GC10895 in shapefile format
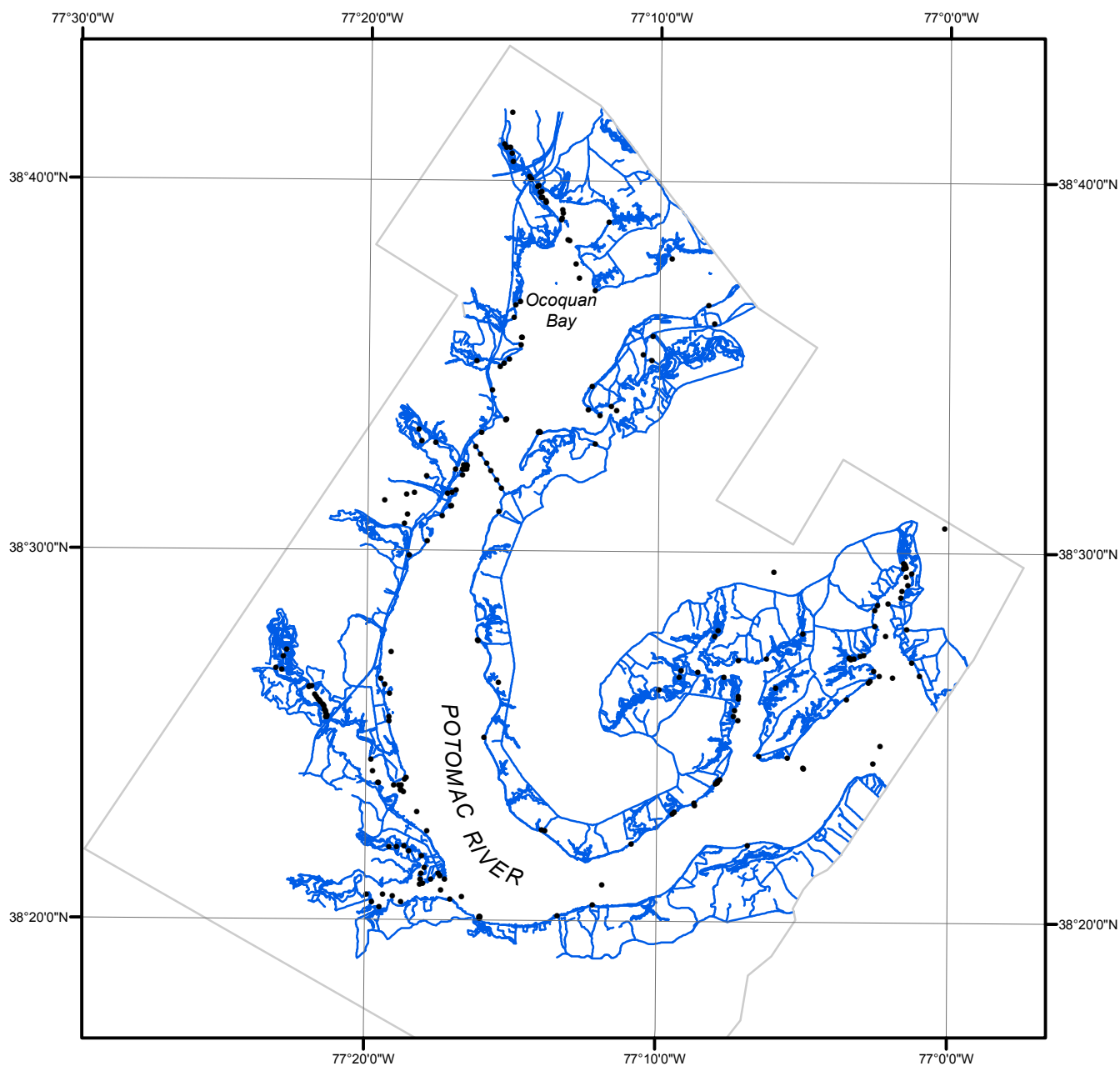- Chart Evaluation File (CEF) in shapefile format

NOAA Shoreline Data Explorer

- GC10895 in shapefile format
- Metadata file for GC10895
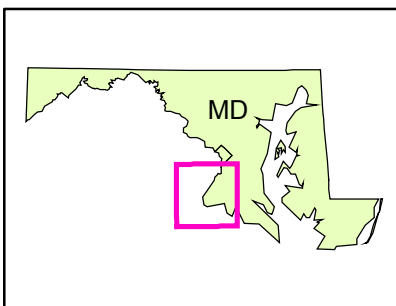- Digital copy of the PCR in Adobe PDF format

End of Report

POTOMAC RIVER, MATHIAS POINT NECK TO MASON NECK

MARYLAND AND VIRGINIA

Ocoquan Bay

POTOMAC RIVER

Overview

MD

MD0701C

GC10895