

NOAA COASTAL MAPPING PROGRAM PROJECT COMPLETION REPORT

PROJECT MD0404E

Chesapeake Bay, Fairmount Neck to Pocomoke River, Maryland and Virginia

Introduction

National Oceanic and Atmospheric Administration (NOAA) Coastal Mapping Program Project MD0404E provides a highly accurate database of new digital shoreline data for portions of the Chesapeake Bay and surrounding coastal areas. The project area extends from Fairmount Neck on the Big Annemessex River to the Pocomoke River and includes various tributaries of the Chesapeake Bay. MD0404E is a sub project of the larger project MD0404, which covers the Chesapeake Bay from Jenkins Creek in the north to the Pocomoke River.

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 Remote Sensing Division (RSD) formulated the Project Instructions for this project following the guidelines of the "Scope of Work, Shoreline Mapping for the Coastal Mapping Program", version 12, dated February 2002. 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

Western Air Maps, Inc. (WAM) contracted the services of Metro Engineering and Surveying Co., Inc. to survey thirty-three (33) ground control points for project MD0404. The control points were photo-identifiable features and were taken from well-defined locations. Refer to the Ground Control Report for a listing of final coordinates, elevations, descriptions and a site map of the control and check points.

Aerial photography and airborne GPS data was captured by Richard Crouse & Associates (RC&A). For each photo mission RC&A captured the photography with the use of a Leica RC30 camera equipped with a Flight Navigation and Management System. The photo missions that acquired the black and white infrared (B&W IR) images were tide coordinated and captured

within tolerance of either the Mean High Water (MHW) or the Mean Lower Low Water (MLLW) tide stages. The color negative photos were flown below the MHW tide stage. All film was captured at a scale of 1:30,000. All images that were acceptable for compilation were flown between August 22nd, 2005 and April 29th, 2010. The Final Photo Mission Report and the Tabulation of Aerial Photography include complete narratives and descriptions of the methods used and results of the final datasets.

GPS Data Reduction

GPS data was processed to provide accurate positions of camera centers for application as photogrammetric control in the aerotriangulation phase of the project. For each photo exposure, the location of the camera was recorded through the use of a dual frequency GPS receiver and on several occasions IMU equipment was employed. The raw GPS data sets were processed using either GrafNAV GPS or Applanix's POSPAC post processing software, which determined the accurate trajectory of all the flight missions. The resulting values were accurate positions of the survey camera. At least two (2) Continuously Operating Reference Stations (CORS) were used to process each raw data set. Refer to the Airborne Positioning and Orientation Report for more detailed information.

Aerotriangulation

Routine softcopy aerotriangulation methods were applied to establish the 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 WAM in December 2005 utilizing a Digital Photogrammetric Workstation (DPW), which is a configuration of computer hardware, modular software components and other associated peripheral devices. The color photographs, the MHW B&W IR and MLLW B&W photographs were each measured and adjusted as separate blocks using Z/I Imaging's ISAT digital aerotriangulation software (versions 6.0.5.0 and 6.1.6.0). 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 0.3 meters for the color photographs, 0.7 meters for the MHW B&W IR photographs and 1.0 meters for the MLLW B&W IR photographs based on a 95% confidence level. An Aerotriangulation Report was written and is on file with other project data within the RSD Electronic Data Library.

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 MD0404E was initiated by WAM in September 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 1:30,000 scale 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 MD0404E were determined according to standard Federal Geographic Data Committee (FGDC) practices. Most cartographic features were compiled to meet a horizontal accuracy of 0.6 meters at the 95% confidence level. Features compiled from the MHW B&W IR photographs meet a horizontal accuracy of 1.4 meters at the 95% confidence level. Features compiled from the MLLW B&W IR photographs meet a horizontal accuracy of 2.0 meters at the 95% confidence level. The predicted accuracy of compiled, well defined points is derived by doubling the circular error calculated from aerotriangulation statistics.

The following table provides information on images used in the completion of this project:

Date	Time (UTC)	Roll Number	Photo Numbers	Scale (nominal)	Tide Level*
Color Imagery					
8-22-2005	15:25 – 15:29	0528CN01	152 – 159	1:30,000	0.2 – 0.4
9-02-2005	15:05 – 15:08	0528CN02	196 – 202	1:30,000	0.6 – 0.7
9-02-2005	15:10 – 15:14	0528CN02	203 – 210	1:30,000	0.6 – 0.8
9-02-2005	15:35 – 15:38	0528CN02	241 – 249	1:30,000	0.6 – 0.8
9-03-2005	14:01 – 14:05	0528CN03	266 – 274	1:30,000	0.1 – 0.4
9-03-2005	14:09 – 14:12	0528CN03	275 – 281	1:30,000	0.2 – 0.4
9-03-2005	14:16 – 14:19	0528CN03	282 – 288	1:30,000	0.2 – 0.5
9-03-2005	14:25 – 14:29	0528CN03	289 – 298	1:30,000	0.2 – 0.3
9-03-2005	14:36 – 14:42	0528CN03	301 – 312	1:30,000	0.2
9-03-2005	14:46 – 14:51	0528CN03	313 – 323	1:30,000	0.2
MLLW IR Imagery					
6-16-2006	15:48 – 15:51	0624R02	289 – 297	1:30,000	0.1
6-16-2006	15:56 – 15:59	0624R02	298 – 304	1:30,000	0.1 – 0.2
6-16-2006	16:05 – 16:06	0624R02	308 – 311	1:30,000	0.1
6-16-2006	16:12 – 16:17	0624R02	312 – 320	1:30,000	0.1 – 0.0
6-21-2007	18:40 – 18:41	0728R02	146 – 148	1:30,000	0.1
6-21-2007	19:29 – 19:34	0728R02	188 – 198	1:30,000	0.1 – 0.2
6-21-2007	19:38 – 19:41	0728R02	203 – 209	1:30,000	0.2 – 0.1
7-07-2007	16:37	0727R05	460	1:30,000	0.0
7-07-2007	16:57	0727R05	491	1:30,000	0.0
7-07-2007	16:58 – 17:00	0727R05	494 – 497	1:30,000	0.0
11-28-2007	17:19 – 17:23	0728R08	843 – 852	1:30,000	-0.2
6-09-2008	16:37 – 16:40	0827R06	530 – 536	1:30,000	0.1

6-09-2008	16:50	0827R06	546 – 547	1:30,000	0.1
10-04-2008	15:08 – 15:09	0828R03	244 – 246	1:30,000	0.0
1-31-2009	15:49 – 15:51	0927R01	001 – 005	1:30,000	-0.1
4-26-2009	15:27 – 15:29	0927R05	839 – 843	1:30,000	0.0
MHW IR Imagery					
4-11-2006	15:00 – 15:01	0627R04	312 – 315	1:30,000	0.5 – 0.8
4-11-2006	15:12 – 15:15	0627R04	316 – 321	1:30,000	0.8 – 0.5
4-11-2006	15:36 – 15:37	0627R04	358 – 361	1:30,000	0.6 – 0.7
4-11-2006	15:52 – 15:53	0627R04	370 – 372	1:30,000	0.6
4-11-2006	16:11 – 16:12	0627R04	403 – 405	1:30,000	0.6
11-04-2006	18:56 – 18:57	0627R13	1408 – 1409	1:30,000	0.4
5-01-2007	19:54	0727R04	333	1:30,000	0.5
5-01-2007	20:05	0727R04	349	1:30,000	0.4
5-01-2007	20:11 – 20:13	0727R04	356 – 359	1:30,000	0.4
5-01-2007	20:15	0727R04	363	1:30,000	0.5
5-01-2007	20:33 – 20:36	0727R04	383 – 389	1:30,000	0.6 – 0.3
5-01-2007	20:41 – 20:42	0727R04	394 – 396	1:30,000	0.6
6-09-2008	15:37 – 15:42	0827R06	487 – 497	1:30,000	0.4 – 0.6
6-09-2008	15:49 – 15:55	0827R06	502 – 513	1:30,000	0.6 – 0.4
7-13-2008	17:48 – 17:52	0828R01	011 – 020	1:30,000	0.6 – 0.7
9-18-2008	16:43	0828R02	147 – 148	1:30,000	0.6
10-03-2008	16:35 – 16:37	0828R03	187 – 190	1:30,000	0.5
10-03-2008	17:05	0828R03	196	1:30,000	0.5
2-09-2009	16:19 – 16:20	0927R01	110 – 112	1:30,000	0.6 – 0.5
2-09-2009	16:34	0927R01	117	1:30,000	0.6
4-26-2009	17:00 – 17:01	0927R05	848 – 850	1:30,000	0.6
4-26-2009	17:07 – 17:08	0927R05	851 – 852	1:30,000	0.6

* Tide levels are given in meters above MLLW and are based on actual observations at the Bishops Head and Snow Hill tide stations with corrections applied to various tide zones throughout the project area. The height of the MHW tidal datum in the project area varies between 0.54 to 0.79 meters above MLLW.

Quality Control / Final Review

Quality control (QC) tasks were conducted during all phases of project completion by a senior member of WAM. The final QC review was completed in November 2012. 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 ESRI ArcGIS (version 10.2) software. All project data was evaluated for compliance to requirements.

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

- 12228, Pocomoke and Tangier Sounds, MD and VA, 1:40,000 scale, 33rd Ed., Oct. 2011
- 12230, Smith Point to Cove Point, MD and VA, 1:80,000 scale, 66th Ed., Apr. 2013
- 12231, Tangier Sound - Northern Part, 1:40,000 scale, 30th Ed., Feb. 2014

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 and Orientation Report (APOR)
- Aerotriangulation Report
- Project database
- GC10759 in shapefile format
- Project Completion Report (PCR)
- CEF in shapefile format

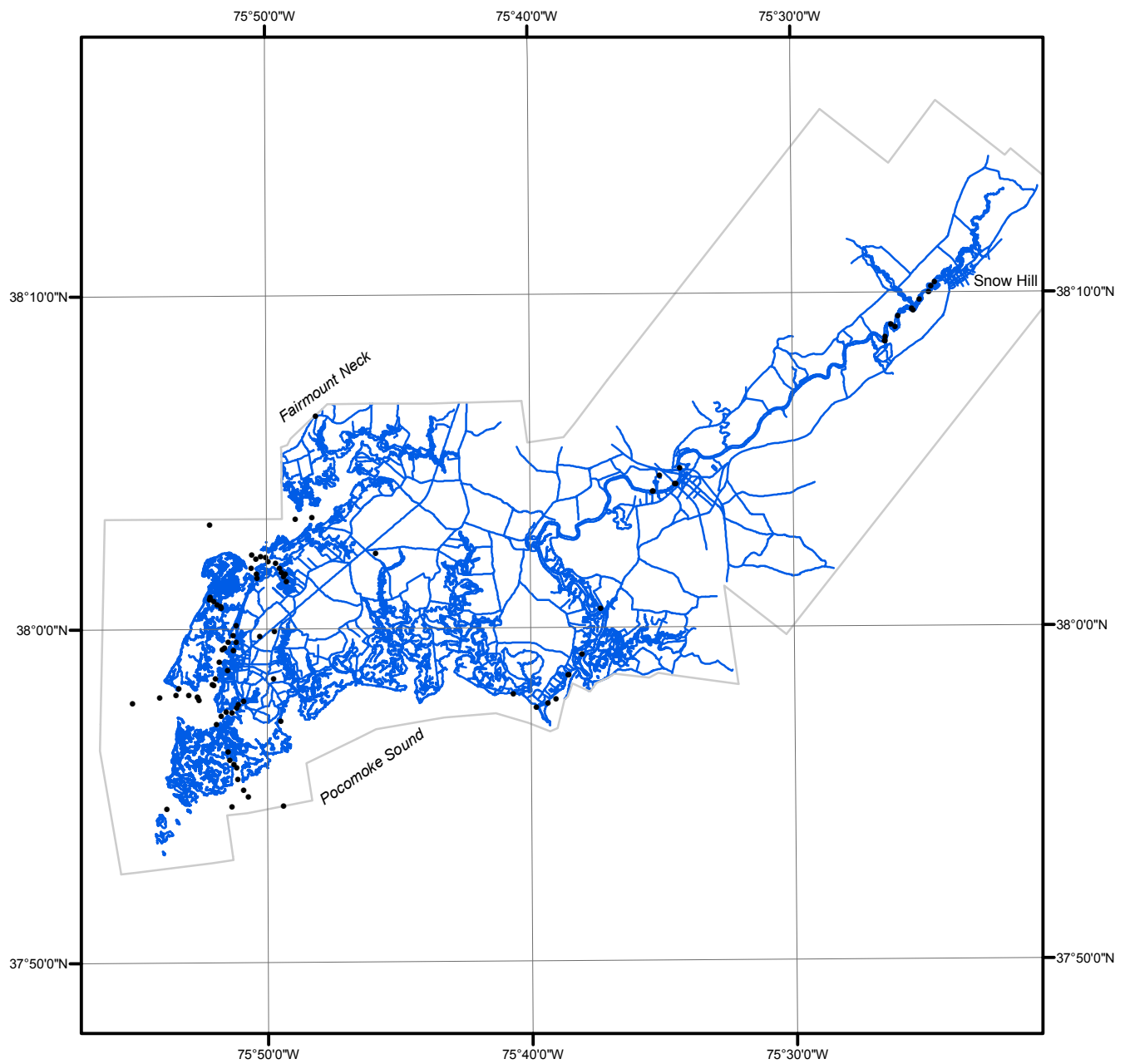
NOAA Shoreline Data Explorer

- GC10759 in shapefile format
- Metadata file for GC10759
- Digital copy of the PCR in Adobe PDF format

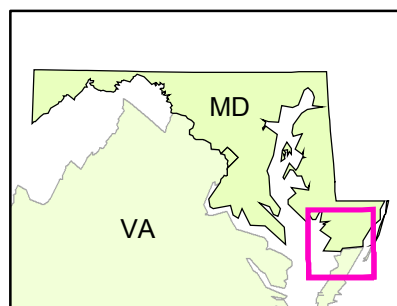
End of Report

CHESAPEAKE BAY, FAIRMOUNT NECK TO POCOMOKE RIVER

MARYLAND AND VIRGINIA



Overview



MD0404E

GC10759