

NOAA COASTAL MAPPING PROGRAM PROJECT COMPLETION REPORT

PROJECT VA0701D

James River, Hopewell to Richmond, Virginia

Introduction

National Oceanic and Atmospheric Administration (NOAA) Coastal Mapping Program Project VA0701D provides a highly accurate database of new digital shoreline data for portions of the James River and surrounding coastal areas. The project area extends from Hopewell to Richmond and includes various small bays and tributaries to the James River. VA0701D is a sub project of the larger project VA0701, which covers the James River from the Nansemond River in the south to Richmond in the north.

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 13B, dated January 2008. 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

Photo Science, Inc. (PSI) surveyed twenty (20) ground control points for acquisition project VA0701. The control points were photo-identifiable features and were taken from well-defined discrete 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 film missions consisting of the black and white infrared (B&W IR) negatives were tide

coordinated and captured within tolerance of either the Mean High Water (MHW) or the Mean Lower Low Water (MLLW) tidal conditions. The color negatives were flown below the MHW tide stage. All film was captured at a scale of 1:30,000. Nine (9) separate photo missions were flown between September 4, 2008 and July 11, 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.

PSI contracted the services of John Oswald & Associates to perform tide gauge installation, positioning and leveling surveys of the tide gauge, obtaining at least thirty continuous days of data from the tide gauge, processing the data to obtain a tidal datum for the tide gauge, maintaining the tide gauge throughout aerial photographic operations, tide prediction, and tide monitoring.

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 camera exposure, the location of each photo exposure was recorded through the use of a Dual Frequency receiver and on several occasions GPS/IMU equipment was employed. The raw GPS data sets were processed using GrafNAV GPS post processing software that 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) stations 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 PSI in March 2011 utilizing a Digital Photogrammetric Workstation (DPW), which is a configuration of computer hardware, modular software components and other associated peripheral devices. The color photographs and black and white infrared photographs were measured and adjusted as one block using Intergraph® softcopy photogrammetry suite for project setup and aerotriangulation. BINGO aerotriangulation software was used to perform the final bundle block adjustment and to provide block analysis. Upon successful completion of the aerotriangulation process, the BINGO 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 0.6 meters for all photographs 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 VA0701D was initiated by PSI in November 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 VA0701D were determined according to standard Federal Geographic Data Committee (FGDC) practices. Cartographic features were compiled to meet a horizontal accuracy of 1.2 meters at the 95% confidence level. The predicted accuracy of compiled, well defined points is derived by doubling the circular error derived from aerotriangulation statistics.

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

Date	Time (UTC)	Roll Number	Photo Numbers	Scale (nominal)	Tide Level*
09/04/2008	15:49 – 15:53	0827CN06	540 – 548	1:30,000	0.4 m
09/04/2008	15:57 – 16:01	0827CN06	549 – 556	1:30,000	0.4 m
09/04/2008	18:21 – 18:26	0827CN06	563 – 573	1:30,000	0.1 m
09/04/2008	18:32 – 18:36	0827CN06	575 – 584	1:30,000	0.2 m
09/04/2008	18:47 – 18:52	0827CN06	597 – 607	1:30,000	0.2 m
03/22/2009	17:39 – 17:42	0927R03	384 – 394	1:30,000	1.0 m
03/22/2009	17:52 – 17:58	0927R03	403 – 413	1:30,000	0.9 m
03/22/2009	18:03 – 18:06	0927R03	415 – 424	1:30,000	1.0 m
03/22/2009	18:16 – 18:20	0927R03	429 – 437	1:30,000	0.9 m
03/22/2009	18:24 – 18:28	0927R03	438 – 445	1:30,000	0.9 m
07/11/2010	14:22 – 14:26	1027R03	102 – 112	1:30,000	0.2 m
07/11/2010	14:31 – 14:37	1027R03	116 – 126	1:30,000	0.1 m
07/11/2010	14:40 – 14:44	1027R03	130 – 139	1:30,000	0.1 m
07/11/2010	14:52 – 14:56	1027R03	143 – 151	1:30,000	0.1 m
07/11/2010	14:59 – 15:02	1027R03	152 – 159	1:30,000	0.1 m

*Tide levels are given in meters above MLLW and are based on actual observations at the Richmond Locks tide station with corrections applied to various tide zones throughout the project area. The height of MHW in the project area varied between 0.81 – 1.05 meters above MLLW.

Quality Control / Final Review

Quality control (QC) tasks were conducted during all phases of project completion by a senior member of PSI. The final QC review was completed in December 2011. 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 10.0) software. All project data was evaluated for compliance to requirements.

Comparisons of the largest scale NOAA nautical charts with natural color photographs, B&W IR photographs and compiled project data resulted in creation of the Chart Evaluation File (CEF). The following nautical chart was used in the comparison process:

12252, Jordan Point to Richmond, VA, 1:20,000 scale, 25th 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 GC10904 file contents, attached to PCR

Remote Sensing Division Electronic Data Library

- Project database
- GC10904 in shapefile format
- Digital copy of the PCR in Adobe PDF format
- CEF in shapefile format

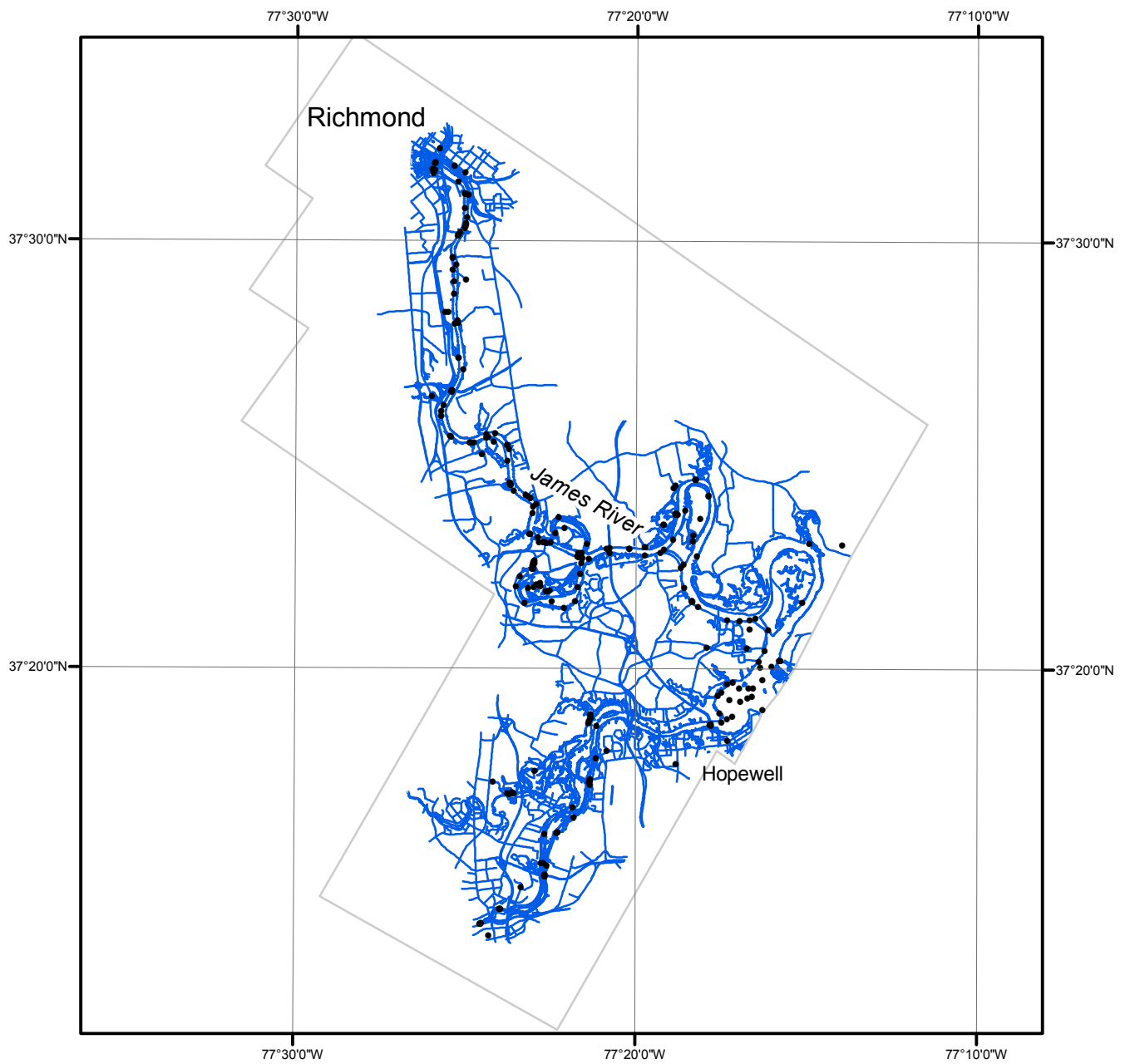
NOAA Shoreline Data Explorer

- GC10904 in shapefile format
- Metadata file for GC10904
- Digital copy of the PCR in Adobe PDF format

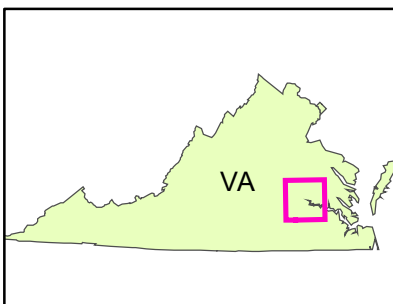
End of Report

JAMES RIVER, HOPEWELL TO RICHMOND

VIRGINIA



Overview



VA0701D

GC10904