

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

## ***PROJECT VA0601A***

### ***South Bank of the Rappahannock River from Meachim Creek to Blandfield Point, Virginia***

#### **Introduction**

NOAA Coastal Mapping Program (CMP) Project VA0601A provides a highly accurate database of new digital shoreline data for a portion of the south bank of the Rappahannock River and surrounding coastal areas from Meachim Creek to Blandfield Point and includes various small bays and tributaries along the river. Project VA0601A is a subproject of a larger project VA0601, which extends further northward to Fredericksburg, Virginia.

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 Requirements Branch (RB) of the 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 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) was contracted by the National Oceanic and Atmospheric Administration (NOAA) to locate a total of fifteen (15) new photo control points for this project. The control points were photo-identifiable features and were taken from well-defined discrete locations. An additional five (5) photo-identifiable points were collected and used as check points for the aerotriangulation process. Based upon the Project Instructions, Section 6.3 and the specifications for Ground Control Points in Chapter O in the Statement of Work version 13B, PSI was not required to perform “Blue Booking” for the ground control points. Please see Sections II and III of the final submitted ground control report for a listing of final coordinates, elevations, and descriptions, as well as a site map of the control and check points.

Richard Crouse & Associates (RC&A) of Frederick, Maryland were subcontracted to capture the aerial photography and airborne GPS data. 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 flight missions collecting the black and white infrared (B&W IR) photographs were tide coordinated and captured within 0.3 ft. for both Mean High Water (MHW) and Mean Lower Low Water (MLLW) tide stages. The color photographs were flown below MHW tide stage. All film was captured at a scale of 1:30,000 with a WILD RC30 camera. The color film was captured on 6/21/2007. The MHW imagery was captured on 8/14/2007, 9/6/2007, and 9/7/2007. The MLLW imagery was captured on 7/3/2008, 10/31/2008, 2/13/2009, 4/27/2009, 5/13/2009 and 5/21/2009.

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. The Final Photo Mission Report and Tabulation of Aerial Photography for VA0601 include complete narratives and descriptions of the methods used and results of the final datasets.

## **GPS Data Reduction**

Richard Crouse & Associates (RC&A) also were subcontracted by PSI to collect and process the airborne GPS datasets. The raw GPS data sets were processed using software that determines the accurate trajectory 24 hours later after the flight. The resulting values are accurate easting, northing and height positions of the survey camera. CORS stations were not used to process the raw data set. Corbin (CORB) CORS was only used to check the trajectory result against the post-processed trajectory. Novatel's Waypoint Software (GrafNAV) was used in the kinematic GPS post processing. The airborne GPS trajectory was processed using TerraPOS. TerraPOS is GPS post processing software that delivers better than 5 cm accuracy of an airborne kinematic trajectory without a base station. The complete report of the data processing can be found in the Airborne Positioning and Orientation Report for VA0601.

## **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 personnel in May 2010 utilizing a Digital Photogrammetric Workstation (DPW), which is a configuration of computer hardware, modular software components and other associated peripheral devices. The softcopy system hardware consisted of a high-end workstation with stereo viewing capability. Intergraph softcopy photogrammetry suite was used for both project setup and aerotriangulation. The ImageStation Automatic Triangulation (ISAT) module was used to measure pass points and tie points. Bingo aerotriangulation software was used to process the block adjustment, and tools within Bingo were used to evaluate the adjustment. Upon successful completion of the aerotriangulation process, the Bingo aerotriangulation 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 0.8 meters based on a 95% confidence level. An Aerotriangulation Report was completed 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 this project was initiated by PSI personnel in December 2010. Digital mapping was performed using a DPW in conjunction with the SOCET SET version 5.4.1 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, US 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 VA0601A were determined according to standard Federal Geographic Data Committee (FGDC) practices. Cartographic features were compiled to meet a horizontal accuracy of 1.6 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 the imagery used to complete this project:

Date	Time (UTC)	Roll Number	Line Number	Photo Numbers	Scale	Tide Level*
6-21-2007	17:44 – 17:55	0727CN01	30-3	0001 – 0025	1:30,000	0.1 – 0.4 m
6-21-2007	18:04 – 18:17	0727CN01	30-4	0034 – 0055	1:30,000	0.2 – 0.1 m
6-21-2007	18:29 – 18:30	0727CN01	30-5	0073 – 0076	1:30,000	0.3 m
6-21-2007	19:42 – 19:43	0727CN01	30-2	0159 – 0162	1:30,000	0.1 – 0.2 m
8-14-2007	14:49 – 14:50	0728R03	30-5	0255 – 0258	1:30,000	0.4 m
8-14-2007	14:59 – 15:01	0728R03	30-4	0266 – 0270	1:30,000	0.5 m
8-14-2007	15:07 – 15:10	0728R03	30-3	0271 – 0277	1:30,000	0.5 – 0.6 m
8-14-2007	16:19 – 16:22	0728R03	30-3	0290 – 0297	1:30,000	0.5 m
8-14-2007	16:29 – 16:34	0728R03	30-4	0298 – 0307	1:30,000	0.6 – 0.5 m
9-7-2007	15:24 – 15:28	0727R08	30-4	0744 – 0750	1:30,000	0.7 m
9-7-2007	15:34 – 15:39	0727R08	30-3	0751 – 0759	1:30,000	0.7 – 0.6 m
9-7-2007	15:48 – 15:50	0727R08	30-2	0764 – 0767	1:30,000	0.7 m
7-3-2008	14:02	0827R08	30-2	0631	1:30,000	0.0 m
7-3-2008	14:33 – 14:34	0827R08	30-3	0633 – 0635	1:30,000	0.0 m
7-3-2008	14:42 – 14:43	0827R08	30-2	0639 – 0641	1:30,000	0.0 m
2-13-2009	15:06 – 15:07	0927R02	30-3	0144 – 0145	1:30,000	0.0 m
2-13-2009	15:17 – 15:22	0927R02	30-4	0154 – 0161	1:30,000	-0.1 m

4-27-2009	13:12 – 13:14	0927R05	30-5	0871 – 0874	1:30,000	-0.1 m
4-27-2009	13:48 – 13:50	0927R06	30-4	0896 – 0900	1:30,000	0.0 m
5-13-2009	14:42 – 14:46	0927R08	30-4	0972 – 0980	1:30,000	0.1 m
5-21-2009	19:49 – 19:53	0927R08	30-3	0981 – 0990	1:30,000	0.0 m
5-21-2009	20:34 – 20:39	0927R08	30-3	0997 – 1006	1:30,000	0.1 – 0.0 m

\* Tide levels are given in meters above MLLW and are based on verified observations at the time of photography recorded by NOS tide gauges at Windmill Point and Wares Wharf, with time offsets and range ratios applied for each tidal zone. The height of the MHW tidal datum in the project area varies between 0.4 – 0.6 m. above MLLW.

## Quality Control / Final Review

Quality Control tasks were conducted during all phases of project completion by a senior member of PSI. The final QC review was completed in March 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 Arc GIS 9.3 software. All project data was evaluated for compliance to CMP requirements.

Comparisons of the largest scale NOAA nautical charts with natural color and 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:

12235, Rappahannock River Entrance, VA, 1:40,000, 34<sup>th</sup> Ed., Feb. 2014  
12237, Rappahannock River to Fredericksburg, VA, 1:40,000, 28<sup>th</sup> Ed., Nov. 2013

## 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 GC10857 file contents, attached to PCR

### Remote Sensing Division Electronic Data Library

- Project database
- GC10857 in shapefile format
- Digital copy of the PCR in Adobe PDF format
- CEF in shapefile format

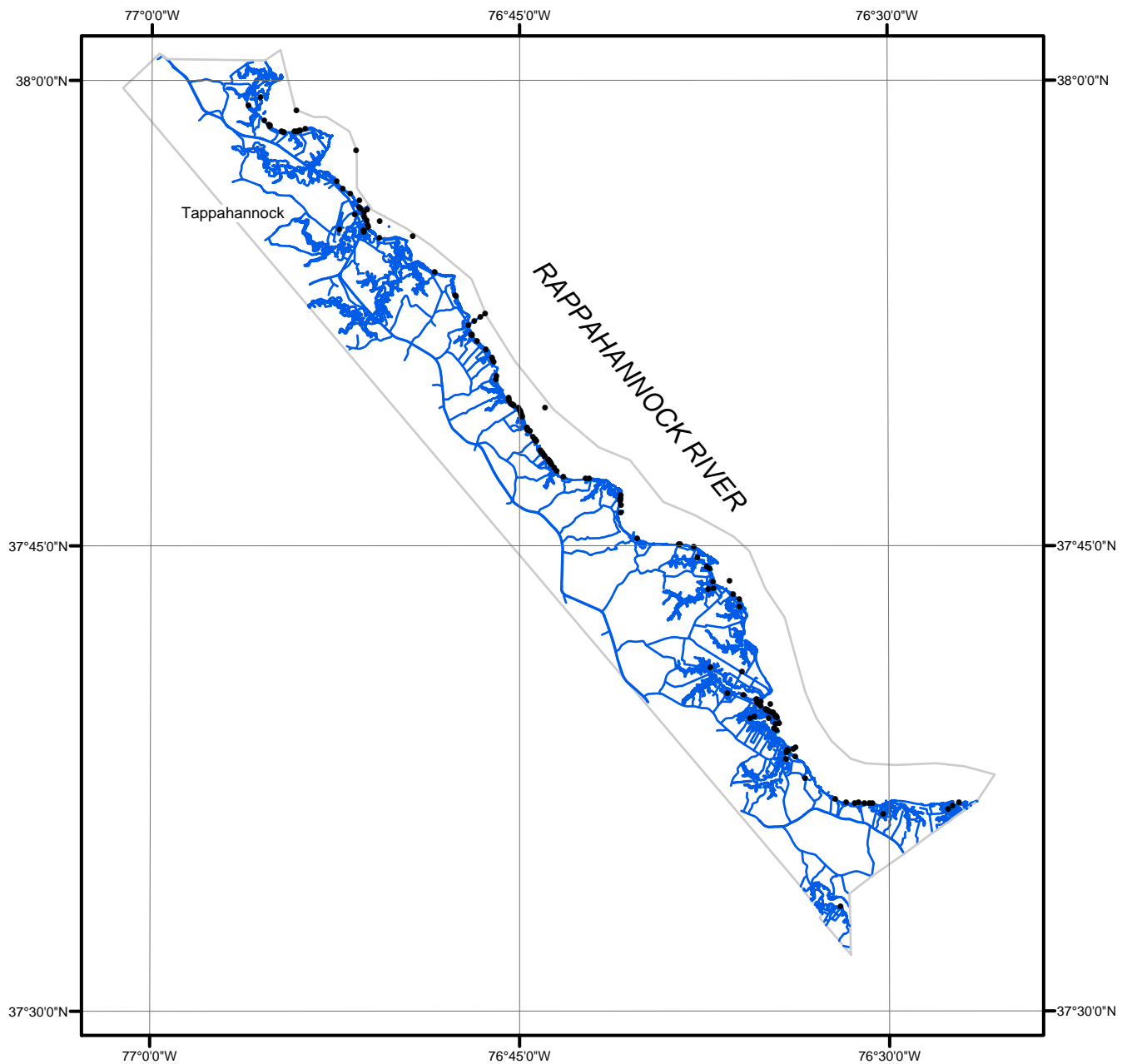
### NOAA Shoreline Data Explorer

- GC10857 in shapefile format
- Metadata file for GC10857
- Digital copy of the PCR in Adobe PDF format

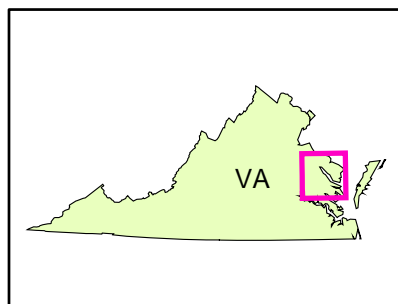
## End of Report

# RAPPAHANNOCK RIVER, MEACHIM CREEK TO BLANDFIELD PT

## VIRGINIA



Overview



VA0601A

GC10857