

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

## ***PROJECT SC0801A***

### ***Coosaw River, St. Helena Sound to Chisholm Islands, South Carolina***

#### **Introduction**

NOAA Coastal Mapping Program (CMP) Project SC0801A provides highly accurate digital shoreline data for the Coosaw River and nearby tributaries near the coast of South Carolina. Project SC0801A is a subproject of the larger project, SC0801 which extends from St. Helena Sound inland to Huspa Creek and south from Port Royal Sound inland to Coosawhatchie River. The Geographic Cell (GC) may be used in support of the NOAA Nautical Charting Program (NCP) as well as geographic information systems (GIS) for a variety of coastal zone management applications.

#### **Project Design**

The Requirements Branch (RB) of the Remote Sensing Division (RSD) formulated photographic mission instructions for this project following standard mission guidelines. The instructions discussed the project's purpose, geographic area of coverage, scope and priority; photographic requirements; flight line priority; Global Positioning System (GPS) data collection procedures and guidelines for both kinematic and static surveys; data recording and handling instructions; and contact and communication information. RB created a Project Layout Diagram, flight maps and input files for the aircraft's flight management system.

#### **Field Operations**

The field operations consisted of the collection of static and kinematic GPS data, Inertial Measurement Unit (IMU) data, and the acquisition of aerial imagery. The photographic mission operations were conducted from October 2009 through February 2013 with the NOAA King Air (N68RF) aircraft and the NOAA Citation II (N52RF) aircraft. Twenty-six flight lines of color and near-infrared (NIR) digital images were acquired concurrently with an Applanix Digital Sensor System (DSS) 439 aerial camera system with one set of color and NIR digital images acquired within tolerance of Mean High Water (MHW) and another set of color and NIR digital images acquired within tolerance of Mean Lower Low Water (MLLW). All imagery was acquired at a nominal altitude of 10,000 feet, resulting in an approximate ground sample distance (GSD) of 0.35 meters.

Quantum Spatial, Inc. (QSI) was contracted by RSD to survey ground control points (GCPs). Two GCPs were established in project SC0801A using static GPS techniques. Survey field work was performed between August 29, 2017 and October 19, 2017. A Ground Photo Control Report was written and is on file with other project data within the RSD Electronic Data Library.

## **GPS Data Processing**

GPS/IMU data were processed by RSD personnel to yield precise camera positions and orientations for direct georeferencing (DG) of the imagery. A local GPS base station was established for use as a reference station for kinematic GPS processing operations. The position of the base station was determined using the NGS Online Processing User Service (OPUS), which computed fixed baseline solutions from nearby CORS stations. The final processing of kinematic GPS data using Applanix POSPAC MMS (ver. 6.1.0) was performed March 2013. For more information refer to the Airborne Positioning and Orientation Reports (APOR) on file in the Remote Sensing Division Electronic Data Library.

## **Aerotriangulation**

Routine softcopy aerotriangulation (AT) methods were applied to establish a 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 performed by QSI personnel in January 2018 utilizing a digital photogrammetric workstation (DPW), which consists of a stereo-enabled PC-based graphics workstation running the Windows 7 operating system and a suite of digital photogrammetric software known as DAT/EM Summit Evolution (ver. 7.5). The DAT/EM software was used to import the photo measurements, while the Match AT automated aerotriangulation system (ver. 5.6) was used to perform automatic point measurements and interactive point measurements of tie points and to perform the block adjustment. The color and NIR images were measured and adjusted as two separate blocks. The final adjustment of the blocks were accomplished by using a rigorous simultaneous least squares bundle adjustment, and analysis tools within Match AT were used to refine the aerotriangulation solution and to evaluate the accuracy of the adjustment. Upon successful completion of this process, Match AT provided the standard deviations for each aerotriangulated ground point, which were used to compute a predicted horizontal circular error of 0.47 meters for the color images and 1.54 meters for the NIR images. Both of these values are 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. Positional data is referenced to the North American Datum of 1983 (NAD83).

## **Compilation**

The data compilation phase of this project was initiated by QSI personnel in February 2018. DAT/EM Summit Evolution Professional photogrammetric software was used to extract feature data from stereo imagery and feature identification, capture, segmentation, and attribution occurred within an ArcGIS (ver. 10.4.1) file geodatabase using DAT/EM's stereo module. Feature identification and the assignment of cartographic codes were based on image analysis of the project digital images 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 SC0801A were determined according to standard Federal Geographic Data Committee (FGDC) practices. Most cartographic features were compiled to meet a horizontal accuracy of 0.9 meters. The MLLW depth contour features were compiled to

meet a horizontal accuracy of 3.1 meters. These predicted accuracies of compiled well-defined points, computed at the 95% confidence level, are derived by doubling the horizontal uncertainties calculated from the AT statistics.

The following table provides information on the imagery used to complete this project:

Date	Time (UTC)	Color Imagery		Infrared Imagery		Tide Level*
		Roll	Strip/Images	Roll	Strip/Images	
11-04-09	15:46 - 15:49	09NC19	50-005 / 5578 - 5593	09NR20	50-005 / 5422 - 5437	1.9 – 2.1 m
11-04-09	15:55 - 15:56	09NC19	50-028 / 5600 - 5607	09NR20	50-028 / 5444 - 5451	2.1 m
11-07-09	15:31 - 15:33	09NC21	50-014 / 5954 - 5966	09NR22	50-014 / 5798 - 5810	2.1 – 2.2 m
11-08-09	17:31 - 17:36	09NC23	50-007 / 6202 - 6242	09NR24	50-007 / 6046 - 6086	2.1 – 2.2 m
11-08-09	17:43 - 17:45	09NC23	50-013 / 6249 - 6267	09NR24	50-013 / 6094 - 6111	2.1 – 2.4 m
11-08-09	17:59 - 18:02	09NC23	50-010 / 6344 - 6367	09NR24	50-010 / 6188 - 6211	2.2 – 2.3 m
11-08-09	18:10 - 18:14	09NC23	50-009 / 6390 - 6418	09NR24	50-009 / 6234 - 6262	2.1 – 2.4 m
11-08-09	18:28 - 18:34	09NC23	50-008 / 6489 - 6526	09NR24	50-008 / 6333 - 6370	2.0 – 2.4 m
11-08-09	18:39 - 18:42	09NC23	50-012 / 6537 - 6555	09NR24	50-012 / 6381 - 6399	1.9 – 2.3 m
11-08-09	18:57 - 19:00	09NC23	50-011 / 6635 - 6657	--	--	1.9 – 2.2 m
3-30-10	20:21 - 20:23	10NC38	50-007 / 16931 - 16949	10NR29	50-007 / 14327 - 14345	(-0.2) – (-0.1)
3-31-10	20:22 - 20:24	10NC39	50-028 / 17102 - 17110	10NR30	50-028 / 14498 - 14506	(-0.2) m
3-31-10	20:49 - 20:54	10NC39	50-008 / 17117 - 17154	10NR30	50-008 / 14513 - 14550	(-0.2) – (-0.1)
3-31-10	21:11 - 21:13	10NC39	50-014 / 17228 - 17240	10NR30	50-014 / 14624 - 14636	(-0.1) – 0.0
04-01-10	14:49 - 14:53	--	--	10NR31	50-011 / 14689 - 14711	2.0 m
04-01-10	20:01 - 20:03	10NC41	50-005 / 17476 - 17491	10NR32	50-005 / 14872 - 14887	(-0.2) m
1-20-12	17:11 - 17:14	12NC03	50-007 / 558 - 579	12NR02	50-007 / 217 - 238	0.0 – 0.2 m
3-06-12	16:37	12NC19	50-013 / 4898 - 4900	12NR10	50-013 / 1937 - 1939	0.2 m
3-06-12	16:42 - 16:43	12NC19	50-011 / 4907 - 4912	12NR10	50-011 / 1946 - 1951	0.3 m
3-06-12	16:48 - 16:49	12NC19	50-012 / 4917 - 4920	12NR10	50-012 / 1956 - 1959	0.2 m
3-06-12	17:13 - 17:14	12NC19	50-010 / 4942 - 4948	12NR10	50-010 / 1981 - 1987	0.2 m
3-06-12	17:22 - 17:23	12NC19	50-009 / 4971 - 4976	12NR10	50-009 / 2010 - 2015	0.2 m
3-06-12	17:51 - 17:53	12NC19	50-012 / 4999 - 5013	12NR10	50-012 / 2038 - 2052	0.2 m
3-06-12	17:58 - 18:00	12NC19	50-013 / 5014 - 5029	12NR10	50-013 / 2053 - 2068	0.2 m
3-06-12	18:07 - 18:09	12NC19	50-011 / 5044 - 5060	12NR10	50-011 / 2083 - 2099	0.2 m
3-06-12	18:15 - 18:17	12NC19	50-010 / 5063 - 5079	12NR10	50-010 / 2102 - 2118	0.2 m
3-06-12	18:23 - 18:25	12NC19	50-009 / 5087 - 5099	12NR10	50-009 / 2126 - 2138	0.2 m
3-10-12	20:34 - 20:35	12NC20	50-009 / 3281 - 3292	12NR11	50-009 / 2277 - 2288	0.2 m

\* Tide levels are given in meters above MLLW and were calculated using the Pydro software tool with a TCARI grid referenced to verified water level observations at NOS gauges throughout the project area. The height of the MHW tidal datum in the project area is approximately 1.77 – 2.37 meters above MLLW.

## **Quality Control / Final Review**

Quality control tasks were conducted during all phases of project completion by a senior member of QSI. The final QC review was completed in May 2018. The review process included analysis of AT 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 ArcGIS software. All project data was evaluated for compliance to CMP requirements.

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

- 11516, Port Royal Sound, 32<sup>nd</sup> Ed., Dec. 2013
- 11517, St Helena Sound, 18<sup>th</sup> Ed., Dec. 2007
- 11519, Coosaw and Broad Rivers, 13<sup>th</sup> Ed., May 2014

## **End Products and Deliverables**

The following specifies the location and identification of end products generated during the completion of this project:

### **Remote Sensing Division Electronic Data Library**

- Project database
- Ground Photo Control Report
- Airborne Positioning and Orientation Report (APOR)
- Aerotriangulation Report
- GC11320 in shapefile format
- Project Completion Report (PCR)
- CEF in shapefile format

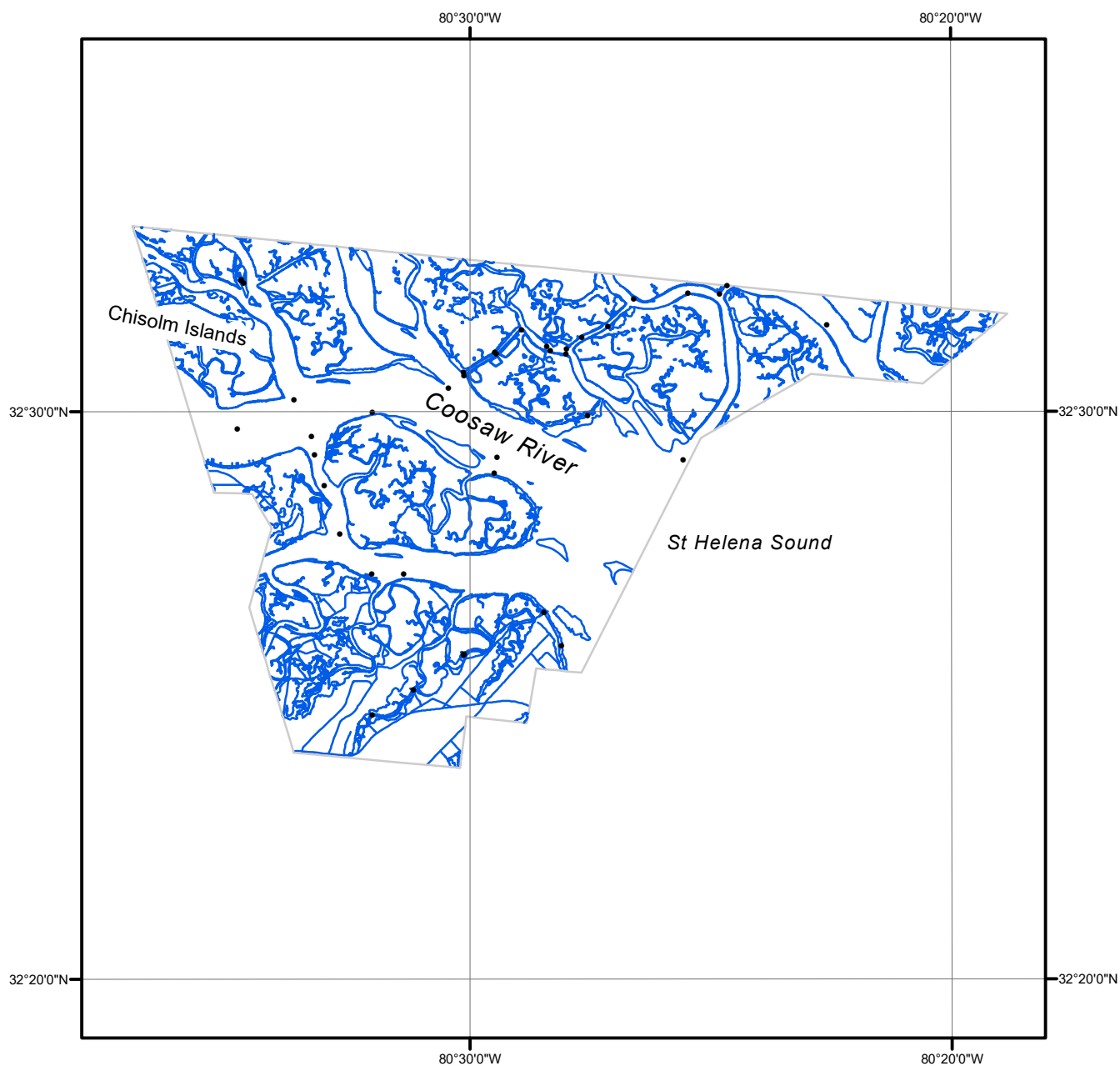
### **NOAA Shoreline Data Explorer**

- GC11320 in shapefile format
- Metadata file for GC11320
- PCR in Adobe PDF format

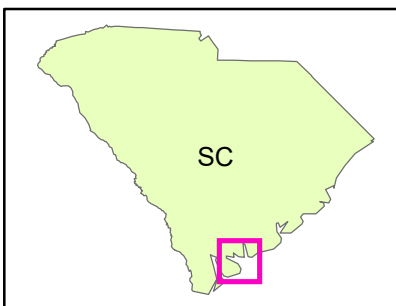
## **End of Report**

# COOSAW RIVER, ST HELENA SOUND TO CHISHOLM ISLANDS

## SOUTH CAROLINA



Overview



SC0801A

GC11320