

NOAA COASTAL MAPPING PROGRAM PROJECT COMPLETION REPORT

PROJECT GA0301B

St. Catherines Island to Jekyll Island, Georgia

Introduction

NOAA Coastal Mapping Program Project GA0301B, which is a subproject of GA0301, required that Western Air Maps, Inc. and its affiliated production team members work together to produce all of the required components needed for constructing an accurate feature database of new digital shoreline data of southeastern Georgia. The project extends from St. Catherine's Island to Jekyll Island, Georgia, as well as major inland waterways along these coastal areas.

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 cartographic feature data of the coastal zone which compliments 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

Project instructions for Project GA0301B were received from NOAA's Remote Sensing Division during September 2003. These instructions outlined the purpose of the project, the geographic area of coverage for the project, the photographic requirements for the project, including the need to acquire tide coordinated photography, GPS data collection procedures and guidelines for ground control surveys, data recording, reporting and handling instructions, and contact and communication information. Western Air Maps, Inc. proceeded to derive a work plan that would comply with all of NOAA's requirements for shoreline mapping projects.

Western Air Maps, Inc. personnel prepared a comprehensive work plan based on the project requirements specified in NOAA's project instructions, NOAA's standard SOW, NOAA provided charts and NOAA instructions for contractor determination of tide windows. Western Air Maps personnel began to generate tide windows immediately and submitted them at the beginning of each month for the duration of the aerial acquisition phase. Tide windows generated using "Tides and Currents" software and NOAA's "TIDE 8" software were submitted to the aerial team members. Western Air Maps, Inc. submitted a work plan and flight maps to NOAA for approval. Western Air Maps, Inc. work plan assigned Tuck Mapping Solutions, Inc. the responsibility for acquiring the aerial photography, Metro Engineering and Surveying Company Inc. the responsibility for conducting the ground control survey. Western Air Maps, Inc. was responsible for softcopy aerotriangulation utilizing ground control and airborne GPS data, as well as for the initial map compilation and attribution of the interim shape files. In

addition, Western Air Maps, Inc. had the responsibility for quality control review and validation of the aerotriangulation results, extraction and attribution of the features into a SOCET SET feature database for NGS review, for applying any NGS specified changes to the mapping and for consolidating the shapefiles and migrating the attribution of the interim feature database to the C-COAST attribution schema and deliver these final files to NGS. Western Air Maps, Inc. would be responsible for preparing the final Project Completion Report. NOAA approved the tentative work plan and the flight maps in the fall of 2003.

Field Operations

Western Air Maps conducted a survey and aerial photography acquisition planning meeting via conference calls between Western Air Maps, Metro Engineering and Surveying Company, and Western Air Maps and Tuck Mapping Solutions, Inc., to plan and develop an initial production schedule and to coordinate surveying and aerial photography activities for the project. Tuck Mapping Solutions, Inc. was tasked with establishing a single ABGPS base station location as well as using CORS stations to QC the ABGPS results and Metro Engineering and Surveying Company was tasked with establishing a network of photo identifiable control points to be used in the aerial triangulation process. (See Airborne Positioning Report.)

Tuck Mapping Solutions, Inc. and Keystone Aerial Surveys, Inc., working under Tuck Mapping Solutions, Inc. supervision set up two ABGPS base stations during the aerial acquisition missions. Both locations were located at Golden Isles Airport, formerly known as Glynco Jetport. The first ABGPS base station location used was FAA BQK GDL A PID -AA2803. This base station location was used at the airport manager's discretion, as the airport is a secure facility and unescorted travel around the facility on weekends is not allowed. As several of the aerial acquisition missions occurred on weekends, an alternative ABGPS non-NGS base station location needed to be established. Tuck Mapping Solution's, Inc. personnel set a 60d nail near the FBO, at the edge of the runway side of the parking ramp. This alternate ABGPS base station location, referred to as "BR1", was used when access to the NGS control point GDL A location was restricted. (See Airborne Positioning Report.)

Metro Engineering & Surveying Co., Inc. used two GPS receivers as base stations and two rovers and ran a 1-hour static survey on the photo control points. Metro Engineering and Surveying Company was responsible for the generation and maintenance while in the field of NGS Station Description/Recovery Form (DR Form), photographs of each photo control point surveyed, NOAA Form 76-53 for each panel, Visibility Obstruction Diagrams, and GPS Observation Logs. (See Ground Survey Report.)

Western Air Maps and its subcontractor, Tuck Mapping Solutions, Inc., flew tide coordinated black and white infrared photography and non-tide coordinated natural color photography to support the coastal mapping program. Aerial photography was acquired using Tuck Mapping Solutions, Inc.'s Wild RC30 cameras and Keystone Aerial Surveys Leica RC30 aerial camera at an altitude of approximately 15,000 feet for a nominal photo scale of 1:30,000. Photographic coverage, resolution, photo overlap, and metric quality were adequate for the performance of the aerial triangulation phase. During the later phases of the project Tuck Mapping Solutions, Inc. hired NOAA certified aerial photography contractor Keystone Aerial Surveys, Inc. to assist in

completing the tide coordinated photography. The color aerial photography was acquired on two dates, 11-25-03 and 12-2-03. The MLLW photography was acquired on 2-18-2004, 5-4-2004, 3-6-2005 and 3-24-2005, and the MHW photography was acquired on 5-5-04, 11-6-2004, 3-2-2005 and 3-13-2005. (See Photo Mission Data Collection Report.)

The maximum range between any exposure flown for this project and a GPS base station during the aerial acquisition was measured on the project map to be less than 50 kilometers. The weather on all days of aerial photography was clear, sunny, with unlimited visibility and very low water turbidity.

All film that was exposed was sent to NOAA's film processing contractor Harry A. Stiller (HAS). The color film upon NOAA's acceptance was scanned at 16 microns and delivered to Western Air Maps via DVD. The BW IR film upon NOAA's acceptance was scanned at 24 microns and delivered to Western Air Maps via DVD. The natural color scans were resampled to 24 micron resolution in order to be ingested with the BW IR scans into the ZI Imaging's AT software package. (See Photo Mission Data Collection Report.)

GPS Data Reduction

Metro Engineering & Surveying used Trimble Geomatics Office, version 1.01, to perform preliminary processing of the collected GPS data. The data imported into Trimble Geomatics Office (ver. 1.01) was reviewed by comparing the antenna heights, antenna types and start and end times to the field GPS. Metro Engineering & Surveying Co., Inc. performed the final data reduction and computation of final coordinates through the NGS online GPS processing tool, OPUS.

- A. Time Period – Field work transpired between March 3, 2004 and March 20, 2004.
- B. Contact: Metro Engineering & Surveying Co., Inc.
186 Selfridge Road
Hampton, GA 30228
Jim Sease or John Salter
(770) 707-0777
- C. Accuracy Standards – The horizontal accuracies of 0.1 meter or better and vertical accuracies of 0.2 meter or better.
- D. Conditions Affecting Progress – There were not any equipment failures during the field survey. The climate was warm to cool and always dry.
- E. Chronology:
 - 1. Reconnaissance of the 25 photo control points and observation was simultaneous.
 - 2. GPS static surveys on the photo control points were made March 3 and March 20, 2004.
 - 3. Processing of GPS data was provided through NGS online positioning user services.

F. Instrumentation – Instruments used during the GPS survey were Trimble 4000 SSE dual frequency receivers.

<u>Type</u>	<u>Serial Number</u>
SSE	3610A14835
SSE	3610A14838
SSE	3616A15486
SSE	3616A15488
SSE	3616A15489

Airborne GPS data was used to determine photo centers for the color, MLLW BW/IR, and MHW BW/IR photo missions. The color photography, BW/IR MHW and BW/IR MLLW triangulation blocks included 22 photo-identifiable ground control points and 9 'check' points. The control was considered to be adequate for the aerial triangulation and map compilation. Please refer to Ground Control Diagram included with the Ground Surveys Report for a visual reference of the density and distribution of the ground control and 'check' points within the project area.

Aerotriangulation

Seven flights of color photography consisting of 189 photos flown 11/25/03 and 12/02/03 were triangulated during the first phase of the project. This photography was non-tide coordinated and covers the entire GA0301 project area. The subject area of ten of seventeen flight lines of BW/IR photography, consisting of 282 photos flown over 2004 and 2005 were triangulated for the MHW mapping. Also, ten of seventeen flight lines of the BW/IR photography, consisting of 281 photos flown over 2004 and 2005 were triangulated for the MLLW mapping.

The aerial triangulation for the color photography (originally scanned at 16 microns), MHW BW/IR and MLLW BW/IR (BW photography scanned at 24 microns) photography was performed using images scanned or re-sampled to 24 microns to establish the network of control required for the mapping phase. The bundle adjustments were performed with Z/I Imaging's ISAT AT software and checked with Inpho's PATB-NT software (version 1.2.164). Z/I Imaging's ISAT AT software (version 04.03.00.08) operating on an SSK Pro workstation was used for the automatic tie point generation and manual measurements of additional tie points and ground control points. The RMS of the standard deviations of the residuals for each aerotriangulated ground point were used to compute a predicted horizontal circular error of 0.23 meters for the color photographs, 0.45 meters for the BWIR mean high water photographs and 0.67 meters for the BWIR mean lower low water 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 a positional listing of all measured points. Positional data is referenced to the North American Datum of 1983 (NAD 83), NGVD 1988, UTM Zone 17. Please refer to the AT Report's Annex 2, Flight Line Diagram for a visual reference of the layout of the flight lines. (See Aerial Triangulation Report.)

Compilation

Although the entire project GA0301 was setup for planning, acquisition and aerotriangulation it was decided that this project should be subdivided into the subprojects GA0301A and GA0301B for the compilation stage. Western Air Maps Inc. began photogrammetric compilation of the subproject GA0301B using SOCET SET Version 5.1 photogrammetric compilation software. Once the feature extraction was completed Western Air Maps, Inc. conducted an extensive QA and QC review using internal resources. The interim GA0301B project Socet Set Feature database was submitted to NOAA for review and was then returned to Western Air Maps for any requisite fixes to topology and/or interpretation or attribution deemed necessary by NOAA cartographers. Once NOAA's areas of concern were addressed the mapping was again diligently reviewed, with the on-line review consisting of reviewing stereo models with a SOCET SET softcopy workstation, reviewing the map features to insure that the proper cartographic feature codes had been used for map feature attribution, and to check and validate the positional accuracies of digital map features prior to release of the SOCET SET feature database for data conversion, data transformation and GIS editing. Cartographic features were compiled to meet a horizontal accuracy of 1.0 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 aerial photographs used in the project completion process for GA0301B:

Date	Time (UTC)	Roll Number	Photo Numbers	Scale (nominal)	Tide Level*
11/25 thru 12/2/2003	1535-1749	0320CN01	001-200	1:30,000	N/A
2/18/2004	1718-1727	0420R02	380-402	1:30,000	-2.2m
2/18/2004	1734-1746	0420R02	403-426	1:30,000	-2.2m
2/18/2004	1800-1809	0420R02	427-450	1:30,000	-2.2m
2/18/2004	1818-1824	0420R02	451-461	1:30,000	-2.2m
2/18/2004	1830-1835	0420R02	462-476	1:30,000	-2.2m
3/7/2004	1639-1641	0519R02	225-231	1:12,000	-2.1m
3/7/2004	1720-1728	0519R02	246-259	1:30,000	-2.1m
5/4/2004	1435-1447	0411R02	188-211	1:30,000	-0.6m
5/4/2004	1449-1459	0411R02	212-234	1:30,000	-0.7m
5/4/2004	1823-1928	0411R01	001-014	1:30,000	-2.2m
5/4/2004	1932-1938	0411R01	015-028	1:30,000	-2.1m
5/4/2004	1943-1948	0411R01	029-041	1:30,000	-2.0m
5/4/2004	1953-1956	0411R01	042-049	1:30,000	-1.9m
5/4/2004	2003-2008	0411R01	050-061	1:30,000	-1.9m
5/4/2004	2014-2022	0411R01	062-081	1:30,000	-1.7m
5/5/2004	1304-1307	0411R01	082-089	1:30,000	0.1m
5/5/2004	1315-1320	0411R01	090-101	1:30,000	0.1m
5/5/2004	1327-1332	0411R01	102-114	1:30,000	0.1m
5/5/2004	1338-1344	0411R01	115-128	1:30,000	0.1m
5/5/2004	1349-1354	0411R01	129-142	1:30,000	-0.0m

11/6/2004	1932-1941	0411R03	277-298	1:30,000	-0.1m
3/2/2005	1659-1708	0519R01	001-020	1:30,000	-0.4m
3/2/2005	1717-1727	0519R01	021-040	1:30,000	-0.4m
3/2/2005	1735-1744	0519R01	041-059	1:30,000	-0.4m
3/2/2005	1904-1905	0519R01	114-119	1:12,000	-0.6m
3/6/2005	1533-1545	0519R02	124-145	1:30,000	-2.2m
3/6/2005	1552-1601	0519R02	146-165	1:30,000	-2.2m
3/6/2005	1616-1626	0519R02	166-185	1:30,000	-1.9m
3/6/2005	1635-1644	0519R02	186-205	1:30,000	-1.9m
3/6/2005	1652-1701	0519R02	206-224	1:30,000	-1.8m
3/13/2005	1504-1508	0511R01	015-025	1:30,000	-0.4m
3/13/2005	1513-1515	0511R01	026-040	1:30,000	-0.4m
3/13/2005	1524-1529	0511R01	041-054	1:30,000	-0.3m
3/24/2005	2008-2013	0511R01	069-082	1:30,000	-1.7m

*NOTE: The "Stage of Tide" is referenced to MHW. The range of tide (MLLW to MHW) is 2.1 meters. The tide range (MLLW-MHW, 1983 to 2001 Epoch) at Fort Pulaski, GA water level station is 2.1 meters and the tide range (MLLW-MHW, 1983 to 2001 Epoch) at Fernandino Beach, FL water level station is 1.8 meters.

Final Review

A senior Western Air Maps Inc. production reviewer familiar with shoreline mapping initiated the final review. The geographic cell was thoroughly reviewed for completeness and accuracy. Data review consisted of an on-line review of the final deliverable shape files for completeness and the associated shapefile database files for completeness of attribution to the C-COAST attribution specification. Since the chart maintenance task was also completed using digital mapping techniques review of the CEF product was conducted visually. The cartographic feature attribution was reviewed by both the Western Air Map's GIS Manager and by Western Air Map's Lead Cartographic Finisher and judged to conform to C-COAST specification.

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

- 11502, Doboy Sound to Fernandina, 1:80,000 scale, 30th edition
- 11506, St Simons Sound, Brunswick Harbor and Turtle River, 1:40,000 scale, 42nd ed.
- 11508, Altamaha Sound, 1:40,000 scale, 21st edition
- 11509, Tybee Island to Doboy Sound, 1:80,000 scale, 29th edition
- 11510, Sapelo and Doboy Sounds, 1:40,000 scale, 19th edition
- 11511, Ossabaw and St Catherines Sounds, 1:40,000 scale, 17th edition

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 GPS Positioning Report
- Hardcopy of the Ground Survey Report
- Hardcopy of the Aerotriangulation Report
- Hardcopy of the Project Completion Report (PCR)

- Page-size graphic plot of GC10577 file contents, attached to PCR

Remote Sensing Division Electronic Data Library

- Project database
- GC10577 in shapefile format
- Digital copy of the PCR in Adobe PDF format
- CEF in shapefile format

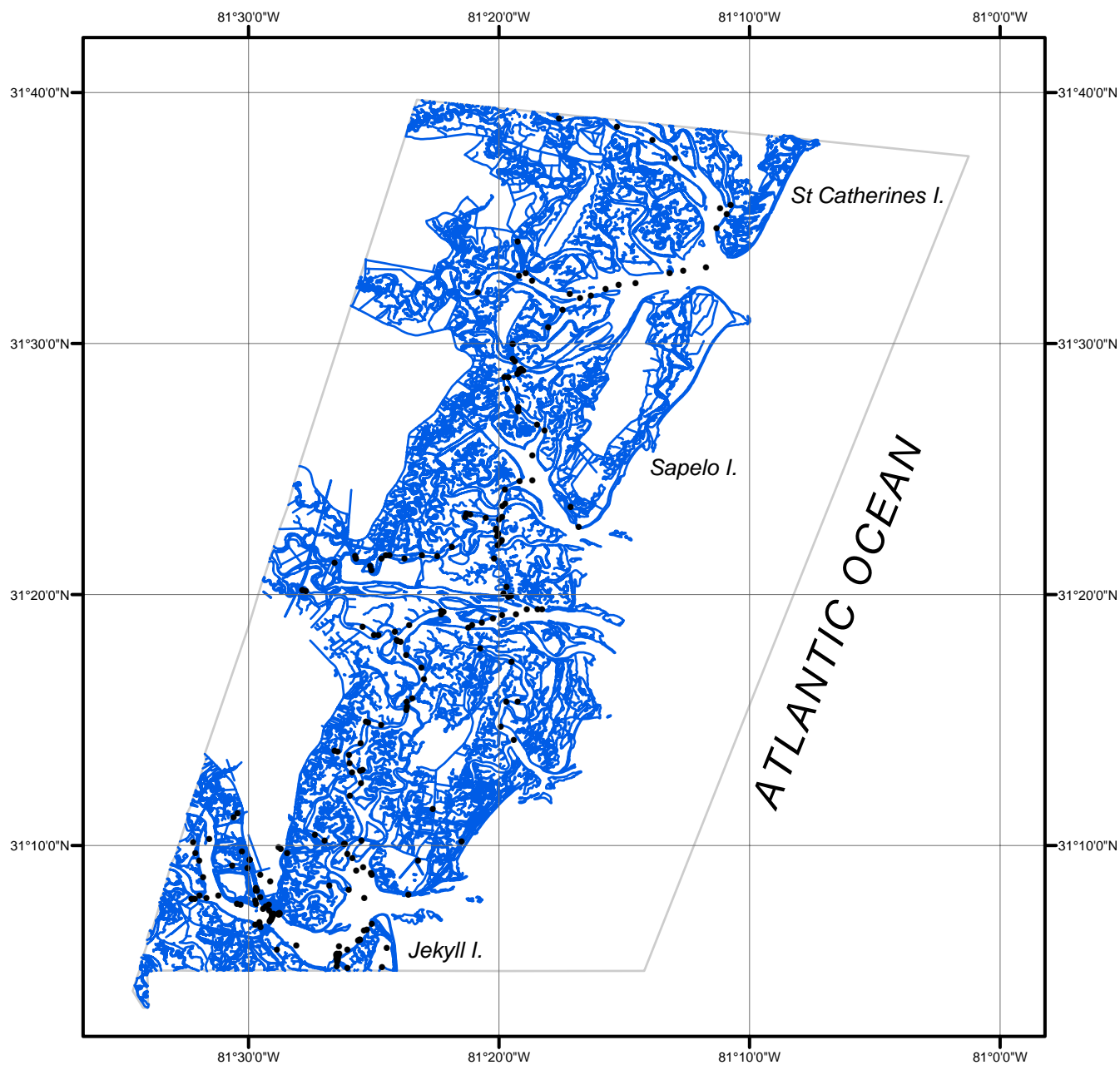
NOAA Shoreline Data Explorer

- GC10577 in shapefile format
- Metadata file for GC10577
- Digital copy of the PCR in Adobe PDF format

End of Report

ST CATHERINES ISLAND TO JEKYLL ISLAND

GEORGIA



Overview



GA0301B

GC10577