

NOAA COASTAL MAPPING PROGRAM PROJECT COMPLETION REPORT

PROJECT MD0702

Port of Baltimore, Maryland

Introduction

Coastal Mapping Program (CMP) Project MD0702 provides highly accurate digital shoreline data for key areas of change in the Port of Baltimore, Maryland, and along the eastern approaches, upon the Patapsco 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 design of Project MD0702 was accomplished by the Requirements Branch (RB) of the Remote Sensing Division (RSD). Project requirements were formulated as a result of analysis conducted within the Coast and Shoreline Change Analysis Program (CSCAP), in which NOAA nautical chart products are compared to contemporary high resolution satellite imagery in order to ascertain the need for more current shoreline data. The results of CSCAP Project MD0407, documented in the RB Memorandum of August 12, 2005, "Change Analysis Report for Baltimore, MD", included a recommendation for full recompilation of the entire shoreline for ENC US5MD11M. A Chart Evaluation File (CEF) was forwarded to the Applications Branch (AB) of RSD once the change analysis was complete. Refer to the RB memo for further details of the chart comparison process.

Field Operations

Field operations consisted of the collection of static and kinematic Global Positioning System (GPS) data and acquisition of digital aerial imagery. The photographic mission operations were conducted on February 9th, 2007, with the NOAA Cessna Citation II aircraft. Four strips of natural color photographs were acquired through use of a Wild RC-30 camera with the NOS "A" lens cone at a nominal scale of 1:30,000.

A base station was established at Salisbury Airfield (KSBY), MD., using static GPS. Airborne kinematic GPS data was collected in conjunction with Inertial Measurement Unit (IMU) data to determine precise camera positions and orientations.

GPS Data Reduction

GPS and IMU data was collected and processed by RSD personnel to provide precise positions of camera centers for application as photogrammetric control in the aerotriangulation phase of project completion. The static GPS base station data was processed in February 2007 using the NGS Online Processing User Service (OPUS) software to compute fixed baseline solutions from three CORS stations. The final NAD83 position reported by OPUS was the average of these three baseline solutions.

The airborne kinematic data was processed using Applanix POSGPS (ver. 4.4) software in June 2007. Refer to the Airborne Positioning and Orientation Report (APOR) for further information on GPS data processing.

Aerotriangulation

Routine softcopy aerotriangulation 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 initiated by RSD personnel in August 2007 utilizing a Digital Photogrammetric Workstation (DPW), which is a configuration of computer hardware, modular software components and other associated peripheral devices. The color photographs were measured and adjusted as a single block using BAE Systems SOCET SET (version 5.3) photogrammetric software in conjunction with the Multi-Sensor Triangulation (MST) module of aerotriangulation software. Upon successful completion of the aerotriangulation process, the MST 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 0.9 meters based on a 95% confidence level. An Aerotriangulation Report was written and is on file with other project data within the RSD 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 RSD personnel in September 2007. 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 the digital 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.

Of particular note, although CSCAP Project MD0407 recommended recompilation of the entire shoreline within the project area, the discovery of ice along the shore in many of the photographs led to the decision to limit compilation to isolated areas of change, particularly to important manmade features. These areas, not affected by the ice, were compiled in order to provide timely updates to the ENC while a much larger project encompassing the same area, already underway, proceeds toward completion.

Spatial data accuracies for Project MD0702 were determined according to standard Federal Geographic Data Committee (FGDC) practices. Cartographic features were compiled to meet a horizontal accuracy of 1.8 meters at the 95% confidence level.

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

Date	Time (UTC)	Roll ID	Photo Numbers	Scale	Tide Level*
02-09-07	1625-1652	07ACN02	403-439	1:30,000	0.1

*Tide levels are given in meters above MLLW and are based on actual observations recorded by the NOS gauge at Baltimore Tide Station (ID: 8574680) at the time of photography. The elevation of the MHW tidal datum at the Baltimore Tide Gauge is equal to 0.4 meters above MLLW.

Quality Control / Final Review

Quality control tasks were conducted during all phases of project completion by a senior member of AB. The final QC review was completed in September 2007. The review process included analysis of the georeferencing 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 9.1. The entire suite of project products was evaluated for compliance to CMP requirements.

Although the original CEF for MD0407 was used during execution of this project to target areas for compilation, additional comparisons were made using the following nautical chart products:

- 12278, Approaches to Baltimore Harbor, 1:40,000, 75th edition
- 12281, Baltimore Harbor, MD, 1:15,000, 51st edition

End Products and Deliverables

The following specifies the location and identification of end 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 GC10676 file contents, attached to PCR
- Hardcopy of the CSCAP evaluation memorandum

Remote Sensing Division Electronic Data Library

- Project database
- GC10676 in shapefile format
- Digital copy of the PCR in Adobe PDF format
- CEF in shapefile format

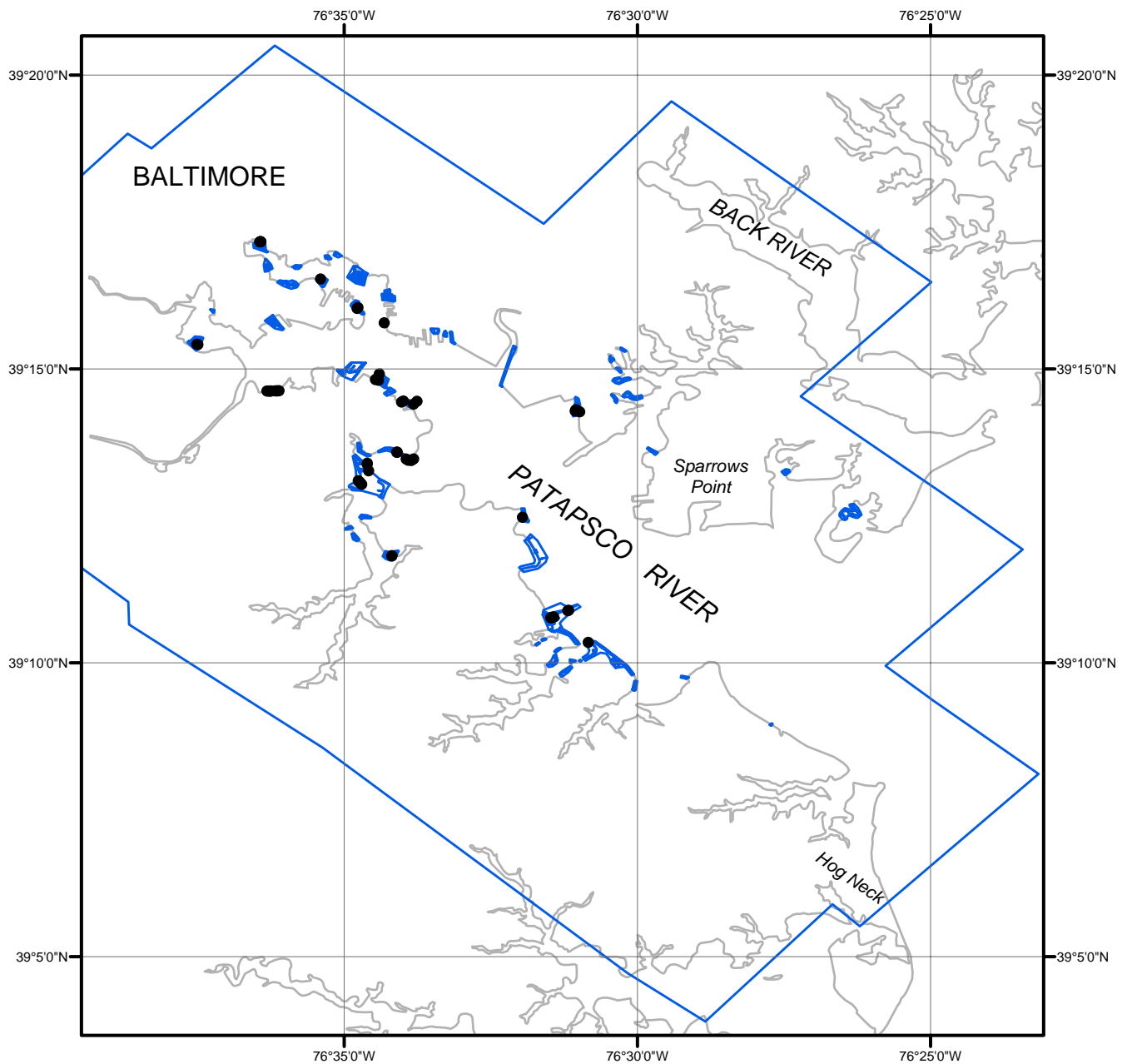
NOAA Shoreline Data Explorer

- GC10676 in shapefile format
- Metadata file for GC10676
- Digital copy of the PCR in Adobe PDF format

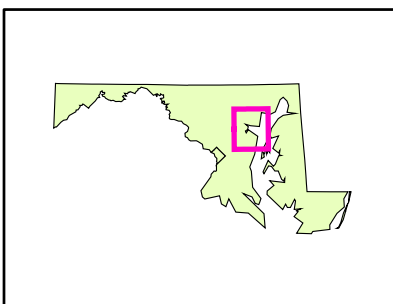
End of Report

PORT OF BALTIMORE

MARYLAND



Overview



MD0702

GC10676