

NOAA COASTAL MAPPING PROGRAM PROJECT COMPLETION REPORT

PROJECT WA0702

Ports of Bremerton and Manchester, Washington

Introduction

NOAA Coastal Mapping Program (CMP) Project WA0702 provides a highly accurate database of new digital shoreline data for key areas of change in the ports of Bremerton, within the Sinclair Inlet, and Manchester, within Puget Sound, in the state of Washington.

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 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

The design of Project WA0702 was accomplished by the Requirements Branch (RB) of the Remote Sensing Division (RSD) in response to the need for timely updates to the NOAA Electronic Navigational Chart (ENC) series. Project requirements were formulated in support of the Coast and Shoreline Change Analysis Program (CSCAP), in which NOAA nautical chart products are compared to georeferenced aerial photograph mosaics in order to ascertain the need for more current shoreline data. Photographic mission instructions were created which 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. Refer to the RB Memorandum of September 10, 2007, "Results of CSCAP Change Analysis for Bremerton and Manchester, Washington (WA0702)," for details of the chart comparison process.

Field Operations

The field operations consisted of the collection of static and kinematic GPS data and the acquisition of aerial photographs. The photographic mission operations were conducted on July 4, 2007, with the NOAA Cessna Citation II (N52RF) aircraft. Three strips of natural color photographs were acquired through use of a Wild RC-30 camera with the

NOS “A” lens cone at the nominal scale of 1:30,000.

A base station was established at Boeing Field International Airport using static GPS. Airborne kinematic GPS data was collected to determine precise camera positions in order to establish a control network necessary for aerotriangulation. GPS data collection operations were conducted in accordance with the GPS Controlled Photogrammetry Field Operations Manual.

GPS Data Reduction

Global Positioning System (GPS) data was collected and processed 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 July 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. 4.2) software in August 2007. An Airborne Positioning and Orientation Report (APOR) was written and is on file with other project data within the RSD Applications Branch (AB) Project Archive.

Aerotriangulation

Three strips of natural color photographs, for a total of 15 images, were bridged using a softcopy stereo photogrammetric system in a Windows XP environment in order to establish the network of control required for the compilation phase. All images were adjusted as a single block. This task was accomplished by RSD Applications Branch (AB) CMP personnel in January 2008. The photographic measurements were made using the Multi-Sensor Triangulation (MST) module within BAE’s SOCET SET version 5.3.0 software. After the final analytical adjustment was performed, the RMS of the standard deviations for all aerotriangulated image points was computed using the MST module. These values were then used to compute a predicted horizontal circular error of 0.9 meters based on a 95% confidence level. Refer to the WA0702 Aerotriangulation Report for additional information.

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 based on the UTM Coordinate System (Zone 10), and referenced to the North American Datum of 1983.

Compilation

The data compilation phase of this project was accomplished by AB CMP personnel in March 2008. 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, 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 cartographic features were further modified with additional descriptive information to refine general classification.

For the project, cartographic features were compiled to meet a horizontal accuracy of 1.8 meters at the 95% confidence level. This predicted accuracy of compiled, well defined points is computed by doubling the circular error derived from aerotriangulation statistics.

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

Date	Time (UTC)	Roll Number	Photo Numbers	Strip	Scale (nominal)	Tide Level*
7-04-07	16:30-16:32	07ACN12	1708-1712	30-002	1:30,000	2.3
7-04-07	16:45-16:47	07ACN12	1718-1723	30-003	1:30,000	2.2
7-04-07	16:52-16:54	07ACN12	1724-1727	30-004	1:30,000	1.9

* Tide levels are given in meters above MLLW and are based on actual observations recorded at the NOS gauge in Seattle, WA, with offsets applied to the Bremerton and Clam Bay substations in the project area. The elevation of the MHW tidal datum in the project area is equal to 3.3 meters above MLLW.

Quality Control / Final Review

Quality control tasks were conducted during all phases of project completion by a senior AB CMP team member. The final QC review was completed in May 2008. The review process included analysis of the aerotriangulation results and assessment of the identification and attribution of cartographic features 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.

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 GC10693 file contents, attached to PCR
- Hardcopy of the CSCAP evaluation memorandum

Remote Sensing Division Electronic Data Library

- GC10693 in shapefile format
- Digital copy of the PCR in Adobe PDF format
- Chart Evaluation File (CEF) in shapefile format

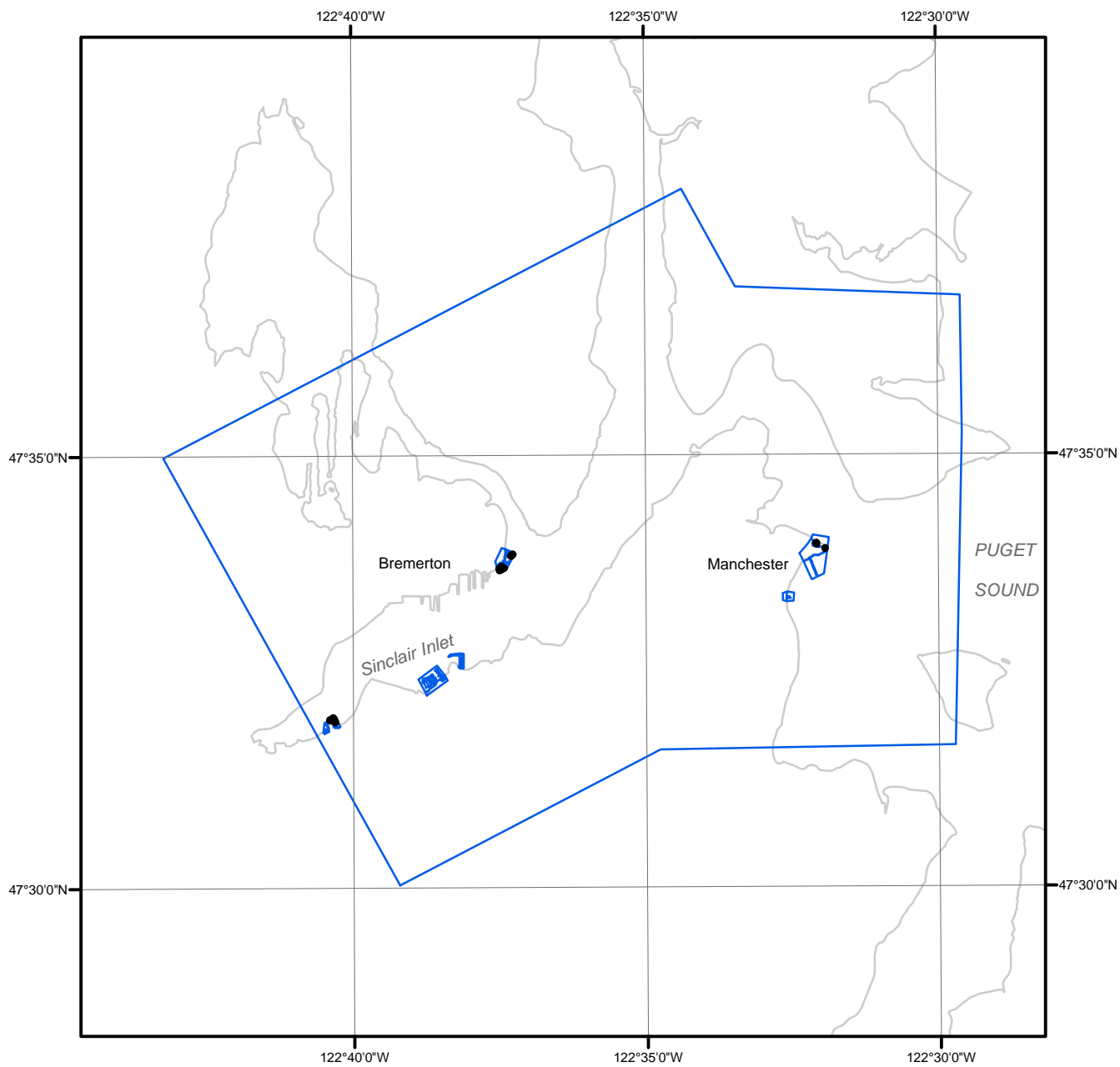
NOAA Shoreline Data Explorer

- GC10693 in shapefile format
- Metadata file for GC10693
- Digital copy of the PCR in Adobe PDF format

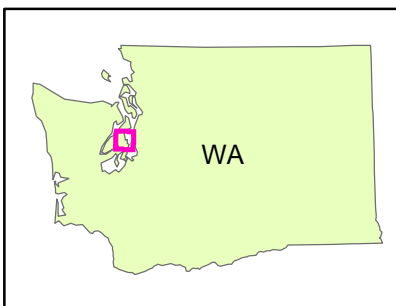
End of Report

PORTS OF BREMERTON AND MANCHESTER

WASHINGTON



Overview



WA0702

GC10693