

NOAA COASTAL MAPPING PROGRAM PROJECT COMPLETION REPORT

PROJECT WA0603

Balch Passage, Washington

Introduction

NOAA Coastal Mapping Program (CMP) Project WA0603 provides a highly accurate database of new digital shoreline data for Balch Passage in Puget Sound, 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 Requirements Branch (RB) of the Remote Sensing Division (RSD) formulated the photographic mission instructions for this project following the guidelines of the Photo Mission Standard Operating Procedure Version II (7/1/93). 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 and the acquisition of aerial photographs. The photographic mission operations were conducted on June 23rd and 24th of 2006, with the NOAA Cessna Citation II (N52RF) aircraft.

Three strips of natural color photographs, three strips of black and white infrared photographs flown at the MHW tide stage and three strips of black and white infrared photographs flown at the MLLW tide stage were acquired through use of a Wild RC-30 camera with the NOS "A" lens cone at the nominal scale of 1:15,000.

A base station was established at the Primary Airport Control (PAC) station at Port Angeles 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 (10/25/99).

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 October 2006 using the NGS Online Processing User Service (OPUS) software to compute a fixed baseline solution from the CORS station. The airborne kinematic data was processed using Applanix POSGPS (ver. 4.2) software in October 2006. A GPS Data Processing Report was written and is on file with the project WA0602- Angeles Point to Sequim Bay within the RSD Applications Branch (AB) Project Archive.

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 RSD personnel in December 2006 utilizing a Digital Photogrammetric Workstation (DPW), which is a configuration of computer hardware, modular software components and other associated peripheral devices. The color photographs and black and white infrared photographs for the Mean High Water were measured and adjusted as one block and the black and white infrared photographs for the Mean Lower Low Water were adjusted as another block using BAE Systems' Multi-Sensor Triangulation (MST) which is an aerotriangulation module within the SOCET SET (version 5.3) photogrammetric software. Upon successful completion of the aerotriangulation process MST provided the RMS of the standard deviations of the residuals for all aerotriangulated ground points which were used to compute a predicted horizontal circular error of 0.5 meters for the color photographs and the black and white infrared photographs for the Mean High Water and 0.6 meters for the black and white infrared photographs for the Mean Lower Low Water 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 in January of 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 1:15,000 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 WA0603 were determined according to standard Federal Geographic Data Committee (FGDC) practices. Most cartographic features were compiled to meet a horizontal accuracy of 1.0 meter at the 95% confidence level. The MLLW line was compiled to meet a horizontal accuracy of 1.2 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:

Date	Time (UTC)	Roll Number	Photo Numbers	Scale (nominal)	Tide Level*
06-23-06	1817-1820	06ACN08	0885-0879	1:15,000	-0.7
06-23-06	1824-1827	06ACN08	0898-0910	1:15,000	-0.7
06-23-06	1832-1835	06ACN08	0911-0923	1:15,000	-0.7
06-23-06	1907-1911	06AR05	0892-0904	1:15,000	-0.3
06-23-06	1916-1918	06AR05	0905-0917	1:15,000	-0.3
06-23-06	1923-1925	06AR05	0918-0930	1:15,000	-0.3
06-23-06	2331-2334	06AR05	0997-1009	1:15,000	2.8
06-23-06	2338-2341	06AR05	1010-1022	1:15,000	2.8
06-24-06	2355-2358	06AR06	1026-1038	1:15,000	2.8

*NOTE: Tide levels are given in meters above MLLW and are based on actual observations at the Seattle station and at the Steilacoom substation within the project area with corrections applied from the Seattle reference station. The mean tide range in the project area was 2.9m.

Quality Control / Final Review

Quality control tasks were conducted during all phases of project completion by a senior member of AB. Final QC review was completed in April of 2007, including 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 ArcGIS 9.2 software. All project data was evaluated for compliance to CMP requirements.

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

18440, Puget Sound, 1:150,000 scale, 28th edition
18445, Puget Sound, 1:80,000 scale, 31st edition
18445, Puget Sound, 1:20,000 scale inset, 31st edition
18448, Puget Sound - Southern Part, 1:80,000 scale, 34th 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 Aerotriangulation Report
- Hardcopy of the Project Completion Report (PCR)
- Page-size graphic plot of GC10668 file contents, attached to PCR

Remote Sensing Division Electronic Data Library

- Project database
- GC10668 in shapefile format
- Digital copy of the PCR in Adobe PDF format
- CEF in shapefile format

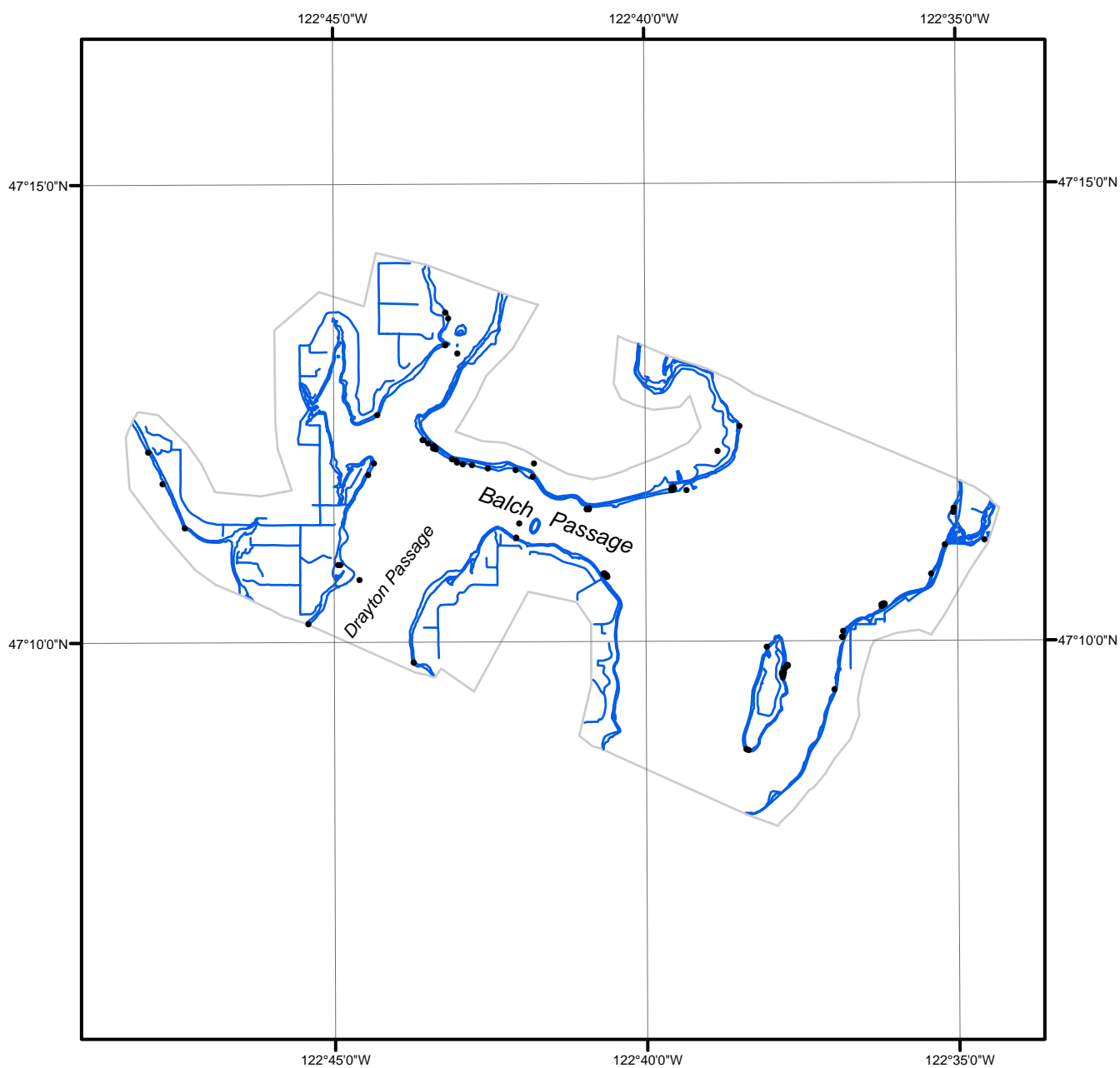
NOAA Shoreline Data Explorer

- GC10668 in shapefile format
- Metadata file for GC10668
- Digital copy of the PCR in Adobe PDF format

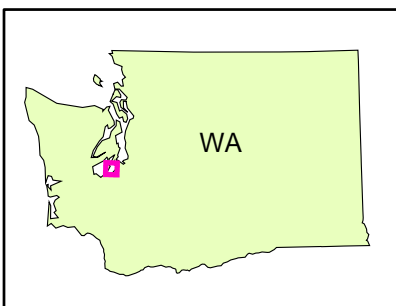
End of Report

BALCH PASSAGE

WASHINGTON



Overview



WA0603

GC10668