NOAA COASTAL MAPPING PROGRAM
PROJECT COMPLETION REPORT

PROJECT WA0602

Strait of Juan de Fuca, Angeles Point to Sequim Bay, Washington

Introduction

NOAA Coastal Mapping Program (CMP) Project WA0602 provides a highly accurate database of new digital shoreline from Freshwater Bay to the west of the city of Port Angeles, eastwards along the Strait of Juan de Fuca, and including the townships of Dungeness, Port Williams, and Washington Harbor, Washington. The project concludes on its eastern end, over the western half of Sequim Bay.

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

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 in June of 2006 with the NOAA Cessna Citation II (N52RF) aircraft. Four strips each of natural color, MLLW infrared (IR), and MHW IR imagery were collected over the project area, however one strip of MHW IR imagery was overexposed and therefore not used in project completion. For the small area subsequently not covered by MHW IR photos, the MHW line was determined using the color imagery. All photography was acquired through use of a Wild RC-30 camera with the NOS "A" lens cone at the nominal scale of 1:30,000.

Two base stations were established, one at Fairchild International Airport, which was utilized during a first phase of the project, and another base station at Takoma Airport, which was utilized during a second phase of the project. Both stations utilized static GPS. Airborne kinematic GPS data was also 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).

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 were measured and adjusted as a single block using BAE Systems' SOCET SET (version 5.2) photogrammetric software in conjunction with the Multi-Sensor Triangulation (MST) module of SOCET SET. 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 0.7 meters at the 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 UTM zone 10 of the North American Datum of 1983 (NAD 83).

Compilation

The data compilation phase of this project was initiated by RSD in December, 2006. The 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. Cartographic features were compiled to meet a horizontal accuracy of 1.5 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*
06-19-06	1647-1709	06ACN08	0830-0857	1:30,000	1.3
06-23-06	1754-1801	06ACN08	0867-0884	1:30,000	-0.4
06-23-06	2207-2228	06AR05	0956-0996	1:30,000	1.7 – 1.9
06-29-06	1719-1721	06AR06	1042-1059	1:30,000	0.2
06-29-06	1731-1754	06AR06	1062-1089	1:30,000	-0.2 – 0.0

* Tide levels are given in meters above MLLW and are based on actual observations recorded by the NOS gauge at Port Townsend at the time of photography, with offsets applied to the Dungeness, Ediz Hook, and Sequim Bay substations in the project area. The elevation of the MHW in the project area varies between 1.9-2.2 meters above MLLW.

Quality Control / Final Review

Quality control tasks were conducted during all phases of project completion by a senior member of the Applications Branch of RSD. The final QC review was completed in January 2007, including analysis of aerotriangulation results and assessment of the identification and attribution of cartographic features within the DCFF according to image analysis and criteria defined in the C-COAST schema. The quality control process concluded with an inspection of topological connectivity within the DCFF using ArcGIS 9.1 software. All project data was evaluated for compliance to CMP requirements.

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

18465, Strait of Juan De Fuca, Eastern Part, 1:80,000 scale, 37th Ed.
18468, Port Angeles, 1:10,000 scale, 18th Ed.
18471, Approaches to Admiralty Inlet, 1:40,000 scale, 10th Ed.

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 Aerotriangulation Report
- Hardcopy of the Project Completion Report (PCR)
- Page size graphic plot of GC10642 file contents, attached to PCR

Remote Sensing Division Electronic Data Library

- Project Database
- Digital copy of GC10642 in shapefile format
- Digital copy of the PCR in Adobe PDF format
- CEF in shapefile format

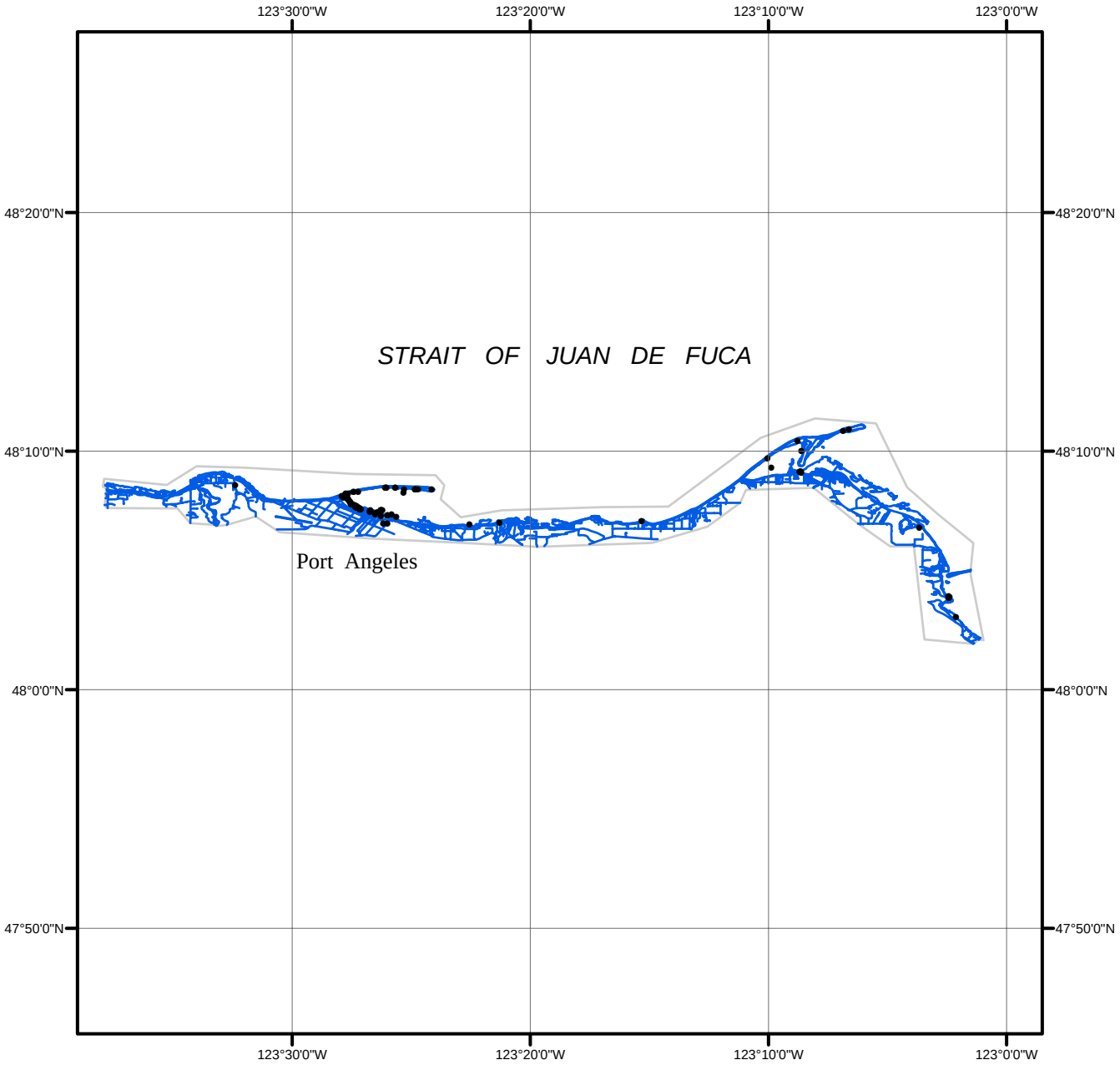
NOAA Shoreline Data Explorer

- Data for GC10642
- Metadata file for GC10642
- Digital copy of the PCR in Adobe PDF format

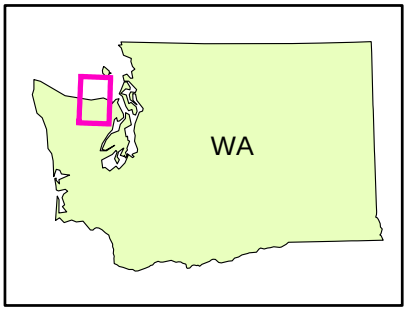
End of Report

STRAIT OF JUAN DE FUCA, ANGELES PT TO SEQUIM BAY

WASHINGTON



Overview



WA0602

GC10642