

# **NOAA COASTAL MAPPING PROGRAM PROJECT COMPLETION REPORT**

## ***PROJECT WA1202***

### ***Port of Bangor, Washington***

#### **Introduction**

Coastal Mapping Program (CMP) Project WA1202 provides highly accurate digital shoreline data for key areas of change in the port of Bangor and vicinity, Washington. 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 WA1202 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 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 digital imagery in order to ascertain the need for more current shoreline data. A Chart Evaluation File (CEF) was forwarded to the Applications Branch (AB) of RSD once the change analysis was complete. Refer to the RB CSCAP Memorandum of August 14, 2012 for details of the chart comparison process.

#### **Field Operations**

The field operations consisted of the collection of static and kinematic Global Positioning System (GPS) data and Inertial Measurement Unit (IMU) data, and the acquisition of digital aerial imagery. Aerial survey operations were conducted on April 21, 2012 with the NOAA King Air aircraft (N68RF). Two strips (50-001 through 50-002) of natural color photographs were acquired between 17:30 and 17:38 (UTC) with an Applanix DSS439 medium format digital camera with a ground sample distance (GSD) of 0.35 m. The collection of these photographs was not tide coordinated.

#### **GPS Data Reduction**

GPS and IMU data was collected and processed to yield precise positions and orientations of camera centers as a means of rendering accurately georeferenced digital images. A local GPS base station was established for use as a reference station for kinematic GPS processing operations. The position of the base station was determined using the NGS Online Processing User Service (OPUS), which computed fixed baseline solutions from nearby CORS stations. The airborne kinematic data was initially processed in April 2012 using Applanix POSPac (ver. 5.3) software, and then was reprocessed in May 2012 to achieve a tightly coupled solution. For further information refer to the Airborne Positioning and Orientation Report (APOR) on file with other project data within the RSD AB Project Archive.

## Aerotriangulation

The aerotriangulation (AT) phase of project completion was performed in January 2013. Routine softcopy AT 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 accomplished by a member of AB utilizing a Digital Photogrammetric Workstation (DPW), which is a configuration of computer hardware, modular software components, and other associated peripheral devices. The digital images were measured and adjusted as a single block using BAE Systems SOCET GXP (ver. 4.0) photogrammetric suite in conjunction with the Triangulation module. Upon completion of the AT process, the simultaneous solve tool within the Triangulation module provided the standard deviations for each aerotriangulated ground point, which were used to compute a predicted horizontal circular error of 0.3 meters based on a 95% confidence level. An AT Report was written and is on file with other project data within the RSD project archive. Positional data is referenced to the North American Datum of 1983 (NAD 83).

## Compilation

The data compilation phase of this project was accomplished by RSD in February 2013. Digital mapping was performed using a DPW in conjunction with a SOCET GXP (ver. 4.0) Feature Database. 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, U.S. 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 WA1202 were determined according to standard Federal Geographic Data Committee (FGDC) practices. Cartographic features were compiled to meet a horizontal accuracy of 0.7 meters at the 95% confidence level. This value was derived by doubling the circular error computed from the AT statistics in order to conservatively predict the accuracy of compiled well defined points.

The following table provides information on the imagery used to complete this project:

Date	Time (UTC)	Roll Number	Photo Numbers	GSD (nominal)	Tide Level*
4-21-2012	17:30 – 17:32	12NC26	7332 - 7341	0.35 m	0.3 m
4-21-2012	17:36 – 17:38	12NC26	7342 - 7351	0.35 m	0.2 m

\* Tide levels are given in meters above MLLW and were calculated using the Pydro software tool with a TCARI grid based on verified water level observations at various tidal reference stations in Puget Sound. The height of the MHW tidal datum in the project area is approximately 3.1 meters above MLLW.

## Quality Control / Final Review

Quality control tasks were conducted during all phases of project completion by a member of AB. The final QC review was completed in March 2013. The review process included analysis of the AT 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 9.3.1. The entire suite of project products was evaluated for compliance to CMP requirements.

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

18458, Hood Canal, 1:25,000 scale, 17<sup>th</sup> edition

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 GC10952 file contents, attached to PCR
- Hardcopy of the CSCAP evaluation memorandum

**Remote Sensing Division Electronic Data Library**

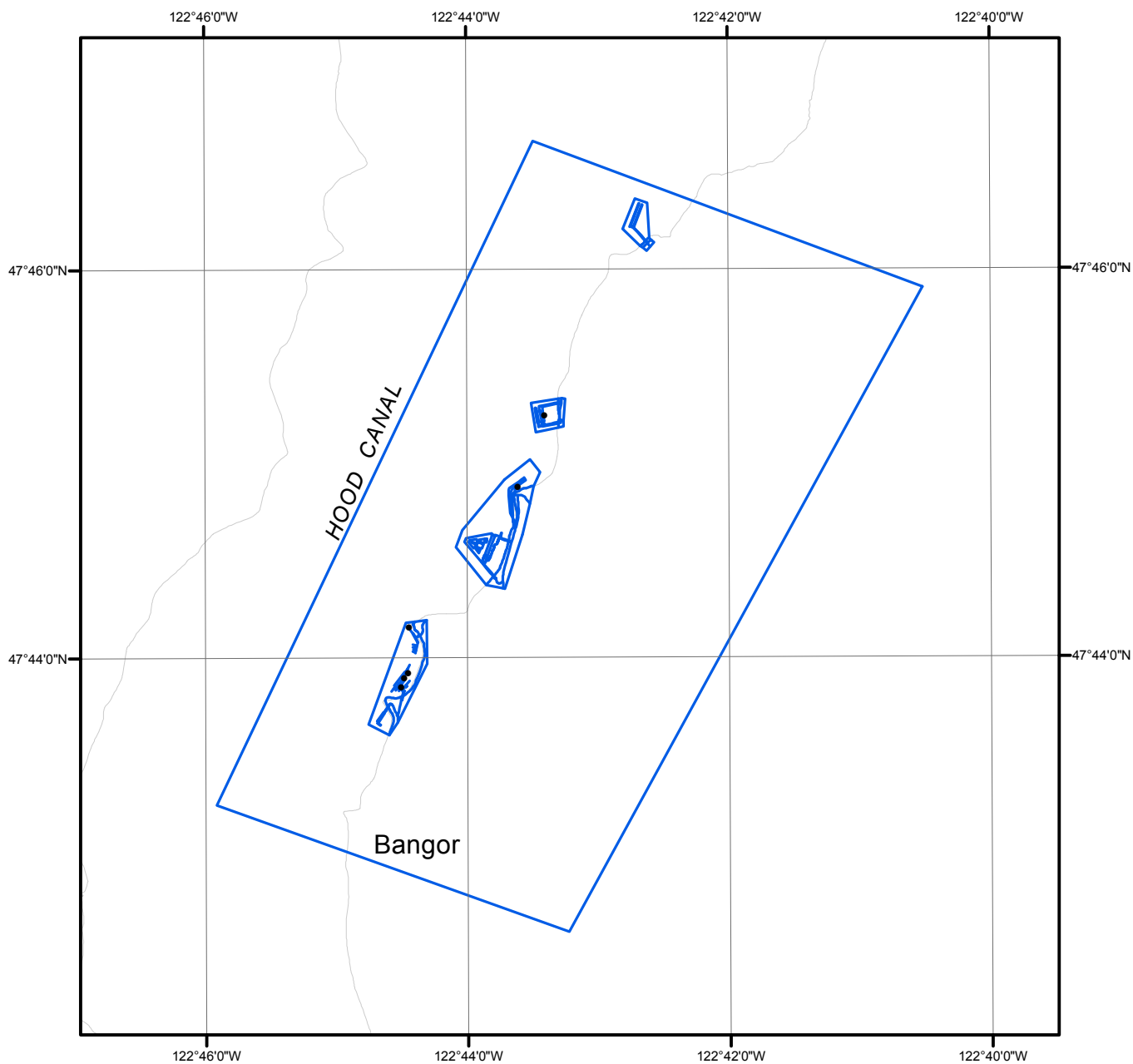
- GC10952 in shapefile format
- Digital copy of the PCR in Adobe PDF format
- CEF in shapefile format

**NOAA Shoreline Data Explorer**

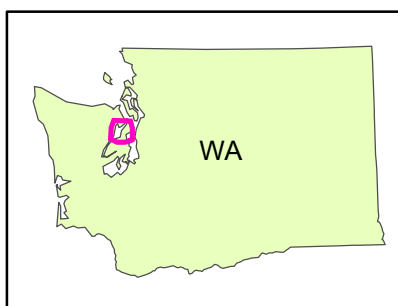
- GC10952 in shapefile format
- Metadata file for GC10952
- Digital copy of the PCR in Adobe PDF format

**End of Report**

# PORT OF BANGOR WASHINGTON



Overview



WA1202

GC10952