

**NOAA COASTAL MAPPING PROGRAM
PROJECT COMPLETION REPORT**

PROJECT OR0202

PORTLAND, OREGON

Introduction

Coastal Mapping Program (CMP) Project OR0202 provides highly accurate digital shoreline data of Portland, Oregon. Project OR0202 is one of three concurrent CMP projects covering port areas along the Columbia River between Oregon and Washington.

Successful completion of this project resulted in a set of controlled metric quality aerial photographs, companion high resolution digital scans, and digital cartographic feature files of the coastal zone to complement the Nautical Charting Program (NCP), NOAA Electronic Navigational Chart (ENC) suite and other geographic information systems.

The project database consists of information measured and extracted from the digital scans of the aerial photographs and metadata related to photogrammetric compilation. Base mapping was conducted in a fully digital environment using Socet Set softcopy stereo workstations. Positional data is referenced horizontally to the North American Datum 1983 (NAD83) and vertically to NAVD88/GEOID99.

Project Design

Project OR0202 covered the Columbia River shoreline within the following project area boundaries:

GEOGRAPHIC

122:32:24 W	45:40:37.56 N
122:32:27.6 W	45:31:27.48 N
122:48:32.4 W	45:31:27.48 N
122:48:32.4 W	45:40:34.68 N

UTM

535825.48	5058274.99
535844.77	5041298.62
514915.8	5041213.91
514875.58	5058100.96

Flight line planning was performed based on the area of coverage. Photo coverage overlap was planned at 60% and sidelap at 50%. The sun angle requirement of no less than 30 degrees was met with approximate sun angle being between 55 and 60 degrees. Weather and visibility was clear with no haze. There was no tidal coordination required for this project.

Field Operations

Field operations consisted of the collection of fast-static and kinematic GPS data and the acquisition of aerial photographs.

Fast-static GPS data was collected following completion of the photo missions to establish seven photo control stations and four verification stations. Kinematic GPS data was collected during the photographic missions, rendering precise camera positions as a means of controlling the photographs. Survey related operations were conducted between June and August of 2003.

Aerial photographic acquisition was conducted on June 25, 2003 using a C-210 aircraft. Photographic requirements consisted of 1:20,000 scale photography, utilizing natural color film. There was no tide coordinated, black and white infrared photography required for this project. All photographs were taken using a Zeiss RMK Top-15 camera.

Please refer to the separately submitted "OR0202 Ground Control Report.wpd."

GPS Data Reduction (Airborne)

GPS data was processed to provide precise and accurate positions of camera centers for application as photogrammetric control in the aerotriangulation phase of the project. The data was collected utilizing a combination of Trimble geodetic receivers. All data was planned to be collected at a 2Hz rate with a 10° horizon mask. The ground monitoring stations were situated so that each photo center would be within 50km of two stations. Existing control stations found in the NSRS were utilized for this purpose. Station KLS is currently occupied by a CORS not affiliated with the NGS program. Data was collected only during times with a minimum satellite count of 5 and a maximum PDOP of 5.0. Session initialization required 6 satellites for a minimum of 10 minutes prior to photo collection. The kinematic data was processed utilizing a precise ephemeris in Trimble Geomatics Office version 1.61. The resulting iono free solutions had a maximum RMS of 0.050m with a median of 0.010m.

During the processing phase it was noticed that the receiver monitoring at AST A had been inadvertently switched to a 15 second collection rate. For this reason it was not used in the final adjustment of the photo centers. Given the planned redundancy in ground monitoring stations, project requirements were still met. In addition to this problem, the receiver monitoring software used onboard the photo aircraft had a bug which caused the events to be recorded 0.09717 seconds before the actual event. For this reason the data was processed twice, once as is and once with a time shift applied. The results for both were supplied. As a final step, the resulting photo center coordinates from each ground monitoring station were compared. The maximum residual from the mean was 0.050m with a median of 0.010m.

Please refer to the separately submitted Airborne Positioning and Orientation report "AGPS Report.wpd."

Aerotriangulation

Softcopy aerotriangulation methods were applied to establish the network of horizontal and vertical control for mapping and to provide model parameter and orientation elements required for digital compilation. The aerotriangulation phase of the project was accomplished using aerial photographs from seven strips that were scanned at 20 micron resolution in VITec format and then converted to TIF format in conjunction with ZI Imaging software in a Windows 2000 environment. The following ZI ImageStation software was used: ISPM (ImageStation Photogrammetric Manager) and ISDM (ImageStation Digital Mensuration) including the Photo-T bundle adjustment module. Softcopy measurements are then exported to the aerotriangulation subcontractor's own aerial triangulation software package (PC-RABATS/BRATS) for troubleshooting, diagnostic work, data editing, and QA. The 95% confidence horizontal circular error (CE) was calculated to be 0.3 meters. The aerotriangulation task and report was completed by [j][f][k] in November 2003. See the separately submitted Aerotriangulation report "PORTLAND.wpd" for further details.

For ease of use by NOAA, the project database that was provided included both the aerotriangulation files generated by [j][f][k] and Socet Set data directory files. The Socet Set project database files consist of the Socet Set project file (.prj), support files (.sup), image point files (.iop), and the ground point file (.gpf).

Compilation

The compilation phase of the project was carried out using the Feature Extraction software module within SOCET SET (version 4.4.2) on a DPW. Feature identification and the assignment of cartographic codes were based on image analysis of the 1:20,000 scale natural color photograph scans and information extracted from corresponding NOAA Nautical Charts, the online version of the US Coast Guard Light List Publication, 2003 (Vol. VI), and the US Coast Pilot Publication 7, 34th ed., August 2002.

The following is a description of the source photographs used to compile cartographic features:

DATE	TIME	ROLL	FLT LINE	PHOTOS	FILM TYPE	SCALE	TIDE STAGE
25-Jun-03	1815 - 1816	0305CN01	12001	0001 - 0005	Color Neg	1:12,000	NA
25-Jun-03	1821 - 1822	0305CN01	12002	0006 - 0010	Color Neg	1:12,000	NA
25-Jun-03	1834 - 1838	0305CN01	20001	0011 - 0020	Color Neg	1:20,000	NA
25-Jun-03	1843 - 1847	0305CN01	20002	0021 - 0032	Color Neg	1:20,000	NA
25-Jun-03	1855 - 1857	0305CN01	20003	0033 - 0039	Color Neg	1:20,000	NA
25-Jun-03	1903 - 1909	0305CN01	20004	0040 - 0054	Color Neg	1:20,000	NA
25-Jun-03	1913 - 1919	0305CN01	20005	0055 - 0069	Color Neg	1:20,000	NA

Digital compilation was completed by SAIC in September 2004. Features were compiled to meet 1 meter horizontal accuracy at a 95% confidence level. This predicted accuracy of compiled well-defined points is a deductive estimate based on aerotriangulation statistics.

Cartographic feature attribution was employed in compliance with the Coastal Cartographic Object Attribute Source Table (C-COAST). Nomenclature was assigned to selected cartographic features to refine general classification.

Final Review

As a means of assuring the quality of compiled digital data, the cartographic feature file was evaluated for completeness and adherence to requirements and accuracy standards both by contractor personnel and by a NOAA Coastal Mapping Program team member. The digital data was reviewed on a model by model basis, utilizing SOCET SET on a DPW, insuring that all significant coastal features captured in the photography are accurately represented in the digital compilation. A hardcopy nautical chart was available for reference. Additionally, a digital version of the applicable nautical chart was loaded as imagery in another view and compared to the stereo models and compiled features. Any significant features seen on the digital nautical chart that had changed in any way were digitally annotated within the feature database. These annotation features were then separately printed out and labeled over the digital nautical chart in accordance with the requirements for production of Chart Maintenance Prints.

The following charts were used in the comparison process:

Hardcopy Nautical Charts

18525, Columbia R., Saint Helens to Vancouver, 1:40,000 scale, 33rd ed. Jun 30/01
18526, Port of Portland, 1:20,000 scale, 55th ed. May 26/01
18527, Swan Island Basin, Willamette River, 1:5,000 scale, 21st ed. Mar. 28/98
18531, Columbia R., Vancouver to Bonneville, 1:40,000 scale, 20th ed. Nov. 10/01

Digital Nautical Charts

18525, Columbia R., Saint Helens to Vancouver, 1:40,000 scale, 33rd ed. Jun 30/01
18526, Port of Portland, 1:20,000 scale, 55th ed. May 26/01
18527, Swan Island Basin, Willamette River, 1:5,000 scale, 21st ed. Mar. 28/98
18531, Columbia R., Vancouver to Bonneville, 1:40,000 scale, 20th ed. Nov. 10/01

Project Final Data and Products

The following specifies the location and identification of the products generated during the completion of this project:

RSD Applications Branch Project Archive

- Hard copy of GPS Processing Report
- Hard copy of Aerotriangulation Report
- Page size graphic plot of DCFF contents
- Hard copy of the Project Completion Report

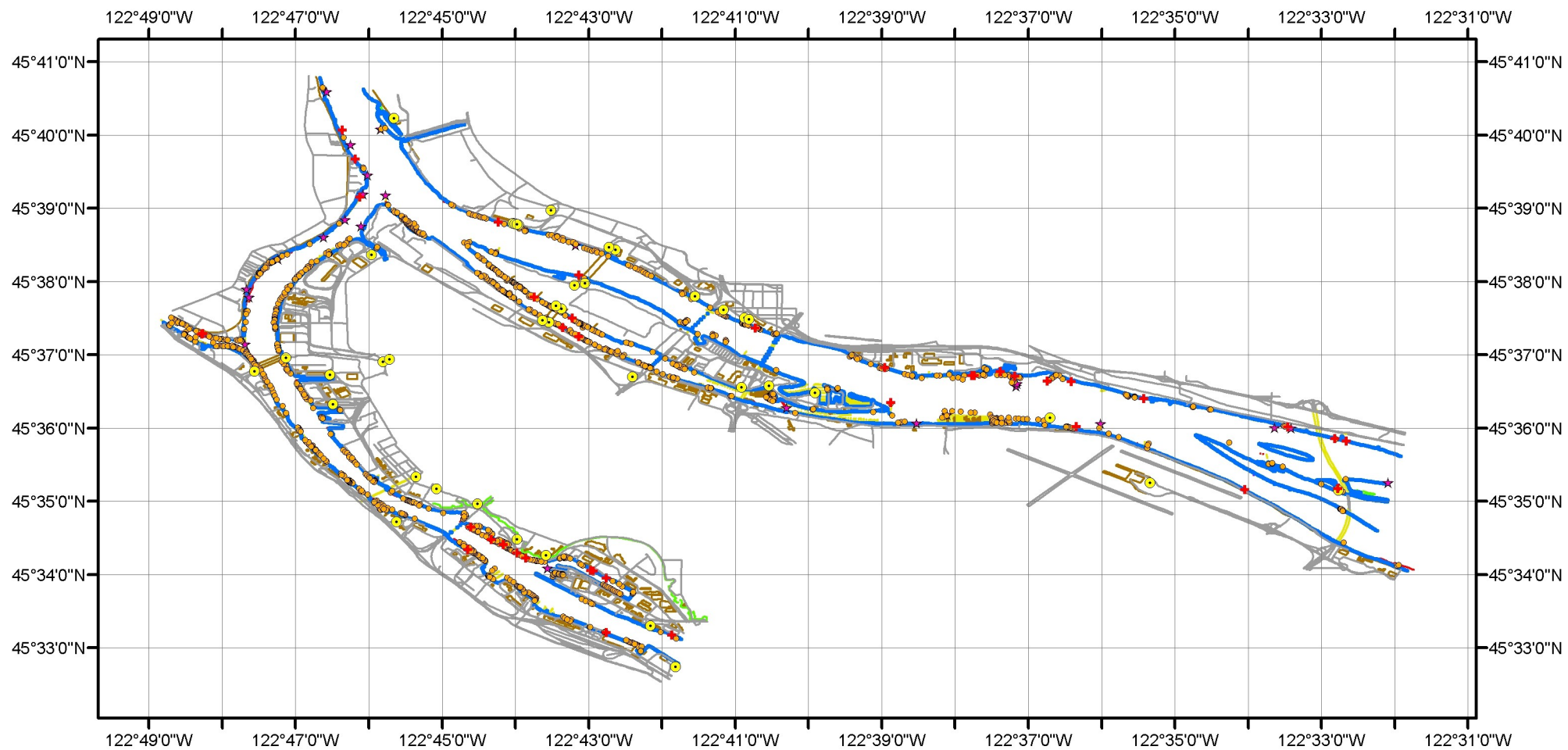
RSD Electronic Data Library:

- Project Database
- Digital Cartographic Feature File: GC-10544
- Digital copy of DCFF in Shapefile format
- Digital Copy of Project Completion Report

NOAA Shoreline Data Explorer

- Digital Cartographic Feature File for GC-10544
- Metadata file for GC-10544
- Digital Copy of the Project Completion Report

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Overview Map



OR0202

GC10544