

NOAA COASTAL MAPPING PROGRAM PROJECT COMPLETION REPORT

PROJECT CA0610

Port of Redwood City, California

Introduction

NOAA Coastal Mapping Program (CMP) Project CA0610 provides a highly accurate database of new digital shoreline data for a portion of the San Francisco Bay extending from Steinberger Slough in the northwest to the Dumbarton Bridge in the east and includes the port of Redwood City. 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 CA0610 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), and documented in the RB Memorandum of January 19, 2007, "Results of CSCAP Change Analysis for Redwood City, CA (CA0610)". However, recommendations in the memo were subsequently superseded and it was decided that the extent of change in the project area warranted full compilation.

Field Operations

Field operations consisted of the collection of static and kinematic Global Positioning System (GPS) data and acquisition of aerial imagery. The photographic mission operations were conducted on November 6, 2006, with the NOAA Cessna Citation II aircraft. Two strips of natural color photographs were acquired, with a nominal scale of 1:30,000, through use of an RC-30 Aerial mapping Camera.

A base station was established at Oakland Airport (KOAK), CA, using static GPS. Airborne kinematic GPS data was collected in conjunction with Inertial Measurement Unit (IMU) data to determine precise camera positions and orientations.

GPS Data Reduction

GPS/IMU data was processed by RSD personnel to provide precise positions of camera centers for application as photogrammetric control in the aerotriangulation phase. The static GPS base station data were processed via the National Geodetic Surveys (NGS) Online Positioning User Service (OPUS) software to compute a NAD83 position for the base station. The airborne kinematic data was processed using Applanix POSpac (ver. 4.31) software in December 2006. Refer to the 06OAK310 Airborne Positioning and

Orientation Report (APOR) for further information on the GPS data processing and results.

Aerotriangulation

Routine softcopy aerotriangulation 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 completed by RSD personnel in July 2008 utilizing the BAE Systems SOCET SET (v. 5.4) Digital Photogrammetric Workstation (DPW). The color photographs were aero-triangulated (AT) and adjusted as a single block using the Multi-Sensor Triangulation (MST) module. Upon successful completion of the AT, MST provided an RMS of the standard deviations of the residuals for each aero-triangulated ground point. These were then used to compute a 95% Confidence Circle (95% CC) of 1.0 meters. An AT 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 (NAD83).

Compilation

The data compilation phase of this project was initiated by RSD personnel in July 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 analysis of the 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 features were further modified with additional descriptive information to refine general classification.

Spatial data accuracies for Project CA0610 were determined according to standard Federal Geographic Data Committee (FGDC) practices. Cartographic features were compiled to meet a horizontal accuracy of 2.0 meters. This predicted accuracy is based on a doubling of the 95% CC reported above.

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

Date	Time (UTC)	Roll ID	Photo Numbers	Scale (Nominal)	Tide Level*
11-06-06	19:37	06ACN18	2822-2823	1:30,000	3.1 m
11-06-06	19:37-19:43	06ACN18	2824-2827	1:30,000	2.9 m
11-06-06	19:43	06ACN18	2828-2829	1:30,000	2.6 m

*Tide levels are given in meters above MLLW and are based on actual observations recorded by the NOS reference station at San Francisco, CA with corrections applied to substations in the project area. The height of mean high water in the project area varied between 2.3 m and 2.6 m.

Quality Control / Final Review

Quality control tasks were conducted during all phases of project completion by a senior member of the RSD Applications Branch (AB). The final QC review was completed in September 2008. The review process included analysis of the georeferencing 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 9.1 software. The entire suite of project products was evaluated for compliance to CMP requirements.

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

- Chart 18651 44th Ed., April 2006, Scale 1:40,000
- Chart 18651 Redwood Creek inset, 1:20,000

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 Airborne Positioning and Orientation Report (APOR)
- Hardcopy of the Aerotriangulation Report
- Hardcopy of the Project Completion Report (PCR)
- Page-size graphic plot of GC10722 file contents, attached to PCR

Remote Sensing Division Electronic Data Library

- Project database
- GC10722 in shapefile format
- Digital copy of the PCR in Adobe PDF format
- Chart Evaluation File in shapefile format

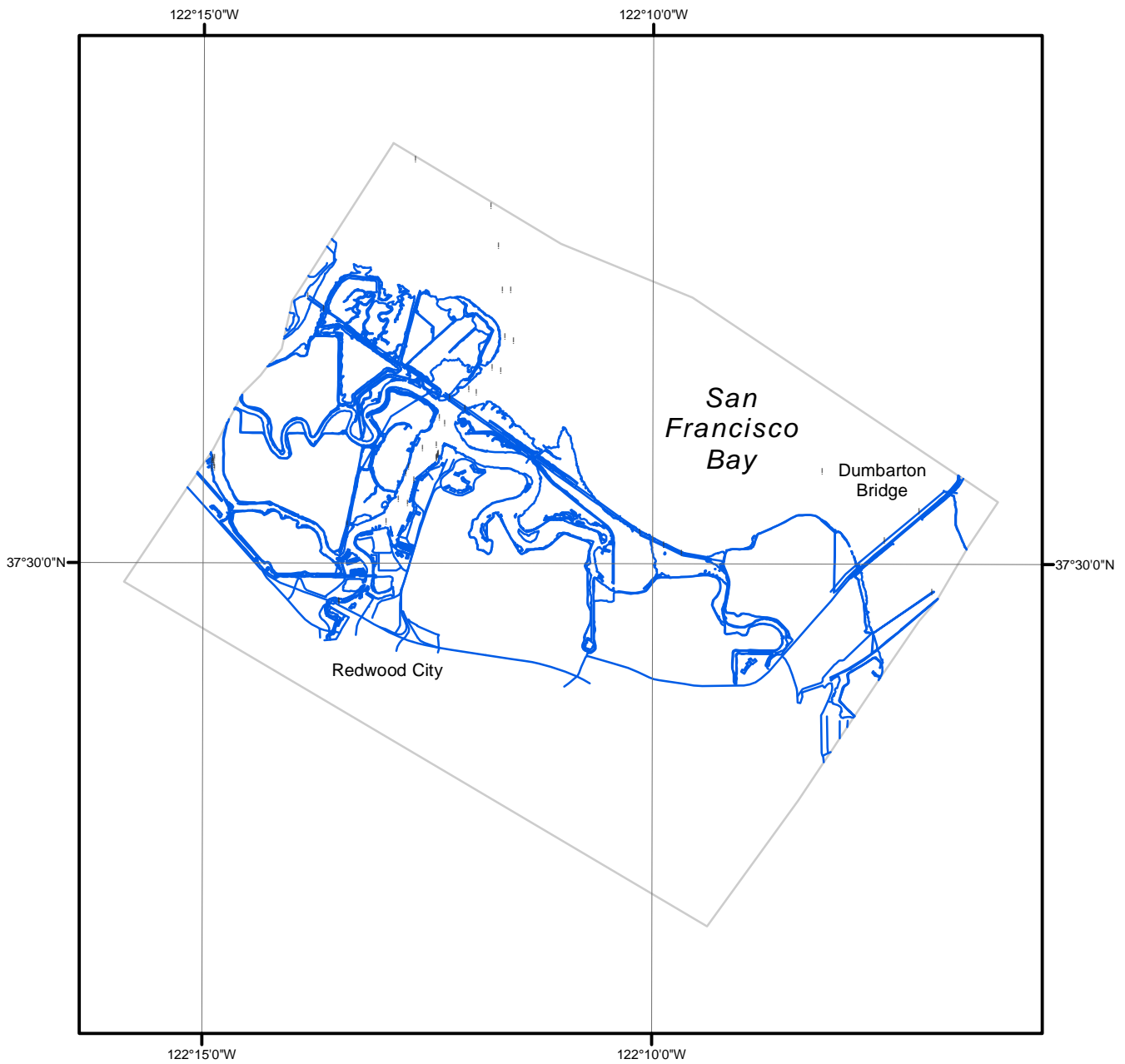
NOAA Shoreline Data Explorer

- GC10722 in shapefile format
- Metadata file for GC10722
- Digital copy of the PCR in Adobe PDF format

End of Report

PORT OF REDWOOD CITY

CALIFORNIA



Overview



CA0610

GC10722