NOAA COASTAL MAPPING PROGRAM
PROJECT COMPLETION REPORT

PROJECT CA1503B-CS-N

Port of Oakland, California

Introduction

NOAA Coastal Mapping Program (CMP) Project CA1503B-CS-N provides highly accurate digital shoreline data for key areas of change within the Port of Oakland, California. 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 CA1503B-CS-N was accomplished by the Requirements Branch (RB) of the Remote Sensing Division (RSD) in response to the need for updates to the NOAA chart suite within key U.S. ports. 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 CSCAP Memorandum of December 8, 2015 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 aerial imagery. Five strips of color digital images utilized for this project were acquired with the NOAA King Air aircraft on September 4, 2015 using an Applanix Digital Sensor System (DSS) dual aerial camera system at a nominal altitude of 10,500 feet, resulting in an approximate ground sample distance (GSD) of 0.33 meters. Near-infrared (NIR) images were also acquired concurrently with the color images, but were not used for this project. Although imagery was not acquired in strict coordination with local tides, the goal was to collect all imagery below Mean High Water (MHW).

Direct Georeferencing Data Processing

GPS/IMU data were processed by RSD personnel to yield precise camera positions and orientations for direct georeferencing (DG) of the imagery. 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 kinematic GPS data was processed in October 2015 using Applanix POSPac MMS 7.1 software. For further information refer to the Airborne Positioning and Orientation Report (APOR) on file with other project data within the RSD Electronic Data Library.

The processed GPS/IMU data were used to derive precise exterior orientation (EO) values of the camera centers required for digital feature extraction. The predicted horizontal accuracy of the imagery was determined by propagating sensor EO and image measurement uncertainties through the photogrammetric collinearity equations using the Exterior Orientation Total Propagated Uncertainty (EO-TPU) tool developed by NGS. Using this tool, the predicted horizontal uncertainty at the 95% confidence level was calculated to be 0.86 meters.

Compilation

The data compilation phase of this project was accomplished by a member of RSD in January 2018. Digital feature data was compiled from orthoimagery generated from the project imagery, using Esri's ArcGIS desktop GIS software. Feature identification and attribution within the GC was based on image analysis of project imagery and information extracted from the appropriate NOAA nautical charts. 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.

Spatial data accuracies for Project CA1503B-CS-N were determined according to standard Federal Geographic Data Committee (FGDC) practices. Cartographic features were compiled to meet a horizontal accuracy of 1.7 meters at the 95% confidence level. This predicted accuracy of compiled well-defined points is derived by doubling the horizontal uncertainty calculated with the EO-TPU tool.

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

Date	Time (UTC)	Roll #	Strip/Photo #s	Tide Level
9-4-2015	18:52 – 18:54	15VC12	53-007 / 1440 – 1450	n/a
9-4-2015	19:50 – 19:51	15VC12	53-005 / 1586 – 1592	n/a
9-4-2015	19:56 – 19:58	15VC12	53-012 / 1593 – 1608	n/a
9-4-2015	20:05 – 20:08	15VC12	53-011 / 1609 – 1630	n/a
9-4-2015	20:13 – 20:17	15VC12	53-010 / 1633 – 1657	n/a

Quality Control / Final Review

The final review of the project was completed by a senior member of RSD in April 2018, and included analysis of DG 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 10.5 software. All project data was evaluated for compliance to CMP requirements.

End Products and Deliverables

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

Remote Sensing Division Electronic Data Library

- CSCAP evaluation memorandum
- Airborne Positioning and Orientation Report (APOR)
- Project database
- Project Completion Report (PCR)
- GC11392 in shapefile format
- CEF in shapefile format

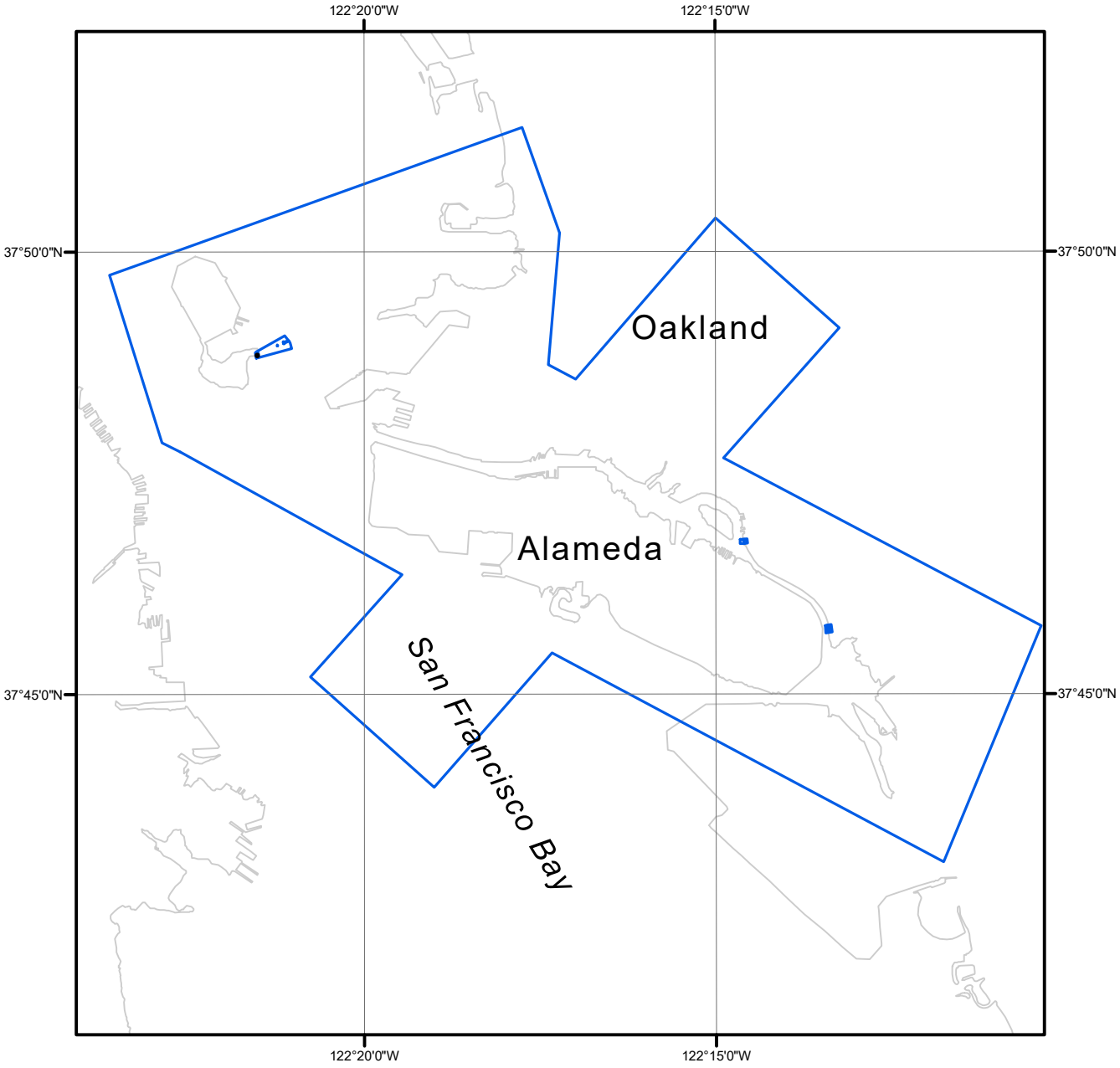
NOAA Shoreline Data Explorer

- GC11392 in shapefile format
- Metadata file for GC11392
- PCR in Adobe PDF format

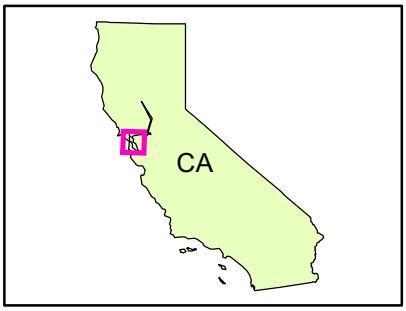
End of Report

PORT OF OAKLAND

CALIFORNIA



Overview



CA1503B-CS-N

GC11392