NOAA COASTAL MAPPING PROGRAM
PROJECT COMPLETION REPORT

PROJECT CA0812

Monterey, California

Introduction

Coastal Mapping Program (CMP) Project CA0812 provides highly accurate digital shoreline data for Monterey Harbor and the surrounding shoreline in central 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 coastal zone management applications.

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. The instructions discussed the project's purpose, geographic area of coverage, scope and priority, image 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 Global Positioning System (GPS) data and Inertial Measurement Unit (IMU) data and the acquisition of aerial imagery. The photographic mission operations were conducted on May 1, 2008 with the NOAA Twin Otter aircraft (N48RF). Two strips of natural color digital images were acquired with an approximate ground sample distance of 0.34 meters through the use of an Applanix Digital Sensor System (DSS-439) Single Cam digital camera.

No base station was established for field operations. Airborne kinematic GPS data was collected in conjunction with an Inertial Measurement Unit (IMU) to determine precise camera positions and orientations.

GPS Data Reduction

GPS data were processed by Remote Sensing Division (RSD) personnel to yield precise camera positions in order to provide a control network necessary for aerotriangulation. Two CORS stations and one UNAVCO station were processed using the NGS Online Processing User Service (OPUS) software to compute fixed baseline solutions for these stations so they could be used as base stations during GPS processing. The airborne kinematic data was processed using Applanix POSPAC (ver. 4.4) software in May 2008.

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 initiated by RSD personnel in December 2010, utilizing a Digital Photogrammetric Workstation (DPW). The digital images were measured and adjusted as a single block using BAE Systems SOCET SET (version 5.5.0) photogrammetric suite in conjunction with the Bingo (version 5.6) aerotriangulation software. Upon successful completion of the aerotriangulation process, the Bingo software provided the standard deviations for each aerotriangulated ground point, which were used to compute a predicted horizontal circular error of 0.5 meters based on a 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, 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 in December 2010. 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 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 CA0812 were determined according to standard Federal Geographic Data Committee (FGDC) practices. Cartographic features were compiled to meet a horizontal accuracy of 1.0 meters at the 95% confidence level. The predicted accuracy of compiled, well defined points is derived by doubling the circular error computed from aerotriangulation statistics.

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

Date	Time (UTC)	Roll Number	Photo Numbers	GSD (nominal)	Tide Level*
5-01-08	21:05-21:06	08NC71	16463-16467	0.3 m	0.0
5-01-08	21:14-21:14	08NC71	16468-16472	0.3 m	0.0

* Tide levels are given in meters above MLLW and are based on actual observations recorded by the NOS gauge at Monterey Harbor, CA. The elevation of MHW at Monterey Harbor is 1.4 meters above MLLW.

Final Review

The final review of the project was completed by a senior member of RSD in February 2011, and included analysis of aerotriangulation 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 software. All project data was evaluated for compliance to CMP requirements.

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

> 18685, Monterey Bay, CA, 1:50,000 scale, 33rd edition
> 18685 Inset, Monterey Harbor, CA, 1:7,500 scale, 33rd edition

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 GC10862 file contents, attached to PCR
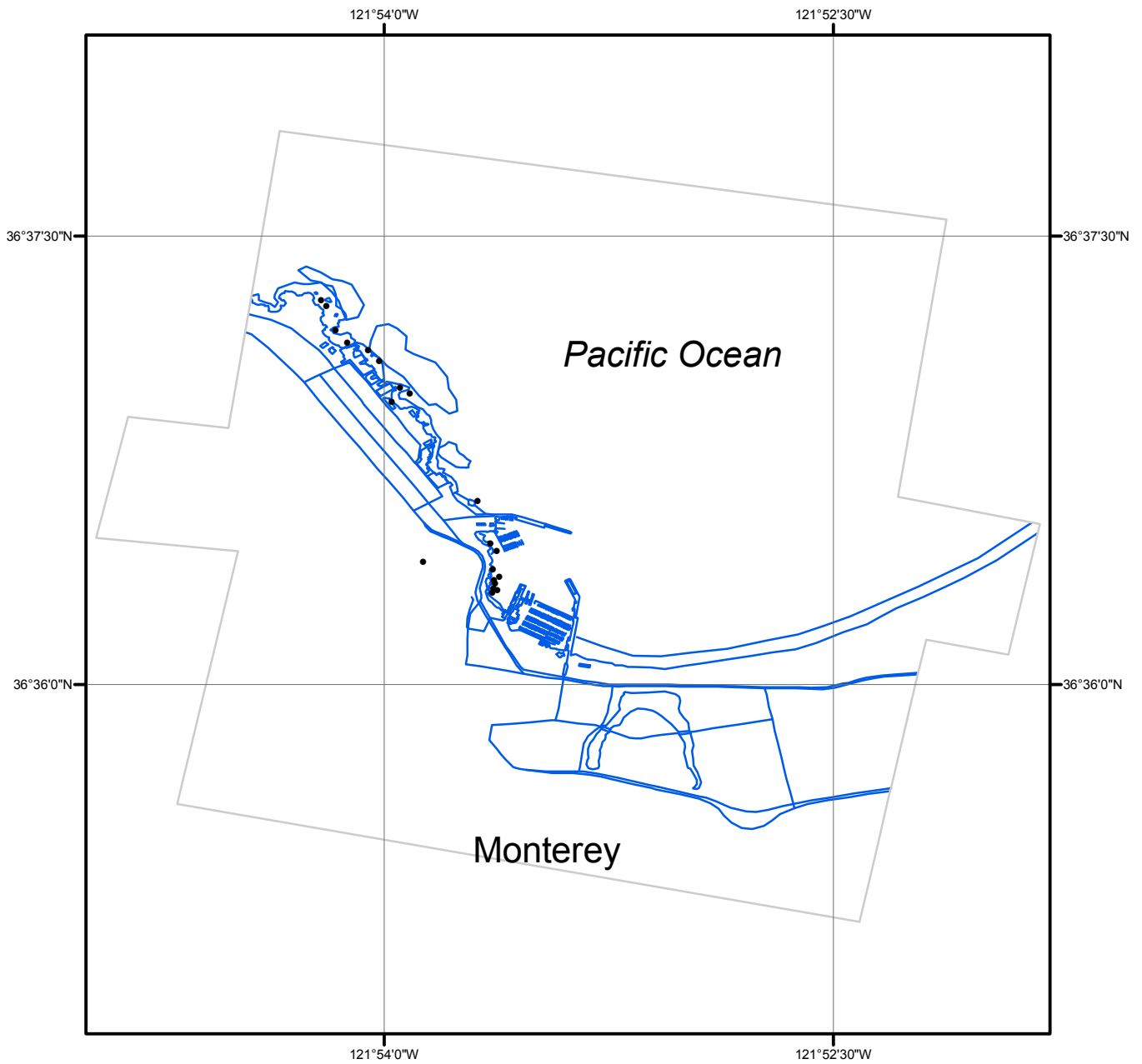
Remote Sensing Division Electronic Data Library
- Project database
- GC10862 in shapefile format
- Digital copy of the PCR in Adobe PDF format
- CEF in shapefile format

NOAA Shoreline Data Explorer
- GC10862 in shapefile format
- Metadata file for GC10862
- Digital copy of the PCR in Adobe PDF format

End of Report

MONTEREY

CALIFORNIA

121°54'0"W   121°52'30"W

36°37'30"N   36°37'30"N

Pacific Ocean

36°36'0"N   36°36'0"N

Monterey

121°54'0"W   121°52'30"W

Overview

CA

CA0812

GC10862