

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

## ***PROJECT CA0601***

### ***Santa Monica Bay, Marina del Rey to King Harbor***

#### **Introduction**

NOAA Coastal Mapping Program (CMP) Project CA0601 provides a highly accurate database of new digital shoreline data for the portion of Santa Monica Bay from Marina del Rey to King Harbor, California.

Successful completion of this project resulted in a densification of the National Spatial Reference System (NSRS), a set of controlled metric-quality aerial photographs, and digital feature data of the coastal zone which compliments the Nautical Charting Program (NCP) as well as geographic information systems (GIS) for a variety of coastal zone management applications.

The project database consists of information measured and extracted from aerial photographs and metadata related to photogrammetric compilation. Base mapping was conducted in a digital environment using stereo softcopy photogrammetry and associated cartographic practices.

#### **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 (7/1/93). The instructions discussed the project's purpose, geographic area of coverage, scope and priority; photographic 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 GPS data and the acquisition of aerial photographs. The photographic mission operations were conducted on July 6, 2006 and November 5, 2006 with the NOAA Cessna Citation II (N52RF) aircraft. Two strips of natural color photographs and two strips of black and white infrared photographs were acquired through use of a Wild RC-30 camera with the NOS "A" lens cone at the nominal scale of 1:30,000.

A base station was established at the John Wayne Airport in Costa Mesa using static GPS. Airborne kinematic GPS data was collected in conjunction with an Inertial Measurement Unit (IMU) to determine precise camera positions and orientations. GPS data collection operations were conducted in accordance with the GPS Controlled Photogrammetry Field Operations Manual (10/25/99).

## **GPS Data Reduction**

GPS and IMU data was collected and processed to provide precise positions of camera centers for application as photogrammetric control in the aerotriangulation phase of project completion. The static GPS base station data was processed in November 2006 using the NGS Online Processing User Service (OPUS) software to compute fixed baseline solutions from three CORS stations. The final NAD83 position reported by OPUS was the average of these three baseline solutions. The airborne kinematic data was processed using Applanix POSGPS (ver. 4.2) software, in November 2006 for the color photographs and B & W IR photographs in December 2006. An Airborne Positioning and Orientation Report (APOR) was written and is on file with other project data within the RSD Applications Branch (AB) Project Archive.

## **Aerotriangulation**

Routine softcopy aerotriangulation methods were applied to establish the 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 2006 utilizing a Digital Photogrammetric Workstation (DPW), which is a configuration of computer hardware, modular software components and other associated peripheral devices. The color photographs and black and white infrared photographs were measured and adjusted as 2 separate blocks and then combined as one by using BAE Systems' SOCET SET (version 5.2) photogrammetric software in conjunction with the Multi-Sensor Triangulation Package (MST) aerotriangulation software. Upon successful completion of the aerotriangulation process, the MST software provided the RMS of the standard deviations of the residuals for each aerotriangulated ground point which were used to compute an overall predicted horizontal circular error of 0.9 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, 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 (NAD 83).

## **Compilation**

The data compilation phase of this project was initiated by RSD in February 2006. Digital mapping was performed using a Digital Photogrammetric Workstation (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 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 CA0601 were determined according to standard Federal Geographic Data Committee (FGDC) practices. Cartographic features were compiled to meet a

horizontal accuracy of 1.8 meters at the 95% confidence level. The predicted accuracy of compiled, well defined points is derived by doubling the circular error derived from aerotriangulation statistics.

The following table provides information on aerial photographs used in the project completion:

Date	Time (UTC)	Roll Number	Photo Numbers	Scale (nominal)	Tide Level*
07-06-06	2212-2217	06ACN09	1006-1076	1:30,000	N/A
07-06-06	2224-2228	06ACN09	1077-1087	1:30,000	1.2m
11-05-06	2115-2119	06AR12	2800-2810	1:30,000	N/A
11-05-06	2124-2129	06AR12	2811-2821	1:30,000	0.0m

\*NOTE: N/A-tide level is not applicable for imagery over land. Tide levels are given in meters above MLLW and are based on actual observations at the Santa Monica station, and at El Segundo substations within the project area with corrections applied from the Los Angeles reference station. The mean tide range in the project area varied between 1.1m and 1.2m

### **Quality Control / Final Review**

Quality control tasks were conducted during all phases of project completion by a senior member of AB. Final QC review was completed in March 2007, including 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 9.1 software. All project data was evaluated for compliance to CMP requirements.

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

18744, Santa Monica Bay, CA, 1:40,000 scale, 32<sup>nd</sup> edition, Mar. 2006

### **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 Aerotriangulation Report
- Hardcopy of the Project Completion Report (PCR)
- Page-size graphic plot of GC10643 file contents, attached to PCR

#### **Remote Sensing Division Electronic Data Library**

- Project database
- GC10643 in shapefile format
- Digital copy of the PCR in Adobe PDF format
- CEF in shapefile format

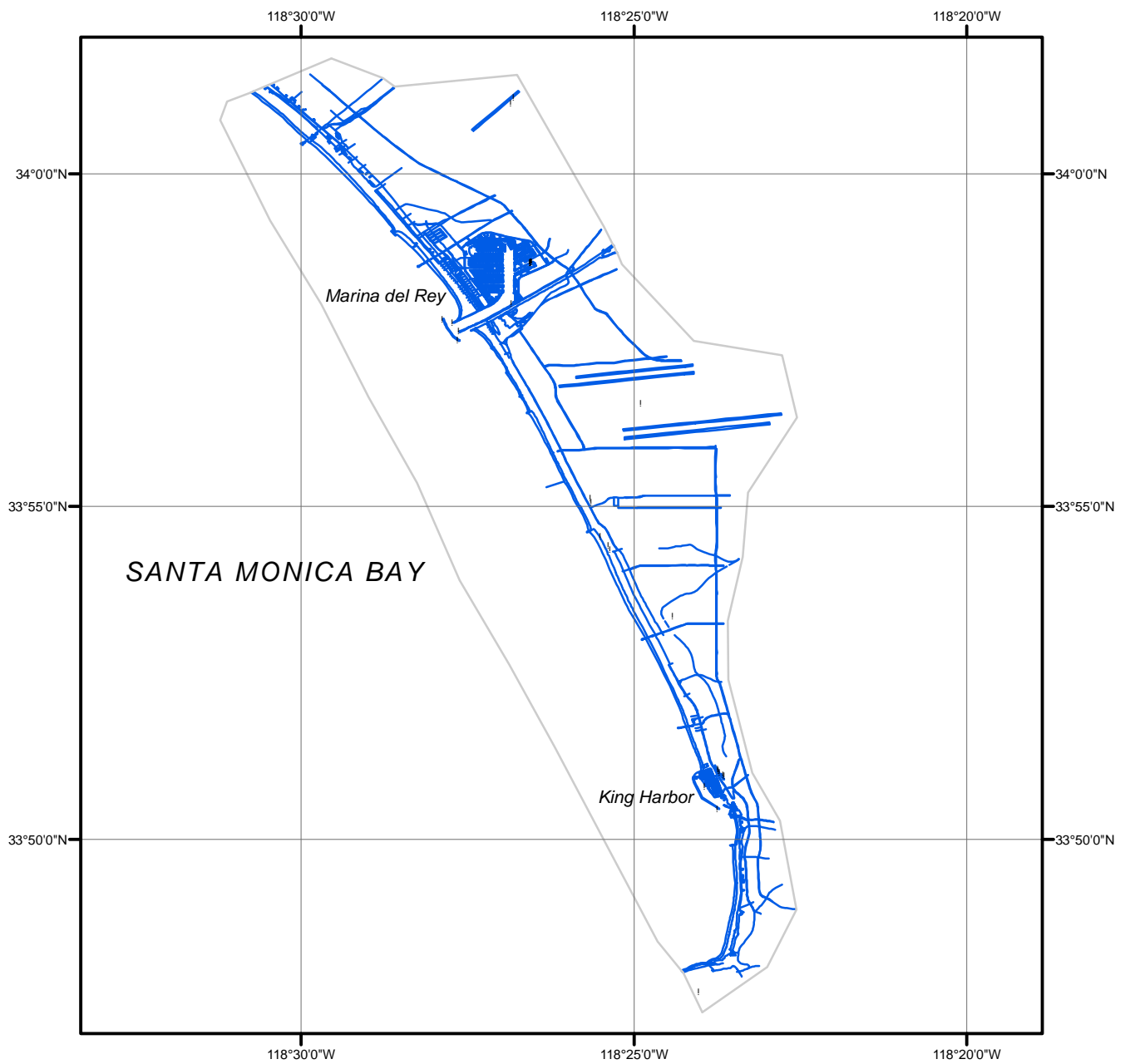
### **NOAA Shoreline Data Explorer**

- GC10643 in shapefile format
- Metadata file for GC10643
- Digital copy of the PCR in Adobe PDF format

**End of Report**

# SANTA MONICA BAY, MARINA DEL REY TO KING HARBOR

## CALIFORNIA



Overview



CA0601

GC10643