

Santa Cruz Harbor SWATH Bathymetry Survey – Precise Navigation

Precise positioning of the *R/V Parke Snavely* was accomplished by utilizing a **R**ea**T**-**T**ime **K**inematic **G**lobal **P**ositioning **S**ystem (RTK-GPS).

A permanent and semi-continuously operating reference base station is located at the marine facility of the U.S. Geological Survey, which occupies part of the Wrigley Building, in west Santa Cruz, CA¹.

The survey control point, named “WCMG”, is the **a**ntenna **r**eference **p**oint (ARP) of the GPS antenna mounted on the roof of the building. The GPS antenna used for this survey was a Topcon choke ring antenna (model CR-G3)² with a hemispherical radome attached (see figure 1).



Figure 1. Antenna reference point is the base of the antenna assembly.

The antenna is attached to the top of a heavy-duty pipe that is firmly attached to a metal roof structure (see figure 2). Also attached to the metal structure is the radio antenna that broadcasts the RTK corrections.



Figure 2. WCMG and RTK radio configuration.

¹ Wrigley Building: 2831 Mission Street, Santa Cruz, CA 95060

² Topcon CR-G3 GPS antenna: P/N 01-044301-01, S/N 383-1208

The GPS base station receiver used for this survey was a Trimble R7 Global Navigation Satellite System (GNSS) receiver³.

The receiver was programmed with the following coordinates:

<u>WCMG</u>
<u>Reference System</u> : WGS84 (G1150), Epoch 2011.0000
<u>Latitude</u> : 36° 57' 32.05948" N
<u>Longitude</u> : 122° 03' 19.38755" W
<u>Ellipsoid Height</u> : 3.579 meters

These coordinates were derived by averaging numerous autonomous solutions for **WCMG**, obtained by submitting previously collected **WCMG**-occupation data to the National Geodetic Survey's (NGS's) One Positioning User Service (OPUS)⁴.

RTK corrections [individual satellite corrections that force the perceived (i.e. observed) autonomous antenna position and the assumed, (i.e. known) antenna position to coincide] in the Compact Measurement Record (CMR)+ format were broadcast to the *R/V Snavely* at a frequency of one hertz (1 Hz).

The corrections were broadcast utilizing a Pacific Crest data radio⁵, operating at a frequency of 414.8750MHz, on "High" (i.e. 35W) power, and powered by an AC battery charger, buffered through a 12-volt battery. A 6db-gain, omni-directional, fiberglass antenna mounted on the roof of the Wrigley Building (see figure 2) was attached to the radio.

Since Santa Cruz harbor sits in the valley of two coastal hills, RTK signal reception was spotty. To get around this shortcoming, a radio-repeater combination was employed. GPS corrections from the base station were picked up by a second Pacific Crest radio (model PDLRVR)⁶ and relayed (via serial cable) to a third Pacific Crest data radio (model PDL4135)⁷ for re-broadcast. This third radio was broadcasting at a frequency of 415.0750MHz and on "High" (i.e. 35W) power. The PDLRVR radio operated on internal batteries while the PDL4135 was powered by a sealed, 36Ahr, lead-acid battery.

³ Trimble R7 GNSS base station receiver: P/N 60163-42 , S/N 4723K30193

⁴ OPUS: <http://www.ngs.noaa.gov/OPUS/>

⁵ Pacific Crest Base Station Data Radio (model PDL4135): P/N 56651-42-01 (PDL4135), S/N 06437618

⁶ Pacific Crest Rover Radio (model: PDLRVR): P/N A01052, S/N 07391802

⁷ Pacific Crest Broadcast Repeater Radio (model PDL4135): P/N A02390, S/N 07381422

The antennas for both repeater radios (5db "whip" antennas) were attached to a magnetic mount and placed on top of a government vehicle. The repeater was positioned at multiple locations within the Santa Cruz Harbor parking lot that offered the best reception and propagation potential.