C. HORIZONTAL AND VERTICAL CONTROL

A complete description of horizontal and vertical control for survey H12129 can be found in the *M-M928-KR-09 Horizontal and Vertical Control Report*, submitted under separate cover. A summary of horizontal and vertical control for this survey follows.

Real-time navigation logged during acquisition was overwritten with a post-processed navigation solution created from Applanix POSPac MMS using the SmartBase option. GPS reference stations from the National Geodetic Survey (NGS) National and Cooperative Continuously Operating Reference Stations (CORS) or the UNAVCO (University NAVSTAR Consortium) Plate Boundary Observatory (PBO) were used during each post-processing session. Table 6 lists the reference stations used in the network subdivided by data provider. North American Datum of 1983 (NAD83) coordinates of the base stations are included in the *M-M928-KR-09 Horizontal and Vertical Control Report*.

Table 6. GPS Base Stations Used During SmartBase Processing

NGS	UNAVCO
CABL	P365
CHZZ	P367
CORV	P373
LFLO	P374
P367	P375
OBEC	P378
	P395
	P404
	P407

Post-processed uncertainty estimates for position, attitude and heading were applied using the HIPS Load Error Tool and used during the calculation of TPE.

C1. Vertical Control

The vertical datum for this project is Mean Lower-Low Water (MLLW). To improve vertical accuracy of this survey, soundings were reduced to MLLW using post-processed GPS water levels. The VDatum derived separation model, *SOrgGRS.bin*, was used to reduce soundings from NAD83 ellipsoid heights to MLLW as described in the *M-M928-KR-09* DAPR. The separation model has been included with the digital deliverables.

Traditional zoning from water level stations was not used for this project, though zoning provided by Center for Operational Oceanographic Products and Services (CO-OPS) and verified water level files for the survey have been included with the digital deliverables

C2. Discussion of GPS Tides

To ensure the use of sounding reduction using GPS water levels was as accurate was accurate as or better than sounding reduction using tidal zoning, a crossline comparison was conducted using one dataset reduced through conventional tidal zoning, and another comparison using a dataset reduced through the use of GPS Tides. The use of GPS tides improved the percentage of soundings which met IHO Special Order specifications by 0.4% from 99.5% to 99.9%.[11]

The decision to use GPS Tides in lieu of discrete zoning was made for the entire project rather than on a sheet by sheet basis. While the use of GPS Tides only provided a slight statistical improvement in soundings that met IHO requirements for H12129, findings were more dramatic for other survey sheets which were part of the Oregon Coastal Mapping Project. As shown in the example for H12124 (Figure 2), the use of GPS Tides considerably improved swath to swath agreement of adjacent survey lines. In many cases the use of GPS tides removed 50- to 60-centimeter offsets between adjacent survey lines reduced with discrete zoning.

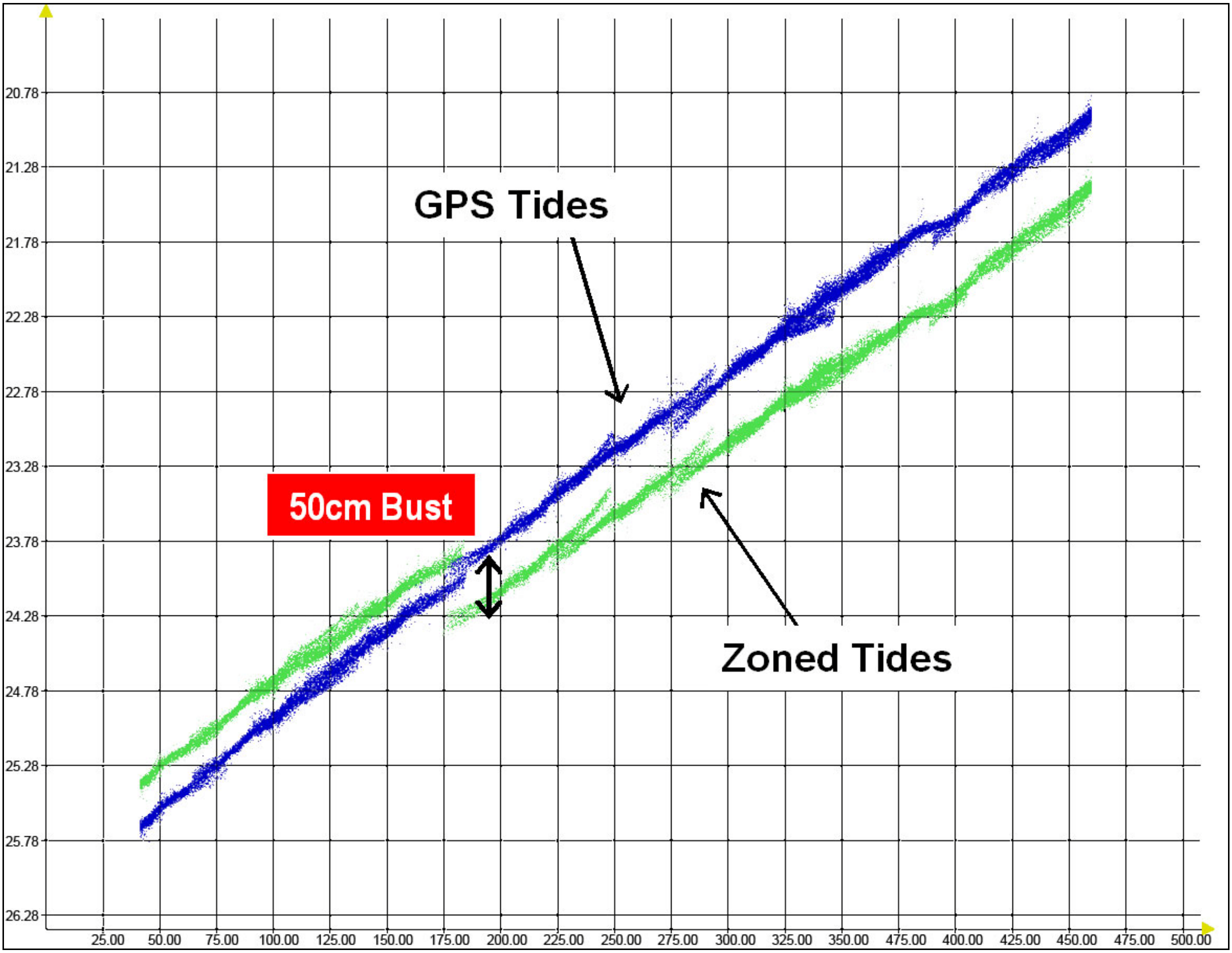

Figure 2. Overview of depth discrepancies

C3. Horizontal Control

The horizontal datum for this project is NAD83. Differential GPS (DGPS) and Starfire Global Navigation Satellite System GNSS positioning were used simultaneously throughout acquisition with DGPS positions only used for a real-time confidence check. DGPS corrections were received from the U.S. Coast Guard (USCG) beacon at Ft. Stevens, OR (287 kHz) or from the secondary beacon at Appleton, WA (300 kHz). All of the primary navigation data were collected using the Starfire Real Time gipsy corrections to GPS (RTG) correction, and are referenced to International Terrestrial Reference Frame (ITRF) 2005.