Feature

One of the fastest emerging trends in hydrographic surveying is the use of the vertical component of RTK GPS to determine real-time water level corrections. There are currently several district offices of the US Army Corps of Engineers using this technique in place of conventional tide measurements.

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RTK Tide Basics

The main purpose of this article is to explain some of the basics behind the technique (without getting overly technical) and to point out some of the benefits and drawbacks to the method.

The Basics

Looking at Figure 1, let's define the following terms:

Term	Description	Source
A	Height of the RTK GPS Antenna Above the Ellipsoid Reference	RTK GPS
RD	Raw Depth from Echosounder Calibrated to the Static Waterline	Echosounder
H	Height of the RTK GPS Antenna Measured Above the Static Waterline	One-time measurement
Tc	Conventional Tide Correction	
Tk	RTK Tide Correction	
SEP	Separation Between the Chart Datum and the Ellipsoid Reference	
CS	Chart Sounding	
D	Dynamic Draft Correction (= 0 in static state)	Automatic sensor, manual measurement or ignored!

For simplicity, I am ignoring the heave-pitch-roll of the vessel and am assuming the vessel is in a pleasantly static, upright, condition. For the following examples, we have calibrated our echosounder to the 'static water line' and our sounder is outputting depths based on this level. From conventional hydrographic surveying, we can define a simplified Chart Sounding (CS) from our example as:

$$CS = RD + D - T_c \quad (1)$$

Based on our drawing, we can see that:

$$A + D = T_k + H + SEP \quad (2)$$

Solving for the RTK Tide component gives:

$$T_k = A + D - H - SEP \quad (3)$$

Substituting this into our formula for the chart soundings results in:

$$CS = RD - A + H + SEP \quad (4)$$

We have everything we need to determine the Chart Sounding in real time without having to resort to a conventional tide reading. Note also that the Dynamic Draft measurement has cancelled itself out of the formula and is not necessary to compute the chart sounding! (More about that later on.) The key to getting this technique to work is to accurately determine SEP (the height of the Chart Datum above the Ellipsoid Reference).

Determining Separation

In Figure 2 I have provided some values to each of our parameters. In this first example, there is no draft correction as the vessel is in its 'static' condition. (D = 0)
Using our conventional formula (1), we get the Chart Sounding:

$$CS = RD + D - T_c$$
$$CS = 10 + 0 - 2 = 8$$

In order to determine the separation

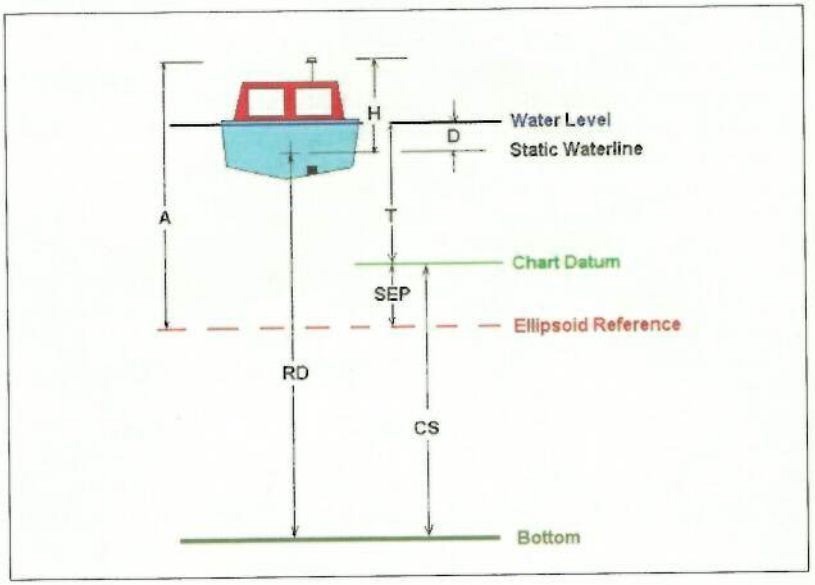

Figure 1: Defining our parameters