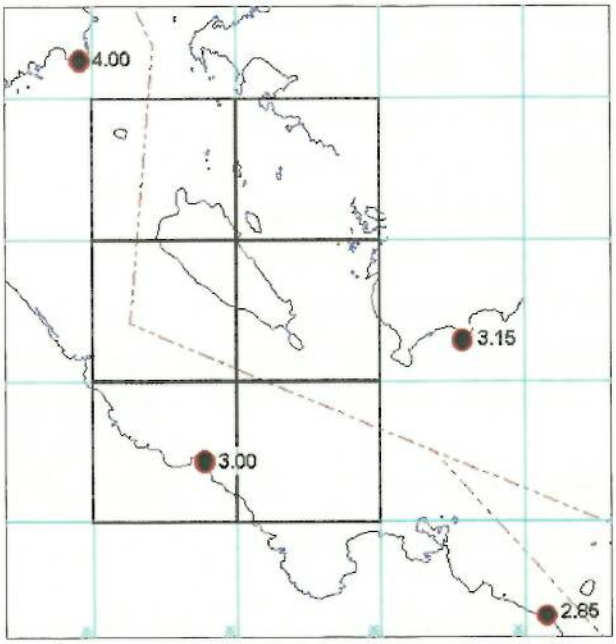

Figure 6: Determining the separation throughout your area

mine our RTK Tide correction gives the following:

$$\mathbf{T_k = A + D - H - SEP}$$
$$\mathbf{T_k} = 8.3 + 0.2 - 3 - 1.5 = 4$$

It follows that our Chart Sounding:

$$\mathbf{CS = RD - A + H + SEP}$$
$$\mathbf{CS} = 11.8 - 8.3 + 3.0 + 1.5 = 8$$

As the vessel squats and the water level changes, we still get the correct Chart Sounding. As long as we can measure the dynamic draft value, the computed RTK Tide should equal the conventional tide correction ($T_k = T_c$)

No Draft Measurement

Having been on hundreds of different survey vessels, I can honestly state that less than 50 per cent of them ever apply any kind of dynamic draft correction. They either don't have the means to automatically measure the draft or they haven't taken the time to manually correct for the draft. (Don't shoot me, I'm only the messenger.) Figure 5 shows the known values. In this case we have the same values as the last example, except that we are going to have to use D = 0, since we don't have any input for the value. Using the available parameters:

$$\mathbf{T_k = A - H - SEP + D}$$
$$\mathbf{T_k} = 8.3 - 3 - 1.5 + 0 = 3.8$$
$$\mathbf{T_k \neq T_c}$$

We compute our Chart Sounding:

$$\mathbf{CS = RD - A + H + SEP}$$
$$\mathbf{CS} = 11.8 - 8.3 + 3.0 + 1.5 = 8$$

Notice that the computed RTK Tide no longer equals the conventional tide correction! In all of our previous examples, $T_c = T_k$. It gave us the ability to compare our RTK Tide with the conventional tide correction value and to generate statistics on the variation between the two.
That is no longer the case. We have now computed some kind of 'pseudo-tide' value. This value, when used in the computation for the Chart Sounding, gives the correct result. If we look at the chart sounding using conventional methods, we will see that we get a result that is in error by an amount equal to the missing draft correction:

$$\mathbf{CS = RD + D - T_C}$$
$$\mathbf{CS} = 11.8 + 0 - 4 = 7.8$$

If you don't have the ability to include the dynamic draft correction, the RTK Tide method will still give you a correct sounding, whereas the conventional method will result in an error.

Varying SEP

When working in a large survey area we can't treat the SEP as a constant. In the chart shown in Figure 6 we have determined SEP values at four different locations in our area and can plainly see that it varies. Any RTK Tide application that works over a large area must somehow incorporate the ability to change the SEP value based on the location of the vessel. In our software package (HYPACK MAX), we use a Kinematic Tidal Datum file that contains the SEP values for the corners of gridded rectangles. Based on the position of the vessel, it determines which rectangle it lies in and then computes an SEP for the vessel position based on its distance from each corner of the rectangle.

Incorporating Data

The height of the RTK antenna above the reference ellipsoid may only be reported once per second by your GPS, whilst the echosounder is updating over fifteen times per second. If the boat is in a dynamic environment (waves), we need to be able to model the movement of the sensors between the RTK updates. A heave-pitch-roll sensor is used in almost all RTK applications. Working with numerous clients, we have developed two different approaches to rectify this problem.
In the first approach, shown in the top half of the Figure 7, we assume the RTK Antenna Heights to be the 'gospel truth' and use the information from the Heave-Pitch-Roll sensor to reconstruct the movement of the sensors between the one-second updates. In a perfect world, the vessel motion between the RTK updates would be a perfect fit. Unfortunately, it isn't a perfect world and we are

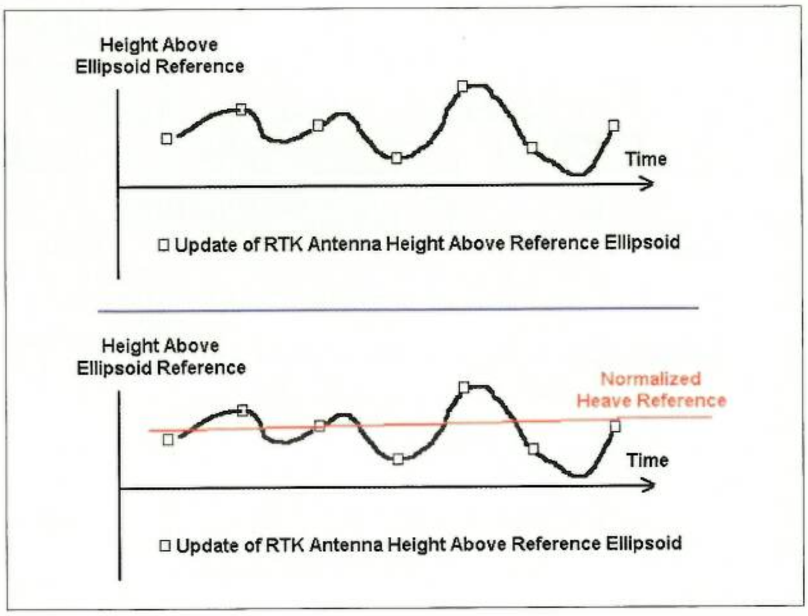

Figure 7: Two methods of integrating RTK and MRU updates