



Using HYPACK® SURVEY to Collect Real Time Topo Data

by Pat Sanders

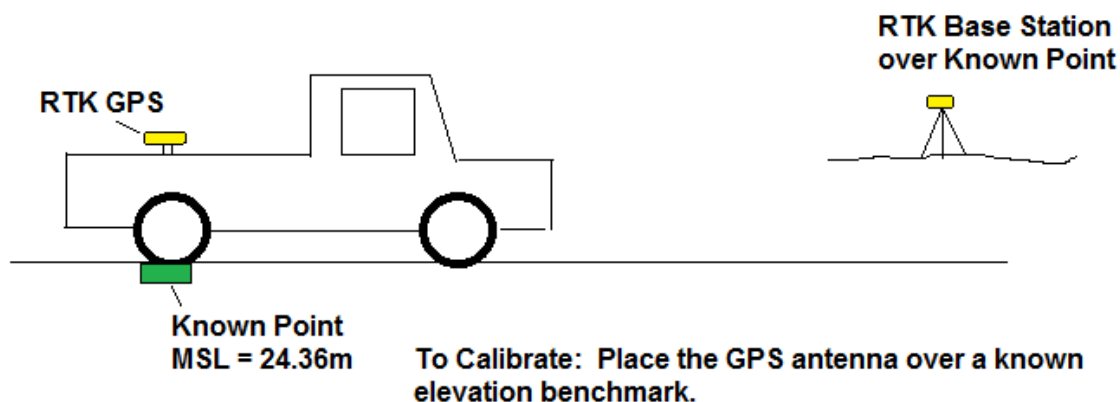
We recently had a request from a client who wanted to map out a construction site (a future golf course) using his pick-up truck and an RTK GPS. I've been telling clients for years that they could do this, but hadn't set one up for so long that I had to go to Mircea Neacsu of HYPACK to get the details. So, I thought I would share them with you.

GPS INSTALLATION

Let's say you mount the RTK GPS mobile antenna over your back axle. The lower the better, because if the truck pitches and rolls, you don't want your antenna sweeping through big arcs. You could always mount it on some kind of weighted gimbel so that it isn't affected by the pitching and rolling of the vehicle.

Measure the height of the RTK GPS antenna above the surrounding surface. Let's say it's 2.3m above the ground. Use -2.3 for the vertical offset of the GPS antenna.

FIGURE 1. RTK GPS in a Pickup Truck



To Calibrate: Place the GPS antenna over a known elevation benchmark.

Check the computed elevation in SURVEY. Then close SURVEY and adjust the Orthometric Height Correction. Go back and check the result in SURVEY. Repeat until SURVEY gives the correct result.

We're going to use a combination of the RTK TIDE technique and using the Ellipsoid Height of the GPS antenna to convert the antenna to a real time elevation.

GEODETIC PARAMETERS

FIGURE 2. Setting the Orthometric Height Correction in the Geodetic Parameters Interface

We'll set up the program so we don't need a geoid model and we'll use an Orthometric Height Correction to adjust the final height of the antenna to the vertical datum (MSL in this case).

Since we don't have a geoid file or a kinematic tidal datum file, we'll use the Orthometric Height Correction in GEODETIC PARAMETERS to calibrate the system. We need to set it to a non-zero value to trigger the RTK TIDES routine in SURVEY, so let's start off by setting it to 0.001m (Figure 2).

HYPACK® HARDWARE

Since the client had HYPACK® 2011, I set it up in that version. We'll use the GPS.DLL for our RTK GPS input. The key is to set up the GPS as a Position and Depth device.

Predefined
Grids: UTM North
Zone: Zone 19(72W-66W)
Distance Unit: Meter
Depth Unit: same as horizontal
Elevation Mode (Z-axis positive going up): ☐
Ellipsoid: WGS-84
Semi-Major Axis: 6378137.000
Flattening (1/f): 298.257223563
Geoid Model: [empty]
Orthometric Height Correction: 0.001 m
VDatum: (none)
zone:

FIGURE 3. Configuring the GPS Device Driver

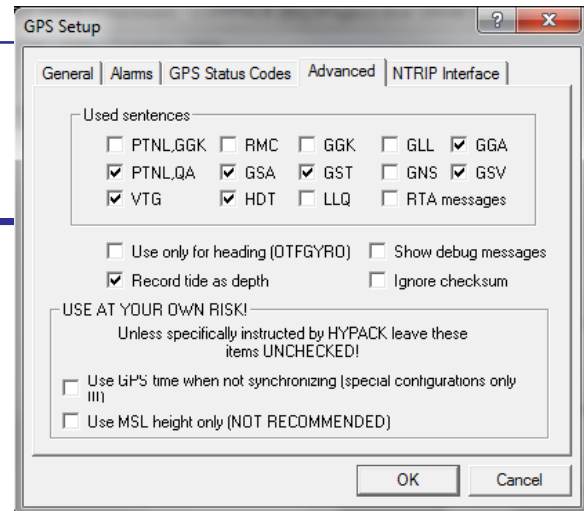
HYPACK Hardware - C:\HYPACK 2012\Projects\Bob Glover 1\survey32.ini
File Edit Options Help
Add Device Add Mobile
Hypack Configuration
Boat
GPS NMEA-0183
Device: Advanced
Functions:
☒ Position
☒ Depth
☐ Heading
☐ Speed
☐ Tide
Options:
☐ Use for matrix update
☒ Record lat/lon data
☒ Record quality data
☐ Record raw messages
☐ Record device specific messages
Setup... Test
Mobile Assignment
Installed on: Boat
Driver: GPS.dll
Offsets:
Starboard: 0.00 m Yaw: 0.00 deg.
Forward: 0.00 m Roll: 0.00 deg.
Vertical: -2.30 m Pitch: 0.00 deg.
Vertical Positive Downward
Latency: 0.000 sec.
Connect: Serial Port
Serial Parameters:
Port: COM1 Speed: 9600
Data bits: 8 Stop bits: 1
Parity: None Flow Control: None

1. In the Functions frame, we check Position and Depth.

2. In the **Offsets** frame, we enter the **antenna vertical offset** —a negative value (-2.30m) because vertical offsets are positive downward from the water line.
3. Click the **Setup** button.
4. In the **Advanced** Tab, we select '**Record tide as depth**'.

FIGURE 4. GPS.dll Driver Setup Dialog

5. **Save your HYPACK® HARDWARE settings.**



HYPACK SURVEY: CALIBRATION

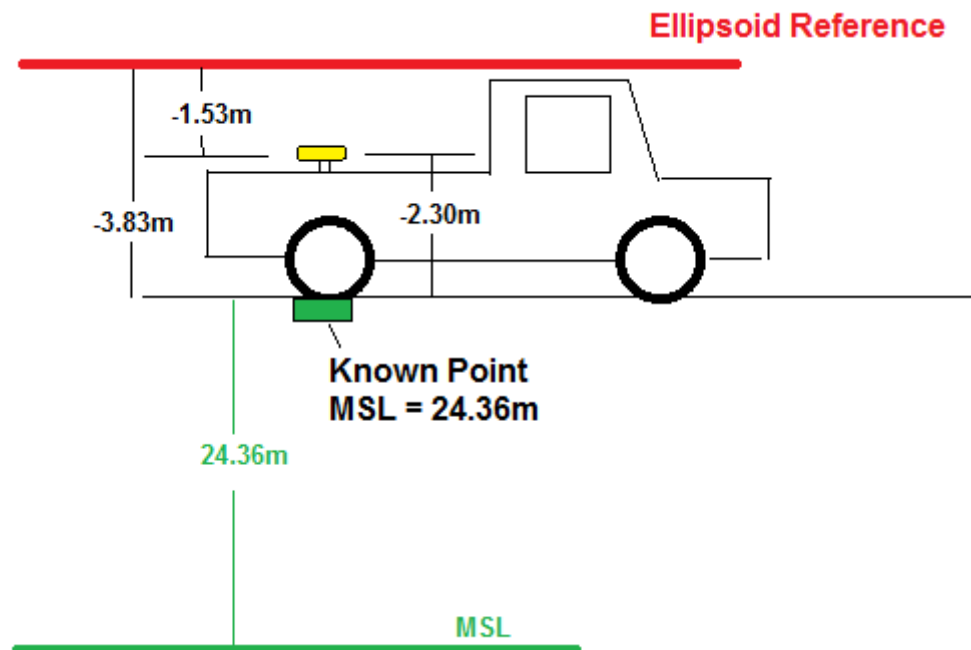
Go find an elevation benchmark in your survey area and pull the pickup truck next to it (or on top of it!) and we'll calibrate it your system.

We start survey and we see the Corrected Depth is -3.83.

How are we getting that value?

The height of the GPS antenna above the ellipsoid is -1.52m (Figure 5). The antenna's offset of -2.3m is applied and then it adds the Orthometric Height Correction (0.001m) and winds up with -3.82, which is rounded to -3.83m (Depth) in the data display. The Final Elevation value is 'flipped' to show 3.82m.

FIGURE 5. Calibrating the System



Here's our situation. We're parked over a benchmark that is at 24.36m above MSL. SURVEY is currently giving an elevation of 3.82m. I need to add a vertical adjustment of 20.54m! I'm going to do that by changing the Orthometric Height Correction in GEODETIC PARAMETERS.

FIGURE 6. Changing the Orthometric Height Correction

So, I go back into GEODETIC PARAMETERS and change the Orthometric Height Correction, as shown in the figure to the right. Now, you'll have to figure out the value that works in your local area. It may take a little bit of trial and error, but you should be able to find the OHC that gives you the correct elevation above your vertical reference.

We can go back into SURVEY now and take a look at the result!

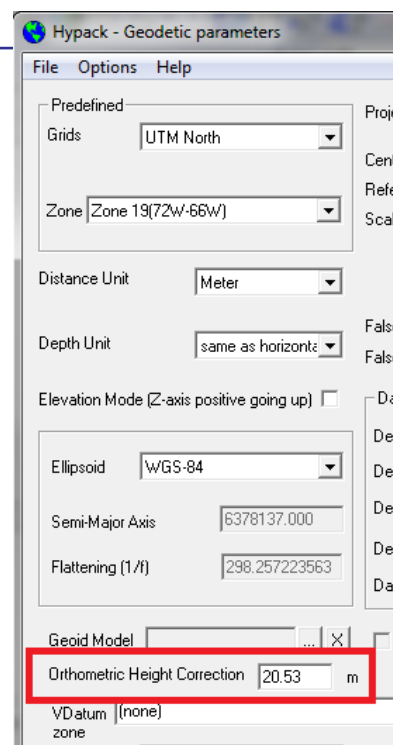


FIGURE 7. The Resulting Depth/Elevation in HYPACK® SURVEY

Data Display(1)		
Font...	Configure...	Style
Status	NOT LOGGING	
File Name		
Speed(kt)	0.00	
Line		
GPS NMEA-0183 Depth	-24.35	
Depth	-24.35	
Corr. Depth	-24.35	
Final Elevation	24.35	
Setup		
HDOP	1.2	0
Sat	7	
Mode	Differential	
Lat	41°18.2813 N	
Lon	071°11.1485 W	25
Ell Height	-1.52 m	
Easting	317013.50	
Northing	4574885.83	
Sigma N	0.00	50
Sigma E	0.00	
Sigma Z	0.00	
Undul	20.53 m	
Ortho Hei...	-22.05	
Tide corr	24.35	75
Time sour...	computer	

We are now off by 1cm! We can now start to drive the truck around the golf course and map the topo elevations.

When we bring the data into the SINGLE BEAM EDITOR (SBMAX), it's going to come in as depths. However, we can just go into the Read Parameters window and tell it to invert the depths. Now they will all be elevations. Edit them, sort them, make a nice contour map, give it to the golf course architect, and start practicing seven irons!

Note: This works great in the HYPACK® 2011 version. The GPS.DLL in the HYPACK® 2012 version was modified to eliminate this option (unbeknownst to me...). It will be back very shortly.

Best regards,

Pat Sanders