



Now, what's tomorrow's challenge?

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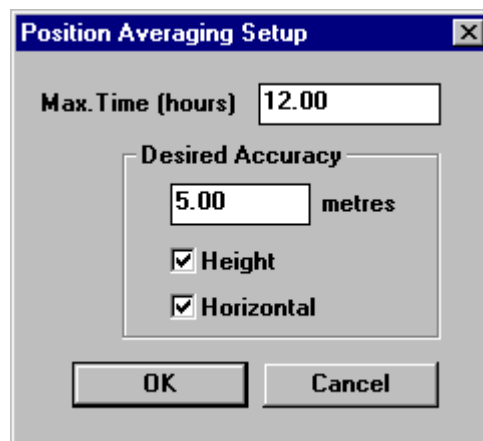
TECHNICAL BULLETIN

Single Point Averaging with GPSolution

Many GPS users may not be aware of the performance capability of the position averaging function provided with GPSolution (formerly known as WinSat). By averaging many GPS measurement epochs over several hours, it is possible to achieve an absolute position based on the WGS 84 datum to better than five meters. This bulletin attempts to explain how the position averaging function operates and to provide an indication of the level of accuracy that can be expected versus total averaging time.

The position averaging function is engaged by selecting **Positioning Averaging** from the view menu. Note that launching this function will unfix the 3-D position if it happens to be fixed, so averaging should not be done simultaneously while the receiver is operating as a differential base station. The position averaging function will record and average the single point GPS position every 10 minutes until one of two user-specified criteria are met:

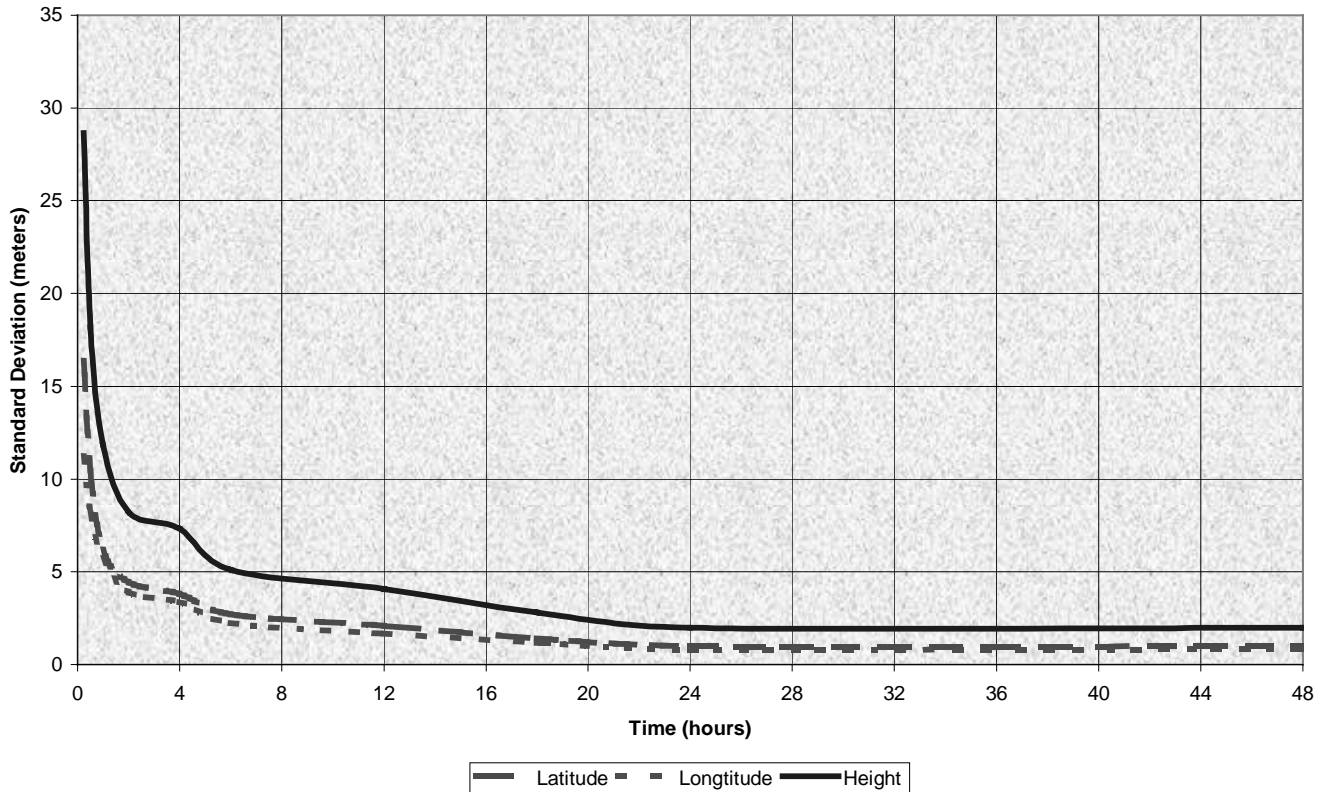
- the total averaging time has elapsed, or
- the desired position standard deviations are achieved.



Both of these criteria are set by the user in the **Position Avg ...** screen located in the **Settings** menu. Once position averaging is complete, GPSolution will fix the 3-D position to the averaged coordinates. The averaging algorithm is more rigorous than straight sample averaging. The function will take into account the current satellite geometry and signal levels to weight each observation appropriately. For this reason, the results of the GPSolution averaging function will be better than performing an average calculation of numerous GPS positions taken over time.

The position accuracy that may be achieved by this method will be dependent on many factors: average satellite geometry, sky visibility at antenna location, satellite health, time of day, etc.. The following graph summarizes the results of several examples of position averaging over different time periods. The intent is to provide an idea of the relationship between averaging time and position accuracy. All experiments were performed using a single frequency receiver with an ideal antenna location.

Single Point Averaging



WARNING: This graph represents typical results using the GPSolution position averaging routine.

This function is useful for obtaining the WGS-84 position of a point to a reasonable accuracy without having to implement differential GPS. It is interesting to note that even a six hour occupation can improve single point GPS accuracy from over fifty meters to better than five meters. This improved accuracy is primarily due to the elimination of the multi-path error in the GPS signal.

Again, it is necessary to keep in mind that the resulting standard deviations of the position averaging can vary quite a bit, especially over relatively short averaging times. To illustrate, the position averaging function was run for a period of one hour at three different times during the day. The resulting standard deviation in latitude varied from 4.7 to 7.0 meters. Similarly, the variation in longitude and height were 4.9 to 6.7 meters and 10.9 to 12.5 meters respectively. This degree of variation is common for averaging periods of less than 12 hours due to changes in the satellite constellation. The graph, however, should at least provide some indication of the accuracy one may expect from single point position averaging.