GPS Accuracy

GPS accuracy is affected by distortions to the signal as it passes through the Ionosphere. This results in position readings that are only accurate to within several meters. To improve accuracy, correction systems have been developed which determine how great the average inaccuracies are so that the rover can develop a more accurate location. Corrected agricultural GPS comes in 3 main levels of accuracy.

The Wide Area Augmentation System was originally developed for Air Navigation and uses references stations scattered across the United States. These reference stations calculate the inaccuracy and supply it to satellites roughly every 5 seconds, and it is then supply it to rover units. This system is usually advertised to provide a non-repeatable accuracy of 15cm-20cm +/- of the desired mark, however studies by the NSTB (National Satellite Test Bed) have only shown accuracies of around 90 cm. This is a free correction system.

OmniStar HP/XP is a subscription based correction system, which also delivers corrections via satellite. Omnistar HP/XP transmits on 2 frequencies allowing the rover to calculate the distortion between those two frequencies delivering a more accurate correction. OmniStar HP/XP is often advertised as non-repeatable 5-10 cm +/- of the desired mark.

Real Time Kinematic correction uses a stationary base station which delivers a correction signal up to 20 times per second over a radio of internet link. These reference station must be much closer to the rover as well, generally less than 20 miles. These factors greatly increases accuracy by minimizing delay in the correction. These systems can be expanded through the use of a CORS (Continuously Operating Reference Station) network, which allows the rover to draw on correction information from several reference stations at once. RTK systems are often advertised as repeatable and sub-inch accuracy.

All of these advertised values need to be look at carefully. Often manufactures advertise based on maximum accuracies and leave out the more important figures. The most important figure is the percentage of time that the advertised values are likely to be achieved. The WAAS design specification only requires it to be accurate to within 7.6m, 95% of the time and meaning that the 15cm-20cm advertised claims may be true at times, but some percentage of the time the location will be far less accurate. OmniStar is 5-10cm 95% of the time meaning that some part of the time it will be more than 10 cm away from the target.

RTK accuracy descriptions brings in one more factor to consider. Because RTK relies on relatively “local” correction stations, accuracy will degrade as the rover move away from that station. Therefore RTK accuracies are described as:



from “Two inches is Enough” Leica Geosystems AG, Heerbrugg, Switzerland, 2007

Early RTK systems using mobile base stations achieved low distance loss because they were rarely more than a mile from the base station. As CORS networks became more common the distance loss became a bigger factor because the rover could often be 10 or more miles from the nearest base

A rough calculation on our GPS system in most operating conditions is as follows:

+/- 1cm (.4”) + {(1\*.063”) \* 12mi} = 1.156” 95% of the time.

This is before any inaccuracies due to calibration, terrain, or equipment are figured in and helps to explain why GPS guidance of cultivators has not worked well. Even in ideal situation we have been consistently experiencing accuracies not better than 2” with all other factors figured in.

For a further discussion of RTK accuracies see “Two Inches is Enough” published by Leica AG, Heerbrugg, Switzerland, 2007. Graphic was used from that publication without permission.