News Standards for Dynamic GPS Accuracy

The American Society of Agricultural and Biological Engineers (ASABE) has initiated a project to develop a standard on the dynamic accuracy of Global Positioning System (GPS) equipment. There are standards in place established by engineering societies to assess the accuracy of GPS units operated in one place but the dynamic accuracy standards planned by ASABE will make it possible to evaluate moving GPS units such as those used by farmers in precision agriculture and other users of mobile GPS units. This is important to farmers spend thousands of dollars on GPS units that are components of tractor guidance systems, variable rate application equipment and crop yield monitoring equipment. These proposed standards will provide farmers with a benchmark to compare the specifications of units for accuracy before purchasing them.

Static performance of GPS units is not always indicative of the accuracy of a GPS unit operated on moving equipment. Accuracy on dynamic GPS units is significantly influenced by the frequency that the GPS unit monitors the signals from satellites. Current specifications assume that GPS units that monitor the GPS satellite signals five times per second deliver greater positional accuracy than units that monitor the signals one time per second. The proposed ASABE standards will provide a more definitive measurement of GPS units that must function on moving vehicles.

Factors that influence accuracy in stationary GPS units affect moving GPS unit similarly. There are three primary groups of errors that influence GPS accuracy. The three error groups are satellite and antenna geometry, ranging errors and user equipment errors. The following paragraphs discuss the various GPS errors.

The geometry of the current satellites visible above the GPS receiver's antenna determines the primary accuracy of any GPS unit. This is commonly referred to as dilution of precision and these errors can be made even larger by signal obstruction due to terrain, foliage, buildings and vehicle structure. There is little farmers can do to reduce these types of errors because they need to use GPS at all times of the day and night preventing them from choosing the time of the day when satellite geometry is best in their area. Users do need to recognize that GPS accuracy will likely be poorer under trees and close to buildings.

Ranging errors include ephemeris data, satellite clocks, ionospheric delay and tropospheric delay. Ephemeris data tells the GPS receiver where each GPS satellite should be at any given time. Each satellite transmits ephemeris data showing the orbital information for that satellite and for every other satellite in the GPS system. Ranging errors can be greatly reduced by using available differential correction GPS signals. Farmers can purchase commercially available GPS correction services or use two free services, the Federal Aviation Administration’s Wide Area Augmentation Service (WAAS) or Coast Guard’s Nationwide Differential Global Positioning System (NDGPS).

User equipment errors include GPS equipment design, multipath reflection, antenna orientation, and radio frequency interference. Mutlipath is the phenomena by which GPS radio signals are reflected by an object or structure before being detected by the GPS antenna. Receiver and antenna design can greatly reduce user equipment error sources. These design differences are primary reasons for the widely varying costs of GPS units. More expensive GPS units generally provide more accurate positioning but it is important to accurately assess all specifications. More information on selecting GPS units is available on the NDSU Geospatial Education We site at http://mapserver.abeng.ndsu.nodak.edu/geospatial/.