NDSU Extension
Geospatial Education Program

GPS Differential Correction Options for Farmers

20 December, 2004

Farmers and others who use the Global Positioning System (GPS) often need greater accuracy than the 10 to 30-foot GPS signal currently available. GPS users employ differential correction (DGPS) services to increase the positional accuracy of GPS. There are several options available for differential correction, some available for a subscription fee, and others without cost, according to John Nowatzki, North Dakota State University Extension Service geospatial specialist. Differential correction reduces GPS errors and provides position accuracy to less than 10 feet. The Global Positioning System is a space-based radio-navigation system consisting of a constellation of satellites and a network of ground stations. Twenty-eight GPS satellites orbit the Earth at an altitude of approximately 11,000 miles providing users with accurate information on position, velocity, and time anywhere in the world and in all weather conditions.

Two US government agencies provide GPS differential correction services without direct cost to users. The Federal Aviation Administration provides the Wide Area Augmentation System (WAAS) differential correction service designed for use by commercial aircraft. The US Coast Guard provides the Coast Guard DGPS Service intended for use by Coast Guard equipment on navigable waters in and around the continental United States.

The WAAS DGPS service consists of a system of satellites and ground stations that provide GPS signal corrections used to increase position accuracy. A WAAS-capable receiver can provide position accuracy of less than 10 feet 95 percent of the time anywhere in North Dakota. WAAS consists of approximately 25 ground reference stations positioned across the United States that monitor GPS satellite data. Two master stations, located on either coast, collect data from the reference stations and create a GPS correction message. The corrected differential message is then broadcast through one of two geostationary satellites with a fixed position over the equator. Any WAAS-enabled GPS receiver can receive the signal and use it to increase position accuracy. Farmers use the WAAS service in equipment guidance systems, combine yield monitors, variable rate crop input application equipment and to mark points and areas in fields.

The Coast Guard Beacon DGPS service consists of two control centers and more than 60 remote land-based broadcast sites. A Beacon DGPS-capable receiver will typically provide position accuracy of less than 10 feet anywhere in North Dakota. The Coast Guard Beacon DGPS service broadcasts correction signals in amplitude modulated (AM) radio frequency. AM radio signals can be degraded by surface weather conditions that can decrease the position accuracy. Farmers use the Coast Guard Beacon DGPS service for the same purposes as the WAAS DGPS service. Both the WAAS and Beacon services are available without cost to users.

There are several commercial differential correction services available for annual subscription fees. Commercial sub-meter differential correction services are available from OmniSTAR, John Deere, Case IH, and Agco companies for approximately $80o per year. The accuracy of the commercial differential correction services varies by company and based on the length of time accuracy is checked. Commercial suppliers often measure the accuracy of their DGPS in terms of “pass-to-pass” which refers to the length of time it takes to travel from one end of the field and back again, usually meaning 15 minutes.

Differential correction services that increase GPS position accuracy to less than 6” are also commercially available. Farmers need this higher accuracy differential correction service when they incorporate guidance technology directly into the equipment steering system to provide automatic steering. The higher accuracy DGPS is often referred to as decimeter-accuracy or centimeter-accuracy DGPS. More information is available on at the NDSU Ag & Biosystems Engineering Department website at www.ageng.ndsu.nodak.edu/.