

GPS/GNSS Technology in Agriculture

Gazing across the Field

The agricultural landscape changes quickly. Location information used to be gained by simply gazing across the field and looking for landmarks. Record keeping was performed in a notebook that was kept in a shirt pocket, and guidance meant paying careful attention to tire tracks and following those track marks with each pass in the field. Reporting information to various parties was done mainly on the honor system and by memory. The industry has come a long way, and many farmers are reaping the benefits of the technological advances that lead to precision agriculture (precision ag).

By Job van Haaften and Emily Harringa



Seeding with AutoTrac.

According to Emily Harringa from John Deere: “John Deere has long been the leader in introducing new and innovative ways in which farmers can work their fields more efficiently, ultimately saving time and money. As an early adopter of Global Positioning System (GPS) technology and in partnership with wholly owned subsidiary, NavCom Technology, John Deere’s precision ag equipment has changed the way farmers do business.” The GPS technology from NavCom ranges from centimeter RTK accuracy to the base-station-free global decimeter accuracy of StarFire. John Deere Ag Management Solutions (AMS) incorporates this GPS technology to create solutions specifically designed for agricultural vehicles and applications.

Automatic Guidance

“The GreenStar AutoTrac Assisted Steering System is a perfect example of an investment with quantifiable payoff.” This automatic guidance system can be installed on a tractor, combine or sprayer, and it actually drives the equipment in perfectly parallel field rows according to the precise GPS location information. The driver indicates where a field begins via the user interface and drives the perimeter of a given field. Parallel tracks, or ‘virtual’ boundaries, are then laid out on the GreenStar display per the GPS location information and the vehicle is guided accordingly. Users need only to manually turn at field boundaries.

The latest innovation, iTEC Pro, builds on the

AutoTrac foundation by giving users the ability to use their GPS boundary maps to determine when to turn at the end of a field pass, and the vehicle turns itself. In addition to the turning capability, implements are controlled and appropriate ‘end of row activities’ are performed automatically. “For example, an operator pulling a planter with no precision ag technology would have to go through several manual steps at the end of a row: 1) determine the end of the row 2) shut off planting 3) raise the planter 4) turn the machine and implement 5) line up the equipment to the next appropriate row 6) lower the planter and finally 7) resume planting. All the time, the user is also looking back to ensure the passes are in-line with previous row. iTEC Pro performs all of these functions automatically.”

Payback

Incorporation of this technology results in more accurate passes by reducing or even eliminating skips and overlaps. Additionally, inputs such as seed or chemical are saved and not wasted on any overlapping passes. When fuel costs are taken into account, farmers can achieve one-hundred percent payback on their investment in just a few seasons.

Damaged Markers

When researching precision guidance, an often overlooked value is how users feel when they use it. When not having to concentrate on the somewhat monotonous task of driving straight rows and not having to manually perform end of row tasks, people just feel better at the end of the day. Before the introduction of the GPS enabled AutoTrac system, drivers would have to rely on finding the physical markers which would often get damaged. “With the implementation of GPS, drivers are no longer straining to see the next marker, they experience less fatigue which allows them to work longer hours (of particular importance during the optimal harvesting period) and can even work into the night. When such technology is introduced, inexperienced people can drive equipment with the accuracy of a seasoned professional and that provides the farmer with more options when allocating drivers to tasks.”

A number of options are available for precision agriculture to best suit the needs of

Signal Option	Application Example	Accuracy*
StarFire SF1	Tillage Pull-Type Spraying Air Seeding	+/- 30 cm (15 Min. pass to pass, 95%)
StarFire SF2	Seeding Self-Propelled Spraying Broad-Acre Harvesting	+/- 10 cm (15 Min. pass to pass, 95%)
RTK Extend	Strip-Till / Inter-row cultivation Bed forming	+/- 2 cm to 10 cm
RTK (Real Time Kinematic)	Strip-Till / Inter-row cultivation Bed Forming	+/- 2 cm Repeatable

**Measured at the receiver*

farmer's applications. While guidance accuracy is dependent on the type of GPS signal being used, the decision of which guidance accuracy to choose is largely dependent on the type of operation being performed. The chart below is an example of typical farming applications and their respective required accuracies.

Allowing users the option to achieve greater accuracy as their needs change over time, the GreenStar guidance system provides "scalable accuracy" whereby a simple upgrade from the StarFire SF1 signal to SF2 delivers the higher accuracy signal to the existing equipment. The core hardware required to run the system (StarFire iTC position receiver, GreenStar dis-

Inputs such as seed or chemical are saved and not wasted on any overlapping passes.

play with AutoTrac activation) remains the same.

Invaluable Information

Aside from automatic guidance and steering, the adoption of GPS technology offers farmers a means to capture invaluable field and crop information that would otherwise be burdensome or inaccurate. Farmers are constantly challenged to maintain their profitability in a global marketplace while maintaining solid environmental credentials. One method to deal with profitability challenges is to learn more about each field from the beginning of the season to the very end. This helps operators evaluate what to do differently from one year to the next. It has been proven worthwhile to maintain detailed records for each field: how the soil was prepared, what seed was planted, what the weather was like, what chemical was applied, who performed the application, when harvesting started and ended and finishing with calculating yield. All of this information helps farmers make better management decisions for their operation.

"Today, this data can be collected with little effort when precision ag is incorporated. Again, using GPS to determine field location,



iTC StarFire Receiver.



Combine with AutoTrac.

users can enter individual seed, chemical or crop information and save to a memory or data card. While in the field, users can see, in real time, exactly what is being performed via the in-cab display. With most user interfaces, including the GreenStar display, operators can enter information for different fields, while continuing to perform tasks on the current field. This saves time when the set-up work for the next field is already done.”

Share Information

Environmental standards are more stringent and government agencies are increasingly more interested in the day-to-day activities of farming. For this reason, keeping accurate, up to date records of all aspects of a farming operation is even more important. “This is another way in which precision ag is a valuable tool. Using the information collected in fields, users can create reports and maps to provide to these agencies to prove compliance with chemical application regulations, for example. Just the capability to share infor-

mation is useful when working with external companies who may do soil sampling or custom spraying.”

For farmers who choose to do most of the data collection and organization from their office instead of in the field, there are options for them as well. “GreenStar Apex Farm Management Software is a desktop software designed specifically for farming operations. Users take the data card or compact flash card directly from the GreenStar display, and download all field and operation data directly to their personal computer. From there, they can view the data they collected, create maps,

build specific reports, write prescriptions for applications and much more. Those users who utilize a guidance product like AutoTrac can even create the GPS lines their equipment will follow when they go back to the field.”

“To say that incorporating precision ag is convenient is an understatement. Many growers, operators and farm owners find it to be invaluable in an age when information about a farm is as important as the crops the farm produces. Companies like John Deere recognize this need and provide the necessary technology to get the job done quickly and efficiently, while maintaining the standards that farmers deserve and expect.”

Notes:

GreenStar AutoTrac and iTEC Pro for precision agriculture are available globally through John Deere Dealerships. StarFire and RTK GPS products and services for non-agricultural markets are available globally through NavCom Technology Dealerships.

Job van Haften (jvanhaften@geoinformatics.com) is editor of GeoInformatics. Special thanks to Emily Harringa, Communication Specialist, John Deere Ag Management Solutions. More information on www.navcomtech.com and www.deere.com.



GreenStar Display.