

TIMELY INFORMATION

Precision Agriculture (PA)

Application of CORS in Agriculture

Continuously Operating Reference Stations

A Continuously Operating Reference Station (CORS) is a static, survey-grade GPS receiver which is permanently positioned at a known geographic location. These receivers are generally mounted on a public building with a solid foundation and collect data 24 hours a day, seven days a week. Coordinated by the National Geodetic Survey (NGS) of the National Oceanic and Atmospheric Administration (NOAA), CORS sites provide Global Navigation Satellite System (GNSS) measurements in support of 3-dimensional positioning activities. NGS supports a network of CORS sites throughout the United States which can provide centimeter level horizontal and vertical position accuracy, relative to the National Spatial Reference System¹. Current sites can be identified by visiting the NGS CORS website (www.ngs.noaa.gov/CORS/) with Alabama sites and information located at aldotcors.dot.state.al.us/SpiderWeb/frmIndex.aspx.



Figure 1. CORS GPS receiver mounted on top of a building in Courtland, AL.

CORS data can be used for Real-Time Kinematic (RTK) applications, meaning that the station provides continuous correction data to roving GPS receivers with internet accessible capabilities. The GPS correction data is typically transmitted at 1-Hz through the internet. Therefore, a GPS system utilizing a cellular modem can obtain the correction data which in return provides centimeter level position accuracy within a short range of the CORS station (1 to 30 miles depending on terrain and other operating conditions). The raw correction data is also archived and made available via the internet for post-processing of GPS data for static surveying, mapping and remote sensing projects. Access to this data is provided through the NGS User Friendly CORS page, www.ngs.noaa.gov/UFCORS/.

CORS Users & Applications

The benefit of a CORS site or network is the ability to provide accurate, repeatable position data free of charge² permitting users to return to the exact same locations over time. Data collected from CORS sites has a wide array of uses. For example, CORS data can be used for monitoring coastal subsidence, surveying, determining the amount of precipitable water vapor in the atmosphere, recording and locating utility lines, and machine guidance for construction and precision agriculture. Users include local, state, and federal government, transportation, construction, emergency management, homeland security, surveyors, education, natural resource, and agriculture.

CORS in Agriculture

The use of CORS in agriculture is unique.

Agriculture equipment equipped with an internet accessible cellular phone or modem (with internet data package) and RTK-level GPS equipment can utilize the around-the-clock data output for their GPS correction signal. Traditionally, base stations have been required for growers to implement RTK-level accuracy for auto-steer systems in their farming operations. These base stations (at a cost of approximately \$12,000 per station or more)

can potentially provide up to a 6-mile coverage radius requiring direct line-of-sight to the base station. In most cases, farmers must move the base station to obtain full coverage of their farm. However, a CORS provides extended signal range (with no line-of-sight required; only cellular coverage), accessibility by a wide range of users, and reduced investment costs for RTK-level technology (i.e. auto-steer systems). Grower applications include planting, harvesting, spraying, controlled traffic, and drip irrigation installation. Therefore, **benefits** include:

1. Reduced investment costs for RTK guidance systems
2. No base station maintenance and movement
3. Free² RTK level correction (mobile phone or modem with internet data plan required)
4. Extended coverage range

In March 2008, ACES facilitated a partnership between Lawrence County, Alabama farmers, the Alabama Department of Transportation, the Lawrence County Board of Education and Alabama commodity groups for installation of the first CORS site designated for agriculture. While the site remains accessible to the public, the primary users have been Alabama producers, making it the first of its kind in the nation. Current research, sponsored by the Alabama Wheat and Feed Grain Committee and the Alabama Cotton Commission, is being conducted by ACES and Auburn University personnel to focus on further utilizing CORS for agricultural applications.

¹ National Geodetic Survey – CORS website, December 10, 2008; www.ngs.noaa.gov/CORS/What_is_CORS.html

² CORS is currently free of charge in the state of Alabama. Other states may impose a fee for the use of CORS.

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Figure 2. Tractor equipped with RTK GPS receiver and internet accessible cellular phone which receives real-time GPS correction signal from a CORS site in Lawrence County, Alabama.