



WHY A **MULTI-GNSS**
CAPABLE **GNSS**
RECEIVER

**IS A MUST HAVE
IN AGRICULTURE**

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GNSS (Global Navigation Satellite Systems) technology has been a key enabler of Precision Ag technology for more than 20 years. While the continuously increasing accuracy allows for new applications and use cases, another crucial factor is the availability of reliable positioning in different field conditions and at various times of the day.



Available and reliable GNSS positioning under all conditions is key for Precision Ag technology

One major trend observed in the Precision Ag market is the adoption of multi-GNSS technology for satellite-based positioning. While initial satellite systems were limited to the US-based GPS (Global Positioning System), there are now four global systems in operation:

1. **GPS.** A satellite navigation system operated by the United States Space Force, consisting of up to 32 satellites providing global coverage as they are orbiting the Earth.
2. **GLONASS.** Launched at around the same time as GPS, the Russian operated GLONASS constellation includes 24 satellites. In contrast
3. **Galileo.** The Galileo satellite constellation is operated by the European Union. Once fully deployed it will include 30 satellites that, like GPS, will provide an even coverage globally.
4. **BeiDou.** The BeiDou system, operated by China, has been launched in phases. BeiDou phase 3 uses 27 satellites that provided global coverage, and

to the GPS, GLONASS provides a slightly higher number of satellites visible at latitudes between 45 and 70 degrees, compared to the equatorial region.

another 8 satellites which remain over the Eastern hemisphere to provide increased coverage at the longitudes which provide coverage over China. It makes this system unique since it has both a global and regional component.

In addition to the global systems, there are two Regional Navigation Satellite Systems referred to as RNSS:

QZSS. Japan's QZSS consists of 4 satellites orbiting over Japan and Australia, with the future expansion option to include 3 more satellites in similar orbits.

IRNSS. India's NavIC (IRNSS) constellation includes 8 satellites providing coverage over India.

It becomes obvious that there are many available satellites in orbit and many GNSS receivers are ready to take advantage of them. According to the European Global Navigation Satellite Systems Agency (GSA), between 2016 and 2020 there was a significant shift from single and dual-constellation receivers to true multi-GNSS receivers tracking all four GNSS systems. In 2016, true multi-GNSS precision receivers

accounted for only 30% of the products offered. By 2020 the number had grown to over 70%. The Hemisphere A631 Smart Antenna falls into this category, tracking all four available GNSS systems in its default configuration.

With a specific focus on Agriculture, GSA reports that "GNSS has become an integral part of smart, connected and integrated farm management solutions and a key driver for precision farming across the whole crop cycle." GNSS technology is a central element when implementing site-specific farm management practices. The ability to gain access to multiple satellite constellations increases the accuracy and dependability of an Ag system. Operators can now benefit from the power of multiple satellites working together to create the most accurate global positioning solution possible.

Receivers used in agriculture without true multi-GNSS precision, are at risk for limited positioning availability, especially in challenging environments. This may cause potential signal interruptions and disrupt the availability of Precision Ag technology for farming operations.

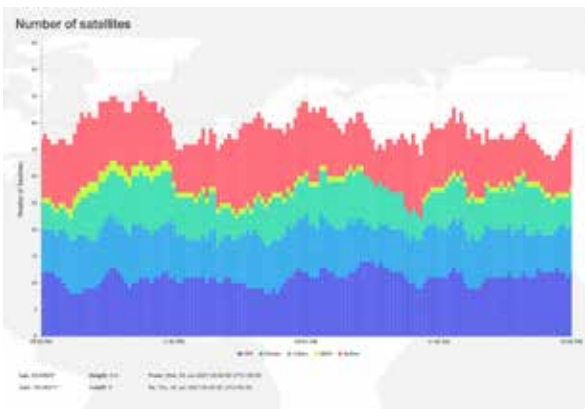


Challenging GNSS environments due to canopy obstructions while operating Agricultural machinery



Topographic conditions in rural areas can impact the availability of GNSS signals during Agricultural operation.

By description, the agricultural outdoors environment brings several challenges and limitations for GNSS positioning, linked mostly to the conditions where those agricultural operations are conducted. One of the main problems is the impact of natural (i.e., tree canopy) or man-made (i.e., buildings or other reflective surfaces) obstructions. But also, areas with specific topographies, interference, can impact the signal availability. The mounting location of the GNSS antenna on an agricultural vehicle or implement can emphasize multipath effects and limited GNSS signal availability. It is also important to consider the transfer of Ag vehicles and implements in between fields at higher speeds than are typically common during farming operations.



Number of available GNSS satellites over a 24-hour period for the Hemisphere GNSS location in Hiawatha, KS

To solve this issue, you can overcome the identified limitations by using complementary technology. This is where the availability of multiple global GNSS positioning systems comes into play. The Hemisphere mission planning tool shows the number of available satellites for a set time. In the example below, we have plotted the number of available satellites for our Hiawatha, Kansas location over a 24-hr. time window. It shows that a receiver that can only utilize the GPS system (or GPS satellite constellation), is limited to work with 7 to 13 satellites during the day. While a true multi-GNSS receiver can utilize on average 35 satellites in this location, at certain times of the day even over 40 satellites.

In this case, the increased number of tracked GNSS signals (GPS, Galileo, Glonass, BeiDou), as provided by the latest Hemisphere GNSS technology used with the A631 Smart Antenna product, allows the receiver to overcome challenging conditions, and ensure a stable and robust positioning solution. For example, if a tree line blocks a certain part of the sky at the headland of the field, it can be compensated by additional satellite signals that are available outside of the blocked area where the receiver has a free view of the sky. This means that guidance, automated steering, and application control are not interrupted.

To take advantage of the full benefits for site-specific agriculture, accuracy and especially signal availability are essential requirements for the successful adoption of this technology with your products or operation.



Hemisphere GNSS A631 Smart Antenna with multi-GNSS technology

The latest Hemisphere GNSS technology used with the A631 Smart Antenna is your path to true multi-GNSS positioning and allows you to make the most of your Precision Ag technology. To learn more about the A631 Smart Antenna and its benefits along with all the Hemisphere technology, visit the HGNS website at hgns.com. Reach out to us, or contact your local Hemisphere Dealer today!



8515 E. ANDERSON DRIVE
SCOTTSDALE, AZ 85255
480-348-6380