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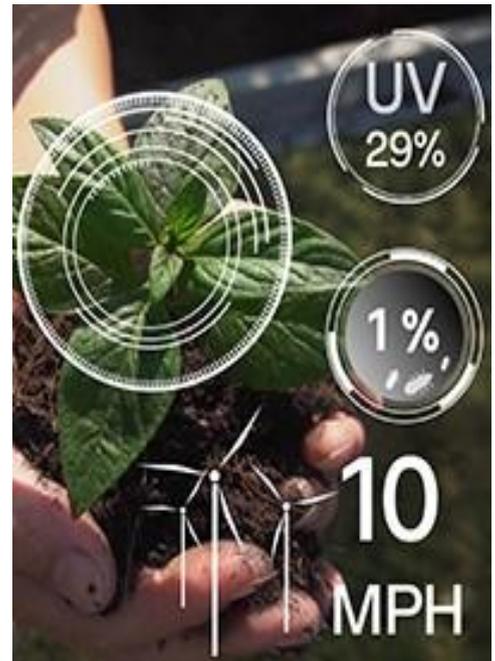
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Satellite Connectivity: A Game-Changer for Smart Farming

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Enabling Agriculture 4.0 With Satellite

Agricultural practices are largely the same today as they were in the 1970s. Back then, farmers oversaw the industrial agricultural revolution that brought high-yield crops, hybrid seed varieties, synthetic fertilizers, pesticides, and other mechanical infrastructures. The challenges farmers are facing today make the techniques of yesteryear obsolete. Issues like decreasing margins, increasingly complex regulatory requirements, greater scrutiny from consumers, growing complexity of machinery, and changing weather patterns that are increasing the incidence of droughts and extreme storms weigh on the minds of farmers looking to meet the yield needs of their customers.



We are now in the midst of another agricultural revolution to utilize connected technologies to help farmers make more informed decisions and optimize their operations through the collection and analysis of a myriad of data points on crops, conditions, and equipment. Perhaps the most game-changing of these digital innovations is connected heavy equipment, which allows farmers to control their large machinery, like tractors, remotely, as well as receive and transmit critical data on equipment performance. This cuts down on the hours required in the field, allowing the farmer to save money on staff and focus on improving yields.

Connected smart farms that employ “precision farming” require robust connectivity solutions to stream data from equipment to the cloud. There are over [570 million farms globally](#), many of which are located in rural locations with poor or spotty access to traditional connectivity solutions. Satellite

communications are giving farm owners, regardless of their location, the reliable connectivity needed to adopt connected equipment and bring on the next great agricultural revolution.

The Rise of Heavy Equipment for Precision Agriculture

Farms rely on large equipment for most of their operations, including cultivation, irrigation, harvesting, planting, and spraying pesticide and nutrients. Much of a farmer's time is spent manning equipment out in the field—often for over 12 hours a day—but new connected solutions can change that. Heavy equipment for agriculture is now being constructed with sensors built in and connectivity on board, allowing the farmer to remotely optimize and troubleshoot machinery while receiving real-time data inputs on the health of their equipment and crops. Already, semi-autonomous equipment gives farmers more freedom and this will be enhanced as they move towards fully autonomous equipment. Also, data transmission enables the monitoring of the machine health to reduce downtime and perform preventive maintenance, while remote repair can be operated. For farmers, this is the assurance of the optimal performance of their equipment at all times.

[Harbor Research](#) forecasts that the heavy equipment and machinery market for agriculture will reach nearly \$10 billion this year, growing to more than \$26 billion in 2030. Just over 37% of the farms in the U.S. had connected equipment last year and Harbor expects that to grow to more than 70% by 2030.

Companies like John Deere are leading the connected machinery market with products like their satellite gateway, which offers onboard telematics to monitor, control, and repair machinery remotely. John Deere's Precision Ag suite of tools includes data dashboards to monitor, analyze, and share data from anywhere. At the Consumer Electronic Show (CES) in 2022, John Deere released the 8R, its [first autonomous tractor](#). Connected and autonomous agricultural equipment will lead to more precise operations, more effective irrigation and reduced labor costs as farmers spend less time in the field and require less labor. Farmers will have more time to focus on real-time data rather than operating machinery. Data insights will allow farmers to make informed decisions, understanding potential outcomes up front rather than waiting an entire harvest cycle to see how their decisions pan out. It all translates to greater operational efficiency and higher yields.

With heavy agricultural equipment operating in rural environments, cellular or Wi-Fi connectivity doesn't cut it. A large tractor being operated remotely needs a reliable connection at all times to move past unexpected obstructions and keep work flowing smoothly. An interruption due to poor connectivity or bad weather can cause operations in a smart farm to shut down completely. [Satellite](#) solutions give equipment manufacturers the tools to build in reliable, redundant connectivity, while farmers can now retrofit existing equipment with compact satellite antennas. Connected Farming for a Changing Climate

Smarter, more efficient farms are arriving at a critical time. Agriculture is extremely vulnerable to our increasingly erratic and changing climate. Warming temperatures, extreme weather, droughts, floods, invasive crops, and pests are creating difficult and unpredictable conditions for farming. Paradoxically, agriculture is also contributing to the problem. Agriculture currently outputs [19 to 29% of total greenhouse gas emissions](#) - a number that is likely to keep going up without intervention to more efficiently run operations.

The environment isn't the only beneficiary of optimized farming. Today, about a third of the global food produced is [lost or wasted](#) despite nearly [9% of the global population](#), or 690 million people,

lacking needed nourishment. [Studies](#) show that by 2050, climate change could result in a 13% decrease of developing countries' wheat production and a 15% decrease in rice production. Connected equipment that allows farmers to more efficiently cultivate, irrigate, and harvest crops will help feed the hungry and prevent waste.

Global population growth, food scarcity, and economic insecurity will continue to put significant upward pressure on agriculture markets to produce sufficient levels of human food, stock feed, and biofuel. This has led to a drive for [Climate-Smart Agriculture \(CSA\)](#), an approach to managing crops, livestock, forests, and fisheries in a way that increases agricultural productivity and resilience while reducing emissions. This is pointing to not only the consumer demand but the global necessity for the integration of connected, intelligent technologies that lead to more sustainable, optimized farming.

The Autonomous Connected Farm and the Farmer of the Future

With connected farms sending over 10 terabytes per year in 2022—growing to 153 terabytes in 2032—the role of the farmer is beginning to evolve. Today's farmers, and the farmers of the future, must understand data analysis in addition to horticulture. With connected equipment and a growing number of autonomous equipment, farmers will spend less time doing manual labor and more time in the critical role of utilizing data to optimize farms for a more sustainable future. Fewer young people are entering agriculture than at any time in human history, but the evolving set of technology skills that smart farms require could very well change that. According to [Harbor Research](#), the agriculture market is conventional in terms of technology adoption, but the combination of consumer demands, climate change, and regulation is expected to drive greater adoption in the next two to three years. Connected and autonomous equipment will allow farms to operate with leaner staff, while the evolving role of the data-savvy modern farmer will attract new talent. Given the average age of farmers in the U.S. is [more than 57 years old](#), recruiting new talent and minimizing labor requirement is critical. For both small and large-scale farms, connectivity challenges have continued to be persistent, leading many farmers to drag their feet on embracing digital solutions. Rural internet access leaves much to be desired. This is particularly true in developing economies. In Brazil, [85% of its nearly 5.2 million farms](#) are small family establishments, often in rural locations. Yet they account for up to 70% of Brazil's food production. The number is similar in developed regions like the U.S., where [90% of its more than three million farms](#) are small family-owned and operated farms that generate 21% of food production. Satellite connectivity gives all farms equal access to technology solutions that can help them weather environmental, economic, and market instability. In the competitive landscape of agri-business, integrating connected equipment, automation, and analytics ensures competitive equity and healthy growth across the market.

Ensuring Reliable Connectivity with Satellite Communications

Satellite communications give farms the reliable connectivity needed to meet the requirements and challenges of an agricultural industry undergoing digital transformation. Geosynchronous satellite networks, whose satellites are located 36,000 km from the Earth's Equator, offer the assurance of robust connectivity, anywhere in the world, even in locations beyond the reach of LTE/5G coverage. And recent advancements—such as the integration of software-defined satellite technology and cloud infrastructure—combined with the merging of multiple orbits and groundbreaking innovations in terrestrial network technology, promise farmers true resiliency to ensure the “always on” connectivity they require for their heavy equipment to stay connected to the cloud and company networks. An

always-on connectivity that should, nonetheless, be secure. Satellite operators must protect farmers against cyber-attacks, by taking a systematic defense-in-depth approach that detects, prevents, and mitigates attacks, including third-party cybersecurity accreditation, but also annual penetration assessments and organization-wide control assessments.

Fully managed connectivity solutions such as Intelsat FlexMove can support a farmer's needs, regardless of the size of their farm or its location. Such a solution removes the complexity of dealing with bandwidth availability, configuration, and management of network infrastructure, giving farmers peace of mind. These include Communications-on-the-Move solutions that are specifically of interest for heavy equipment in the field, as they offer a simple equipment-mounted satellite antenna that automatically acquires a connection and maintains communication while it's moving. Farmers don't have to worry about a tractor losing connectivity and unintentionally running through crops or holding up operations. Farmers will also benefit from Communications-on-the-Pause solutions with highly compact and portable satellite terminals designed to automatically connect in a fixed location, enabling many smart farm solutions. These cost-effective, easy-to-install terminals can establish reliable connectivity in seconds, making them the perfect solution for connected farms worldwide. These fully managed connectivity solutions also accommodate the volatile world of agriculture with flexible, unparalleled service agreements.

In the competitive landscape of agri-business, integrating connected equipment, automation, and analytics ensures competitive equity and healthy growth across the market. Reliable and robust connectivity is key and satellite communications provide farmers the connectivity they need to operate, where and when they need.