Written Statement
of

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Before The

Subcommittee On
Technology and Communications
Committee on Energy & Commerce
U.S. House of Representatives

"Realizing the Benefits of Rural Broadband: Challenges and Solutions"

July 17, 2018

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Chairman Blackburn and Ranking Member Doyle:

My name is John May. I am President, Ag Solutions and Chief Information Officer for Deere & Company. Our company, better known as John Deere, is a global leader in the manufacture of agricultural, construction, turf and forestry equipment. Deere provides advanced agricultural and other equipment and services to customers that work the land to meet the world's dramatically increasing need for food, fuel, fiber and infrastructure.

For 181 years, John Deere has been helping farmers get more production from their fields, and do so in the most efficient, sustainable manner possible.

Technology is a big part of agriculture in general, and the John Deere story in particular. It's the key to helping farmers be more successful and making sure they can meet the world's need for food and other agricultural goods in the future.

And, as I will discuss, broadband is a big part of leveraging all that this technology has to offer.

Agriculture's Technology Evolution

Our industry's technological march can be divided into four categories – Farming 1.0, 2.0, 3.0 and 4.0.

The first phase involved using implements such as John Deere's original steel plow, propelled by draft-animal power;

The second phase – which started roughly 100 years ago -- involved using power equipment such as early tractors or threshers;

Agriculture 3.0 – which dates back about 20 years -- refers to the use of guidance- or GPS-based systems, which introduced new levels of precision into farming operations.

The fourth phase, where we are today, refers to the advantages of connected farming, in which planting, spraying and harvesting decisions are determined by computer-generated prescriptions.

In this phase, we are seeing the emergence of productivity-boosting concepts such as artificial intelligence and machine learning. These technologies have game-changing promise in terms of improving yields and making more efficient use of fertilizers, herbicides and other chemicals.

The continued evolution of technology in agriculture is critical. Why?

Global demand for agricultural output – which has more than tripled since 1960 -- shows no signs of easing. Given forecasts of global population growth and dietary improvements, farm output will need to roughly double from 2000 levels to meet projected demand in 2050.

These output gains will need to take place with essentially the same amount of land and water we use today, and with even less labor. For this reason, continual improvements in agricultural productivity are essential.

And, in many cases, the technologies that will produce these gains depend on the delivery of reliable broadband connections to farmers in the field. The fact is, farmers need reliable internet access to capitalize on the great technological advancements that modern farm equipment offers.

Many farmers, however, cannot do so today.

The extent of the broadband access problem for agriculture is difficult to define. We know, for example, the rate of successful connections between our John Deere customers and our data management platforms. That tells us that there are missed opportunities for producers to fully leverage the benefits of their data. But we don't know the extent of successful connections experienced by producers using other platforms. And we don't know about connections that are never made because the producer, knowing he has poor coverage, never invests in the technologies and solutions that could improve his productivity.

The nature and extent of this problem is exactly why federal broadband policies and programs should focus on the needs of farmers and ranchers. Without a better understanding of the problem, we can't begin to design the right solutions.

Precision Agriculture

When we talk about precision agriculture, we mean the use of data and technology to increase the productivity and profitability of agricultural operations, such as row crops, livestock, aquaculture, dairy, forests and orchards.

The introduction of data-driven insights and decision-making have transformed agriculture into a technology-driven sector that is more and more dependent on access to broadband. GPS-enabled precision steering systems, modems, sensors, third-party and cloud applications, and powerful in-cab and farmhouse analytic and mapping programs comprise the highly specialized systems that make up modern agricultural operations today. Agricultural equipment has evolved into a mobile data platform used to receive, use, sense, store and transmit data as an essential part of the producer's performance. The "Internet of Things" in rural America includes not only smart meters and appliances, but also smart tractors, combines, and production systems. We see the adoption of information technologies and services in agriculture as no less

transformative than the introduction of self-propelled machines to farming a century ago.

Today, farmers can plant seeds and apply chemicals to within a few centimeters of accuracy thanks to innovative GPS-enabled positioning systems that are now standard on virtually all modern farming equipment. Using wireless broadband connections, advanced agricultural equipment and services now include technology that generates real-time agronomic data for analysis. This allows farmers to optimize the precise amount of seed, fertilizer and pesticides needed; reduce costs for fuel, labor, and water; and identify best practices for fields in any given location.

What's more, producers use these technologies and wireless connections to communicate with their customers and vendors. They can request machine diagnostics remotely, follow commodity markets, receive real-time information on weather and field conditions, manage their fleets, and achieve regulatory compliance. Access to mobile broadband services also lets farmers employ innovative machine-to-machine operations in the field and machine-to-farm data transfers from the field. This improves real-time decision making and cost management.

Precision technologies are also positive for the environment and help farmers operate in a more sustainable manner. They promote the more efficient use of water, fertilizer, herbicides and fuel by allowing producers to tailor farming practices and applications to the conditions of an individual field.

The Importance of Mobile Broadband

Without reliable, extensive wireless broadband connections, many of these benefits cannot be realized. Real-time connections allow machines to sync up in the field, have remote access to in-cab displays, gain access to planting, application and yield data, adjust variable-rate prescriptions and consult with advisors while in the field. Digital connections also enable section control and prevent over-application of fertilizers and pesticides. And they allow for remote

machine diagnostics that can identify and resolve machine performance issues at an early stage. In other words, mobile wireless broadband helps farmers reduce downtime, optimize assets, curb costs, and increase yields.

As a matter of public policy, Deere believes the necessity of connecting agricultural lands is clear: Indeed, the agricultural sector's ability to meet the rising global demand for food will depend on continuous improvements in farm productivity, efficiency, and sustainability. And it is only through the intensive use of data and technology that farmers will be able to make these improvements.

A range of technologies can contribute to meeting the need for rural broadband on agricultural lands. Fiber optic facilities, satellite and fixed wireless services can play a role in meeting demand for broadband service on ag lands. Even low power unlicensed services may have the potential to meet certain needs on ag lands. However, none of these technologies alone is sufficient, and it is clear that cellular mobile services are essential to addressing the need for high speed broadband on ag lands. Cellular technology is uniquely suited to certain smart farming applications that require full mobility, superior coverage and throughput, particularly in areas not otherwise served by fixed facilities.

John Deere commends the Energy & Commerce Committee's approval of H.R. 4881, the Precision Agriculture Connectivity Act. Along with our partners in the Agricultural Broadband Coalition, John Deere has endorsed this bill. We see it as an important first step in getting the FCC and USDA to work more closely together to address the agricultural-broadband issue. We are hopeful this legislation will be enacted this year, either as part of the Farm Bill or on its own.

We also believe federal agencies with broadband-deployment mandates should view access through an expanded lens -- one that incorporates a geographic and functional usage metric, as opposed to looking only at population centers. In our view, broadband access on active croplands should be included as a metric for identifying areas where broadband infrastructure investment is most needed. Cell towers are, for the foreseeable future, the key

for delivering high-speed LTE terrestrial signals, and we need more of them in croplands and ranchlands.

Farms represent a significant center of commercial activity in rural communities. Owners, employees, buyers, vendors and service providers all conduct business in and around farming operations. By supporting increased wireless broadband deployment in areas where most farming operations occur -- in the fields -- rural communities and the U.S. economy will benefit through increased economic growth, improved environmental stewardship, and enhanced food security.

The Future of Farming

Deere believes that precision agricultural practices in use today are laying the foundation for the future of farming: a continually smart, evolving and more efficient farm. Key technologies advancing this future include Artificial Intelligence, or AI, and Machine Learning.

Deere is investing to bring AI and machine learning to the farm. Through our recent acquisition of Blue River Technology, we are exploring the use of cameras, computers and AI to allow machines to see every plant in a field. This will allow more precise application of herbicides or fungicides, potentially reducing the use of chemicals in the field by up to 90%.

Another application, introduced in our newest combines, is ActiveVision - the use of embedded image processing so that the combine understands how it's performing and automatically adjusts settings to maintain optimal performance.

In the next several years, we see several key developments taking place that will deliver more intelligent and productive equipment to customers, including higher degrees of automation, and machines being able to react intelligently in a second or a millisecond.

In short, agriculture's tech evolution is moving rapidly. Decisions once made at the field-level are evolving to section-level, row-level, even to the plant level.

In each and every case, these technologies need reliable access to broad-band internet connections in order to be effective.

Conclusion

John Deere's higher purpose, or mission, is to help people live better lives through our commitment to those linked to the land.

We take this mission seriously, as we have for many generations.

We are demonstrating it today in the many ways we are developing and utilizing technology and solutions – almost all of which are digital in nature and internet-based -- that will help feed the world in a sustainable manner for generations to come.

Thank you. I look forward to your questions.