Smart Agriculture: Increasing Productivity through Technology

NTIA Webinar Series

You must dial in to hear the webinar!
Conference Line: 800-593-7190 Passcode: 984-4951#
Helpful Information

Questions

• Please type questions in the Q&A box on the right hand side of the screen. Questions will be taken after the final presenter.

Presentation

• The presentation along with a transcript and recording will be available on the BroadbandUSA website within 7 days following this webinar under Events.
• (https://broadbandusa.ntia.doc.gov/past-event)

Audio

• Please dial in to hear the webinar: 800-593-7190 Passcode: 984-4951#
Participants

Moderator
• Don Williams, Senior Specialist for Broadband Development, BroadbandUSA, NTIA

Presenters
• Mark N. Lewellen, Manager of Spectrum Advocacy, John Deere
• Aaron Ault, Senior Research Engineer for the Open Ag Technology and Systems Center, Purdue University
• John Selep, President of AgTech Innovation Alliance
Presentations

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Smart Agriculture: Increasing Productivity Through Technology
Our Cropland Needs Mobile Broadband
June 2018 Mark N. Lewellen, John Deere
Megatrends & Key Drivers in Agriculture

Today & Tomorrow

- Growing demand for more food, feed, and fuel
- Global markets and more volatility
- Farm size growth and specialization
- Environmental sustainability and compliance
- Reduced skilled labor
- Precision agriculture
Why Precision Agriculture?

Yield & Cost Optimization

Smart Use of Resources

Challenge of Regulation
Technology Evolution in Agriculture

- **Early 2000s Guidance Systems**
- **2006-2011 Precision Farming**
- **2012 and Beyond Coordination Enabled by Telematics**
Today’s Farming is Extremely Complex

- Tillage
- Nutrients
- Residue

- Seed Variety
- Depth
- Spacing
- Timing

- Pesticides
- Fertilizers
- Timing
- Accuracy
- Waste

- Weather
- Storage
- Commodity Prices
- Yield loss

Did I make the right decisions?
The Star of the Show: StarFire™

Guidance Systems  The “Precision” in Precision Ag Technology
Precision Planting* (and Spraying and Harvesting)

*Relies on High Precision GPS
Field Preparation – Every Inch Matters
Water Optimization
Production Efficiency
What is Telematics Anyway?

- Provides previously unknown insights on how the machines are used
- Improved Dealer Services to customers especially in the area of machine availability/uptime through Expert Alerts
- Use the data to predict and prevent downtime
- Predict conditions which lead to fault and correct before fault occurs

No unplanned downtime is one goal
Cellular

Features (current and near-future):

- **Remote Display Access** – PC to In-Cab display anywhere
  - Highest data rate, pseudo real-time, ~1MB/sec preferred
- **Wireless Data Transfer** – File transfer to/from Deere host servers
  - Background transfers, ~20KB/sec
- **Service ADVISOR Remote** – Remote diagnostics
  - Background transfers, ~10-500MB payload size
- **JDLink Telematics** – Machine data (100's-1000's of parameters), breadcrumbing
  - ~2KB/sec, 8MB/hour
- **DataSync/MapSharing** – Coverage map sharing in field
  - Pseudo real-time, needed during active farming ops
  - ~2KB/sec, 8MB/hour
- **Mobile RTK** – RTK GPS corrections
  - Low data rate, high criticality
  - ~300B/sec, ~1MB/hour

Most of the features above work very well with the 3G speeds (100KB – 350MB). Our drive testing on 4G LTE indicated speeds of 125KB-1.25MB. There are higher protocol maximums for 3G/4G, but our drive testing rarely shows those rates in more rural areas. Very coverage dependent.

Need better coverage at 3G speeds at a minimum.
What Are We Doing About It?
Relevant Federal Programs

Universal Service Fund (FCC)
• Established to connect rural America to the landline telephone network in the 20th century
• Evolved to reflect advances in telecommunications and information services
  o Connect America Fund: revised USF framework to distribute funds to address communications infrastructure challenges of today and tomorrow, i.e., rural broadband
  o Mobility Fund: wireless component of CAF, provides support for the expansion of mobile broadband networks in areas that might otherwise not be served

Rural Utility Service (USDA)
• Portfolio of loans, guarantees and grants to support telephone and (now) broadband infrastructure deployment
  • Long term loans not grants
  • Money must be repaid with interest
  • Funds must be used for Capital Expenditures, not Operations
Agricultural Broadband Coalition (ABC)
Agricultural Broadband Coalition (ABC)

Supports Policies to:

• Speed the deployment of broadband infrastructure and services to rural areas -- including croplands and ranchlands -- where farming, ranching and other ag operations occur

• Ensure that the economic benefits of precision agriculture can be fully realized for U.S. farmers, rural communities and the national economy

• Improve U.S. ag productivity, efficiency, and sustainability
ABC Engagement at the FCC

• Several active FCC docket addressing USF reforms and RBB needs assessment:
  o Recognize needs of U.S. agriculture sector
  o Introduced “cropland” as an eligibility metric for assessing unserved, underserved areas

• Maintain, enhance Mobility Fund component of CAF
  o Support ‘middle mile’ facilities
  o Support M2M services
  o Revise RBB deployment assessments to go beyond “households”
Federal Advisory Groups under FACA

- FCC – Broadband Deployment Advisory Committee
  - Developing State and Municipal Model Codes
  - Some interesting insights came from the Navy

- NTIA – Commerce Spectrum Management Advisory Committee (CSMAC)
  - Advocating for rural 5G policies in addition to the capacity building ones in urban areas
Iowa 2015 Rural Broadband Expansion

Iowa Governor Terry Branstad signing Rural Broadband Expansion Bill into Law
“Connect Every Acre”

The signed bill includes the following initiatives:

- Provides for the coordination and facilitation of broadband access in targeted services throughout the state
- Establishes a grant program to that prioritize connecting Iowa farms, schools, and communities
- 100% property tax exemption for 10 years for fiber optic infrastructure investment in targeted service areas
- Creates uniform rules and limitations for wireless communications facilities and infrastructure pertaining to cell towers
- Tasks the office of the Chief Information Officer to lead and coordinate the installation of fiber optic conduit where it does not currently exist
New Nebraska Broadband Legislation

Nebraska Senator Curt Friesen introduced new legislation to:

1. Create a rural broadband task force
2. Allow the State’s Public Service Commission to implement a reverse auction program for service providers in unserved or underserved areas
3. Establish and a registry of locations within the State of Nebraska for complaints about lack of wireless coverage
4. Instruct the Commission to annually prepare and publicize a report describing the areas of the state not receiving adequate wireless service

Nebraska is “All-In” on Agriculture
Precision Agriculture Connectivity Act of 2018

• Legislation introduced last Thursday afternoon in both the US House and Senate

• The bill creates a Task Force within the Federal Communications Commission to work with USDA, other government and private stakeholders:
  o to assess the unique broadband connectivity needs of ag producers
  o identify existing service gaps on croplands and ranchlands, and
  o make policy recommendations to improve broadband (wired and wireless) to address these gaps

By its introduction, the bill signals to the FCC that Congress believes broadband connectivity for precision ag should be a priority
Precision Agriculture Needs Two Things:

1. GPS Technology and
2. Connectivity: Cell Towers over Cropland

Better Machine Performance

Better Job Performance

Better Agronomic Decisions
Presentations

• Mark N. Lewellen, Manager of Spectrum Advocacy, John Deere

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• John Selep, President, AgTech Innovation Alliance
Smart Ag: Tech and Data in Agriculture

http://oatscenter.org/
http://openag.io
http://trellisframework.org
http://isoblue.org

Aaron Ault – ault@purdue.edu
Background: Aaron Ault

Farmer

Computer Engineer

Purdue OATS

Beef

Corn, Beans, Wheat
OATS

Enable: Strategy, Conversation, Collaboration, NIH Vaccine

Provide: Marketing, Education, Administration, Research

Build: Projects, Talent, Community, Demand

Research Demand NIH Vaccine
Many thanks to our generous supporters:

ADM, Ag Gateway, Centricity, CNH Industrial, Foundation for Food and Ag Research, Infosys, Purdue University, Produce Marketing Association, Primus Labs, Winfield United, Wilson Produce
Open Source = Fast Innovation
Livestock Treatments App

Code: [https://github.com/aультac/treatments](https://github.com/aультac/treatments)
Live: [https://aultac.github.io/treatments/](https://aultac.github.io/treatments/)

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1,400 lines of my code
20 hours of work

296,022 lines other people's code
764 open source libraries
Lilly approves almost $40M grant to make the area global 'epicenter' in ag, manufacturing

Shannon Hall, Journal & Courier  Published 6:36 p.m. ET Dec. 18, 2017

3 Pillars for Ag and Industrial IoT

Next-Generation Manufacturing

Digital Agriculture

Regional Cultivation Fund

Testbeds, Education, Research, Adoption
What Farmers Want from Data

Data should flow

from whatever source a farmer has

into whatever tool a farmer wants

without manual intervention
What Farmers Want from Data

Data should flow from whatever source a farmer has into whatever tool a farmer wants without manual intervention.
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Data should flow from whatever source a farmer has into whatever tool a farmer wants without manual intervention.
What **EVERYONE** Wants from Data should flow from whatever source a farmer has into whatever tool a farmer wants without manual intervention
What **EVERYONE** Wants from Data

**automation**
Connection-based Architecture for Automated Data
Connection-based Architecture for Automated Data

MachineHealth.com

fields, yield machine info

yield

OEM cloud

yield

OATS
Connection-based Architecture for Automated Data

MachineHealth.com
Connection-based Architecture for Automated Data

- MachineHealth.com
- Field Sensors
- Benchmarking Service
- University Data
- Recommendations Service
- Farmer's Cloud of Choice
- OEM cloud
- Logistics Management Service
- fields
- yield
- machine info
- fields
- yield
Connection-based Architecture for Automated Data

MachineHealth.com

Field Sensors

OEM cloud

Farmers Cloud of Choice

University Data

Recommendations Service

Co-op

Logistics Management Service

fields, yield, machine info

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yield

fields

yield

fields
Connection-based Architecture for Automated Data

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- Recommendations Service
- Farmer's Cloud of Choice
- Co-op
- Blockchain
- Logistics Management Service
- OEM
- Cloud
- Machine
- Info
- Fields
- Yield
- QATS
Basic Abstractions For Data Automation

- API Connection
- (micro)service
- Storage/Cache
- Open Source Libraries
The Trellis Landscape

Certification Body → Auditor Mining → Certification Analytics → Traceability Team

Grower → Packer/Shipper/Processor → Distributor → Retailer

http://trellisframework.org
Thank You!

Aaron Ault ault@purdue.edu

Open Ag Technology and Systems Center
Presentations

- Mark N. Lewellen, Manager of Spectrum Advocacy, John Deere
- Aaron Ault, Senior Research Engineer for the Open Ag Technology and Systems Center, Purdue University
- John Selep, President, AgTech Innovation Alliance
Rural Broadband Connectivity & Precision Ag Technology

John Selep
Co-Founder, Strategy & Business Development; The VINE Community Founder and President, AgTech Innovation Alliance (AgStart)
Ag-&-Food Value Chain – Farm to Fork

Our global food system is a **Multi-Trillion-Dollar** enterprise, spanning an extremely diverse array of crops, cultivation practices, climate environments, and cultures.
Information Technology underlies our entire food chain

Insight:

Information Technology, and the connectivity that it requires, spans the entire length and breadth of our food system.

Connectivity is key to enhancing the productivity, efficiency, and sustainability of our global food system.
Critical Issues Threaten America’s Ag Leadership

- Labor
- Water
- Consumer Preferences
- Land, Energy & Economics
- Regulatory Compliance
Labor Shifts Crop Selection, Spurs Innovation

California’s challenges bring berry business to Mexico

IMMIGRATION ISSUES, LABOR SHORTAGE SEND CROPS SOUTH

By Tha Nguyen
McClatchy Foreign Staff

CITRUS-GOZONAS, Mexico – Mexico, already the world’s thirdlargest export of blueberries, raspberries, blackberries, and strawberries, is searching for ways to get US consumers to throw more fresh blueberries into the panache butter and keep more raspberries onto their fruit salads.

As long as US and other foreign consumers well down berries, Mexican proprietors of the industry say the surge will continue. And that’s more than just an agricultural oddly in a land better-known for fields of blue-green cactuses and patches of cactus. The growth of the berry industry has had major consequences on residents long affected by high unemployment and drug-related violence.

The industries, which didn’t exist just two decades ago, employ more than 200,000 people and make nearly $1 billion a year. And it’s still growing.

TECHNOLOGY

The future of farming: robots

LABOR COSTS DRIVE MOVE TO AUTOMATE

Two efforts are underway locally to help automate farming operations. A group of researchers in Davis is developing a robot to help kill weeds. And an Australian company is building an automated olive press in Woodland that will produce olive oil more quickly and with less labor than other.
U.S.-Wide Strawberry Source of Supply

U.S. Fresh-Market Strawberry consumption nearly tripled over the past 25 years, with California producing over 80% of U.S. supply.

However, import competition remains strong, with imports from Mexico growing over 10x in the same period.

By 2022, California strawberry production costs are expected to rise 30-40% as $15 minimum wage and 40-hour workweek (before overtime) takes effect.

Robotics & automation are needed to boost productivity.
California: 45% Drop in Stone Fruit Acreage

California stone fruit acreage has **dropped 45%** in 15 years driven by uncertain harvest-labor availability and changing consumer preferences.

California Stone Fruit Acreage 1991-2016 (000’s Acres)

Once a ‘Top-20’ California crop, peaches and other stone fruit could diminish further, unless a harvest labor solution is found. Robotics & automation are needed to boost harvest productivity.
Feds’ water cutoff slams Valley

FARMER’S DROUGHT
As rural regions struggle with epic dry conditions, lawmakers propose building a major new reservoir

Farmers face a bleak year

STATE ECONOMIC IMPACT IN BILLIONS OF DOLLARS LIKELY
By Dale Kasler

CALIFORNIA’S DROUGHT

Farmers: Drought takes toll on Valley residents

FROM PAGE AH

THE VINE
California: 80% of Global Almond Production

California produces 80% of global almonds by value, with almost a million acres in production. Mechanization has enabled dramatic growth in tree nut acreage, avoiding labor constraints.

2014 Global Almond Product Value (US$ B)

Top Almond Counties

source: U.N. Food & Ag Organization, fao.org/faostat (2014 data)
Mechanization has enabled dramatic tree nut industry growth, but water availability may constrain further growth.

Precision agriculture is needed to stretch a finite water supply.
The VINE represents a collaboration of the University of California, AgStart, and a range of incubators and accelerators across California. Like a grapevine, The VINE will connect clusters of innovation resources, making it easier for innovators and entrepreneurs to identify and access the resources they need.
A Collaborative Statewide Network of Resources for Ag-and-Food Entrepreneurs
Thank You!

REACH OUT TO ME DIRECTLY:

John Selep
John@TheVINE.io

TO LEARN MORE ABOUT THE VINE PROGRAMS, EVENTS & OPPORTUNITIES, PLEASE VISIT:

Facebook: @TheVINE.io
LinkedIn: The VINE Community
www.TheVINE.io
Don Williams, Senior Specialist for Broadband Development, BroadbandUSA, NTIA
Global Cities Team Challenge

• GCTC brings together
  • industry
  • universities
  • nonprofits
  • local and state government
to work on projects to share
knowledge and best practices on
smart community technologies

• National Institute of Standards and
Technology leads GCTC, in
partnership with NTIA, Dept. of
Homeland Security, National
Science Foundation, International
Trade Administration and others
Ag & Rural Supercluster – Objectives

Farmers & Ranchers
Help farmers and ranchers improve water efficiency, produce higher quality crops and raise healthier livestock, while making it easier to meet federal and state reporting requirements.

Rural Communities
Focus on projects to bridge the digital divide and close the homework gap, improve healthcare and the ability to age in place, improve economic development and spur innovation.

Results
Set of best practices and a replicable blueprint for other communities and partners to use.

If you are a community, city, company or university interested in participating in the Ag & Rural Supercluster, join us!
Ag & Rural Supercluster – Action Cluster

Agriculture
Looking at ways to streamline food sheds (supply chain, i.e., farm to table) and increase smart ag (crops, livestock).

Rural Communities
Potential collaborations to streamline and improve government services, education, workforce development and deploy regional approaches.

HealthCare
Collaborating on telehealth projects (wearables, data analytics, remote monitoring), telemedicine (physical and mental), blockchain, and cybersecurity.

Contacts:
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Jean Rice, Sr. Program Specialist, BroadbandUSA, NTIA, jrice@ntia.doc.gov
Smart Agriculture: 
Increasing Productivity through Technology

Questions and Comments

• Please type your questions in the chat or Q&A box.

• Slides and transcript will be posted on the BroadbandUSA website within 7 days after the webinar.

https://broadbandusa.ntia.doc.gov/past-event
Thank you for attending.
Tune in for the next Practical Conversations Webinar

Statewide Strategies for Rural Digital Inclusion
July 18, 2018
2:00 pm EST

Registration is required for each webinar:
https://broadbandusa.ntia.doc.gov/event
BroadbandUSA is available to help communities with their broadband access and digital inclusion efforts

BBUSA Resources:
- Implementing a Broadband Network Vision: A Toolkit for Local and Tribal Governments
- Community Broadband Roadmap Toolkit
- Guide to Federal Funding of Broadband Projects
- Using Partnerships to Power Smart Cities

For General Information:
- 202-482-2048
- broadbandusa@ntia.doc.gov
- https://broadbandusa.ntia.doc.gov/resources

To Request Technical Assistance (TA):
- Broadband TA Request Form
  - https://broadbandusa.ntia.doc.gov/ntia-common-content/how-we-can-help