

January/February 2017

RESOURCE

engineering and technology for a sustainable world

VisualChallenge6 Champs • AE50 Awards • Ethics Essay Winner • "Thirsty Land" Film Documentary



PUBLISHED BY AMERICAN SOCIETY OF AGRICULTURAL AND BIOLOGICAL ENGINEERS 

Stewardship: Using *all* the tools



My recent attendance at the 2016 World Food Prize in Des Moines and our Society's Engineering and Technology Innovations for Global Food Security conference in Cape Town reaffirmed for me the vital role our members play in stewarding the planet's resources. This issue of *Resource* highlights the AE50 Awards and the innovations that our profession contributes toward a

safer, healthier world. Working together, we make a difference in providing a growing population with adequate food, clean water, clean air, and sustainable energy.

While our formal training is in the math and science of engineering, we must also be aware of the social and political factors and public perceptions that affect how our technologies are implemented. We must follow the ethics of our profession and use the technologies we develop to benefit humanity. We must be willing to share what we know with the public and with policy makers to ensure that science-based decisions are made. Our input in the development of long-term agricultural policies, which are still lacking in many parts of the world, will be vital to achieving global food security.

The common thread of both conferences was that there is no single solution; we must use all the tools in our toolbox to feed the global population. One of those tools is genetic engineering, which relies heavily on our biological partnerships. It holds significant promise to supply adequate nutrients as well as adequate calories. Genetic engineering of staple crops can enhance water use and drought/salt tolerance to cope with climate change, improve disease and pest resistance, and improve the micronutrient content of the foods made from those crops. We cannot be against both hunger and technology if we are to achieve the goal of feeding the world.

Building on the success of the 2015 Climate Change conference and the recent Global Food Security conference, ASABE has begun planning a Global Water Security conference for 2018. This conference will advance ASABE's Global Initiative to create a sustainable world with abundant food, water, energy, and a healthy environment, building partnerships for greater impact.

To sum up, I'd like to share the challenge extended by Andrew Mude, recipient of the 2016 Borlaug Field Award. In his acceptance speech, Andrew invoked a higher authority to remind us of our moral obligation: "To those whom much is given, much is expected."

Let me know your thoughts at mherron@myasabe.org.

Maynard Herron, P.E.

events calendar

ASABE CONFERENCES AND INTERNATIONAL MEETINGS

To receive more information about ASABE conferences and meetings, call ASABE at (800) 371-2723 or e-mail mtgs@asabe.org.

2017

Feb. 13-15 **Agricultural Equipment Technology Conference.**
Louisville, Ky., USA.

July 16-19 **ASABE Annual International Meeting.**
Spokane, Wash., USA.

2018

July 29-
Aug. 1 **ASABE Annual International Meeting.**
Detroit, Mich., USA.

ASABE ENDORSED EVENTS

2017

Feb. 21-24 **45th International Symposium "Actual Tasks on Agricultural Engineering."**
Opatija, Croatia.

March 11-17 **International Fluid Power Exposition (IFPE).**
Las Vegas, Nev., USA.

Aug. 6-10 **CSBE-SCGAB Annual General Meeting.**
Winnipeg, MB, Canada.



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Congratulations AE50 Winners!

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ON THE COVER:

Smallholder farmer in Rwanda delivering milk to a dairy collection and processing cooperative on bicycle. *Visual Challenge* photo by John Lumkes.



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A Proud History

Resource magazine is pleased to sponsor the AE50 Award program, celebrating companies for their recent developments in agricultural, food, and biological systems. From the many entries submitted by year-end 2016, an expert panel selected 50 products for recognition. The award-winning products are those ranked highest in innovation, significant engineering advancement, and impact on the market served.

The products featured on the following pages represent the diversity of agricultural and biological engineering, as well as the variety of companies that continue to bring advanced technology and exciting innovations to the marketplace. This year's AE50 recipients join the ranks of many who have been honored for their ingenuity in product development—saving producers time, costs, and labor, while improving user safety as well.

The AE50 Awards had their beginning in June 1984, in a special issue of ASABE's *Agricultural Engineering* (now *Resource*), in which 25 new techniques, inventions, and innovations were showcased. The featured items were drawn from product information solicited by the Society and screened by



a panel of engineers. From this focus on identifying innovative technology, two years later the AE50 Award program was born. As the announcement stated, "Acceptance in the marketplace is the highest accolade any new agricultural product can receive. But for innovative developments in the last 12 months, a singular honor is to be named one of the year's Agricultural Engineering 50 outstanding innovations." Product nominations poured in. An enlisted panel of experts reviewed the entries, and in 1986 the first AE50 Awards were presented.

As *Resource* brings you the 31st year of the AE50 Awards, the interest in new technology and innovative applications of existing technology remains constant. Over the years, many award-winning products were patented and their names trademarked. Some were further improved as technology advanced, and with time, won another AE50. But the most important yearly constant: all winning entrants continually strive for excellence, and we are pleased to honor their work with the highest honor in the only awards program of its kind.

Congratulations to this year's honorees!



2230 FIELD CULTIVATOR

John Deere
Moline, Illinois, USA
www.deere.com

The 2230 Field Cultivator enables producers to efficiently flow residue, leave a smooth seedbed, and cover more acres per day. These implements operate at depths of 0 to 5 in. and come in floating hitch or Level-lift™ frame configurations, including a new five-section Level-lift frame. The floating hitch maintains consistent depth while traveling over uneven ground, while the Level-lift is designed for flat or gently rolling terrain. Operators can cover up to 217 more acres per day than with the previous model thanks to 8% wider working widths of up to 69.5 ft, 25% faster working speeds of up to 10 mph, and no daily maintenance. Each rear harrow in the ProFinish™ Leveling System is compatible with all implement configurations, and rolling baskets have full hydraulic control. Compact transport dimensions are provided with the 50 ft Level-lift model that tightly folds to 14.5 ft high by 14.3 ft wide.



2330 MULCH FINISHER

John Deere
Moline, Illinois, USA
www.deere.com

The 2330 Mulch Finisher enables producers to efficiently size and flow significant amounts of residue and leave a smooth seedbed. Operators can cover up to 127 more acres per day than with the 2310 Mulch Finisher thanks to 22% wider working widths of up to 56 ft 3 in. Working speeds of 10 mph and no daily maintenance provide additional efficiency. The 2330 Mulch Finisher features a Level-lift™ hitch that provides level performance at depths of 0 to 5 in. The ProFinish™ Leveling System includes multiple enhancements across six rear harrow options for superior residue handling and leveling performance depending on customer preferences. Coil-tine harrows feature a knock-down tine configuration on the front rank for superior leveling plus tool-free adjustability. The round-bar or flat-bar rolling baskets both feature adjustable hydraulic down pressure with in-cab control. Larger radial tires provide up to 42% bigger footprint for higher floatation and improved durability.



30 AND 40 SERIES ROTARY TILLERS

Blount International, Inc.
Oregon, Illinois, USA
www.woodsequipment.com

The Woods 30 and 40 Series rotary tillers are 3-point mounted, gear-driven tillers designed specifically for small-acreage farming and gardening. A unique double-flange rotor design was developed for these forward and reverse rotating tillers, which incorporates a single bolt that positions the tiller blade at the proper orientation for engaging the soil. The double-flange design creates two shear planes in the bolted joint, which reduces the load on the bolt by half when compared to existing single-flange designs. This design is advantageous in reducing assembly and service times by as much as 50% and providing a more durable product to the customer. This creative approach in attaching the tiller blade to the rotor shaft makes domestically manufactured components more competitive in a price-driven global market.

4400 SERIES CORN HEAD STALK ROLL SPIRALS

Case IH
Racine, Wisconsin, USA
www.caseih.com

The Case IH 4400 Series Corn Head Stalk Roll Spirals are a significant product change that dramatically improves the harvesting capability of the corn head. This spiral technology has been designed to work in concert with the other feeding elements of the corn head row unit to ensure that all of the corn plant is processed and no corn kernels are left behind. The smooth and gradual introduction of the crop to the auger flights, combined



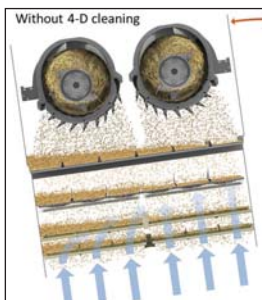
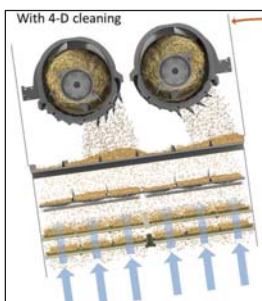
with the specifically designed height and pitch of the auger flighting, ensure that all stalks, even when they are lying on the ground, are moved smoothly and gently into the stalk rolls for processing. This feature will be available as standard equipment on all 2017

Case IH 4400 Series rigid and folding corn heads built in Plock, Poland, and can be used on all Case IH combines.

4D CLEANING

CLAAS of America, Inc.
Omaha, Nebraska, USA
www.claas.com

4D Cleaning is an automatic, multi-directional system that compensates for the combine's side roll when harvesting on a cross-slope and for the combine's fore or aft pitch when harvesting uphill or downhill. As the combine leans, the rotor cover-plate's axial louvers angle away from the slope, optimizing the distribution of material passing out of the separation rotor grates onto the rotor returns pan to prevent material build-up on the low side and overburdening the low side of the cleaning shoe, which can cause increased grain loss. When harvesting downhill, the cleaning fan reacts automatically to the forward travel angle of the combine by increasing speed to prevent material build-up in the front area of the cleaning system, and it slows when the combine harvests uphill, as well as opening the lower sieve automatically, allowing grain to pass through the sieve more quickly to minimize the potential for loss.



500D DRAPER PLATFORM

John Deere
Moline, Illinois, USA
www.deere.com

The 500D Draper Platform is a new addition to the John Deere windrower product line. This family of products is compatible with W235 and W260 Self-Propelled Windrowers and allows farmers to use the same traction unit for both rotary and draper heads on a single traction unit in 30 minutes or less. The 500D is available in three models: the 25-ft 525D, the 30-ft 530D, and the 36-ft 536D. These products are engineered for high-performance reliability, and all header functions are controlled with the Hydro Handle in the cab. The 500D Draper Platform enables greater productivity through center-driven belts and uses hydraulic pump control logic to deliver a constant header speed for more uniform cut quality and windrow formation. An improved reel increases durability in heavy crop conditions and includes quick-replace reel teeth.



5G SERIES TRACTOR FOR 2017

John Deere
Moline, Illinois, USA
www.deere.com

The new 5G Series tractors offer a variety of configurations to maximize productivity in constrained environments. For narrow row crops, viticulture, and orchards, the 5G delivers 75 to 100 hp within a minimum operating width of 39 inches, coupled with a turning radius of 11.9 ft. The Intelligent Power Management option senses when the tractor is being used for heavy PTO work and delivers up to a 9.9% power boost to improve productivity. For improved efficiency, the Economy PTO option allows a 15% reduction in engine speed for light PTO work, yielding reduced fluid consumption. The 5G offers a rear hitch lift capacity of up to 4400 lb, a 29% improvement compared to the prior 5EN model. The 5G is also one of the first products for the specialty crop segment that fully meets Final Tier 4 emissions requirements, with all after-treatment devices fully enclosed.



9009A TERRAINCUT™ ROTARY ROUGH MOWER

John Deere
Moline, Illinois, USA
www.deere.com

The 9009A TerrainCut™ Rough Mower is a five-gang, 27 in. (68.58 cm) independent rotary deck mower with a 9 ft (2.7 m) cutting width. The deck allows quick, tool-free height-of-cut adjustment, and the asymmetric rear discharge minimizes the need for blowing and dispersing clippings. The 9009A traction system with a standard eHydro™ traction pump, wheel motors, and internal wet disc brakes maximizes performance on undulating terrain while eliminating adjustments and linkages. Operator improvements include AutoPedal, which controls engine rpm and transport speed through the eHydro™ foot pedal. The TechControl display on the command arm allows the operator to electronically set mowing and transport speed, and control turning speed, deck drop rate, and weight transfer. The TechControl display also engages the LoadMatch™ power management feature, which automatically adjusts the machine speed to power the cutting deck, to maintain cut quality in heavy load conditions.



9220 COFFEE HARVESTER

Oxbo International Corporation
Lynden, Washington, USA
www.oxbocorp.com

The Oxbo 9220 Coffee Harvester is a completely redesigned machine based on a previous successful version. The machine now has a taller picking tunnel to accommodate the plantation-style trees now common in the coffee industry. The capacity of the lower conveyors has increased 25%, and the capacity of the elevators has increased 100%. The plastic bucket elevators have been replaced with simpler paddle elevators. The cleaning system, adapted from proven vineyard technology, is new to the coffee industry and demonstrates more efficiency and capacity than previous designs. The large on-board storage bin can unload on the go, another new concept for the coffee industry. These features allow the Oxbo 9220 to harvest faster and produce a cleaner product than previous models. Growers have commented that the coffee is easier to process due to less trash in the fruit, and operator comfort is improved with the new air-conditioned cab.



AAH-300b ABSORPTION/ REFLECTANCE VISIBLE SPECTROMETER

SpectroClick, Inc.
Champaign, Illinois, USA
www.spectroclick.com



The AAH-300 is a visible spectrometer coupled to a cloud back-end to allow ad hoc measurement of minor and trace chemicals of importance in agriculture for screening purposes. Personnel trained at the

point of use, employing QR-coded reactant packets synchronizing human, instrument, and data reduction activities, can screen for environmental, economic, or yield-enhancing materials using an instrument that is fundamentally rugged and inexpensive because many functions previously achieved through precision hardware are now performed in software. While the current product provides absorption and reflectance spectrometry with a dedicated camera, the technology should easily transfer to smartphone cameras, further reducing cost and enhancing portability. Applications include optimizing fertilizer use to control costs and environmental impact, detecting the levels of desirable bioconstituents, and screening for toxins, impurities, or contaminants. Data are automatically archived in the cloud, establishing a chain of custody while maintaining confidentiality.



ARRO™ CONVERSION FOR CORN HEADS TO HARVEST SORGHUM

Kopper Kutter LLC
 Cimarron, Kansas, USA
www.kopperkutter.com

The ARRO™ Alternate Rotary Rowcrop Option consists of a conversion kit for existing corn heads so that they can harvest additional crops including sorghum (milo), sunflowers, millet, and some cellulosic crops. The ARRO™ reconfiguration kit uses simple sprockets driving the dual disk cutters. It can be installed on reliable base corn heads, preferably those have been used for a few seasons and have worn stalk rolls and deck plates. These used corn heads already have individual row unit slip clutches, enclosed gearcase drives, and poly divider shields and points, along with reliable (optional) header height control systems. A benefit of the ARRO™ head is the long poly points that can lift lodged crops. The higher cutter positioning on the top side of the frame leaves over 10 inches of stalk remaining in the field. This ability to leave more crop residue is valuable for no-till crop rotations.



AUTO CROP FLOW

CLAAS of America, Inc.
 Omaha, Nebraska, USA
www.claas.com

AUTO CROP FLOW is a combine overload prevention system designed to actively prevent plugging or stopping of a LEXION combine's primary operating systems (feeding, threshing, separation, and residue management). AUTO CROP FLOW responds to combine overloading with a step-by-step process to prevent downtime and damage. Under manual operation (without using the CRUISE PILOT throughput control system), AUTO CROP FLOW will automatically stop the feederhouse and header and disengage the separator when the combine senses a sudden overload (drive shaft belt slip). When operating with the CRUISE PILOT throughput control system, AUTO CROP FLOW will gradually slow the combine's ground speed to 1.0 mph to recover from overloading. If unloading on the go, AUTO CROP FLOW will automatically disengage the unloading system, freeing up power to recover. If overloading continues or is sudden, the processor will automatically shut down, stopping the feederhouse and header.

AUTO TRAC™ VISION AND AUTO TRAC™ ROWSENSE™

John Deere
 Moline, Illinois, USA
www.deere.com

John Deere AutoTrac™ Vision and AutoTrac™ RowSense™ guidance systems provide assistance to AutoTrac™ that enables the sprayer to follow the actual planted crop row in post-emergence applications. RowSense™ keeps the sprayer tires between the rows during late-season application, while Vision guides the sprayer during early application. The two solutions allow operators to spray up to 15% faster in-row while reducing operator fatigue over manually driving, resulting in greater productivity and increased versatility. For producers, the systems keep the wheels in the row up to 30% better than manually driving, reducing crop damage. Advanced camera imaging and processing units and tactile sensors are used for sprayer position identification. The new systems work with vehicle auto-steering system, complementing existing GPS-based positioning systems by providing accurate relative location to crop rows. AutoTrac™ Vision and RowSense™ have proven to meet customers' needs for spraying performance.



AUXILIARY ALTERNATOR AUTOMATION ON CASE IH EARLY RISER® 2150 FRONT-FOLD PLANTERS

Case IH
 Racine, Wisconsin, USA
www.caseih.com

Case IH Early Riser® 2150 Front-Fold Planters now feature Auxiliary Alternator Automation, the first hydraulically driven, auxiliary alternator drive system that uses smart technology to match electrical power generation with demand to minimize hydraulic flow requirements. The need for onboard electrical power varies due to planter size, configuration, target population, and ground speed. The new smart alternator drive system auto-detects the machine size, configuration, and components of the system that require electrical power and then uses the target population, ground speed, and work status to set the proper Auxiliary Alternator operating speed. In this way, operating efficiency and power demand are matched for optimal hydraulic power efficiency, resulting in reduced cost of operation. Until now, auxiliary power systems have been sized and driven to constantly supply the highest electrical demand possible for a given machine, resulting in increased fuel consumption when maximum power is not required.



GK BLUEBERRY HARVESTER

GK Machine, Inc.
Donald, Oregon, USA
www.gkmachine.com

The GK Blueberry Harvester is an innovative machine designed to provide fresh market growers, who hand-pick blueberries, with a mechanized harvesting aid that provides increased productivity and picking rate while improving field logistics management. The most unique feature of the GK Blueberry Harvester is that it provides a platform for workers to stand on in the field rather than walking in and out of the field. The GK Blueberry Harvester carries multiple empty trays to the field and carries full trays of berries for transport from the field. This helps to reduce labor, save time, and improve worker safety. The GK Blueberry Harvester assists with managing empty and full trays of berries in and out of the field, eliminating the need for workers to manually lift the trays and walk them out of the field for transport.



C850 COMMODITY AIR CART

John Deere
Moline, Illinois, USA
www.deere.com

The John Deere C850 Commodity Air Cart increases productivity by seeding more acres per hour with increased accuracy and technology integration. The 850 bushel capacity is provided by four tanks optimally sized to maximize the number of acres seeded between fills. The AirPower™ 2 dual-blower air system accurately delivers high rates of commodities across the widest drills on sloping terrain while maintaining productive seeding speeds. Individual tank scales and the new John Deere ActiveCal™ system make it easy to calibrate the metering system. A cart-side display provides information on tank scales and tank pressurization, and enables cart-side calibration control and bag weight entry. A 100 bushel per minute belt conveyor, large tank lids, hydraulically powered stairs, and spacious platforms reduce seed and fertilizer tendering time and effort. The C850 combines these and many more software and hardware features in an accurate and integrated seeding solution.



CHALLENGER 1000 SERIES

AGCO Corporation
Duluth, Georgia, USA
www.agcocorp.com

Designed to deliver lower cost of ownership and improved productivity per acre, the Challenger 1000 Series tractors allow producers to invest in a machine that can serve multiple needs, helping them be more profitable. These compact fixed-frame tractors with flexible ballasting options are designed to prepare an operation for the needs of tomorrow, as producers need to cover more acres in less time, and compete one-for-one on efficiency and cost of ownership with any comparable tractor. The 1000 Series tractors combine the power of a small-frame, articulated four-wheel-drive tractor with the flexibility and speed of a lighter-weight, fixed-frame row crop machine. This allows maximum utilization from spring to fall without the need for two tractors to perform row crop and heavy tillage work. The Challenger 1000 Series includes four models ranging from 396 to 517 engine hp with a weight range of 31,204 to 50,706 lbs.

CRUMBLER® M24ci CHIPMUNCHER™

Forest Concepts LLC
Auburn, Washington, USA
www.forestconcepts.com

The Crumbler® M24ci ChipMuncher™ machine is an industrial pilot-scale rotary shear designed to process up to two green tons per hour of raw biomass into precision, flowable particles for



producing energy pellets, biochemicals, biofuels, and other bioproducts. Size reduction by hammer milling, the previous industry standard, requires the inefficient drying of biomass to less than 10% MC because it does not work with high-moisture feedstocks. The Crumbler® M24ci is unique in that it processes feedstocks with

moisture levels ranging from 10% to more than 80% using very low energy and without the need to pre-dry. PLC-controlled, the Crumbler® machine can economically process a variety of raw materials, including wood chips, corn stover, switchgrass, bamboo, sage, and others into highly uniform particles down to 2 mm in size that can optimize conversion efficiencies.



NEW HOLLAND CX/CR COMBINE WITH EVEREST LEVELING SYSTEM

New Holland Agriculture and I2J Solutions
Zedelgem, Belgium, and St. Sulpice, France
www.newholland.com and www.i2jsolutions.com

New Holland CX/CR Combines with the Everest Leveling System give operators a new way to experience flagship combine technology in extreme hilly conditions. The I2J Everest Leveling System is a stand-alone kit that converts the harvester from a standard combine into an expert hill-climbing machine, while providing the advantages of operator comfort and harvesting capacity. To achieve self-leveling of the combine, the system commands each traction wheel separately by means of a hydraulic cylinder. Together with a dual-axis inclination sensor, the machine is kept level with a closed-loop control algorithm during lifting and tilting, which in turn keeps the combine stable during harvest operations in all circumstances. This greatly improves the combine capacity due to optimized cleaning, threshing, and feeding while providing operator comfort, machine stability, and safety on steep sideslopes. Operators can manage the system with a user-friendly interface in the cab.

EXTENDED-WEAR ROTOR INLET TRANSITION CONE ON CASE IH AXIAL-FLOW® 240 SERIES COMBINES

Case IH
Racine, Wisconsin, USA
www.caseih.com



The new extended-wear rotor inlet transition cone on Case IH Axial-Flow® 240 Series combines provides farmers and custom-harvest operators with a robust harvesting component that has nearly three times the expected

wear life of the original cones and is included in the base combine. While being able to handle ever-higher throughput and capacity, modern combines are challenged with the wear that comes with harvesting crops with high rates of material other than grain (MOG) and more abrasive crops such as rice. The cone transitions the linear flow from the feeder house to a helical path before entering the threshing chamber. The new extended-wear cones are manufactured using a marquench heat-treatment process that makes the steel even more resistant to abrasion and wear, saving customers expensive downtime and repair/replacement costs. The extended-wear cones are standard equipment on all Axial-Flow 240 Series combines, including models 7240, 8240, and 9240.

EZEE DRY BIN

MFS/York/Stormor/Brownie Systems,
a Division of Global Industries
Grand Island, Nebraska, USA
www.globalindinc.com

The new Ezee Dry system includes a completely new plenum, bin structure, and control system for fully automated grain drying with up to 25,000 bushels of storage capacity. The Ezee Dry system operates by filling the plenum in the upper part of the bin with wet grain. Fans push heated air into the bin below the plenum and through the wet grain. When the grain is dry, the system dumps the grain into the bottom of the bin, where an aeration fan cools the grain. The heat recovered from the

dried grain helps dry the wet grain in the plenum. The control system makes the entire system fully automated by moving wet grain to the Ezee Dry, drying the grain, and then moving dried grain to a storage bin. The system can be set up to dry grain in continuous flow, automatic batch, or manual batch operation.



F4365 HIGH-CAPACITY NUTRIENT APPLICATOR

John Deere
Moline, Illinois, USA
www.deere.com

The F4365 High-Capacity Nutrient Applicator features a dual C-channel frame and parabolic leaf springs and shocks that provide a 30% better ride quality than the leading competitor while reducing operator fatigue and improving machine reliability. The CommandView™ III cab with the new Generation 4 CommandCenter™ display is tailored to dry application operators to make setup, operation, and adjustments easy to complete. The Final Tier 4 9.0 L engine with 400 peak hp coupled with the

Infinitely Variable Transmission (IVT™) allows spread speeds up to 30 mph and transport speeds up to 46 mph. Multiple dry spinner spreader options are available, allowing

variable-rate spreading of up to four products. Paired with the 4 Series Sprayer line-up and the latest technologies from John Deere, including AutoTrac™, John Deere Section Control, JDLink™, Wireless Data Transfer, and AgLogic, the F4365 can maximize productivity throughout the spreading season.





GATEWAY 300 ADVANCED COMPUTING PLATFORM

Appareo
Fargo, North Dakota, USA
www.appareo.com

Gateway 300 is the industry's first truly all-in-one global control, monitoring, and telemetry solution, equipping motorized farm vehicles with terrestrial and satellite communication connectivity capabilities, enabled by the global Iridium® satellite network. Appareo designed this powerful computing platform to provide a wide range of communications technologies, including WiFi, Bluetooth, cellular, GPS, 433 MHz, CAN, and Iridium satellite. Gateway 300 is built with a rugged enclosure for outdoor use and for mounting on heavy machinery. The device can collect and distribute real-time data, product and performance data, health and asset management data, location data, and security and recovery data, in addition to remote diagnostics and the possibility for future predictive maintenance capabilities. The benefit to farmers is greater uptime for their machines, more optimized use of their machines, and less time and energy required to manage the service and maintenance of their machines.



GUIDED HITCH FOR PULL-TYPE IMPLEMENTS

Laforge Systems, Inc.
Concord, California, USA
www.fronthitch.com



The Laforge® Guided Hitch allows a semi-mounted (2-point) planter or applicator to follow the tractor's RTK guidance line with a high level of accuracy on flat fields and on hillsides with up to 13% slope. The unique compact design with linear side-to-side movement of the guiding element guarantees more responsive control of the implement and less impact on the tractor's yaw movement compared to other designs, especially under heavy loads. Automatic Guidance with the Laforge® Guided Hitch brings the planter or other implement to the same accuracy as the tractor for precision placement of seed and nutrients in separate passes. Chrome-plated slide rods and self-cleaning, self-lubricating bushings ensure maintenance-free operation. The basic design replaces the factory crossbar on John Deere's planters, and adapters for several strip-till implements and nutrient applicators are available. The Laforge® Guided Hitch was developed in collaboration with John Deere as an Allied Product.

INTELLIBALE™ ISOBUS CLASS 3 TRACTOR AND BALER AUTOMATION FOR NEW HOLLAND ROLL-BELT™ SERIES ROUND BALERS

New Holland Agriculture
New Holland, Pennsylvania, USA
www.agriculture.newholland.com

The New Holland IntelliBale™ ISOBUS Class 3 Tractor and Baler Automation system provides automated control of the tractor stop, bale wrap, and bale ejection cycles on New Holland Roll-Belt™ Series round balers. The system reduces operator fatigue by eliminating repetitive arm and leg movements that are normally required to control the tractor and baler functions. Productivity is improved by optimizing the tailgate raise and lower cycle times for each bale automatically. Using ISOBUS communication protocol, the baler sends commands to the tractor that control the tractor stop, wrapping of the bale with net wrap, and activation of the tractor hydraulic remotes to raise and lower the tailgate, without requiring any inputs from the operator. The IntelliBale™ option is compatible with ISOBUS Class 3 equipped New Holland T6 and T7 Series tractors with AutoCommand™ continuously variable transmissions and with T7 Series tractors with PowerCommand™ full-powershift transmissions.



iHSD – INTEGRATED HARRINGTON SEED DESTROYER

De Bruin Engineering
Mount Gambier, Australia
www.ihsd.com

The iHSD is an innovative weed seed management product that mechanically destroys weed seeds at harvest time. The iHSD is installed on and powered by a combine harvester. Once the grain is separated, the chaff containing standing weed plants is



processed through an impact mill that results in up to 99.8% destruction of specific weed seeds. Importantly, this process is non-selective to herbicide-resistant weed species. The benefits of using the iHSD in continuous cropping operations include reduced overall emerging weed numbers and decreased populations of herbicide-resistant weeds, resulting in lower volume, fewer spraying treatments, and fewer chemical herbicide groups. Organic matter is returned to the field and retained, resulting in healthier, more productive soil and reducing the need for supplemental phosphate, nitrogen, and potassium applications. The iHSD can be fitted to an expanding range of combine harvesters.



LETTUCEBOT AUTOMATIC THINNING MACHINE

Blue River Technology
Sunnyvale, California, USA
www.bluerivert.com

The LettuceBot is the first precision smart implement that identifies every plant, makes a decision based on what it sees, and precisely sprays individual plants. LettuceBot automatically thins lettuce fields with a precision that increases yields and gives farmers a valuable alternative to scarce farm labor. Lettuce seeds are planted at a higher rate than required to ensure that enough plants emerge to make a uniform stand. The LettuceBot then keeps the best plants using criteria based on optimal spacing and the most uniform size of the plants available. Onboard technology, including cameras, 20 top-of-the-line processors, computer vision algorithms, and 1/4-in.-precise sprayers, allows more than 5,000 decisions per minute. LettuceBot represents a major step toward smart implements that have the ability to see and spray plants individually at field scale. This see-and-spray capability is a major step toward reduced chemical use and increased sustainability

M1240 SELF-PROPELLED WINDROWER

MacDon Industries Ltd.
Winnipeg, Manitoba, Canada
www.macdon.com

The MacDon M1240 Windrower provides increased speed and improved ride quality with patented CrossFlex™ suspension. To obtain higher speeds without sacrificing low-speed torque, the M1240 varies the displacement of the wheel motors electronically. This leaves the operator with full available wheel



motor torque at low speeds, combined with the ability to reach road speeds without the need to shift speed ranges. The 248 hp Cummins engine uses dual-radiator cooling that draws air from the cleanest location, behind the cab. To

keep the clean air flowing constantly, a hydraulic-drive reversing fan blows out unwanted debris on the go, without the need for operator input. An all-new One-Touch-Return preset system allows the operator to adapt to changing field conditions with the push of a button. Other operator features include a high-back leather vented and heated seat, auto climate control, Bluetooth radio, and 360° visibility from eight LED work lights.

MAXEMERGE™ 5e PLANTER ROW UNIT

John Deere
Moline, Illinois, USA
www.deere.com

The MaxEmerge™ 5e row unit uses a single electric motor to control John Deere's MaxEmerge™ 5 seed meter with the traditional seed tube offered on many planters at a lower price than ExactEmerge™. MaxEmerge™ 5e row units include many features found on ExactEmerge™, such as curve compensation, vacuum automation, SeedStar™ 3 HP, and RowCommand. In addition, MaxEmerge™ 5e row units allow many options to be factory installed that used to require time-consuming installation by the farmer or dealership. These options are all integrated into the SeedStar™ 3 HP monitoring system and include individual row hydraulic downforce (IRHD), pneumatically controlled row cleaners, SeedStar™ Mobile, and more. With SeedStar™ 3 HP and MaxEmerge™ 5e, farmers can run their planters statically to tune the meters before working in the field. MaxEmerge™ 5e planters also support JDLink, allowing remote diagnostics to keep farmers in the field during the ideal planting window.



MINI GAC® 2500 GRAIN MOISTURE ANALYZER

DICKEY-john
Auburn, Illinois, USA
www.dickey-john.com

The DICKEY-john mini GAC® 2500 is unique, being the only handheld moisture tester that uses 149 MHz/UGMA technology for grain moisture analysis. The huge benefit to producers and seed companies of this new technology is that the mini GAC® 2500 is the only handheld grain moisture tester that will consistently match the new UGMA moisture testing at the elevator. Using 149 MHz / UGMA technology provides farmers with control and accuracy not achievable before with a handheld tester. Capturing data and calibrating equipment, such as harvesting equipment, make this new development a necessity. The mini GAC® 2500 builds on the industry-leading mini GAC®, offering Bluetooth communication to mobile apps. DICKEY-john's "Moisture Manager," a new mobile app, gives farmers greater control of data capture and transfer, resulting in improved grain moisture decisions.





MIXED-FLOW GRAIN DRYER

Sukup Manufacturing Co.
Sheffield, Iowa, USA
www.sukup.com

The Sukup Mixed-Flow Grain Dryer combines the use of mixing/heating chambers with vacuum cooling technology to produce a dryer that removes moisture from grain more evenly and economically than other dryers. The vacuum-cooling system recycles warmed air back into the dryer, which reduces the amount of fuel



needed to reach the optimum drying temperature. Fuel savings may exceed 25% compared to traditional pressure-cooled cross-flow dryers. The mixing chambers allow more uniform drying of grain, and they are made of solid sheets instead of perforated material, which eliminates the need to sweep debris from hard-to-reach upper screens on traditional cross-flow dryers. The patent-pending design of the Sukup Mixed-Flow Grain Dryer allows for a single center unloading system, compared to two in competitors' mixed-flow dryers. This new Sukup dryer can be ordered with gravity-flow or auger loading and with auger or drag conveyor unloading.

MTS MAXX RIDE SUSPENSION

AGCO Corporation
Duluth, Georgia, USA
www.agcocorp.com

The MTS Maxx Ride feature adds ultra-high capacity shock absorbers to the class-leading and industry-exclusive Mobil-Trac system. Today's Mobil-Trac system offers the softest track suspension on the market for a two-track tractor. This is a key differentiator for the Challenger line of track tractors. However, with a soft ride can come negative side effects, such as excessive pitching and unwanted movements of the machine and implement. The use of ultra-high capacity shock absorbers delivers an unmatched harmony of ride and control in a track suspension system. As a result, MTS Maxx Ride maintains soft track suspension while limiting unwanted movements of the machine. MTS Maxx Ride dampens excessive pitching motion, allowing the operator to feel more comfortable in the field and



have more control on the road. MTS Maxx Ride is available on both the MT700E and MT800E series of tractors.

N-VISION ANHYDROUS AMMONIA SENTRY

Capstan Ag Systems
Topeka, Kansas, USA
www.capstanag.com

N-Vision carefully monitors every drop of anhydrous ammonia, providing a detailed, real-time look into the tank and plumbing to provide vapor-free liquid to metering and distribution devices. N-Vision is the first product on the market that allows operators to determine exactly when the tank and plumbing capabilities are being overrun, as well as when the tank is truly empty, by actively maintaining a preset liquid level.

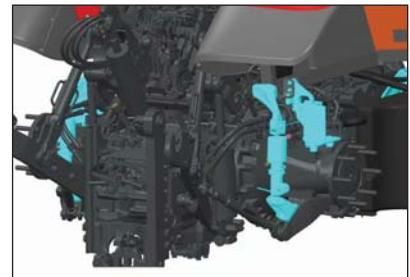


This in turn allows the operator to make informed application decisions. These decisions garner confidence in application quality with the ability to use more of the anhydrous ammonia in each tank. Instead of leaving a remaining "buffer amount" in the tank, the entire tank volume can be used, resulting in improved productivity, which enables greater efficiencies in nitrogen distribution and tendering times.

OPTI-RIDE ACTIVE CAB SUSPENSION

AGCO Corporation
Duluth, Georgia, USA
www.agcocorp.com

The MF 6700S Series tractors have received high marks about the ride comfort that results from the new front suspension system. The new Opti-Ride Active Cab



Suspension represents another step forward. The Opti-Ride Active Cab Suspension system benefits from the use of components commonly used by premium truck manufacturers in their cab suspension systems. Massey Ferguson has adapted these proven components for use in agricultural conditions for the MF 6700S Series. The conventional spring and damper unit, as used in mechanical cab suspension systems, has been replaced with dampers that are controlled by proportional electro-magnetic valves. These valves are controlled electronically and take into account the travel speed, acceleration, and braking as well as the chassis size of the tractor. The Opti-Ride Active Cab Suspension system is thereby able to compensate for different operating conditions, such as in-field versus road operation, and when taking corners.



PRO-CHOP 150 BALE PROCESSOR

Anderson Group, Inc.
 Chesterville, Quebec, Canada
www.grpanderson.com

The Pro-Chop 150 bale processor is a bale blower with a new modular chopper system. The chopper system is easily adjustable to the optimal cutting length for each use (bedding or feeding) and material (straw, hay, or haylage). This system is a combination of a new rotor equipped with 264 aggressive knives, a top gate that helps chop fiber when engaged, counter-knives that chop finer when used along with the top gate, and a removable recutter screen with 2 in. holes that force longer fibers to be recut. The flexibility in cutting length (from no cut to 1 in.) and ability to process all fodder types is unique. A



conveyor and comb allow bales to be fed perfectly through the rotor, preventing blockages. The 68 in. diameter blower can spread up to 52 ft, and the 5 ft wide chamber is ideal for all type of bales.

ROWTRAC® CARRIER SYSTEM ON CASE IH EARLY RISER® 2160 ROWTRAC® FRONT-FOLD PLANTERS

Case IH
 Racine, Wisconsin, USA
www.caseih.com

The Rowtrac® Carrier System for the new Case IH Early Riser® 2160 Rowtrac® Front-Fold Planter represents an industry-first, three-axis steerable track solution for a planter to provide increased flotation and a smoother toolbar ride versus wheeled carriers. The



Rowtrac® system is the only towed- implement track undercarriage that is pivotable about three major axes for pitch, roll, and yaw movement, thereby allowing the track

system to be steered while it simultaneously undulates to follow terrain changes in both the pitch and roll directions. The system allows for equal $\pm 23^\circ$ steering motion while simultaneously allowing the track belt to follow the ground contour without impacting steering angle changes. Depending on the planter row-spacing configuration, operators may choose the Rowtrac® Carrier option with either 88 or 120 in. centers and with either 18 or 24 in. belt widths.

RTV X1140 UTILITY VEHICLE

Kubota Tractor Corporation
 Torrance, California, USA
www.kubota.com

The new Kubota RTV X1140 Series of utility vehicles provides customers with significant enhancements in comfort and performance, building on the reputation of the RTV series. The



new K-vertible™ Cargo Transformation System allows the RTV X1140 to be converted between 2-passenger and 4-passenger configurations in less than a minute while still allowing easy access to the cargo bed. In 4-passenger configuration, the X1140 has 9.9 cubic feet of cargo space, converting to 19.1 cubic feet in 2-passenger configuration. The integration of four-wheel independent suspension coupled with the reliability of the 24.8 hp Kubota diesel engine and the exclusive two-range VHT-X variable hydraulic transmission make the RTV X1140 dependable and smooth-riding, while the ROPS and cargo bed transformation system make the RTV X1140 unique in the industry.

SINCLAIR PRINT ON DEMAND™

Sinclair Systems
 International LLC
 Fresno, California, USA
www.sinclair-intl.com



Sinclair Print on Demand™ allows packinghouse customers to print produce labels at the point of application and thereby reduce multiple label inventories and improve packing efficiency. The Print on Demand™ system prints GS1 DataBar codes, PLUs, fruit variety, lot numbers, and any combination of images or data that uniquely identifies attributes associated with loose produce. The previous requirement for multiple label designs is reduced to a single design with variable data printed in a blank area. Direct thermal print technology integrated with precision stepper motor control and Sinclair's bellow application technology provides exceptional print quality while maintaining high label application rates. With the largest portfolio of label shapes, sizes, and features in the produce labeling industry, Sinclair Print on Demand™ meets all of the industry's labeling needs. In addition, Print on Demand™ complies with all relevant food contact legislation, including the Food Safety Modernization Act.



SMARTTRAX™ WITH FLEX TECHNOLOGY FOR NEW HOLLAND CX AND CR COMBINES

New Holland Agriculture
Zedelgem, Belgium
www.newholland.com

SmartTrax™ with Flex Technology for New Holland CR Combines gives producers a new, economical way to experience the benefits of using tracks as an alternative to tires. This optional equipment offers an alternative to traction tires to reduce ground compaction and improve operator comfort. The track units use the same triangle design and ground-following behavior as the New Holland SmartTrax™ with Terraglide™ suspension system, yet cost considerably less due to the new design using rubber strut suspension rather than hydropneumatic suspension. Operators choosing SmartTrax™ with Flex Technology can ride comfortably and safely at road speeds up to 19 mph and benefit from a 60% reduction in ground compaction compared to combines with tires. Double-hinged rollers in the tracks maximize the contact surface between track and ground and reduce stress on the track belt and roller, resulting in longer belt life.



SPRAY FILL XPRESS

Summers Manufacturing
Devils Lake, North Dakota, USA
www.summersmfg.com

The Spray Fill Xpress is a patent-pending fill system that features a unique chemical batching process. It comes in two convenient



sizes with a modular design. The larger SFX2430 can be customized with 3, 4, 5, or 6 stainless-steel chemical tanks in 40 or 80 gallon capacities for a total maximum capacity of 240 gallons. The smaller SFX1630 can hold

160 gallons in 2, 3, or 4 tanks. Chemicals remain separate until drawn into the sprayer. This avoids premixing, which can cause undesirable reactions. Available flowmeters and scales provide precise measurements. The tanks have aggressively angled bottoms to aid in chemical induction and ensure complete drainage. For easy cleanout, each tank includes a jug rinse system that doubles as a whole-tank rinse when the lid is closed. An attached rinse wand provides a convenient solution for cleaning or making a slurry during dry chemical induction.

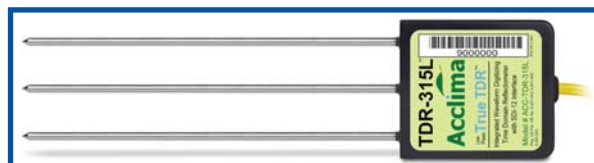
T7 HEAVY DUTY ENHANCED ENGINE BRAKE

New Holland Agriculture
New Holland, Pennsylvania, USA
www.agriculture.newholland.com

The T7 Heavy Duty features an enhanced engine brake system designed to absorb additional kinetic energy when compared to a conventional design. Dissipating energy with an effective engine brake reduces the burden placed on the tractor axle or



trailer brakes, especially while descending long gradients. When activated, the engine's electronic control unit cuts the fuel injection and closes a valve in the exhaust manifold. The resulting backpressure generates a negative torque, and this is increased significantly on the T7 by using the electronic variable-geometry turbocharger to automatically maximize the manifold pressure. Additional braking effect has been added by incorporating a new variable-pitch cooling fan into the system. The fan vane angle adjusts when the brake is used to deliver maximum airflow, increasing the energy required to rotate the fan. The combined effect generates up to 140 hp of braking effort from the engine brake system.



TDR-315L LOW POWER CONSUMING DIGITAL TIME DOMAIN REFLECTOMETER/ SOIL CONDITION SENSOR

Acclima, Inc.
Meridian, Idaho, USA
www.acclima.com

The TDR-315L is an integrated, waveform digitizing, true time domain reflectometer that uses high-speed electronics to bring this device down in price by about 25% from its predecessor, and up to 20 times less than its competitors. It has also halved its predecessor's power consumption. This device is extremely accurate at measuring soil water content (even in saline soils out to 4 dS/m bulk EC), soil temperature, soil (bulk) EC, and soil pore water EC. The TDR-315L is a SDI-12 compatible sensor, which makes it a critical component for logging soil water content in SDI-12 moisture monitoring systems. The TDR-315L will work with numerous third-party SDI-12 data loggers as well as with Acclima's own DataSnap data logger. This newer and more accessible technology will have profound ramifications for researchers and farmers alike in terms of learning how to save water and fertilizers while increasing crop quality and yields.



TIGER-MATE® 255 FIELD CULTIVATOR

Case IH
Racine, Wisconsin, USA
www.caseih.com

The Case IH Tiger-Mate® 255 Field Cultivator is a rugged and productive seedbed preparation tool that creates a high-efficiency seedbed for the most accurate seed placement. The new Advanced Conditioning System with TigerPaw™ Crumbler® has an easily adjustable front spike bar to optimize leveling and residue flow for various conditions. The frames are designed with high strength-to-weight ratios for maximum durability while minimizing unnecessary compaction. The tire offering includes stubble-resistant radial tires that prevent downtime due to tire failures and reduce compaction by up to 24%. The wheel retraction feature allows the wing wheels to automatically retract during folding, which results in a narrow transport size. The 10 mph maximum operating speed results in a 25% increase in productivity compared to traditional field cultivators of the same size with 8 mph speed limit. The Tiger-Mate® 255 is available in working widths ranging from 22 to 60 ft.

TOUGHFLIGHT™ AUGER

Kondex Corporation
Lomira, Wisconsin, USA
www.kondex.com

Kondex Corporation's patented laser-clad ToughFlight™ Augers feature proprietary Tungstrong™ laser cladding on the leading edge of the auger flighting. This tungsten carbide application provides a wear coating that extends the life of the product and prevents grain pinching and damage when used in grain handling applications. The result is better grain quality, and thus



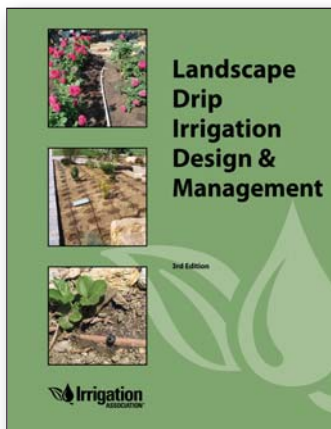
better payout to the producer. Unlike other high-wear material applications, laser cladding creates a true metallurgical bond between the substrate and the tungsten carbide powder matrix, preventing it from chipping off while

minimizing the heat-affected zone and product distortion during application. The Kondex ToughFlight™ Auger also combats wear at its origin through its leading edge application, whereas alternative high-wear augers with additives on the flighting surface will continue to lose material from the outside edge in. The result is significantly greater product life, and ultimately a better-performing auger that prevents crop trapping.

TREE DRIP CALCULATOR

Irrigation Association
Fairfax, Virginia, USA
www.irrigation.org

Tree Drip Calculator (TDC) is a soil physics based tool for designing and operating drip irrigation systems for trees. Previous design guidelines were manufacturer-specific and based on empirical data; this tool is based on USDA-ARS soils data and specifications of ANSI/ASABE Standard S623 and guides the designer in fully specifying design parameters, including emitter flow rate, emitter spacing, emitter placement, and run time. Run time must enable the system to meet crop evapotranspiration and wetted area requirements and not lead to deep percolation. TDC guides the designer through complex interactions of design parameters, soil type, and run time, giving the designer operational results of particular parameter selections. TDC warns the designer if certain design conditions are not met. TDC helps the designer specify the system, and guides the irrigation manager in system operation.



TRIBINE HARVESTER

Tribine Harvester LLC
Newton, Kansas, USA
www.tribine.com

The Tribine Harvester is a 4WD grain harvester with a high-capacity threshing and separating front module that is connected by articulation joint to a large 1,000 bu capacity grain tank on the rear module. By removing the grain tank from the top of the processing unit, and removing the guide axle from beneath, the Tribine Harvester achieves a new architecture that allows for massive gains in harvesting throughput to accompany the on-board grain tank. The unit features a 38 in. diameter rotor (for huge threshing capacity) underlain by an equally upsized 103 in. wide cleaning system. On each side of the large rotor is one of two engines that power the unit, giving great weight balance and limitless total power combinations for the harvester's future. The 40° articulated steering combined with another 22° of rear axle steer allows the machine to turn tighter than other current combines.

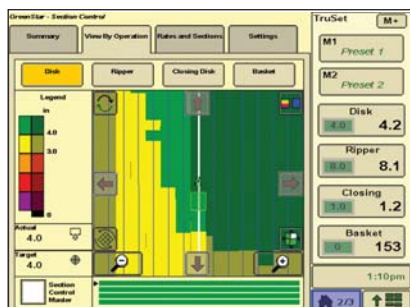


TRUSET™ TILLAGE

John Deere
Moline, Illinois, USA
www.deere.com

TruSet™ Tillage now allows producers to benefit from expanded functionality with documentation and prescription features.

Documentation of a tillage pass now provides producers a historical record of jobs performed by mapping implementation data of tool depth or pressure based on GPS location. With this information, producers can analyze the impacts of a job performed on their fields, enabling them to make decisions on their next pass. Prescription functionality will give producers the capability to pre-map the settings for a tillage machine, ensuring that operations are executed correctly based on location. Both the documentation and prescription aspects of TruSet™ can be performed on up to four functional areas, depending on the implement. These two additions to the TruSet™ Tillage system allow producers to optimize their crop production cycle and maximize return on their tillage investments.



TTI TWINJET® (TTI60) TWIN FLAT SPRAY TIP

TeeJet Technologies
Wheaton, Illinois, USA
www.teejet.com

The TTI60 TeeJet® twin flat spray tip provides extremely large droplets for maximum drift control along with the improved coverage of a wide-angle twin spray. By using existing air-induction spray technology in a new configuration and with new geometries optimized specifically for creating Ultra Coarse droplets across the majority of the

recommended operating range, TeeJet Technologies has improved spray application coverage while maintaining superior drift reduction in comparison to conventional spray nozzles. Twin style flat spray tips are best suited for broadcast spraying where superior leaf coverage and canopy penetration are important. The single-piece tip and cap design allows for easy installation and, unlike some other twin sprays, has a very compact size.

The TTI60 is ideal for the application of systemic, post-emerge herbicides. The excellent drift control provided makes it ideal for operating near sensitive areas such as susceptible plants, open water, or residential areas.



VT FLEX APPLICATOR

Summers Manufacturing
Devils Lake, North Dakota, USA
www.summersmfg.com

The patent-pending VT Flex Applicator from Summers Manufacturing is a fully customizable fertilizer applicator that precisely places up to three products (dry, liquid, and NH₃) at high speeds and can be set to 15, 20, 22, or 30 in. row spacing. The coulter blades and application knives can be configured to unique residue management needs. Users can choose between five coulter blade options (coulter spacing can be set for on-row and mid-row) as well as customizable application knives and levelers. The system allows operating speeds of 6 to 8 mph with dry application rates of 600 to 700 lbs per acre. The VT Flex Applicator is liquid ready and can accept practically any tank setup. Each fertilizer type's depth can be independently set, while the patent-pending machine leveling requires no tools to adjust and offers quick and easy depth setting.



ZERO-ENTRY COMMERCIAL PADDLE SWEEP

Sukup Manufacturing Co.
Sheffield, Iowa, USA
www.sukup.com

The Zero-Entry Commercial Paddle Sweep is a grain unloading machine that sweeps grain from large bins without requiring the operator to enter the bin. The sweep's A-frame design provides horizontal rigidity that prevents the sweep from bending as it moves through grain and vertical rigidity that allow use in deeper grain. The A-frame design also helps prevent stalling in the event of a grain avalanche. Vertical loads on sweeps in large bins may exceed 5,000 lbs/ft², requiring tremendous design strength to endure such heavy loads. There are three major benefits of this product: safety is vastly improved because the sweep is operated entirely from outside the bin, its patent-pending design allows it to be used in deeper grain than other sweeps, and its paddles provide a cleaner sweep than machines using augers, thus saving on labor costs.

ASABE Co-Sponsors “Thirsty Land” Documentary

Conrad Weaver

Editor’s note: “Thirsty Land” tells the story of extreme drought, agriculture, and the water crisis in the western U.S. and how these challenges affect farmers, urban communities, and the environment. Underwritten in part by ASABE, the documentary vividly explores the depleted water resources in the American Southwest and presents one of the most urgent challenges of the 21st century facing agriculture and growing urban communities. The drought in this region has local, national, and global impacts, not only for the present but also for future generations. After the film was shown at the 2016 Annual International Meeting, viewers gave “Thirsty Land” rave reviews.

The summer of 2014 was hot and dry in southwest Kansas. My wife Jodi and I had been invited to show my film, “The Great American Wheat Harvest,” at the very popular 3iShow in Dodge City. During the show, we met farmer after farmer talking about the heat and the drought that had wreaked havoc across the southern plains over the previous years. They expressed concern that a continued drought would severely limit the amount of water that farmers would be able to use to grow crops in this semi-arid part of the American West. Listening to these farmers and remembering the scenes of ankle-high wheat during the harvest of 2013 propelled me to produce the film “Thirsty Land.”

In order to learn as much as possible about the current water situation in the west, we interviewed farmers, ranchers, city and state leaders, as well as scientists, meteorologists, and other climate experts from central Kansas to California’s Central Valley. Ironically, just as we began filming in southwest Kansas, it began raining there. So the story’s focus took us to California, where thousands of acres of farmland have been taken out of production and fallowed at a tremendous cost to the farmer’s bottom line, impacting jobs and local economies as well.

Many California growers have been frustrated by the state “bowing” to environmental groups that demand more water for a few endangered fish species. Farmers in the

Westlands Irrigation District, the largest irrigation district in the U.S., have had zero water allocation for several years and have had to fallow thousands of acres of highly productive farmland or purchase water on the open market at rates that often exceed \$2,000 per acre-foot.

One farmer told us, “Drought makes us think differently,” and so it does. It was amazing to see the innovation that has come out of this water shortage. One irrigation district in the Central Valley is working hard to get all of its growers to use drip irrigation systems rather than the more traditional flood irrigation. Many have made the switch, and a few are going a step farther and using subsurface drip systems. There are holdouts, but mostly because the cost of changing to drip is prohibitive for many growers.

Other farmers are using state-of-the-art technology to help them better manage their water use. As A. G. Kawamura, the former California Secretary of Food and Agriculture, said, “There’s no farmer who wants to use too much or not enough water.” This desire to conserve has led one western Kansas company to design an irrigation system that marries drip technology with a center-pivot system. Monty Teeter of Teeter Irrigation (full disclosure: Teeter Irrigation is a sponsor of “Thirsty Land”) estimates that his newly patented Dragon-Line mobile drip irrigation system reduces the water needed for a crop by 20% to 50% compared to conventional sprinkler systems. These types of innovations can be found throughout the west as farmers look for ways to save as much water as possible while producing the same amount or more for a growing population.

The innovations and adjustments to this new normal go beyond farming. Many cities have already built water-recycling facilities to reduce the use of potable water for landscape and agricultural irrigation. But the cost is high for these cities and states in the drought-impacted regions. In order to meet the required 25% state-mandated reduction in water use, the city of Los Angeles spent \$450 million by paying residents to remove water-intensive turf and replace it with desert landscaping. Las Vegas spent more than



California's Lake McClure, just northeast of Fresno, dropped to 10% of capacity in 2015. The drought revealed huge cracks in the ground where there should be 200 feet of water depth.

\$800 million to build a new water intake and pumping station 600 feet under Lake Mead to secure the city's water supply for years to come. The new intake permits the Southern Nevada Water Authority to pump water even if the lake falls to "dead pond" level and can no longer supply water to Hoover Dam's turbines. Currently, Lake Mead has fallen 147 feet and contains only 38% of its capacity.

A few cities have made financial deals with farmers to purchase water that normally would be used to grow food. Colorado cities have been buying up water rights from farmers on the eastern plains, causing farms to go out of business or reduce their operations to dryland practices.

"Thirsty Land" covers many of these stories and more. The film premiered at the Global Water for Food Conference



Cutting off water to California farmers has far-reaching impacts for local communities.



An aerial view of California's Central Valley shows thousands of acres of fallowed farmland.



The Dragon-Line Precision Mobile Drip Irrigation (PMDI) system reduces water use by an estimated 20% to 50%.

in April 2016. The Water for Food Institute and the Institute of Agriculture and Natural Resources at the University of Nebraska-Lincoln, along with ASABE and other organizations, were the sponsors of the film project. We're currently scheduled to screen the film at a number of universities and agriculture-related events over the next several months. To view the trailer of the film and for booking information, visit www.ThirstyLandMovie.com.

Conrad Weaver, President, Conjo Studios LLC, Producer and Director of "Thirsty Land," Emmitsburg, Md., USA, conrad@conjostudios.com.

Conrad's work in documentary filmmaking has been recognized nationally. His 2014 documentary, "The Great American Wheat Harvest," was presented a Best of NAMA award by the National Agri-Marketing Association and received a Mid-America Regional EMMY Award, while the film's trailer received a Silver Telly Award. "The Great American Wheat Harvest" was featured on television, in theaters across the Midwest, and at film festivals in the U.S. and the Czech Republic.

YPC News & Notes

Greetings from the Young Professionals Community (YPC) of ASABE. Beginning with this issue of *Resource*, the "YPC News & Notes" column will update all ASABE members on current YPC activities and upcoming events, and highlight young professionals who are contributing to the advancement of our Society. In addition to this column, you can also visit our blog (asabe.org/blogypc) to see what we've been up to and where we've been.

The YPC dates back to 2001-2002. Through the efforts of Chad Yagow, Russell Persyn, Travis Tsunemori, Audrey Alexander, and Scott Wilcox, the YPC was founded with one all-important goal: to foster the involvement and leadership of the younger, recently graduated members of our Society and keep them active in ASABE by providing them with a network and content relevant to their needs. Eyeing the retention rates of young professionals and recent graduates who had been active student members, the YPC's founders reached out to this vital group. When the YPC began, young professionals represented around 15% of our total membership. As of 2016, that total has risen to 23%.

YPC-sponsored activities and events, particularly at the Annual International Meeting (AIM), have helped the YPC grow over the years. These events include Continuing Professional Development sessions, social outings, educational seminars, and a 5K Fun Run. We recently expanded our involvement to the Section level, sponsoring social activities at the Iowa and Texas Section meetings, and we have supported new AIM activities targeted at graduate students. We continue to have a presence at student Regional Rallies and other events, including the Agricultural Equipment Technology Conference (AETC), that engage new and young professional members of ASABE.

Where would you like to see an increased YPC presence, or is there an issue that you would like the YPC to tackle? Let us know! Your input is welcomed, encouraged, and always appreciated.

ASABE member Shane Williams, YPC Chair, Design Engineer, Kuhn North America, Inc., Brodhead, Wisc., USA, shane.williams@kuhn.com.

Big Data Ethics and the Digital Age of Agriculture



Jason Schuster

"My graduate research focuses on yield monitoring systems and improving accuracy. Producers rely on precision agriculture and yield maps to help make management decisions to increase their bottom line."

Editor's Note: ASABE member Jason Schuster of Iowa State University captured first place in the 2016 Ag and Bio Ethics Essay Competition by submitting an original work of up to 1500 words on an ethics topic that affects "the practice of professions related to agricultural and biological engineering, systems, or technology." Second place went to ASABE member Maria Balcazar of North Carolina State University (*Is more production the answer? A critical look on our framework to solve food security*), and third place was awarded to ASABE member Sarah Freriks of the University of Illinois (*Bioethical considerations of CRISPR-Cas9*). The annual Ag and Bio Ethics Essay Competition is open to undergraduate and graduate student members of ASABE and the Institute for Biological Engineering (IBE). The three finalists presented their work at the ASABE Annual International Meeting in New Orleans last July, and their essays are available at <http://www.asabe.org/ethics-essay-comp.aspx>.

Recent technology innovations in agriculture have allowed farmers to take a step back and examine the broader view of their crop production practices. Yield monitors, soil maps, and GPS guidance technologies that ushered in precision agriculture over the last quarter century are now being aggregated and combined with new sources of information to provide actionable recommendations to producers. As the industry enters the digital age of agriculture, new policies, analytics, security, and management techniques will be required to handle the terabytes of big data coming from crop fields. It will take collaboration between producers, agriculture technology providers (ATPs), and agricultural and biological engineers to ensure that ethical, consistent principles are established during the transition to digital agriculture.

A survey conducted by the American Farm Bureau Federation (AFBF) in 2014 showed that of the respondents who were active in a farming operation, 65% were skeptical or fearful of new technologies. The survey also showed that one of the farmers' top concerns is data usage and collection. There must be more transparency between ATPs and producers on what data is being collected and when it is being collected. A single tractor can be used for several crop management applications throughout a growing season, so it is important for producers to recognize who has access to the different types of data that is generated. It is already a common practice for producers to agree to data privacy statements prior to being able to use ATP technology. However, these terms of data privacy and collection should be more clearly defined to protect the interests of the farmer. Both producers and ATPs will need to work together to ensure that proper business ethics and the interests of both parties are maintained.

Another common concern that arises within the crop-to-computer data cycle pertains to ownership of the data. Most producers believe they own all data that is generated on their farming operations. However, there is no precedent regarding this issue. In an updated survey by the AFBF, 55% of respondents who have signed contracts with companies said that the contract doesn't express data ownership. During the 2016 ASABE Annual International Meeting, Martin Richenhagen, President and CEO of AGCO Corporation, expressed that his company believes that farmers own the data that is generated on their farms. While many larger companies are following suit, there is no precedent on this issue. There should be a common standard of agreement between ATPs and producers to limit confusion about each independent ATP's rules regarding data privacy, use, and ownership. During this transition period, much of the responsibility for understanding the

terms of each agreement will fall on the farmer. As a result, farmer adoption of digital agriculture technology will likely be slow and cautious until universal standards are in place.

After data has been collected, issues of data access, security, and control arise. In the same survey conducted by the AFBF, 66% of farmers supported an independent third-party warehouse to store farm data in 2014, and this support has since increased to 71%. Independent data storage would allow farmers better control over their information and who has access to it. There have already been developments in this area to help meet farmers' interests. In early 2016, the Agricultural Data Coalition was formed as a partnership between ATPs, universities, and producers to focus on the design, creation, and management of neutral-party data warehouses. These data warehouses may provide advantages to the producer by being able to maintain data history, simplify the transfer between file formats of different ATPs, and support IT solutions. As agricultural data warehouses are formed, security and access will be paramount to address producer safety and liability. A report released by the Identity Theft Resource Center indicated that 781 U.S. data breaches occurred in 2015, a near-record high. Recent lawsuits between federal administrations and private technology providers will create precedents regarding data access for future cases. The footprint that big data leaves may have a double impact for farmers, depending on who has access to the data and how it is being analyzed. Data security will become a major concern as the transition to digital agriculture continues.

ATPs have an ethical responsibility when using data that has been collected on-farm or through a data warehouse. ATPs should not recommend specific products or services nor speculate in commodity markets as a result of big data analytics due to ethical implications. The race for competitive advantage and the recent agricultural market downturn may fuel some of these unethical practices. Producers need to be wary of targeted product marketing and differential pricing, which may become evident in the digital age of agriculture. ATPs should also uphold the right of the producer to opt in,

opt out, or terminate ongoing services at any time during the contract. However, the producer must understand the ATP's data deletion and transfer policies before contracting for services with the ATP.

Agricultural and biological engineers play a major role in ensuring that the collection and use of big data are performed ethically. By serving in this discipline, we are committed to upholding the ASABE Code of Ethics of Engineers for the greater good. As the first of The Fundamental Canons states, we shall hold paramount the safety, health, and welfare of the public in the performance of our professional duties. Often, engineers are the first line of defense in speaking out against unethical practices. Software ethics issues, similar to the recent Volkswagen and Mitsubishi cases, may become more common in the future. Therefore, as a profession, we must be on the lookout for unethical data use and manipulation as the industry continues to evolve.

In conclusion, digital agriculture and the use of big data will allow producers to artificially increase their farm acreage through aggregation of data to make informed decisions. These data-driven decisions aim to accelerate the progress of successful farm practices. With big data comes big opportunities, as well as new issues. Policy

between ATPs and producers on the collection and ownership of data needs to be more transparent. ATPs and data warehouses need to invest in data security to ensure producer confidence for further progress of digital agriculture. Stronger policy is needed regarding access of federal entities to producer data. Finally, ATPs need to uphold their ethical responsibility when using big data for analytics and recommendations. Ultimately, the digital age of agriculture will present producers, ATPs, and agricultural and biological engineers alike with many challenges, as well as opportunities to better meet the demand of the growing population and ensure a sustainable agricultural future.

ASABE member Jason Schuster, Graduate Student, Iowa State University, Ames, USA, schuster@iastate.edu.



"At Iowa State University, students learn about precision agriculture and guidance systems during hands-on labs. GPS guidance and automated steering systems are not new to agriculture, but they are enabling new sources of big data to fuel agronomic recommendations."

VisualChallenge6

BEYOND THE WORDS

IMAGES OF AGRICULTURAL AND BIOLOGICAL ENGINEERING

Visual images are always a big part of producing *Resource* magazine. Images complement the written word by engaging reader interest and providing further information. The 6th annual Agricultural and Biological Engineering Visual Challenge—our call for “statements without words”—proves once again that ag and bio engineers are often as proficient in photography as they are in science and technology.

We thank the many contest contributors for their images from close-to-home locations and far-flung assignments—all with an eye for color and composition.

The beauty and meaning of the ABE profession come to life in these images, showing those outside the field: “This is what we do—on the job and off.”

Of course, the photos selected are only a glimpse of the wide variety of activities within the ABE profession, and the selection process was inevitably subjective, but we are confident that these photos show some of the visual wonders that ag and bio engineering careers can offer. We hope you enjoy the finalists’ efforts! Be inspired ... we await your entries for *VisualChallenge7*!



Photograph by Ian Grob, submitted by ASABE member Harold Thistle, Program Manager, USDA Forest Service, Forest Health Protection—Forest Health Technology Enterprise Team, Morgantown, W. Va., USA, hthistle@fs.fed.us.

HEMLOCK STAND

A forestry technician works under a mature hemlock stand in New Germany State Park, Maryland, as part of a study to evaluate canopy penetration of an aerially applied fungal pathogen for the hemlock woolly adelgid, which is killing hemlock in the eastern U.S. This stand was later heavily damaged by 30 inches of wet snow associated with Hurricane Sandy, and only about half of the trees pictured here remain.



ASABE member John H. Lumkes Jr., P.E.,
Associate Professor, Department of Agricultural and Biological Engineering, and Associate Director, Global Engineering Programs, Purdue University, West Lafayette, Ind., USA, lumkes@purdue.edu.

MOVABLE FEASTS: FOOD AND TRANSPORT

Above: A local agricultural market in Kigali, Rwanda, photographed during the Land O'Lakes Global Food Challenge summer experience.

Left: David Wilson (Purdue BSAE, MS) in Faranah, Guinea, teaching a shop class to ag engineering students at the Institut Supérieur Agronomique et Vétérinaire de Faranah. The class built a PUP (Purdue Utility Platform) over a two-week period.



ASABE member A. J. Both, Associate Extension Specialist, Department of Environmental Sciences, Rutgers University, New Brunswick, N.J., USA, both@aesop.Rutgers.edu.

Above left: LAMP TESTING Measuring the spectral light output of an LED lamp designed for horticultural applications.

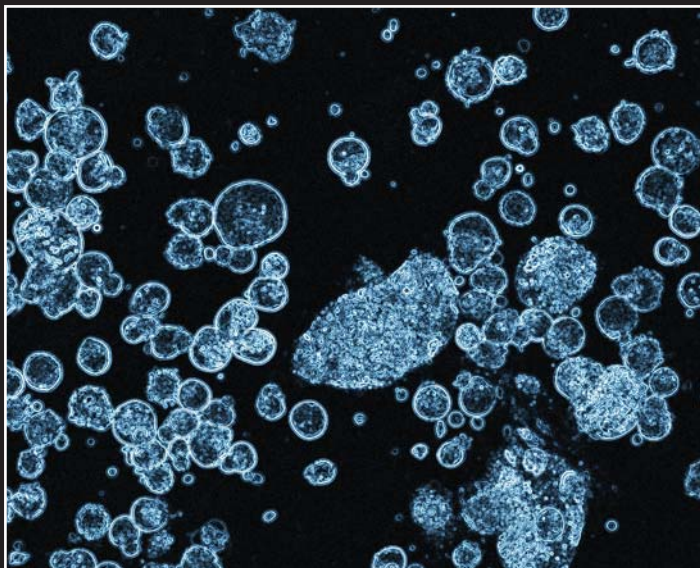
Above right: ORCHIDS Phalaenopsis orchids growing in a Michigan greenhouse.



ASABE member Saleh Taghvaeian, Assistant Professor and Extension Specialist in Water Resources, Department of Biosystems and Agricultural Engineering, Oklahoma State University, Stillwater, USA, Saleh.Taghvaeian@okstate.edu.

FOOD-ENERGY-WATER (FEW) SYSTEMS

In a field in northwest Oklahoma, irrigation water is supplied from the declining Ogallala aquifer with a center-pivot system. The wind turbines in the background represent the integrated nature of FEW systems. "I was laying catch cans to test the efficiency and uniformity of the system. If you look closely you will see the catch cans on the ground—three of them under the nozzles in the first span. Agricultural engineers must employ a holistic approach of utilizing renewable energy resources, efficient land and water management, and agronomic improvements to achieve sustainable agricultural production."



ASABE member Suresh Neethirajan, Program Leader, BioNano Laboratory, and Bioengineering Assistant Professor, School of Engineering, and students **Ryan Berthelot** and **Abdulmonem Murayyan**, University of Guelph, Canada, sneethir@uoguelph.ca.

Above: FIRE MOUNTAIN Nanoscale 3D atomic force microscopy height profile image of *Listeria monocytogenes* bacterial biofilm.

Left: NEON BUBBLES Human colon cancer cells reacting to the isoflavones extracted from Ontario-grown onions observed using a microscopic plate reader.



ASABE member Paul Funk, USDA-ARS Southwestern Cotton Ginning Research Laboratory, Mesilla Park, N.M., USA, pfunk@msnu.edu.

TEXAS FIELD

"I took a few photos along the way, traveling east from New Mexico to Texas. Just west of Roscoe, a flash of Texas sun caught my eye. It was an ag pilot cartwheeling between wind generators."



ASABE member Jason Schuster, Graduate Research Assistant, Department of Agricultural and Biosystems Engineering, Iowa State University, Ames, USA, schuster@iastate.edu.

RYE COVER CROP

Soybeans push through a spring terminated cereal rye cover crop in northeast Iowa. Cover crops of cereal rye (pictured), oats, and radishes are gaining popularity as a means of soil and water conservation. Cover crops can help slow the movement of soil and nutrients when primary crops are not actively growing. Weed suppression in the spring is another added benefit of planting cover crops.



ASABE Fellow and Past President Jim Dooley, P.E., *Chief Technology Officer*, and **ASABE member David Lanning**, *Mechanical Engineer*, *Forest Concepts, LLC, Auburn, Wash., USA*, www.forestconcepts.com.

BIOMASS HAMMER MILL SCREENS

Hammer mill performance is optimized through screen selection, with the right perforation and gauge for a specific grinding operation.

**ASABE member
Allison Graham**,
*Manufacturing Group Lead,
Research and Development,
Engineer-in-Training,
Seed Hawk Inc., Langbank,
Saskatchewan, Canada,*
allison.graham@seedhawk.com.

THE LIMITS

With urban populations ever expanding, “the farm” can now be on your doorstep! It is an exciting time to be an engineer who gets to work on solving the unique challenges brought by the mixing of rural and urban cultures.





ASABE member Brian McLaughlin,
*Agricultural Graphic Designer, Notre Dame,
Ind., USA, brianmclaughlin@gmail.com.*

ROUND BARN, FULTON COUNTY, INDIANA

*Built in 1924 and a recent tornado survivor,
the barn was rehabbed by an Amish crew
using cedar shakes and a diamond-shaped
roof bracing system. The signature braces,
seen from the interior, prevent catastrophic
roof shift, which round barns can experience
after decades of aging and exposure to wind
and weather.*



ASABE Foundation Work in Focus

Like to plan ahead?
Make charitable giving to ASABE
part of your overall estate plan

Robert J. Gustafson, P.E.



Glenn Schwab, 1919-2003
Photo circa 1975

Dr. Glenn O. Schwab was a highly regarded faculty member at The Ohio State University for many years. He was well known for his leadership in developing text materials, particularly as first author of the popular textbook *Soil and Water Management Systems*. He was also very active in ASAE (now ASABE). In 1968, Glenn received what is now the ADS/Hancor Soil and Water Engineering Award, and in 1987, he received the John Deere Gold Medal Award. One of his most significant passions within ASABE was the textbook committee.

Always a planner and loyal ASABE member, Glenn set aside a portion of his estate to support an ASABE cause important to him—the Harold Pinches Memorial Textbook

Loan Fund. The fund honored Harold Pinches who, when employed by Harry Ferguson, Inc., initiated the financing and production of the Ferguson Foundation series of textbooks, which were used by several generations of agricultural and biological engineers.

After his death at age 84, Glenn's bequest dramatically expanded this endowed fund, so much so that the fund was renamed the Harold Pinches and Glenn Schwab Teaching Materials Fund. It now supplies annual funding for projects that facilitate the development or effective distribution of ASABE teaching materials, including textbooks. This is a lasting legacy for both Harold Pinches and Glenn Schwab.

Since 1987, the ASABE Foundation has provided members with opportunities to build a legacy to ensure that agricultural and biological engineering continues to prosper. More than 90 separate funds are administered by the ASABE Foundation. They are used for awards, scholarships, and special projects. Awards are given to those who have made exemplary contributions to the work of ASABE and the professions served by our Society. Scholarships are granted to promising students enrolled in agricultural or biological engineering programs. Special purpose funds enable ASABE to capitalize on unique opportunities for growth in our professions and our Society. Check out the Foundation website for more details on current funds (asabe.org/Funds).

If you want to leave a lasting legacy upon your passing, consider including ASABE in your estate plan. For questions regarding contributing to an existing fund or establishing a new fund, please contact Mark Crossley, ASABE Director of Advancement, at 269-932-7002 or crossley@asabe.org.

**ASABE Fellow, Past President, and Foundation President
Robert J. Gustafson, P.E.**, Professor Emeritus, The Ohio State University, Columbus, USA, gustafson15@gmail.com.



Honoring the Newly Elected

At the July 2016 Annual International Meeting in Orlando, Florida, thirteen new ASABE Fellows were recognized. Election to Fellow is one of the highest distinctions an ASABE member can achieve, and those elected often say that this recognition by their peers is one of the most significant experiences of their career.

ASABE's Constitution establishes that "a Fellow shall be a member of unusual professional distinction, with outstanding and extraordinary qualifications and experience in, or related to, the field of agricultural, food, or biological engineering. A Fellow shall have had 20 years of active practice in, or related to, the profession of engineering; the teaching of engineering; or the teaching of an engineering-related curriculum. The designation Fellow shall have honorary status, to which members of distinction may be elected, but for which they may not apply. Admission shall be only after a minimum of 20 years as an active Member-Engineer or Member of ASABE."

As in the previous issue of *Resource*, we shine the spotlight on three of the newly elected honorees:



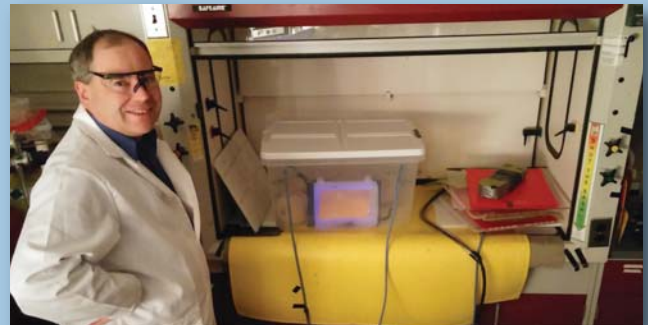
Maynard M. Herron P.E., ASABE President, Engineering Manager, Product Proving, AGCO Corporation, Hesston, Kansas, is honored for his selfless service to ASABE and his tireless advocacy for the profession of agricultural and biological engineering. Herron's passion for improving agricultural productivity and the lives of farmers is evident throughout his career, particularly at AGCO, where he works on improving hay and forage harvesting equipment. Herron's work on the design of round balers has earned him several patents, and his improvements to baler technology have significantly reduced transportation costs and storage losses for farmers around the world.

Pictured here: Maynard, leader of his local Boy Scout troop for 26 years.



Joseph P. Harner, P.E., Department Head and Professor, Department of Biological and Agricultural Engineering, Kansas State University, is honored for advancing engineering principles and implementing innovative ideas toward a safer and more sustainable food system. A member of the Kansas State University dairy team, Harner has been involved in bringing fundamental engineering principles to the design and evaluation of heat abatement systems for conventional dairy structures in the development of low-profile, cross-ventilated, free-stall building design.

Pictured here: Joe reviewing the K-State Vision 2025 with colleagues.



Kevin M. Keener, P.E., Director and Professor, BioCentury Research Farm Center for Crops Utilization Research, Department of Food Science and Human Nutrition, Iowa State University, is honored for his outstanding technical contributions through application of science and engineering principles to improve food safety, enhance quality, and reduce waste to promote sustainable practices in the production and processing of food through engagement with entrepreneurs, companies, researchers, students, and government. Keener has developed educational training programs for food entrepreneurs, food companies, and regulatory agencies in North Carolina, Indiana, Iowa, across the U.S., and for international audiences.

Pictured here: Kevin in the lab testing high-voltage atmospheric cold plasma.



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Plugging Off-Road Equipment into the Industrial Internet of Things

Scott Dixon

The Industrial Internet of Things (IIoT) and Big Data have been trending topics over the past couple of years. Increased interest and excitement surrounds the massive opportunity associated with creating a network of connected industrial assets (fixed and mobile) to improve the efficiency of industrial systems. In 2015, Accenture released a report estimating that IIoT has the potential to add \$14.2 trillion to the world economy by 2030. It's anyone's guess if this estimate will come to fruition, but it's hard to deny that over the next decade many new companies and services will be built on this new capability.

With promises for the off-road industry of simplified fleet management, reduced breakdowns, and gains in machine performance, it's easy to see why large and small off-road equipment owners are starting to take notice and even implement some of these tools and services into their operations. So how can ASABE play an active role in leading IIoT adoption for off-road equipment? Two areas are quickly becoming significant headwinds for IIoT development in off-road equipment, and ASABE members are well positioned to provide smooth sailing in both areas by contributing unique skills and promoting industry standards.

Bridging the skills gap

Many industrial companies are having a hard time finding qualified candidates with the skills needed for growth in IIoT. It's easy to think that if you hire the best and brightest in majors like computer science, mathematics, or statistics, then you'll be well on your way to developing a strong team in IIoT, cranking out advanced analytical models faster than you can market them to your customers, right? Not so fast. Strong programming and analytical skills are only a part of the story, and it can be argued that a solid understanding of the "domain" is a bigger piece of the hiring puzzle for a successful IIoT team.

Imagine that you're trying to develop an app to predict when a machine will need repair. Wouldn't it be valuable if part of the development team was knowledgeable or experi-

enced in maintaining off-road equipment? After all, that is the objective of your app, right? Sounds reasonable, but this has been an issue for many early companies in IIoT. ASABE members are well positioned to take a lead role in the growth of IIoT in off-road machinery by leveraging their knowledge of machinery, but don't submit your résumé just yet. A grasp of programming languages like Python or R, relational databases, and machine learning algorithms is critical to ensure that you can help to bridge the skills gap.

Industry-wide data standards

"The devil is in the details," and for IIoT, the details start with a robust data set. A critical piece of the IIoT puzzle is establishing a common set of channels that are available on each piece of equipment. The good news: much of the work has already been done by the Society of Automotive Engineers (SAE J1939) and the International Organization of Standardization (ISO 11783, based on SAE J1939). A list of channels has already been reviewed and accepted by the SAE J1939 committee, encompassing over 6,000 unique channels that communicate through a standardized bus, which can serve as a tremendous foundation for an IIoT standard.

Obviously not all 6,000 channels are relevant to every piece of equipment, and there are limits on how much data can be pushed through the communication bus. This is where ASABE members could take an active role. Experts from across the off-road industry could come together and establish a minimum set of SAE J1939 channels that are needed to support IIoT capability. As few as five or ten channels (e.g., engine speed, engine load, and ground speed) could serve as a robust first version of an off-road equipment IIoT standard. Using this as a starting point, ASABE members could promote standards adoption across the off-road industry, helping to unlock value to off-road equipment companies, dealers, and customers.

Scott Dixon, Senior Analytics Team Leader, Information Analytics team at Caterpillar, Inc., and ABE Advisory Committee member, University of Illinois at Urbana Champaign, Dixon_Scott_A@cat.com.

Views expressed are solely those of the author and do not necessarily represent the views of ASABE.



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Keynote Speaker



Ambassador Kenneth M. Quinn
President
The World Food Prize Foundation

