



MINIATURE AGVS AND OTHER DESIGNS PERFORM UNIQUE FARMING TASKS

Because the vast majority of Americans have little to no experience with farming work, they might be excused for thinking that the tools employed in such work are the old-fashioned designs of the last century. In fact, automation has made massive inroads into farming, especially over the [last decade](#). As in any industry, such automation does meet with some suspicion, as it often eliminates or changes the composition of jobs, though many farm operators have in fact chosen to adopt automated farming solutions to execute jobs for which there aren't many laborers available to hire anyway.

The automation of farming's most identifiable vehicle — that of the tractor — has gotten the most press coverage over the last two or three years. But complicating the cost-effective implementation of some such solutions (at least over the short term) is how tractors serve many different functions on the farms where they're used: essentially representing indispensable multipurpose "Swiss Army knives" of farm equipment. Satisfying tractors' myriad uses necessitate several sensor systems rugged enough to operate despite exposure to dust and mud, and controller and motor-amplifier tuning can be necessary with changing environmental conditions. The pricetag for some such designs is typically several hundred thousand dollars and can run in the millions.

Where farmers can't currently justify incurring the largest expenses (or if recent investments in traditional equipment precludes such expenditures) sometimes procuring somewhat more modest automation technologies can complement existing equipment and provide value. These agriculture-technology or so-called agtech solutions often leverage the benefits of automation for very specific (dedicated) farming tasks.



Shown here are several Minnesotan farms interspersed among some of the state's famous lakes. Emphasizing farm profits over gross yields has spurred automated approaches to farm herbarizing and fertilizing that are more precise than traditional methods. Such approaches can in turn can help reduce the amount of runoff into waterways adjacent to farming operations. Image source: Barbarag58

Closely associated with the precision agriculture movement, such solutions take the form of robotics, artificial intelligence (AI) systems, and other pieces of vegetal monitoring and weeding equipment defying neat classifications.



The autonomous MetoMotion GRoW robot is equipped with twin robotic arms to harvest rows of greenhouse tomatoes quickly yet gently. Notice the vertical belt-driven axes and other motion components. Image source: Ridder

Several research teams and startups in this space are located in the Midwest close to the geographical intersections of lucrative corn, soybean, and wheat growing monocultures in the U.S. [The Center for Digital Agriculture \(CDA\)](#) at the

University of Illinois at Urbana-Champaign unifies one such decentralized team. Initiatives of the CDA have yielded copious new possibilities for future technologies and the release of the EarthSense [TerraSentia](#) — an automated ground vehicle (AGV) capable of exceptionally targeted scanning actions on plants, weeds, and soil.

Precision agriculture to boost other farm efficiencies



Shown here is a linear-motion application for automated soil sampling — a requirement for certain organic-soil certification. Image source: Sereda Slavko

Other job specific AGVs for precision farming abound to sow cover crops, assess plant and field health, pull weeds, and much more.

An insect-collecting Bug Vacuum vehicle from Spanish company Agrobot provides a pesticide-free method of pest control that promises to help farmers deliver produce that's healthier for consumers even while trimming farm-operating costs over the long term.

Israeli startup MetoMotion now of Ridder sells a harvesting vehicle called the *Greenhouse Robotic Worker* (GRoW) equipped with twin robotic arms; specially designed for greenhouse settings, these arms employ path-planning algorithms and flexible motion controls for precise grasping of fruit on and between plants.

Sometimes the application-specific offerings of relatively modest startups ultimately come to see adoption by the biggest equipment manufacturers in their biggest tractors and other vehicles. Case in point: Blue River Technology's See & Spray technology (distributed on John Deere equipment) promises to vastly improve the precision with which herbicides are applied to fields. Here, machine vision pairs with controls and sprayer actuators on booms to reduce the use of expensive chemicals, which has the secondary benefit of preserving the long-term effectiveness of such chemicals by ultimately preventing herbicide-resistant weed strains.

At the core of these and various other emerging and commercially available farming robotics and AGVs are various permutations of electric motors, motion controls, and linear systems. Consider two suitably robust options for the latter: Bishop-Wisecarver® [LoPro® linear actuators](#) come in an array of stock as well as customizable variations to work in robotic axes of all strokes. Farm-robot OEMs can choose from a number of drive types, including chain or belt drives. Another BW offering are [UtiliTrak® linear guides](#), which excel at supporting and guiding loads on automated farm equipment. Both UtiliTrak® guides and LoPro® actuators come in variations to address two major design challenges associated with farm equipment:

Exposure to harsh and corrosive environments

Both UtiliTrak® and LoPro® are built with Bishop-Wisecarver's DualVee Motion Technology®: guide wheels and track with specialized angled running surfaces that clear off debris as the motion system runs. On top of that, [UtiliTrak® CR series linear guides](#) and LoPro's range of customizable actuators include stainless-steel guide track mounted on hard anodized aluminum to deliver maximum corrosion

resistance.

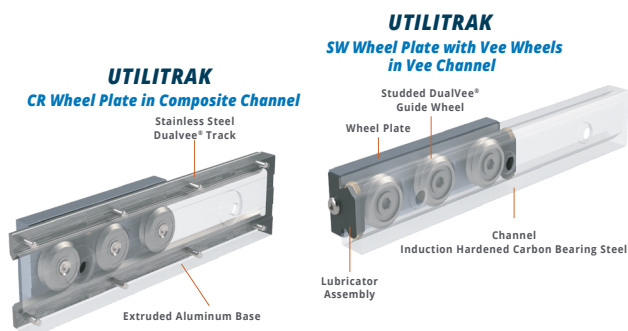


LoPro® Linear Actuator from Bishop-Wisecarver®

Vibration

BW engineers designed versions of their core motion systems specifically for tractor-mounted systems and other vibration-prone agricultural equipment. Fitted with anti-vibration lock nuts, these solutions prevent problems associated with fasteners coming loose or off of their threaded elements and requiring additional maintenance. This feature is especially useful on farm-equipment end effectors that dig, probe, or shake field soil.

These linear guides, actuators, and designs based on Bishop-Wisecarver's DualVee® wheels can be specified singly or built into completely custom solutions as necessary. Another benefit to integrating motion components from BW into farm equipment is that they withstand the abrasive nature of even very gritty soils. In this regard at least, the challenges of machine tool and textile manufacturing aren't unlike those in agriculture. Ultimately, ruggedness in motion components makes for a lower cost of ownership for farmers and other agriculture end users, which is paramount when equipment is often expected to last for multiple decades.



UtiliTrak® SW-series and CR-series linear guides are two options that are particularly well suited to specification on the linear axes of precision farming equipment.



Cattle hauler image: Robert Carner

Automation profits peripheral animal husbandry work

The opportunities for automation in agriculture extend beyond the farm. Consider the truck washes required for vehicles that transport cattle and other livestock. Cattle trucks in particular can become quite fouled, so require full interior washdowns after every transport. The messy and unpleasant job can cost hundreds of dollars per wash when done manually.

Now, actuators from Bishop-Wisecarver automate this process with linear-robotic systems capable of strokes to 70 ft; after cows disembark, this long-stroke system fitted with high-pressure water nozzles and other washing elements enters the trailer and sprays out dung and other debris. BW components are well suited to this wet and dirty outdoor environment.

For more information, call Bishop-Wisecarver at (925) 439-8272 or visit www.bwc.com.

ABOUT

Bishop-Wisecarver develops innovative motion solutions that are expertly designed and delivered to perform from a company you can trust. Leveraging over 70 years of experience, we've earned the reputation of providing unmatched quality, reliable service and engineering support for every stage of a customer's design cycle. No matter your application, volume shipment requirements or extreme environmental conditions, Bishop-Wisecarver listens to your specific needs and delivers innovative solutions.



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