Eye in the Sky

The sky is just the beginning for the future of drone technology in agriculture.

by ***Heather Smith Thomas***

The birds flying overhead may soon have to make room for a new addition to their aerial community. Drones — commonly referred to as small, unmanned aircraft systems (sUAS) or unmanned aerial vehicles (UAVs) — were once a novelty but are proving to have much more potential beyond a hobby. Innovative and practical agricultural uses for drones are gaining traction alongside the increasing popularity and implementation of drone technology itself. Drones have many applications in the technology-driven agriculture industry, including crop and livestock monitoring.

A cattleman's camera

An "eye in the sky" is a great tool for efficient oversight of large properties, pastures and herds. A drone can even be used for capturing high-quality photos and videos for cattle marketing and advertising purposes. Aerial surveillance is useful for tasks like monitoring activity in breeding or calving pastures, detecting sick animals, monitoring herd movement and patterns, locating cattle before a gathering, and checking fencing — ultimately saving time and miles.

For economic reasons, it is often impractical for ranchers to hire a helicopter to accomplish those tasks, so substantial quantities of valuable time and money are invested in human labor instead. For example, ranchers with large amounts of pastureland often spend hours poring through hillsides and valleys, checking feed and water supplies or looking for sick, injured or missing cattle. Drones are a more affordable and time effective alternative for completing those jobs, and they double as a safety mechanism — some cattlemen use drones as herding tools to move cattle out of areas that are not convenient, or safe, for human access.

John Walker, Ph.D., professor and resident director of research at Texas A&M AgriLife Research and Extension Center in San Angelo, Texas, works with many ranchers who also run sheep and goats, which attract multiple predators. Drones can be utilized to determine if animals are being chased or harassed and help with checking traps.

"If they [cattlemen] are trapping predators and have snares along some of the fences, they can check trap lines or fly a drone down the fence, without having to drive out there to look," Walker says.

Drones can be utilized for a variety of tasks, including monitoring cattle out in pastures. The image on the left was captured with a drone, a process shown in the image on the right.

In addition to managing cattle, an extra set of eyes is useful for monitoring other domains of the ranch. “In Texas, hunting income is important for many ranches, and they do deer surveys with helicopters,” Walker explains. “You can do the same with a drone, less expensively. You can send your drone out on a pattern, record all the video from the flight and then you have a permanent record.”

As cattlemen continue to incorporate drones into their management routines, they continue to come up with innovative applications for drone technology. However, all drones are not created equal. It is important to pinpoint the intended use of a drone before making a selection.


With many types of drones on the market today, it is important to identify the best one for your goals.

Know your drones

When choosing a drone, it is important to understand the technology of different models. According to Brent Auvermann, Ph.D., Texas A&M AgriLife Research and Extension Center director, Amarillo, Texas, there are two overarching categories of drones.

Auvermann explains, “The type people are usually most familiar with are the ones that look like helicopters, with two, four, six or eight rotors. They can go slowly and hover like a helicopter. These are very handy for some types of monitoring. The other type are fixed wing, more like an airplane. They fly faster but can’t hover. If you want to cover a lot of ground in a hurry, the fixed-wing drones are best.”

Still, both types of drones are very useful and can be tailored for specific circumstances. After deciding which type of drone to use, the next step is deciding which type of sensors to use.

“All drones can be outfitted with a variety of sensors,” Auvermann says. “We can also mount regular cameras or more sophisticated sensors on drones — such as thermal cameras.”

Thermal cameras can detect differences between temperatures of objects or animals in a pasture or field, which can be useful for tracking livestock at night or under the cover of trees.

Since not all farmers and ranchers can double as drone pilots, Walker appreciates that drones come equipped with an easy solution. “You can pre-program drones to run a route, such as checking a fence,” he says.

Preprogramed routes allow farmers to focus on the cattle without worrying about the drone itself. “You can send the drone on that route, and all you have to do is concentrate on watching the screen to see where the cattle are,” Walker explains. “Otherwise, you are distracted between two tasks — flying the drone and watching the screen.”

Flight delays

Unfortunately, drones were originally intended for recreational purposes, so this technology has a few bridges to cross before widespread adoption in the agriculture industry is feasible. In Walker’s mind, the biggest limitation of drones is battery life. “The upper end [of the battery life] is about 30 minutes,” he says. “In my experience, however, wind will cut that down and you might get about 80% of the advertised battery life.”

Along with wind speed, Walker acknowledges the speed the drone is flown contributes to a shortened battery life, as well. “The faster you go, the more battery it takes,” he explains.

Because of brief battery lifespans, flight length is abbreviated. “Most of the flights we do with a rotary drone have a maximum duration of 20 to 25 minutes,” Auvermann explains. “The batteries are heavy. The more power you need [to operate the drone and its sensors], the more batteries you need and the heavier the drone will be.”

Although flight times are brief, Auvermann admires that drones uniquely allow for a fairly up-close imaging experience of items close to the ground. “You can stay under the cloud deck and be close to the ground and the things you want to image,” he says. Satellites are simply too high above the ground, and clouds can interfere with satellite imaging of objects on the ground.

These vast capabilities have only spurred an increase in drones. To ensure aerial safety, drones are accompanied by an individualized set of rules and regulations established by the Federal Aeronautics Administration (FAA). Drones totaling less than 55 lb. — including the drone itself and any attached sensors — are classified as small unmanned aerial systems (sUAS) and fall under the FAA’s Part 107 rules. According to the Part 107 rules, any individual with a desire to do commercial work with drones must be a certified UAS pilot. Hobbyists still must register their drones, but do not have to be certified drone pilots themselves.

“A rancher or feedlot operator flying his or her own drone for checking animals would not fall under the hobby category; this use has commercial value so you would need to be certified as a sUAS pilot,” Auvermann explains. “I recommend being safe rather than sorry.”

Drones of this nature can fly no higher than 400 ft. above ground and must remain in an unaided line of sight. Reliance

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on binoculars or additional people is not allowed — the drone must remain in the pilot's visual line of sight. "It is good to have additional observers, but this is not required," Auvermann says.

Besides limitations on height and piloting methods, drone airspaces are also closely regulated. Drones can fly only in Class G airspace — which refers to airspace not under the control of an airport control tower. Most Class G airspace is outside the 5-mile radius of the nearest airport that has a control tower.

Therefore, it is no surprise a portion of the sUAS pilot's training is learning how to read aeronautical charts and knowing the location of Class G airspace. "Ignorance is no excuse if a drone strays into controlled airspace without authorization," Auvermann says.

According to current regulations, drones cannot fly at night. As it is for hunters, nighttime is defined as the time 30 minutes after sundown and 30 minutes before sunrise. Visibility is simply not adequate for flight during that time.

Drones, whether for agricultural or hobby uses, are just one intriguing piece in an era full of technological advances for cattlemen. With a bit of background research and careful consideration of FAA regulations, farmers and ranchers just might be able to incorporate drones and "fly through" previously time-consuming tasks in a way they never dreamed possible. Regardless, the drone's many unique capabilities make it a promising new innovation with many features that can ultimately prove beneficial in today's cattle industry. HW

High-tech crop management

Aside from aiding cattle producers, drone technology can also benefit crop farmers through improved plant monitoring. "If you want to count the number of berries or grains on the head of a sorghum plant, we can now do that," says Brent Auvermann, Ph.D., Texas A&M AgriLife Research and Extension Center director, Amarillo, Texas.

The Texas A&M agricultural engineering professor specifically points out LiDAR, a technology that operates on the principle of radar but uses light energy instead of radio energy. When hung underneath a drone and flown over the canopy of a sorghum field, LiDAR creates what is known as a point cloud. "This can actually image the head of the sorghum plant and count the grains," he says.

Specialized sensors can also be attached to drones and used to measure the light that reflects from the ground's surface or a crop canopy. "We can select different parts of the light spectrum, depending on what we are looking for, and put a sensor on a drone to measure that," Auvermann notes. When drones with those sensors pass over crop fields, LiDAR can then identify things like water stress, nutrient deficiency, and disease or insect pressure on plants. HW