

Ag drone field grows

Robotic aircraft to pilot future of farming

By Thomas Sumner

For The Salinas Californian

While deadly military drones grab headlines, a very different type of drone glides above the vineyards of Davis. Precisely aligning itself along a row of grapes, the robotic helicopter releases its 16-liter pesticide payload on the crops below.

The sight of the snowmobile-sized aircraft might seem out of place now, but agricultural drones are poised to become more common. This shift is thanks to clever engineering and a new federal policy aimed at opening the skies to commercial drones by 2015. The drones, which range from helicopters the size of hummingbirds to full-sized, fixed-wing aircraft, can be flown by remote control or by an automated flight system.

In agriculture, drones can snap photos, take measurements and spray crops, allowing farmers to manage their

fields at a plant-by-plant level.

“What one plant needs on one side of the acre and what another plant on the opposite side needs might be completely different,” said Chris Mailey, vice president of the drone advocacy group Association for Unmanned Vehicle Systems International. “Using robotics in agriculture allows you to get more detailed information and apply whatever nutrient or water you need in a much more precise manner.”

The practice of precision agriculture means plants get the exact amount of fertilizer and other chemicals they need, reducing waste and nitrate runoff. “If you’re better managing your crops, you’ll use less fertilizer while increasing your yield,” said Mailey. “That’s a win for everyone.”

By 2025, the agricultural drone industry is projected to

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become a nearly \$400 million industry in California and create more than 4,000 new jobs. Agricultural uses are estimated to make up more than 80 percent of the commercial drone industry.

Japan's drones

The use of unmanned aerial vehicles — more commonly referred to as drones — in agriculture already is widespread in Japan. In 1990, manufacturer Yamaha began leasing the remote-controlled RMax crop-spraying helicopter to Japanese farmers. In 2010, the RMax helicopter and its copycats accounted for 30 percent of the crop dusting in Japan, according to data from Yamaha.

The RMax solved two major problems for the country's agriculture industry. In Japan, limited farmable land means many fields run alongside residential neighborhoods. Residents living near rice paddies worried imprecise chemical sprays by manned aircraft would drift into their homes. The country also faced an aging and shrinking agricultural workforce, making labor-intensive tasks such as pest control difficult.

"They have the same problem a lot of the U.S. has, where the agriculture industry is aging without a younger generation to take their place," said Ken Giles, a professor of agriculture engineering at the University of California, Davis. "Part of the idea was that having a more interesting vehicle might entice the younger generation into farming."

Drone tech comes stateside

Giles and his research team are working with Yamaha to develop crop-spraying technologies for the U.S. market using an RMax. Last year his team tested their system on grapevines and almond trees. Though it's still in the early stages, Giles says the technology shows potential.

"This will be a new capability for agriculture operations where ground operations are hazardous," he said. "On steep slopes, like you have at a

vineyard, an unmanned aerial vehicle is a lot safer. You're not going to have a rollover and you've removed the operator from contact with the chemical."

Giles worked with Bradley Higbee, an almond grower and research entomologist for Paramount Farms in Bakersfield. Higbee says he was impressed by the amount of spray coverage the RMax demonstrated in their tests, but says the real value of the automated aircraft will be collecting data.

"The technology to put these vehicles up in the air is already here," Higbee said. "The bigger issue is creating sensors that can collect the information we need, such as where the nutrients are going."

Higbee hopes the sensors will eventually be able to detect a spider mite infestation before it spreads to the rest of the orchard. The tiny pests love munching on almond trees and live on the highest branches, making them difficult to detect before it's too late.

Higbee says that while popular culture might paint farming as a low-tech industry, the exact opposite is true.

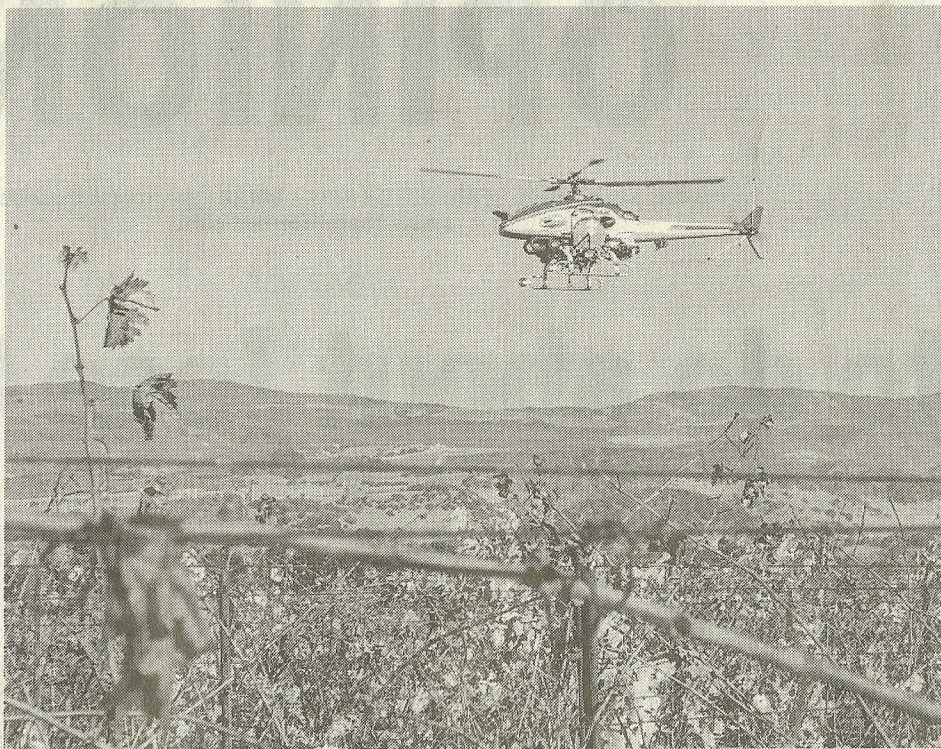
"It's definitely a misconception," he said. "We're always looking for new techniques and tools to help us improve. Most all of the farmers I've talked to [about the drones] seem interested."

Safety and privacy

While farmers are certainly curious about drone technology, current Federal Aviation Administration regulations make testing difficult. In February the FAA revealed that some 327 domestic drone operators have active research permits.

The number of permits is set to increase after Congress passed a law in February giving the FAA until the end of 2015 to open national airspace to unmanned civil and commercial aircraft. The FAA has already begun the approval of six drone test sites across the country.

"When we're doing research, working with farmers is a mutually beneficial process," said Bret Kugelmass, co-founder of the Bay Area commercial drone startup Airphrame. "Since we don't have agriculture



A drone helicopter flies over an Oakville vineyard. PROVIDED/KEN GILES, UC DAVIS

backgrounds, we're learning about that side as we go."

While the new policies will allow more researchers to enter the field, the safety policies currently in place will remain. Giles' team has the only RMax in the U.S. and is required to clear their test flights with the FAA several days in advance. The aircraft's pair of remote

control operators must always have a clear line of sight to the vehicle and no one is allowed in the field during testing. If a drone loses contact with its controllers, it is designed to automatically stop and hover above the ground.

Besides safety, the other big concern about a growing number of commercial drones is privacy. Smaller drones are fairly

quiet and some observers are concerned they could be used to peek at people's personal property. Mailey says this concern is more focused around security and law enforcement systems and isn't as applicable to those built for farms.

"I don't want to be spied on either, but there are laws in place to prevent that, and these

flights will likely be far away from people's houses," said Mailey. "Plus nobody cares about the privacy of lettuce."

A drone future

The owners of farm drones won't likely be the farmers themselves. The drones will likely be too expensive, costing tens of thousands of dollars. Instead, private contractors would lease or purchase the devices and rent their services to farmers.

"The growers I've talked with have heard a lot about unmanned vehicles and know the problems they have," said Giles. "They see the application the vehicles have for places that are hard to reach and for collecting data."

Higbee predicts that once commercial drones are introduced into the market, it will take several years for farmers to embrace the technology.

"It will take a while to find out what they can do and what their limitations are before they'll be flying above farms," said Higbee. "But at a certain point down the road, drones will become just like any other tool farmers have."