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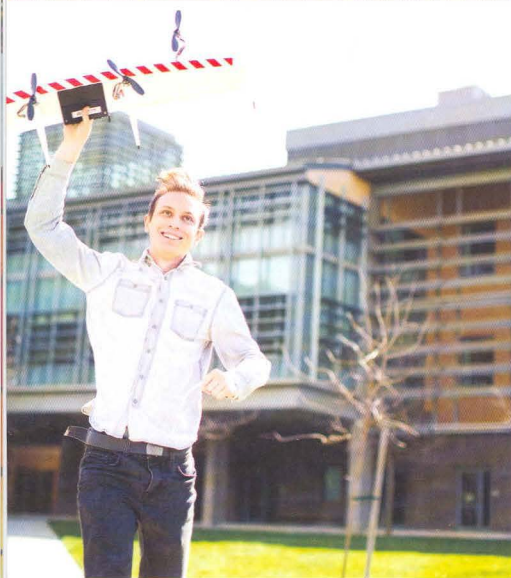
SIERRA VIEWS – a look at UC Merced
research in the mountains



THE
MATTER OF **DRONES**

THE MATTER OF DRONES

BY ADAM ASHTON
PHOTOS BY ELENA ZHUKOVA



ABOUT THE WRITER

Adam Ashton is a professional journalist with more than 12 years' experience as a reporter and editor including at the Merced Sun-Star and the Modesto Bee. He works for the Tacoma News-Tribune covering military affairs at Joint Base Lewis-McChord in Tacoma.

UC Merced engineering Professor YangQuan Chen lets the machines do the talking when he invites budding engineers to his program in unmanned aerial vehicles, the flying machines better known to the public as drones. Well, they don't really speak.

But Chen knows a sure-fire way to recruit a curious engineer is to let a student get hands-on experience building, programming and testing small flying vehicles at UC Merced's mechatronics lab.

The offer hooked Sean Rider, who found Chen's program as a senior last year and returned this fall as one of the school's first homegrown graduate students in unmanned systems.

"I had a great time and I wanted to do more," he said.

Rider is joining an industry poised for takeoff as researchers and entrepreneurs dream up new uses for a technology most often associated with the military.

California alone stands to gain some 12,000 jobs in the field through 2017, according to projections recently published by the Association of Unmanned Vehicle Systems International.

Advocates of the technology say the next generation of unmanned aircraft will help farmers make the best use of their irrigation resources, enable environmental agencies to count rare animals in the wilderness and support fire crews looking for advantages against sprawling wildfires.

Count Chen among them.

He says the possibilities for doing good with small, affordable unmanned vehicles are "endless, just limited by your imagination."

'UAVS ARE GOING TO BE EVERYWHERE.'

Chen and his students face a challenge at UC Merced that goes beyond creating cutting-edge machines, however. They're working in a field that conjures up images of deadly military strikes in the Middle East, or a step toward total surveillance in the manner of Big Brother at home.

His students, accordingly, have to be ambassadors for the technology.

"Privacy is a big issue because unmanned aerial vehicles (UAVs) are going to be everywhere," Rider said. "Like any technology, you have to be careful how you use it."

All over the country, local and state governments are setting the parameters for how public agencies and private businesses can employ unmanned aerial vehicles in coming years.

They're trying to get ahead of the Federal Aviation Administration, which is preparing to open the skies to more UAVs by 2015.

Seattle's police department earlier this year received a license to fly unmanned aircraft and bought two of the machines, only to ground the operation when residents raised concerns about officers misusing them. Similarly, several state legislatures, including California's, are considering laws that would set clear guidelines for when, where and how unmanned aircraft could be flown.

"Surveillance is nothing new; what's new is that we have a new medium to do it," state Sen. Alex Padilla, D-Pacoima, said at an August hearing on possible UAV restrictions. He wrote one of the proposals to define how unmanned aircraft can be used. >>

UNMANNED AERIAL VEHICLES, OR DRONES, ARE BEING DEVELOPED FOR AGRICULTURAL AND ENVIRONMENTAL RESEARCH APPLICATIONS. BY EQUIPPING THESE FLYING ROBOTS WITH CAMERAS AND SENSORS, HIGH-RESOLUTION MULTI-SPECTRAL IMAGERY CAN BE OBTAINED FOR LAND SURVEYING, INVASIVE SPECIES MONITORING, CROP YIELD ESTIMATIONS AND MANY OTHER APPLICATIONS THAT CAN DIRECTLY BENEFIT THE CENTRAL VALLEY.



Padilla that day heard from a string of public safety officials seeking permission to fly unmanned aircraft, industry representatives looking for new markets and privacy advocates asking legislators for tight restrictions on the technology.

Much of the discussion focused on law enforcement agencies, which some fear might use unmanned aircraft without warrants to gather information that could be used against people in court.

“When you have a nearly silent drone, one might simply not be aware that surveillance is going on,” UC Davis law Professor Elizabeth Joh told lawmakers.

Chen spoke at the hearing, too. He has led discussions at the San Joaquin Valley campus about how to respect privacy in an era that could see the use of low-cost unmanned aircraft explode to the point where anyone could afford them.

The collision between technology and privacy appears inevitable as the price of new technology plummets while its quality improves.

“Today you just point and click” on personal computers, he said. “The technology (for UAVs) will mature to a point where you can just put it in the air and use it.”

The right path, he said, is to be transparent about what any given agency or business will and will not do with drones.

For example, agricultural cooperatives employing unmanned aircraft to assess their crops could announce that they won’t be approaching towns. They might stress to residents of their communities that the aircraft would not retain any videos from the flights beyond a certain amount of time.

“It does take a lot of us being proactive saying ‘we don’t fly over people, we don’t spy on people. That will never be our goal,’” said Brandon Stark, a doctoral student in unmanned systems at UC Merced who helped Chen launch the lab.

TURNING POINT

The summer ended with a powerful example of state agencies turning to unmanned aircraft for help in an emergency.

With the Sierra Nevada burning through one of its most severe wildfires ever this fall,

a Predator drone with a 55-foot wingspan piloted by the California National Guard kept a watch on the 200,000-acre Rim Fire. Its reports gave fire commanders up-to-the-minute information on the fire’s movements without putting firefighters’ lives in danger.

Multimillion dollar Defense Department drones likely will remain outside the realm of what local governments can afford as they experiment with unmanned aircraft over the next few years.

Instead, they’ll turn to less expensive options to help them work through hostage situations or assess natural disasters.

Chen and his students want a hand in creating those tools. The professor in a 2011 research paper showed someone could purchase, program and pilot an unmanned aerial vehicle for less than \$500.

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MARK HENDRICKSON
Merced County director of commerce,
aviation and economic development

From there, he said, researchers could develop “swarms” of low-cost UAVs that could fly into fire zones or airborne toxic events to gather data.

Losing one wouldn’t break a budget, and with many aircraft collecting information on the same incident, officials would be empowered with a full picture of events.

Those are the kinds of problems that motivate Rider, Stark and the rest of the students in UC Merced’s unmanned systems program. They’re getting plenty of company as word gets out about the research taking place in the drone lab.

“Attracting people is not an issue with us,” said Stark, who came to UC Merced as Chen’s only student in the Fall 2012. More than 40 students joined the lab a year later. “People flock to us because we offer this real exciting hands-on opportunity for research on all sorts of exciting projects.”

Rider’s senior project looked at how PG&E might use UAVs to spot gas leaks in remote locations. It made a lasting impression on Mark Hendrickson, Merced County’s director of commerce, aviation and economic development.

“The research being carried out at UC Merced right now is nothing short of extraordinary,” said Hendrickson, who helped UC Merced’s School of Engineering evaluate student projects in unmanned systems for its annual Innovate to Grow contest in May.

Hendrickson liked the “real-world practicality” he noticed in the gas-leak detecting UAVs Rider’s team designed.

For his graduate work, Rider’s thinking of studying ways to develop unmanned vehicles that could monitor their own systems so researchers on the ground know when they’re in danger of falling from the sky.

His experience in Chen’s lab opened his eyes about what he wanted to do with his career, and showed him where he wanted to get his start.

“Because of this program, UC Merced is the only grad school I want to go to,” he said.

