

Amateur drone operators soon could face high-tech barriers

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Something weird happened to Duncan Sinfield's drone shortly after he was told by a security guard to stop flying over a tech company's campus in the heart of Silicon Valley.

It flew off, defying attempts to control it, and headed for a watery demise.

"It mysteriously crashed into the bay ... and sank," said Sinfield, a television news assignment editor who in the past few years has used his drone to chronicle the valley's tech boom, posting his personal flyover videos on YouTube.

"I watched it go down at full speed, even as I was using my thumb to raise elevation. It was as if there were some invisible hand controlling it."

Sinfield has no clue what happened, and neither does drone-maker DJI, which reviewed the craft's flight data stored on the company's servers.

But with amateur operators increasingly buzzing corporate headquarters, sports venues and the private homes of tech celebrities such as Facebook CEO Mark Zuckerberg, emerging counter-drone technologies could soon spawn an intriguing cat-and-mouse game in the region's increasingly crowded skies.

"You can't just put a fence around a property anymore," said longtime

industry analyst Patrick Egan, who teaches a course in drone video production at the Academy of Art University in San Francisco. "You have to wrap it up completely."

Egan said many Bay Area tech companies go out of their way to protect their privacy, "so these flyovers are probably really getting their goat."

And that's where tools like "geofencing" come in. Using GPS or radio signals, the technology essentially creates a virtual barrier against intrusions. Software that prevents a drone from breaching a geofence can be embedded in the craft's navigation system, which is what DJI, the world's largest consumer drone manufacturer, does with its "geospatial environment online" feature.

DJI's software constantly updates the places users are prohibited from flying over, and operators are warned when they approach no-fly zones, such as airports, military installations, active wildfires and even presidential motorcades. By default, a DJI drone will not fly into or take off in locations that raise safety or security concerns.

But experts say there are other ways to surround property with a geofence, and some drone enthusiasts believe Silicon Valley companies may be quietly working to install "hidden" barriers set up by third parties. Robi Sen, founder and chief technology officer of Maryland-based communications and security company Department 13, said that in addition to creating potential safety hazards, drones can be used to steal trade secrets - and his firm is helping companies thwart the crafts from hovering over their properties.

While the small size of drones can make them hard to identify or distinguish from, say, a bird, Sen said, some tech companies are "using machine learning to help differentiate objects in the air so they can say, 'Hey, this is a drone.'" Other companies are using acoustic technology to

identify unmanned aerial vehicles, or UAVs, Sen said, and "these tools are being used by prisons and at events like the Boston Marathon."

Sen said his firm's software would allow a company to remotely "redirect an unwanted drone by setting up a geofence around its campus that says, 'Don't come in.'"

There are plenty of sites catching drone pilots' attention. Apple's highly anticipated "spaceship" campus, under construction in Cupertino, has appeared in dozens of amateur YouTube videos, drawing millions of viewers. The tech giant would not comment for this report. And at Levi's Stadium in Santa Clara, where some drone users say they've been unable to penetrate the airspace, a spokesman would say only that drones are prohibited by the Federal Aviation Administration from flying over the stadium.

Faced with growing threats - from invasion of privacy to corporate spying to terrorists using "swarms" of drones to bring down an airliner - public agencies and private companies are rushing to stay ahead of the drone trend.

But much of the anti-drone technology is being developed in secrecy for the government, so it's hard to know exactly what tools companies might be using to stop drones. Some in the industry worry that some claims by anti-drone firms may be misleading or exaggerated.

"There's a question of what technology is being used to create a virtual wall," said Brendan Schulman, DJI's vice president of policy and legal affairs. "If it's a jamming technology, I'd worry about violating FCC rules.

"And taking over control of a drone sounds like hijacking to me. The idea that a third party will take over control of someone else's aircraft is

potentially a serious violation and safety concern."

Yet Schuman acknowledged that there have been industry demonstrations in which people have managed to hack into an open Wi-Fi connection and commandeer someone else's drone.

Since anti-drone technology is relatively new, much of the aerial sparring that may be underway is unfolding in a legal gray area. For the drone users, FAA spokesman Ian Gregor said simply that "if you're operating a drone for recreational purposes, you don't need authorization from the FAA to fly, but you must fly safely and you can't endanger people or property on the ground."

And for those who might want to stop the intruding drones, Sen said there's currently no law prohibiting a company from setting up a geofence around its property.

Technologies using acoustic software to identify intruding drones are also being deployed, Sen said - by prisons trying to stop contraband from being flown in over the walls and by movie production companies seeking to keep competitors from spying on an active set. "It's 100 percent espionage," he said.

Department 13 and other firms are testing tools that can manipulate the radio signals sent between a drone and its user. "We essentially trick the drone into thinking we're the user, and our product allows you to take control and safely land it - or even turn off its video camera while it's flying in the air," Sen said.

Technology like that could help valley companies such as Apple keep airborne intruders at bay. In the meantime, flyover videos of the company's iconic new campus have found a huge audience on YouTube.

Sinfield, who started his monthly Apple flyovers in June 2015 and has generated more than 4 million views to date, said guards at the construction site have seemingly amped up their anti-[drone](#) security in recent months.

He was still able to post a recent video update on YouTube, albeit a bit shorter than those he'd done before the security ramped up.

"I was still able to do my video each month," he said, "except the last time, when they kicked me out before I was able to get" as much footage as in previous months.

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