# Is there a drone in your future?

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It's easy to start a conversation when you tell someone you're a helicopter pilot. But everyone has an opinion about drones, some people certain they heard one buzzing at their bedroom windows last night, others looking forward to having one deliver their next package from Amazon.

Helicopter pilots wonder if they will finish their careers sitting behind video game consoles.

That is most unlikely.

Microdrones, more formally known as "small Unmanned Aircraft Systems" ("sUAS"), will proliferate, but they will perform jobs in law enforcement, journalism, utility infrastructure support, agriculture, and real estate sales not now performed by helicopters. Machodrones, those the size of light helicopters, will likely be too expensive, or too limited in capability to tempt many customers to replace their helicopters with them.

The FAA, scrambling to meet Congressionally-imposed deadlines, tentatively has declared its intention to create a safe harbor for commercial microdrones of light weight, flying at low altitudes below most manned aircraft. It has a long list of issues that must be resolved before machodrones will be legal, including the applicability of traditional airworthiness certification for drone types, existing pilot certification for drone operators (DRoneOPerators or "DROPS"), and current VFR and IFR requirements.

Microdrones are available now for a few hundred to a few thousand dollars. Most of them have 15-50 minutes of endurance, ceilings of 600-1,000 feet AGL, maximum speeds of 30-40 knots, and GPS-based autopilots that permit them to hover without operator intervention and to return autonomously to their launching points when the control link is lost. Many of them can carry HD video cameras that stream images to the ground during flight or record them for later download.

Such vehicles can be useful in supporting law-enforcement, news gathering, powerline and pipeline patrol, agriculture, real estate marketing and SAR. They could be launched by ground personnel already on a crime scene or newsworthy event. But they will always operate at the margins. Performance limitations and control depending on line of sight excludes them from most of what helicopters do well, such as dispatch from a central location and arrival on a scene within minutes.

They won't be able to carry much—an existing top of the line searchlight, for example, is out of the question.

For machodrones, carrying heavier payloads and flying longer distances, performance would be indistinguishable from that of today's police patrol and ENG helicopters--theoretically.

Design options are intriguing. A multi-copter design is attractive, for example, because it dispenses with a tail rotor's essentially parasitic appetite for 30% of the total horsepower. If the multiple

rotors are driven by small electric motors, transmissions, gearboxes, and long, energy-sucking drivetrains are unnecessary. Controlling thrust by varying RPM rather than by changing blade pitch gets rid of control rods, swashplates, and pitch links. Existing battery technology permits these simplifications for microdrones. Whether it does for machodrones remains to be proven.

Radically new designs for machodrones will, moreover, face a gauntlet of airworthiness certification hurdles. Every basic system—structures, airfoils, rotors, electric motors and their control systems, batteries, flight control systems, and sensors--will have to be validated in flight test and in aircraft certification. The development effort—and cost--would be enormous. It's not yet clear who in the aircraft manufacturing community is brave enough to undertake it.

Traffic separation may be less of a problem than most pilots think. By 2020, everything in the air will be equipped with Automatic Dependent Surveillance-Broadcast ("ADS-B"). Machodrones almost certainly will be similarly equipped. Telemetry will allow everyone to "see" and avoid each other.

But what will a DROP be able to see? It surely will be less than the view from the cockpit.

DROPs need visual information as close as possible to what a pilot gets from looking outside the cockpit. They can't get that from a flat screen with a limited field of view. With eyeball rotation (but no head inclination or rotation), a human pilot has a horizontal field of view of about 270 degrees. He can shift his field of view or the point of concentration in an instant by rotating and inclining his eyes and turning his head. To replicate this, a DROP ground station would need an array of high definition video screens that provide real-time imagery captured from multiple cameras on the drone. Even then, the two dimensional display cannot provide depth perception.

Apart from questions about what technology can deliver, daunting economic and political challenges exist.

The grueling certification process for machodrones will make it difficult to obtain production runs long enough to cover development costs. Operating costs could end up being higher than those for manned helicopters. It may be difficult to recruit and train DROPS. Most candidates may be unwilling to relinquish their dreams of actually being in the clouds as they fly.

The politics already are ugly. Some forty states and municipalities have enacted or are considering legislation to restrict drone operations, despite the likelihood of federal preemption.

Seeing this play out will be exciting. But helicopter pilots should sit back and relax, while throwing in their two-cents worth on the regulatory architecture.

Helicopters still will fill the skies, collecting news, enforcing the law, searching for lost children, checking for breaks in powerlines and pipelines, and taking pictures of soybean fields and mansions on the market. Lots and lots of microdrones will help—but only in the hard-to-get-to places.

It will be a long time before a helicopter pilot hears the tower say, "Helicopter 014: extend your downwind for a machodrone on long final to Runway 32."