

ANDREW MORGAN,
a partner at EY, is
pursuing an advanced
drone pilot's licence



BY LUC RINALDI

**PHOTOGRAPH BY
DANIEL EHRENWORTH**



INSPECTOR GADGET

On a bright afternoon last winter, Andrew Morgan walked, clipboard in hand, across an asphalt car lot. All around him, neat rows of trucks gleamed under the sun. Morgan's job as a senior assurance manager at EY was to count the vehicles, inspect a sample of them—two dozen of a thousand or so—and ensure his client's inventory reports were accurate. "We were going truck to truck," he recalls, "and I said, 'There must be a better way to do this.'"

So, Morgan pitched his bosses on an unusual idea: why not use a drone to do the inventory count? EY auditors in the U.S. had already tried it, and he knew a thing or two about the technology. Morgan, who is now a partner in EY's assurance practice specializing in data analytics and automation, owns three drones himself—the recreational kind, which tend to retail for \$100 to \$1,000 (professional models can cost upwards of \$10,000). When the brass gave him the green light, the firm hired a pilot from a professional drone services company and returned to the truck lot with a sleek, all-white DJI Phantom 4 Pro drone in tow.

The pilot placed the drone on the ground, slotted his iPhone into a gadget that looked like an Xbox controller, and then gently tilted one of its joysticks

**Faster. Cheaper.
Safer. Welcome
to auditing in the
age of the drone.**

forward. The machine, small enough to fit in a backpack, started buzzing like a swarm of bees. It took off and was soon a blinking dot in the sky, taking hundreds of pictures as it flew an S formation over the yard. Though Morgan still had to perform an old-fashioned walk-around to check the condition of the vehicles, the count was significantly faster. "Traditionally, it might have taken half a day or even a full day to count the lot by foot," says Morgan. "Flying a drone, it took 45 minutes."

Not that their work was done. Back at the EY office in Toronto, Morgan and his colleagues used a piece of software called DroneDeploy to stitch the photos together into a single, hyper-detailed overhead image of the area. Then, they layered text boxes over the trucks and typed in numbers to tally

them, creating a shareable reference document. “We could count 100 per cent of the vehicles, so it resulted in a much better inventory count,” he says. “It’s an easier way to do better-quality work. Any tool that makes it easier is worth using.”

Morgan’s high-flying pet project provides a glimpse of the ways that drones are transforming accounting worldwide. In New York three years ago, Deloitte’s then-CEO Cathy Engelbert told a conference of financial executives, “This might sound a little sci-fi to you, but drones could do physical inventory observations. Maybe you wouldn’t have to send people out.” In the past

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several years, tax authorities on multiple continents have used drones to investigate suspicious properties and tax return claims. KPMG has used them to count livestock in Australia. PwC has set up two separate teams of drone experts in Europe.

Drones have infiltrated nearly every industry. They allow foremen to inspect construction sites, relief workers to deliver supplies and filmmakers to capture stunning bird’s-eye-view footage. PwC estimates that, in the U.K. alone, the drone economy will add more than \$70 billion to the GDP by 2030, at the same time creating 628,000 jobs. That translates to 76,000 drones over Great Britain, surveying traffic, inspecting mines and delivering dinner.

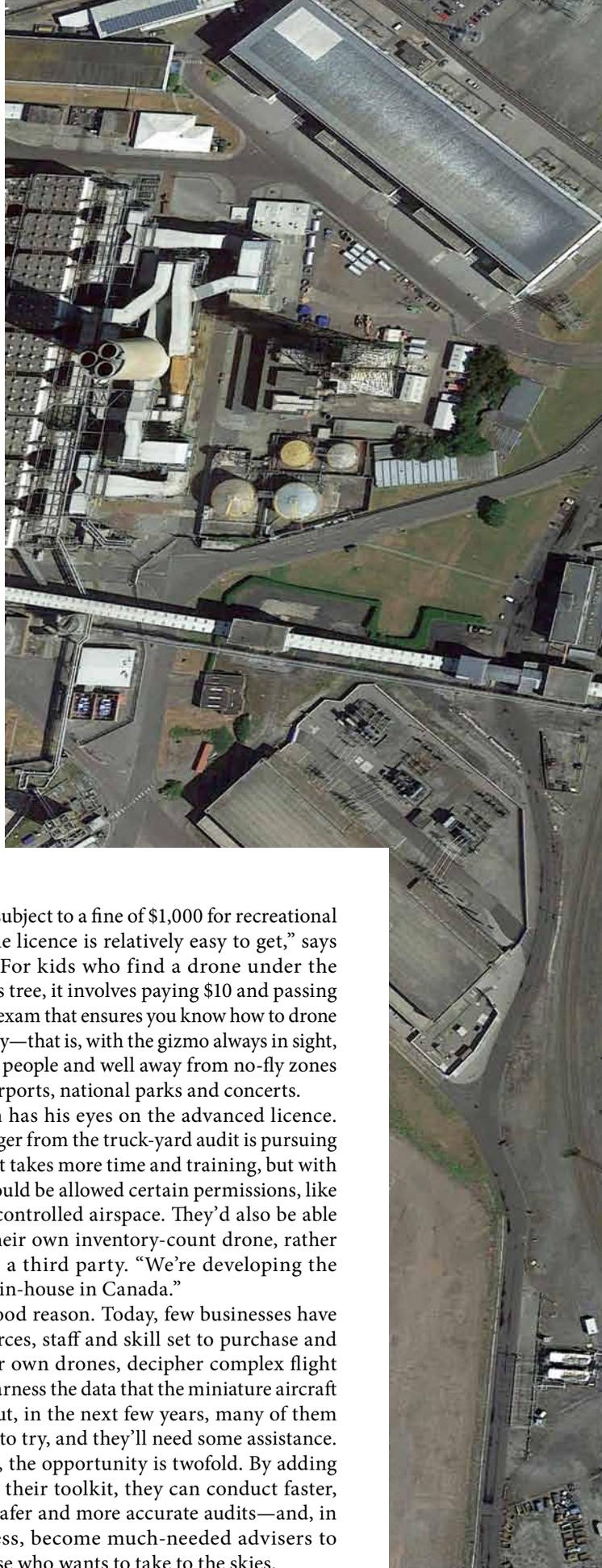
To some, that many tiny tentacled devices whirring around may sound like a dystopian *Black Mirror* episode waiting to happen. Critics argue that drones could prove to be a tool of unlawful or inhumane state surveillance. In Canada, there’s already an alarming stream of headlines: a malfunctioning machine dropped on a woman’s head in 2016, a drone collided with an airplane in 2017, and residents complained of a nosy neighbour using a drone to spy on them in 2018. Outside London, U.K., last year, hundreds of flights were cancelled following drone sightings near an airport runway. In 2014, Transport Canada recorded 38 incidents in which a drone “posed a risk to aviation safety.” By 2017, that number had more than tripled.

Though difficult to enforce, most countries’ drone legislations prohibit some of the technology’s more nefarious (and numbskulled) uses. Canada tightened its regulations on June 1, requiring all drones heavier than 250 grams to be registered and all pilots to be

licensed, subject to a fine of \$1,000 for recreational fliers. “The licence is relatively easy to get,” says Morgan. For kids who find a drone under the Christmas tree, it involves paying \$10 and passing an online exam that ensures you know how to drone responsibly—that is, with the gizmo always in sight, not above people and well away from no-fly zones such as airports, national parks and concerts.

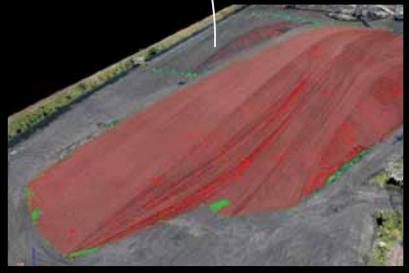
Morgan has his eyes on the advanced licence. His manager from the truck-yard audit is pursuing one, too. It takes more time and training, but with it, they would be allowed certain permissions, like flying in controlled airspace. They’d also be able to pilot their own inventory-count drone, rather than hire a third party. “We’re developing the expertise in-house in Canada.”

With good reason. Today, few businesses have the resources, staff and skill set to purchase and pilot their own drones, decipher complex flight rules or harness the data that the miniature aircraft collect. But, in the next few years, many of them will want to try, and they’ll need some assistance. For CPAs, the opportunity is twofold. By adding drones to their toolkit, they can conduct faster, cheaper, safer and more accurate audits—and, in the process, become much-needed advisers to anyone else who wants to take to the skies.





In 2018, PwC used a drone to audit **COAL RESERVES** at a power plant in Wales



The drone measured various points in the red zone to calculate the total volume of coal.



The audit team launched the drone from a field adjacent to the plant.

With a drone, researchers counted **LIVESTOCK** 35 times faster than with traditional methods



The researchers used machine-learning algorithms to automatically recognize and count the cattle.



there was an opportunity to advise our clients on how to use drone technology,” says Whyte. She now leads the firm’s drones team in the U.K. (In Poland, PwC has a similar group called Drone Powered Solutions.)

“Some people might associate drones with being a toy,” says Whyte, but her team’s work proves otherwise. Since launching in January 2018, the group has used drones to, for example, inspect key infrastructure at ports across the U.K., including hard-to-access locations like warehouse roofs and gutters. Using a drone, Whyte says, the inspections had the potential to be 83 per cent faster and 65

**After the count,
the ranchers asked,
“Can we always do our
audits with a drone?”**

Like a lot of innovative technologies, drones were developed as machines of war. In the early 1900s, inventors in the U.K. and the U.S. raced to create the first unmanned aerial vehicles (UAVs), kamikaze-style weapons that could pierce zeppelins or crash into enemy positions. None of those early inventions saw combat, but the idea returned in the Second World War, when the Germans used remote-controlled UAVs to drop bombs on Allied ships.

Drones remained the purview of armies and air forces until the mid-2000s, when hobbyist and industry interest became strong enough to prompt the Federal Aviation Administration to relax UAV regulations in the U.S. Other countries largely followed suit, and once civilians could fly, consumer drones slowly entered the market. But they received little attention until 2013, when Jeff Bezos predicted self-flying drones would be delivering the majority of Amazon packages within five years. (Still waiting, Jeff.)

As a Royal Air Force engineer in the 1990s and 2000s, Elaine Whyte witnessed the evolution of UAVs firsthand, occasionally working with drones herself. After she retired from the RAF, she joined PwC, where tapping that experience seemed like a no-brainer. “It occurred to me that

per cent cheaper than using traditional methods, and her team has since worked with the client, a port operator, to introduce drones to other parts of their business. Whyte says UAVs could also be used to inspect gas flares (imagine thin smoke stacks spewing fire), allowing oil and gas companies to pinpoint problems without shutting down their plants, a move that can cost millions of dollars per day. “With a drone,” she says, “you don’t need to incur that cost or put people in harm’s way until you know exactly what work you need to do.”

In late 2018, Whyte’s team completed its first drone-assisted audit. Working with British drone company QuestUAV, it captured hundreds of overhead images of coal reserves at a power plant in Wales. Then, using a process called photogrammetry (deriving measurements from pictures), the auditors created a 3D model of the entire plant. The digital model helped calculate the volume of the coal piles, and they could share it with other PwC staff and offices instantly. “It leads to a much more collaborative approach,” says Joanne Murray, a senior manager with the drones team. “We’re very keen now to pilot the technology on other types of assets, like scrap metal or livestock. We’d capture the data using a drone, then run artificial intelligence routines to bring efficiency and improved quality to the mundane task of manually counting tens of thousands of heads of cattle on a farm.”

Chris Thatcher, the innovation leader for Deloitte’s Canadian assurance group, says that’s the technology’s true potential. “The most exciting thing in

this area is not the drones themselves, but visual recognition,” he says. In other words: sure, drones are cool, but check out what you can do with the photos and footage they capture. AI software can distinguish objects—boxes, sedans, sheep—without the human eye. Thatcher envisions a day when auditors wear body cams, walk through their sites, upload the footage and let AI do the math. When Deloitte tested visual recognition technology, he says, “one of the questions we had going in was: how accurate will it be?” They suspected it would fall short of manual counts, at least at first. “But, generally speaking, the visual recognition was significantly more accurate than humans.”

Rather than replace human CPAs, proponents say, the technology will allow them to spend less time on-site disrupting clients and more time analyzing the data, focusing on strategy or, at the very least, doing something better than tallying cars and cattle. “There are a number of clients in the Canadian marketplace for whom drones would work very well,” says Thatcher. “There are so many opportunities there.”

Whyte believes companies ignore UAVs at their own risk. “Drones are becoming embedded as day-to-day tools in many different sectors, including auditing,” she says. “All we see is growth.” If companies don’t consider how the technology could benefit—or threaten—their business, they may end up playing catch-up. “Businesses could miss the opportunity and incur costs that their competitors aren’t facing, and therefore they could be squeezed on price or profit.”

Forty floors above Toronto’s Financial District, Andrew Morgan is about to take flight. Well, kind of. Inside a high-ceilinged EY boardroom, he crouches and powers up a small DJI Mavic Air drone at his feet for a test flight. “We’re trying to figure out which other audits we can use the drone on,” he says, as the machine hums to life. Weather permitting, outdoor settings are ideal, he explains. Warehouses with tall shelves and wide aisles can work, too. An indoor space like this skyscraper boardroom? Not so much.

But it’s not a bad metaphor for the “in-house expertise” that Morgan wants to develop. Last year, when he realized a drone would improve his job, he called a third-party UAV company. In the future, when other businesses get the same idea, he hopes they’ll call EY.

For now, he swivels the drone’s camera and demonstrates its automatic safety features—it gracefully steers itself away from the walls and desks as it zooms around the boardroom. Then, suddenly, it starts beeping. Its battery is low. Like any technological revolution, this one comes with some technical difficulties. ♦

THREE WAYS AUDITORS ARE USING DRONES TODAY



NEIGHBOURHOOD WATCH

In 2014, Argentinian tax investigators used drones to inspect a wealthy neighbourhood in Buenos Aires. They found 200 mansions on supposedly empty lots, as well as 100 unregistered swimming pools—discoveries that reportedly netted the tax authority an extra \$2 million (U.S.) in property tax revenue.



SHELF LIFE

As part of a proof of concept, EY dispatched self-flying drones within large manufacturers’ warehouses in the U.S. The machines, equipped with cameras and barcode scanners, whizzed down the aisles, allowing auditors to inspect the inventory without stepping onto a scissor lift. “You can technically fly the drone any time of day, so you can pick the least invasive time for clients,” Hermann Sidhu, EY’s global assurance digital leader, told the *Journal of Accountancy* podcast. “We want to make it as seamless and real-time as possible.”



FARM IT OUT

Some ranchers tally their sheep by herding them through a gate, tying a knot in a piece of twine for every 100 animals. For a March 2019 paper, researchers from three American universities gave that time-worn method a high-tech update, using drones to create overhead images of livestock pastures in Utah and Kansas. David Wood, one of the authors and an associate professor at Brigham Young University, says the herders were skeptical at first, but the drone was significantly more accurate and about 35 times faster. “They didn’t have to ‘babysit’ the auditors,” he says. By the end of their research, he says, the ranchers asked, “Can you make it so that internal audits are always done this way?”