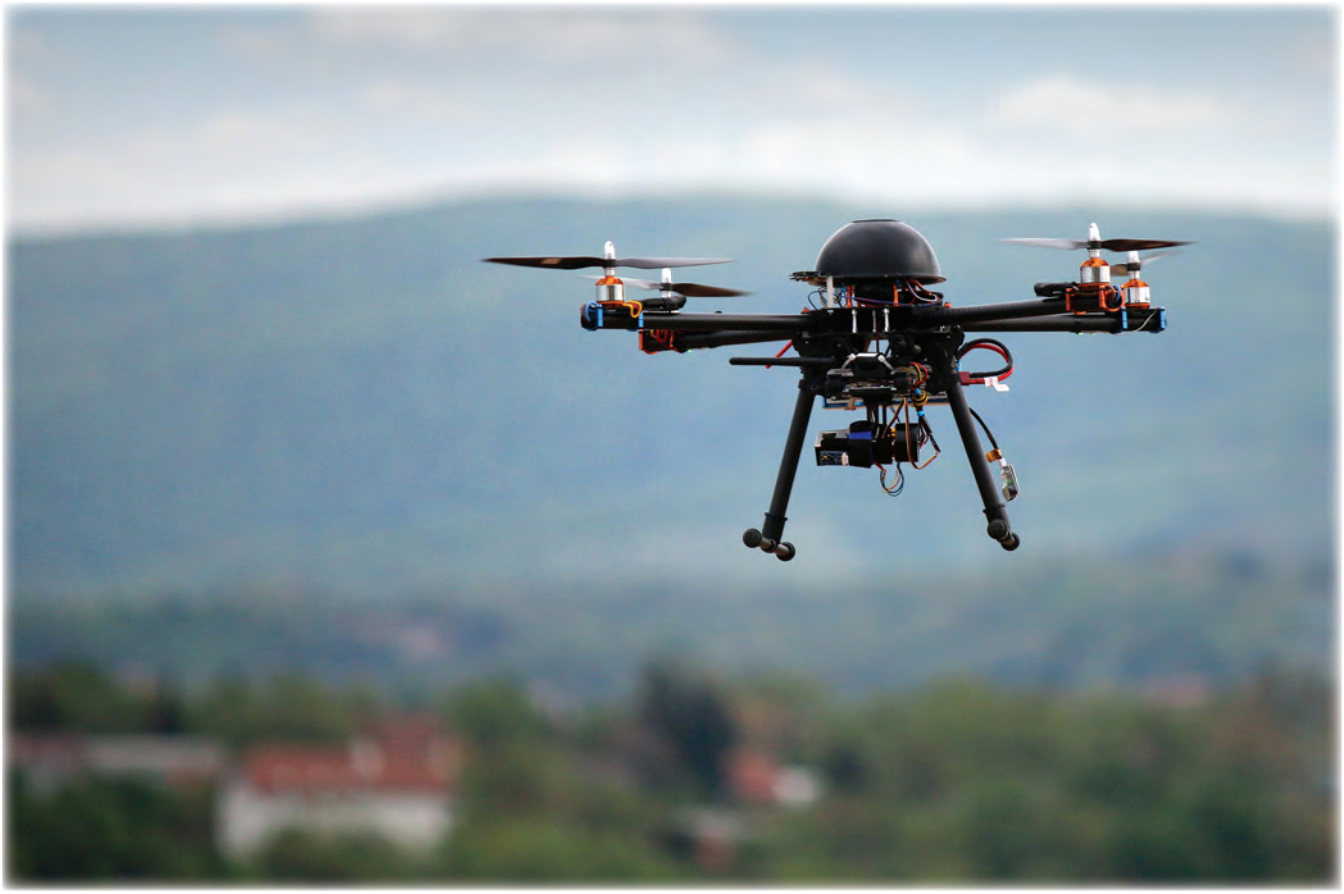
Is There a Drone in Your District's Future?

Drones are making their way into more and more districts—with multiple uses.

By Richard Weeks, RSBA



By now, your school district most likely has the open-source software, robotics hardware, and myriad other equipment used to build drones—or unmanned aerial vehicles (UAVs) as the industry folks prefer to call them—in your science classrooms and after-school student activities. Or maybe your students are experimenting with the already-assembled UAVs that are widely available.

The already-assembled UAVs we purchase for our students are actually what the Federal Aviation Administration (FAA) considers part of unmanned aircraft systems (UAS). The object that flies over our campuses is the microdrone, not to be confused with the larger commercial drone. Microdrones are supported by an operator with a control station, data links, navigational equipment, and other accessories.

The most popular type of microdrone is commonly called a quadcopter. Unlike fixed-wing aircraft, the quadcopter is a multipurpose helicopter that is lifted and propelled by four rotors. The concept is not new—it has been around for generations of flight. What *is* new is its affordability, thanks to advancements in robotics and

the market competition among the numerous vendors. Districts can purchase a simple UAS with a four-pound quadcopter for between $750 and $2,000.

The FAA supports our students' interest in UAS and their educational and recreational uses, but the agency has rules and regulations regarding their use. School administrators who are interested in promoting the use of UAVs and UAS on campus can and should familiarize themselves with all the pertinent issues by visiting the FAA's Unmanned Aircraft Systems webpage (www.faa.gov/uas).

For example, current FAA regulations require UAVs to be flown within the line sight of the operators; if flown within five miles of an airport, the operators must provide the airport or the control tower with prior notice. To avoid contact with manned aircraft, UAVs cannot be flown above 400 feet. New FAA regulations of drones are expected in 2015, pursuant to Congress's FAA Modernization and Reform Act of 2012.

Ready to Fly?

How are UAVs used in schools? They are often incorporated into the STEM (science, technology, engineering, and math) curriculum:

> A drone is a complex machine, and once you peek inside, one STEM concept leads to another. To design the aircraft, you begin with concepts like Bernoulli's principle, which when applied through a mathematical formula, determines parameters such as stall speed (how slow the plane can fly before falling out of the sky). Stall speed dictates the power you need to fly, which opens an opportunity to deliver content about electricity and electric motors. And delivering content about electricity and electric motors segues nicely into lessons about battery chemistry and capacity. All the while, students are applying this content knowledge as they make key decisions about how this aircraft will be designed and deployed (Schroyer 2013).

The UAV industry has begun to donate software and provide training for students in STEM-based high school classes. With the expanding use of drones in the commercial and military sectors, students with UAS experience will likely have numerous job opportunities after graduation.

As far as procurement is concerned, schools may be wise to purchase several microdrones of the same make and model. Because the students who remotely control the microdrones are still learning to operate them, the microdrones in flight will probably hit the sides of buildings and become lost in trees.

Our young pilots may be terrific at playing video games, but piloting microdrones is another matter. Microdrone pilots need a keen kinesthetic sense—the ability to detect body movements. Since the pilot does not feel the drone's turns or the air turbulence, he or she must learn when to take precautionary actions. It takes a lot of experience to fly microdrones safely.

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By having microdrones of the same make and model, students can learn to "cannibalize" broken aircraft for parts to keep other drones in service. Also, schools will need to purchase numerous rechargeable lithium polymer batteries because the flight time per battery is only about 15 minutes.

Drones Outside Academics

Drones are legal and are commonly used throughout most of the world. Therefore, we can infer from the experiences in other countries their eventual use in our school districts and communities. However, when the day comes that district leaders and their communities legally fly commercial drones, they will likely procure services from outsourcing companies—professional systems cost between $20,000 and $70,000 and require highly trained operators. The soon-to-be enacted FAA regulations may require drone operators to have pilot licenses and to fly their craft only during daylight hours.

How else can be drones used in the district?

Planning. Site preparation is an important front-end task when new schools are built. The engineering companies we hire will most likely outsource that task to UAS operators who will have the sensing technology, hardware, and software to produce the high-definition photos for the engineers' use.

The German firm Wasser-und Verkehrs-Kontor GmbH explains how the drone is transforming its engineering work: "Before, workers took ground-based measurements for two days to yield a two-dimensional map of a flood-prone intersection with an accuracy of 1.5 meters, or roughly 1.6 yards. The drone required just three 10-minute flights to produce a 3-D model of the intersection with 1-centimeter, or about 0.4-inch, accuracy" (Nicas 2014).

Maintenance. School business officials may consider procuring reasonably priced microdrones similar to those purchased for students. Maintenance personnel will likely find them useful for aerial monitoring of buildings and grounds, for example, checking rooftops after storms for clogged gutters and snow accumulation. They could also be used to check the integrity of utility lines and potential damage to fences, trees, outbuildings,

and aspects of a large campus that are not easily accessible.

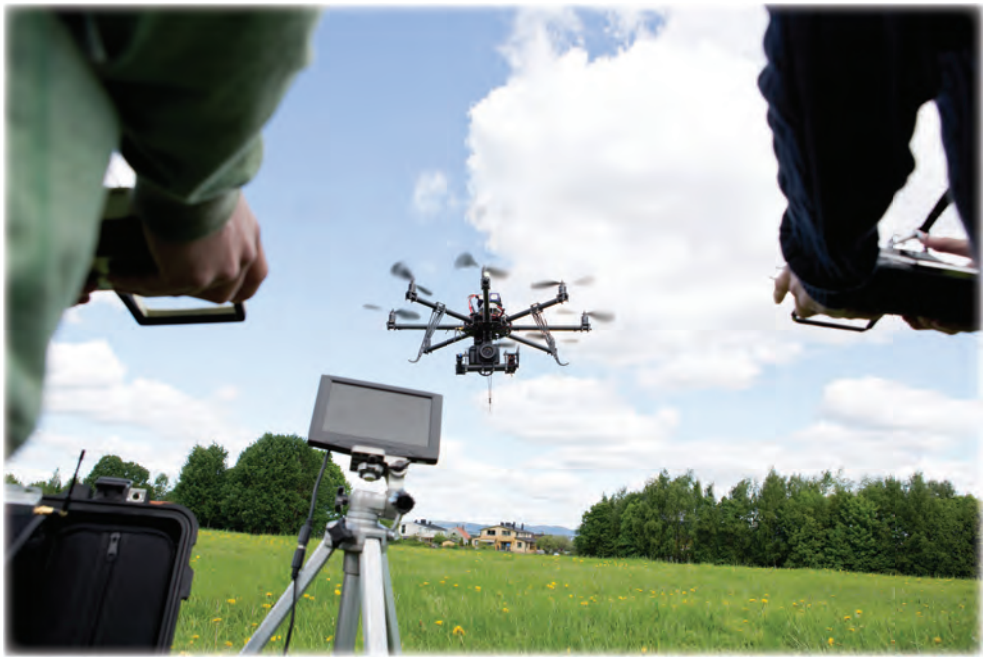
Surveillance, Safety, and Sports. In the United States, drones are commonly used for photography and videography and for surveillance. In recent years, 43 states have introduced legislation, and 9 states have enacted laws, regarding drones (Bohm 2013). At the close of the June 2014 legislative session, 13 states and the city council of Iowa City, Iowa, had placed restrictions on using drones for surveillance purposes.

Drones could easily become extensions of surveillance cameras located practically everywhere on school campuses.

People are concerned that local law enforcement agencies may use drones to invade their privacy, as evidenced by the thousands of citizens who have testified before legislative hearings. According to an American Civil Liberties Union report (Stanley and Crump 2011): "The prospect of cheap, small, portable flying video surveillance machines threatens to eradicate existing practical limits on aerial monitoring and allow for pervasive surveillance. UAVs are not fixed in a specific location or vantage point and may raise unique privacy concerns because of their physical ability to track an individual's activities or patterns of movement more persistently over time." The American Civil Liberties Union of North Carolina contends that it maintains a dialogue with UAS manufacturers that "allows the industry to thrive while ensuring that the government not use this new technology to infringe on the constitutional rights of its people" (Preston and Lindsey 2014).

The Office of the Privacy Commissioner of Canada issued a report in 2013 that served as a catalyst to overhaul regulations by Transport Canada, Canada's equivalent to the FAA. In October 2014, Transport Canada established new guidelines for the use of noncommercial or recreational drones, including a guideline limiting the distance between drones and vehicles, boats, buildings, structures, or people to no closer than 100 feet. In populated areas or near large groups of people, that restriction applies to sporting events, concerts, and festivals.

Transport Canada facilitated the commercial use of microdrones weighing fewer than 4.4 pounds through a process whereby operators can more quickly obtain a Special Flight Operations Certificate. The Privacy Commissioner's report reaffirmed that "drone operations that involve the surveillance of Canadians or the collection of personal information are subject to the same privacy law requirements as with any other data collection practice" (p. 13). In addition, "federal government departments



intending to use drones will have to ensure their program activities are carried out in accordance with the *Privacy Act*" (p. 13).

Drones could easily become extensions of surveillance cameras located practically everywhere on school campuses. However, state laws and local ordinances may govern the privacy rights of those being recorded by aerial flyovers on school or municipal property, requiring drone operators to obtain permission before filming.

During the 2014 high school football season, many amateur microdrone pilots recorded practices, scrimmages, and games. The cameras provided coaches and players with a real bird's-eye perspective unavailable from sideline land-based photography. Those videos proved useful for prepping players for upcoming games, and the recorded games were entertaining to fans on local cable TV.

The proliferation of drones overhead has left many school officials reeling, as few protocols or guidelines for their use have been implemented. In an article for the National Federation of State High School Associations, attorney Lee Green (2014) states, "In addition to the federal regulatory framework for small drones, schools should consult any applicable state laws regulating UAS, most of which address the privacy implications of aerial image-capturing." Green cites the Texas Privacy Act (Texas House Bill 912), which "prohibits the use of drone photography without the expressed consent of the person who lawfully occupies or owns the real property captured in the photos or video being shot. The Texas law is typical of most state statutes governing drones in that it is intended to prevent surreptitious photography of persons on their private property, inside buildings or inside homes."

Lee also warns schools to "exercise a high degree of care in the operation of drones to avoid common law tort liability for injuries to players, coaches, spectators or other third parties that might result from a drone crashing into a crowd." Drones are prone to fall from the sky if their GPS signals are lost between the drones and the pilots' control stations.

Taking to the Skies

Drones have become a serious issue, in part because many are apparently being flown illegally on school property. School business officials will want to closely monitor this technology for the benefits it should eventually provide, to protect the safety and privacy of those on school campuses, and to minimize liability to our districts.

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Richard Weeks, RSBA, is retired past president of Massachusetts ASBO and serves as a mentor to New England SBOs. Email: richardhweeks@aol.com