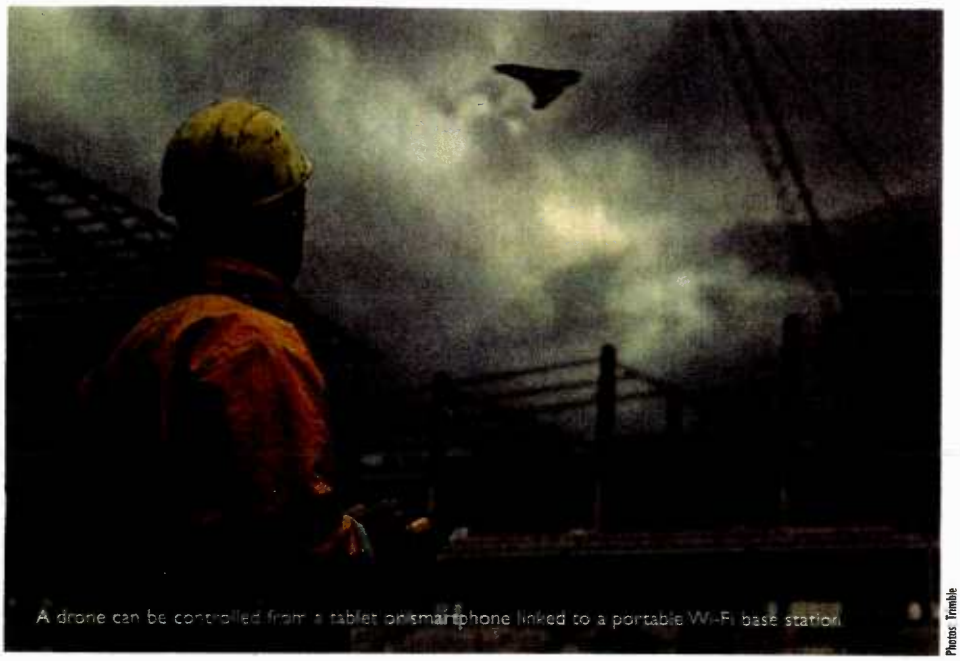
A Versatile Eye in the Landfill Sky

The use of drones could prove invaluable in the solid waste industry. BY AMY LONG AND BRUCE CLARK

Could a drone have a useful purpose in the solid waste industry? Perhaps. First, these are not the military-style drones you may have seen on the evening news. There are dozens of companies that make drones for recreational and commercial use that could be employed in the industry. And, no, they do not carry weapons.



A drone can be controlled from a tablet or smartphone linked to a portable Wi-Fi base station.

Photos: Trimble

Drone Basics

Drones, also known as unmanned aircraft systems (UASs), are unique for many reasons, including their abilities to fly vertically and complete specific tasks for humans. Drones have vastly different shapes, sizes, and prices, all of which mostly depend on the drone's purpose. Most drones are fewer than 36 inches across and have multiple motors and propellers that enable vertical and horizontal flight. Prices for a basic but well-equipped recreational unit range from $500 to $15,000, with the difference attributed mostly to battery life, durability, payload capacity, and camera quality. Typically, the rechargeable battery on a drone provides somewhere between 20 minutes and one hour of continual use.

Most drones come equipped with a high-definition camera and can record video and save photographs to a built-in storage device. Some drones can have a higher-end camera, such as the Go-Pro, mounted on them for better video and still photography. Using GPS waypoints, a drone can be programmed to take videos and photographs of target information at specified distances and angles. Newer drones can also be used to capture aerial photographs that are georeferenced, where points of the aerial photographs have GPS waypoints associated with them. These georeferenced aerials can be used to create 3D models of sites.

There are multiple ways to control drones, and the technology is continually improving. A drone can be controlled from a tablet or smartphone linked to a portable Wi-Fi base station. Distance between a drone and the Wi-Fi base is limited when using a tablet or smartphone as the controller. The available Wi-Fi distance varies between drone models. However, about 600 feet is average to have real-time imaging feedback from the drone. Newer drones can travel beyond the signal of a controller when it is flying a preprogrammed flight path based on GPS waypoints. Using ground control software, the drone operator has the ability to plan, simulate, monitor, program video and still-shot instructions (including direction of the shots), and control the drone's flight path prior to and during its flight.

Most drones come equipped with a high-definition camera, fully capable of recording video and saving photographs.

Possible Uses at Solid Waste Facilities

Drones are already being proposed for use on phase-one environmental site assessments (ESAs) where there is rugged and partially inaccessible or dangerous terrain and/or significant structures. They also are being used by consultants in emergency situations to survey damage to the exterior of buildings from natural disasters.

At solid waste facilities, drones could potentially have many practical uses that could result in savings of time and money:

- Periodic inspections of more remote parts of a landfill, enabling the inspector to cover more terrain and seeing areas that are not necessarily easily traversed on foot
- Map changes in landfill fill areas
- Tracking the quality of the growth of cover vegetation at a landfill
- Tracking the size or location of a landfill workface
- Inspecting areas where getting a person in is either a safety risk or very difficult (the receiving pit at a waste-to-energy plant or transfer station, for example)
- Assessing the earth dikes or outfalls (which may be hard to access) at large leachate or wastewater treatment ponds
- Periodically surveying a site's fence line, where parts may not be readily accessible, to determine if any new "neighbors" have appeared
- Assessing an accident in which hazardous materials are involved and access to the accident site is difficult
- Inspecting the interior and exterior of buildings, especially where access is difficult
- Inspecting the public access road outside the facility for trash that has blown off vehicles
- Documenting the presence or absence of certain forms of wildlife

One other potential time- and cost-saving benefit of using a drone for site inspections is the ability to record and play back high-resolution videos for future use. A drone can be programmed to run the same route over and over, which would allow for easy comparisons of landfills over time. Drones may even lead to the ability for site inspections to be conducted without the physical presence of a human or a manager. With the ability of drones to stream live video, the potential cost savings would seem to far outweigh the purchase price.

Regulations

One of the obstacles for professional use of drones is the current regulatory landscape. Congress directed the Federal Aviation Administration (FAA) to design a plan by September 2015 to safely integrate UASs into the National Airspace System (NAS). The plan will be incremental, and the regulations will not change overnight. Currently, the FAA's unmanned, nonrecreational aircraft policy is based on who is operating the aircraft. If a US government agency, including state and local agencies, is using a drone it is considered a public aircraft. If an unmanned aircraft is not public, then it is considered a civil aircraft. So a drone used at a county or city solid waste facility would be required to follow different regulations than at a privately owned waste company.

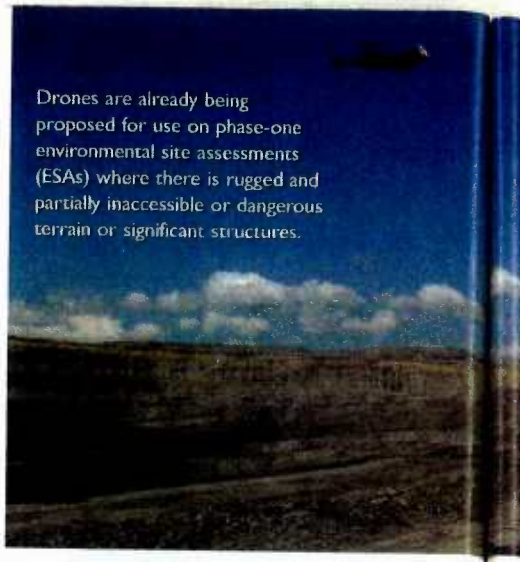
For a municipal agency to legally use a drone, it must obtain a certificate of waiver or authorization (COA). To obtain a COA, a COA account must be created on the FAA website. From there, an application can be submitted that details the drone and how the drone will be used. The FAA reviews the application and may contact the applicant for additional information. As of January 2014, the average time to issue a COA for

nonemergency operations was less than 60 days. On December 4, 2013, there were 545 active COAs.

Currently, drone uses are limited in the private sector (civil) and cannot be used for routine business purposes. However, a business can obtain an experimental airworthiness certificate that would allow it to conduct research and development, training, and flight demonstrations. The experimental airworthiness certificate is issued for the entire unmanned aircraft system, including the drone and all supporting equipment including communication equipment and data links.

To obtain an experimental airworthiness certificate, an application must be submitted to the FAA. According to an FAA employee, the FAA must come to the applicant's site and assesses the proposed operation and its safety before approving an experimental airworthiness certificate. The process of obtaining an experimental airworthiness certificate typically takes from 60 to 90 days.

Currently, there are many hoops to jump through to legally operate a drone for business purposes, both for the private and public sector. However, later this year the FAA expects to publish a rule for small UASs, under 55 pounds, that will likely provide provisions for commercial operations. Once the rule is published, the public will be allowed to comment, and the FAA will make adjustments to the rule as warranted. The comment/adjustment phase will last approximately 18 months. Once the small UAS rule is effective, it may be easier for solid waste facilities to use drones for business purposes.



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Waste Operator's Comments

The authors spoke with a few landfill operators to get some sense of what concerns and comments they might have with using a drone. Comments we received included the following:

a. Could it be equipped with an infrared camera to scan for subsurface fires?
b. Could it be used for laser surveys of the landfill topography?
c. Upper management will have to accept that it is not a toy but a useful tool.
d. Can see that it could save time on landfill and perimeter inspections.
e. Prefer a lower-budget unit, something under $5,000.

In response to a. and b., the answer to each is yes. Heat-sensing devices are being use on drones, as are devices for producing 3D mapping images with supplemental software. As electronic devices themselves become smaller, their use on a drone becomes practical. Industries not normally

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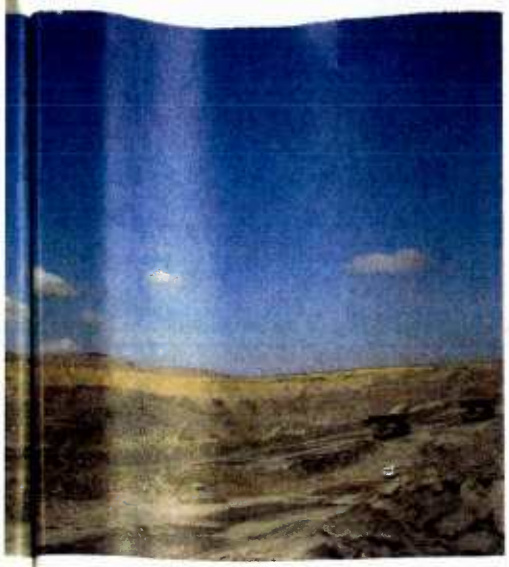

associated with use of high-tech devices, such as agriculture, are finding new uses for drones that might soon find relevancy in the solid waste industry too.

Closing

As you probably have noticed, drones are currently caught up in controversy. Hot buttons being debated include security, privacy, and safety. Proponents see them as the future way to do many tasks, and the potential risks can be mitigated. Opponents see them as threats that could potentially get out of control. One thing we have found is that once you try one, and take the time to learn how to use it, they are fun. However, the question of whether a drone can evolve into something more than a fun thing, and become a useful cost-saving tool for our industry, remains to be answered. MSW

Bruce Clark, P.E., is a project director and Amy Long is a staff engineer with SCS Engineers in Tampa, FL.

Taking in the Overview

Mesa County in Colorado recently received a certificate of authorization (COA) allowing its public works department to operate a Trimble UX5 Aerial Imaging Solution throughout the county. A COA is an authorization from the Federal Aviation Administration (FAA) allowing the operation of an unmanned aircraft in a designated area and not for commercial use. The authorization is currently required to legally operate a public unmanned aircraft in the US. The COA was granted to the Mesa County Sheriff's Office, who manages the county's unmanned aircraft system (UAS) operations and has been flying systems since 2008.

Mesa County's public works chose the Trimble UX5 for a variety of applications: determining the volumes and compaction of its county landfill, surveying and monitoring capital improvement projects such as roads and bridges, and assisting the Mesa County Sheriff's Office or other county departments, as needed. "With the Trimble UX5, Mesa County is one of the first to benefit from a cutting-edge solution that can change how surveyor's collect data," says Frank Kochevar, GPS and survey supervisor for the Mesa County Public Works Department. The Trimble UX5 was used by public works to gather aerial images of the landslide that occurred in Western Colorado in May of this year.

"Trimble's goal is to allow geospatial professionals to quickly and efficiently capture and convert existing field conditions into actionable information for their customers. We are pleased that Mesa County will now be able to apply the Trimble UX5 Aerial Imaging Solution to meet their public works department needs," said Phil Sawarynski, business area director for Trimble's geospatial imaging solutions.

Mesa County has received multiple COAs since 2008 from the FAA for public safety purposes. This is the first COA issued to the Mesa County Sheriff's Office that will be used specifically for aerial mapping on surveying and engineering projects, in partnership with the Public Works Department. According to Ben Miller, UAS program director for the Mesa County Sherriff's Office and coordinator for all their COAs, "In collaboration with Trimble, Mesa County, CO, continues to demonstrate that small unmanned aircraft are not just a tool to save lives but a community asset that can help save its citizens tens of thousands of tax payer dollars."

The Trimble UX5 is an unmanned fixed-wing aircraft targeted at the surveying, oil-and-gas, mining, environmental, and agriculture industries. The system autonomously captures a series of high-resolution images during flight, which is typically up to 50 minutes, covering as much as approximately 1 square mile when flying approximately 400 feet above the ground. Using Trimble Business Center Office software, images are easily used to generate 2D and 3D deliverables such as orthomosaic images, three-dimensional point clouds and contour maps. The Trimble UX5 enables the collection of large amounts of data, often faster than traditional surveying technologies.