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# A Versatile Eye in the Landfill Sky

The use of drones could prove invaluable in the solid waste industry



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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.

## 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 aeri



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and still-shot instructions (including direction of the shots), and control the drone's flight path prior to and during its

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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



flight.

### 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.



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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.

### **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:

1. Could it be equipped with an infrared camera to scan for subsurface fires?
2. Could it be used for laser surveys of the landfill topography?
3. Upper management will have to accept that it is not a toy but a useful tool.
4. Can see that it could save time on landfill and perimeter inspections.
5. 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 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.

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