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# Engineering GEORGIA

## GETTING UP CLOSE WITH DRONES

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## GOING BEYOND THE BLUEPRINT

HOW BUILDING INFORMATION MODELING IS TRANSFORMING THE INDUSTRY

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# GETTING UP CLOSE WITH DRONES

*Unmanned Aerial Vehicles Pose Benefits on Job Sites, but Concerns Remain Before Commercial Use Really Takes Off*

*By Lori Johnston*

## DRONES HAVE AN EYE FOR DETAIL.

The images are so clear, engineers like Sofie Weber-Snapp can see items as small as a cooler in a truck. But, the potential for drones is much bigger. Businesses that use them can expect cost savings, fewer safety risks and a faster ability to gather critical data to design and build structures.

Weber-Snapp's employer, Atlanta-based Environmental Planning Specialists, Inc., has previously used airplanes to fly over superfund sites, remediation sites and brownfields to capture photos and video for client assessments. "Now we decided to try to do the drone instead, over a regular plane," said Weber-Snapp, an Environmental Engineer and Senior Scientist. "The drone is half the price, which is a big thing."

*FlyWorx, based in Atlanta, has worked for a variety of clients, including the Serenbe community. Credit: FlyWorx*

The Federal Aviation Administration (FAA) expects sales of drones for commercial use to rise from 600,000 in 2016 to more than 2.7 million drones by 2020. Total drone sales – commercial use and hobbyists – are expected to reach 2.5 million this year and increase to seven million in 2020.

In the engineering, construction and architecture industries, these unmanned aircraft are primarily used for land surveying, engineering surveying, bridge and building inspections, traffic surveillance, safety inspections and monitoring structures such as roads and pipelines. Drones can also take thermal images and collect data – on everything from terrain to infrastructure to equipment – which can then be used to create 2D photos and 3D models with lifelike representations of the site. High-resolution images and video produced by drones can also be used for marketing and advertising.

"It's hard to capture the feats engineers perform for their clients with just a camera on the ground," says Don Eberly, President and CEO of Eberly & Collard Public Relations, an Atlanta firm with clients in the design and construction industry who have used drones.

Aerial photography, inspections, surveys and construction are among the top commercial applications in Georgia for unmanned aerial vehicle operators that hold a government-required Section 333 exemption, according to the Association for Unmanned Vehicle Systems International (AUVSI). This Section 333 exemption refers to the FAA Modernization and Reform Act of 2012, which grants the Secretary of Transportation the power to determine whether a certificate –required of any aircraft to operate in national airspace – is legally necessary.

Concerns about privacy and liability remain, as companies use drones to capture footage and data. "Technology is being developed faster than society is able to adopt rules and regulations to monitor and control it," says Orrin B. MacMurray, P.E., FACEC, Chairman Emeritus of New York-based C&S Worldwide Holdings, Inc. ▸

## CURRENT USES

Drones are nothing new, says MacMurray, a former American Council of Engineering Companies (ACEC) Chairman and 2012 ACEC New York Engineer of the Year. The first reports of unmanned aircraft even go as far back as the mid-1800s. They have been used by hobbyists for decades and regularly by the military since the 1970s.

As a consulting engineer, MacMurray represents ACEC on a Federal Aviation Administration committee working to establish rules on how small unmanned aerial vehicles can be operated beyond visual line of sight. "The technology has taken on a greater degree of visibility because of its military use and the fact that we can make sensing devices and cameras so small and light they can be put on the vehicles," he says. "More and more are entering the environment."

Some unmanned aerial vehicles are as large as the military drones, while others are as small as a finger, MacMurray says. Copters, which have rotors, are small, can hover and are light enough to be carried by a person. But, they are often unable to carry heavy loads. Fixed-wing craft, which are more like those used by the military, can't hover — a significant disadvantage in industries such as engineering.

Interest in drone shoots is increasing on projects such as bridges, stadiums and highway construction, like bypasses, Eberly says. For example, HOK, the designer of Atlanta's Mercedes-Benz Stadium, has created a video with footage from a drone fly-over showing the progress of construction. The stadium is set to open in 2017. "You just can't capture the essence of those types of heavy construction projects that span long distances without a drone. The inclusion of drones makes it more possible," he says.

For one of its clients, FlyWorx circumnavigated an Atlanta high-rise that had sustained tornado damage. The drone provided a solution for what would have been a complicated, long and expensive process, possibly requiring humans to physically evaluate the damage, says Roman Molla, President of FlyWorx. His Atlanta-based aerial drone imaging company was founded in 2014 and operates with a Section 333 exemption.

Last year, Burns & McDonnell, which is based in Kansas City, Missouri, and has an Atlanta, Georgia office, was one of the first engineering, architecture and construction firms to receive certification from the FAA to fly drones for commercial use. Unmanned aerial vehicles can help manage and reduce safety risks, simply by removing the need for a human to pilot an aircraft or to be on the ground in a potentially dangerous site, and especially when evaluating projects such as facility and transmission line routes.

The company says using these remotely operated aircraft could reduce the need for environmental permits, since engineers may no longer need to put boots on the ground to collect measurements and data, and could help them impact project and operational efficiency, saving time and money. "While the FAA continues to explore additional leeway for the use of UAVs throughout the country, utilities and other commercial businesses can begin reaping the benefits immediately," says a 2015 report by Burns & McDonnell.

Drones can also quickly update measurements by flying over areas. Sensors and cameras attached to the drone take high-resolution photos by the second that are saved with data points, such as GPS coordinates, elevation and volume metrics, and surface temperatures, Molla says.

The millions of data points FlyWorx's cameras and sensors collect are used to create 3D models and 2D images, such as orthophotos, that visualize the property. An orthophoto is an aerial photograph that has such a uniform scale it can be used to measure true distances. Ortho-images and generated maps help firms visualize and work with real-time data, such as high-resolution generated, geo-referenced 2D maps, Molla says. Airplanes also can be used to create the 2D maps and 3D models, but the images are not as high-resolution and the process can be longer and more expensive, he says.

Bob Gonsalves, President and CEO of UAVUS (U.S. Association of Unmanned Aerial Videographers), the nation's largest membership association of commercial UAV operators, says some of his members have used drones to fly over piles of stock materials, such as gravel, to gauge the volume for clients and track progress at a worksite.

Often, video and photo shoots using a drone happen a few times over the life of the project, if there's the budget to capture each phase, Eberly says. But the commercial application is still new enough that Eberly's firm typically is the one to introduce drones and execute the shoot for them.

## SURVEYING THE LANDSCAPE FOR DRONES

Being a drone operator does not make you exempt from rules operating in air space, says Gonsalves, whose Atlanta-based organization, founded in April 2014, has more than 5,000 registered members. Almost every Section 333 exemption application that the company writes for its members includes uses such as infrastructure surveying and aerial inspection, he says. Georgia has 84 companies with Section 333 exemptions, according to AUVSI. ▸

*A geo-referenced orthophoto is created using a drone that shot 450 photos for a developer, construction and architect firm. Credit: FlyWorx*

## AERIAL ACRONYMS

**UAVs:** Unmanned aerial vehicles (can include devices or controls and can be equipped with various sensors, such as a video and still cameras)

**UASs:** Unmanned aerial systems (normally comprised of a control station for a human operator and one or more UAVs)

**UAMS:** Unmanned aerial mapping systems

**BVLOS:** Beyond visual line of sight

Companies have had more wiggle room, in terms of where and when to use drones, but Eberly believes the flexibility will become more restrictive as legislation and regulations are passed in the next five years. "At the same time, equally important, it's necessary. No one wants to be involved in a drone photo shoot or drone shoot that would not be safe, viable or reasonable. It's important to protect people's privacy and safety," he says.

The restrictions are still loose, Eberly says, but he expects rules about how and where drone shoots can be conducted to become more restrictive in the next three to five years. With existing laws, firms should be careful about where and how they execute drone shoots, such as flying over private property. But it's tricky, he says, if you're in a city and must keep the drone high above the street, while making turns.

While the technology is moving fast, new regulations are coming slowly, Gonsalves says. The FAA has set the ceiling at 400 feet for most operations, including many of those with exemptions that allow the commercial use of unmanned aerial vehicles outside of restricted airspaces. "There are also limitations in regards to altitude and flying beyond line of sight," Gonsalves says. "For some applications, this is all evolving, but right now those are the limitations that have to be considered."

Beyond that, however, there is little FAA guidance, and legislators have already sought to fill the vacuum. In Georgia, the 2016 General Assembly passed a bill that would have made it illegal to use a device to capture images where there is an expectation of privacy, such as a backyard. Governor Nathan Deal vetoed the bill in May, however, arguing that the state should allow the FAA the chance to complete its guidelines before adding a layer of potentially competing rules. In the interim, the Governor announced he would issue an executive order to create a commission to propose state-level guidelines that can be used until the FAA acts.

## FUTURE USES FOR UNMANNED VEHICLES

Weber-Snapp believes her firm is an early adopter of drones in Georgia's engineering industry. The environmental consulting firm has worked with FlyWorx on three sites, including a manufacturing plant in Milledgeville. "We are kind of rare," she says. "It's the same thing when people began using GIS; now everybody is using it."

AUVSI projects drones will create more than 70,000 new jobs from 2015-2017 and more than 100,000 by 2025, with an economic impact of $82 billion. Still, some engineering firms that work with drones in other states have not yet used them for Georgia projects, or for work by their Georgia offices.

However, a 2014 study from Georgia Tech, commissioned by the Georgia Department of Transportation (GDOT), identified uses for unmanned aerial vehicles, including for construction site measurements, bulk material measurements and airport inspection. GDOT uses drones to analyze congestion when planning for projects or improvements.

University of Georgia researchers are testing a prototype that uses ultrasound sensors on unmanned aircraft to relay information which can help operators map the interior of structures and guide them to locations. The research is conducted as part of a contract with Southern Co., which plans to use unmanned aircraft to improve reliability and enhance crew safety.

However, the immediate future of commercial drone use might run into turbulence. Limitations include having a visual line of sight from where the drone is allowed to fly, along with the quality of the data and privacy concerns. For example, a firm using a drone for a bridge inspection might not want to close traffic lanes (or the entire bridge), but rules and regulations under development may force a closure if they restrict drones from flying over the heads of people not directly involved in operating the system.

Firms must pay attention to regulations and liability concerns, which often cause companies to hire government-approved operators instead of purchasing their own drones. They also face a learning curve, from making sure the aerial vehicle hovers over the correct property and can adjust to the height of structures and topography. "It's not always going to be easy to use the technology," MacMurray says.

Molla adds some firms underestimate the skill needed to effectively use drones. He's heard from firms who told him they were going to buy their own drones. Then a few months later, they tell him, 'my drone is in a tree.' "Think very hard before you get into it thinking you can do it yourself," he says.

However, drones aren't expected to be the only choice as engineering, architecture and construction firms go about their business. Weber-Snapp's firm, for example, will likely continue to use airplanes for work in large, wooded areas or wetlands, she says.

MacMurray reminds folks that unmanned aerial vehicles are just another tool for collecting data and information. "I think, as professional engineers and design professionals, it's going to be important for us to recognize that it's our responsibility to judge whether the quality of the data that's generated by these tools is adequate for the purpose we're going to use it for," he says.

*High-resolution photos taken from a drone helped create a geo-referenced 3D model and orthophoto for FlyWorx clients. Credit: FlyWorx*

## BY THE NUMBERS

**The projected economic impact of unmanned aerial vehicles for Georgia.**

### DIRECT EMPLOYMENT

2016: 668

2017: 1,003

2020: 1,161

2025: 1,481

### TOTAL EMPLOYMENT IMPACT

2016: 1,299

2017: 1,949

2020: 2,256

2025: 2,880

### TOTAL DIRECT SPENDING

2016: $65.7 million

2017: $98.6 million

2020: $114.1 million

2025: $145.7 million

### TOTAL ECONOMIC IMPACT

2016: $126.3 million

2017: $189.5 million

2020: $219.3 million

2025: $279.97 million

***Source: "The Economic Impact of Unmanned Aircraft Systems Integration in the Untied States," March 2013, Association of Unmanned Vehicle Systems International***

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