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THINGS TO CONSIDER B4UFLY A DRONE ON A JOBSITE

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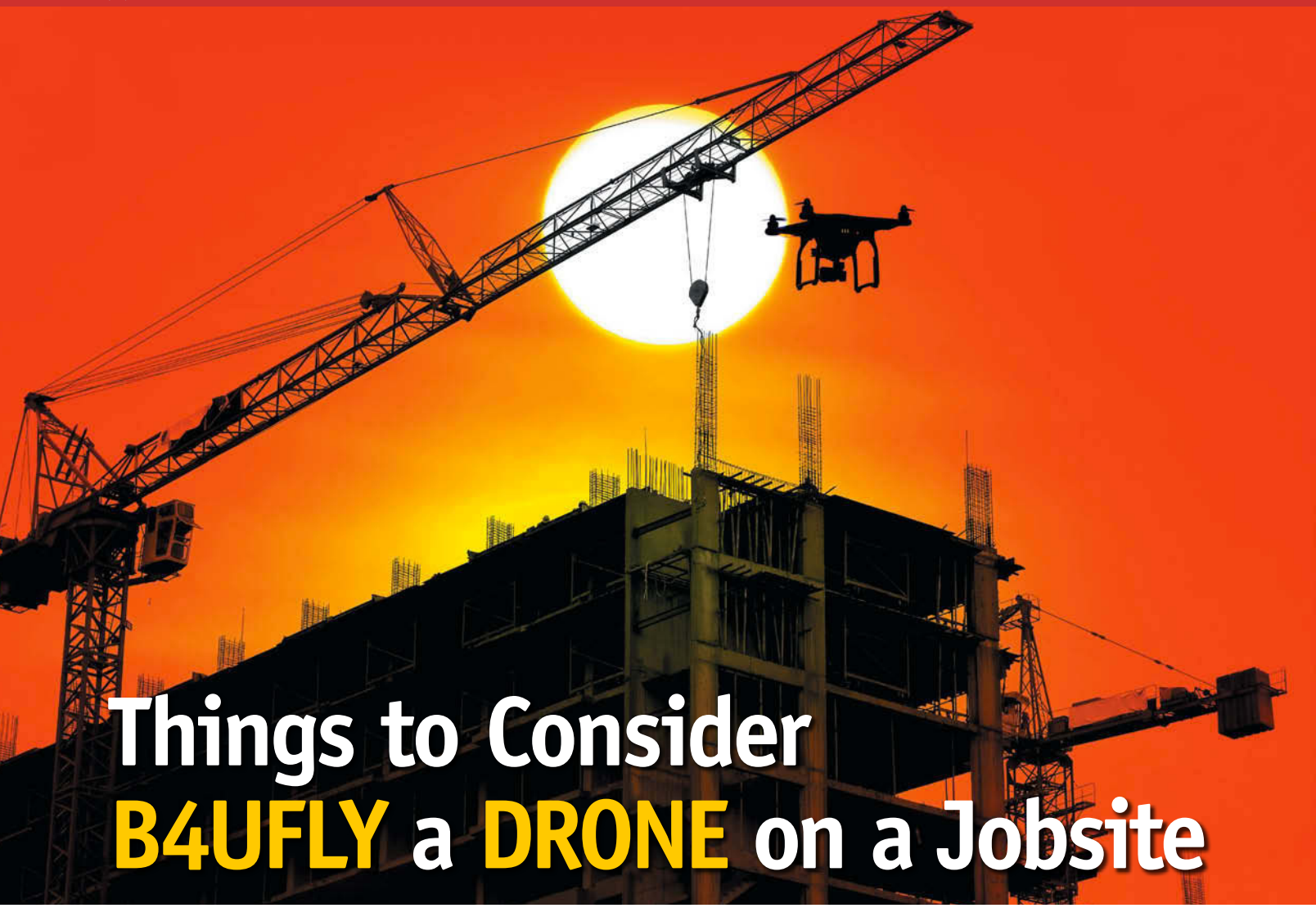


Things to Consider B4UFLY a DRONE on a Jobsite

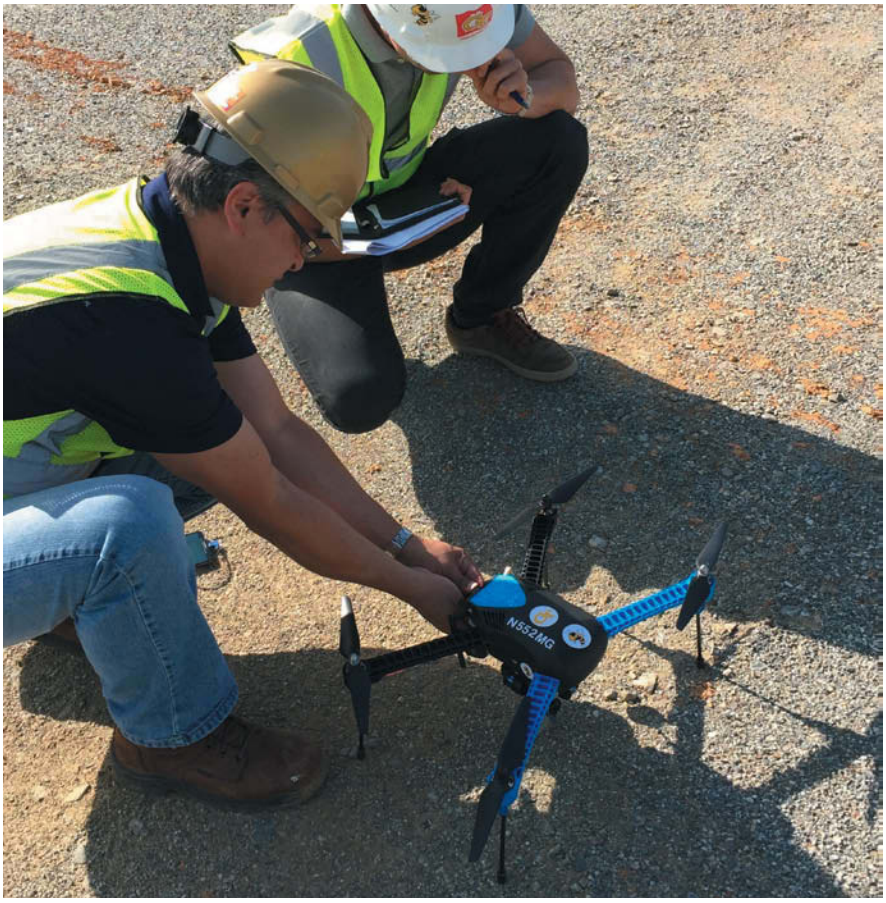
By Dr. Javier Irizarry, P.E., Associate Professor,
School of Building Construction, Georgia Tech

Many of you have seen the amazing pictures and videos taken with commercially available small unmanned aerial systems (sUAS) or more commonly known as "drones." Given the recent controversy these "drones" have caused, you may be asking yourself if these images were taken legally, and more importantly, could I use a drone on my jobsite to get similar images? Well, the answer is not simple. There are many factors to consider when thinking about using a drone on a job site. This article is intended to provide information you need to consider when thinking about using a drone on a construction site. Given the negative connotation the term "drone" has, we will use a term many in the UAS industry and government regulators use to describe this technology, sUAS.

First things first. What is a sUAS? In general, Unmanned Aerial Systems (UAS), can be defined as, *"A powered aerial vehicle that does not carry a human operator, uses aerodynamic forces to provide vehicle lift, can fly autonomously or be piloted remotely."* This system includes a portable control station for the operator and one or more Unmanned Aerial Vehicles (UAVs). The UAVs can collect and process data through various sensors, such as video or still cameras, including far and near infrared, radar or laser based range finders, or specialized communication devices. Most UASs are capable of real-time data transfer between the UAV(s) and the control station; some have additional on-board data storage capabilities for enhanced data collection tasks. UASs can perform tasks similar to those that can be done by manned aerial vehicles but often faster,

safer, and cheaper. Having said that, there are many issues with the use of these systems. What follows are some of the most relevant issues and factors to consider when thinking about using a sUAS.

Before you fly a sUAS, consider your intended use. The three main uses of sUAS include recreational/hobby, public, and commercial. This article will focus on the commercial use, which is what you would be doing if you use a sUAS in a construction site since it would be in support of a commercial enterprise. Today, in order to use a sUAS in a construction site, you need to have what is known as an exemption to Section 333 of the Federal Aviation Administration's (FAA) Modernization Reform Act of 2012, or more commonly known as a Section 333 exemption. This documentation is what provides safe and legal access to the National Airspace System or NAS. By definition, starting from the ground up, all airspace is under the jurisdiction of the FAA and the safety of the NAS is their primary concern. There is also the issue of privacy of property owners when a sUAS is over their property. This issue is more complex and is currently being debated in our legal system. I will not go into that issue since privacy and access to a jobsite is dependent upon project owner and contractor agreement and may be an easier hurdle to overcome. In terms of the relevant requirements for a Section 333 exemption, having a pilot that possesses a private pilot license is the one that limits many from being able to use a sUAS for commercial applications. There are other requirements which can be satisfied with proper training. Final regulations from the FAA, which are expected sometime in 2016 or 2017, will likely require passing a knowledge test instead of having a pilot's license, thus making sUAS more accessible. If you are interested in learning more about the FAA, the Section 333 exemption process and the NAS, visit www.faa.gov.



Assuming you have a Section 333 exemption and meet the pilot license requirement, what should you consider when deciding to use a sUAS at your construction site? What training is available to learn to fly a sUAS? What type of sUAS is most beneficial on a construction site? What could I use a sUAS for on my jobsite? This section will discuss the answers to these questions and provide ideas on how sUAS could be integrated into construction sites based on our research.

Learning to fly a UAS

There are an increasing number of options to learn about UAS operations. From traditional education programs to open access online education, knowledge can be found in many places. Embry-Ridle Aeronautical University is one of the most well-known traditional programs in this field. Unmanned Vehicle University is another respected provider of UAS education. Typically, the goal of people enrolling in the mentioned universities is to have a career in the UAS industry as an operator, manufacturer, maintenance technician, etc. For the purpose of sUAS operation on a construction jobsite by construction personnel, such level of education may not be needed. Other educational opportunities such as continued education courses could be sufficient to safely operate a sUAS for the specific purpose of construction use. For example, in the spring of 2015, AGC Georgia, in collaboration with Georgia Tech, provided a course in the use of UAS for construction applications. We are also teaming to provide more education at the Construction Professionals Conference in April 2016. These types of courses usually cover the theory of UAS use but not the practical aspects. In my team's experience researching UAS, understanding the rules, the process, and the factors that must be considered when using a UAS, the hardest part is learning to fly a UAS. To get started learning

how to fly one, consider buying a toy quad-copter. There are many options available for less than $100. In our research, we use the Hubsan brand to introduce our students to flying. This type of sUAS is small and lightweight and can help you become familiar with basic flight controls.

Guidelines to follow when practicing

Always practice with this type of sUAS in an open space such as a park where use is not strictly forbidden. Make sure you comply with safety precautions such as flying below 400 feet, maintaining visual line of sight with the sUAS, and not flying your sUAS over people. As long as the sUAS is below the 0.55lb weight category, you do not have to register with the FAA. You may wonder what I mean by registering with the FAA. Recently, the FAA established a registration system for sUASs used by hobbyists (commercial use would still require a Section 333 exemption). This requires anyone intending to fly a sUAS weighing more than 0.55lb to register with the NAS and pay a $5 registration fee. This allows the FAA to match a sUAS with a user in case of damage to people or property. After registering, you are required to use the number provided by the FAA on all the sUAS you use. The unique number assigned to you has to be clearly marked on the sUAS. Not complying with the registration requirement exposes you to a $27,000 fine. The type of sUAS that does not require registration usually does not have any of the sensors or features that assist flight in more capable sUAS. Sensors such as GPS, autopilot for automatic return to home in case of problems such as loss of communication with the sUAS, and other sensors that assist flight in low GPS signal situations. Once you have learned how to fly a simple sUAS, you can consider which version of the more advanced ones is appropriate for your jobsite. Next, we'll discuss the question of sUAS usefulness on a jobsite.

What type of UAS would be useful on a construction site?

Many models of sUAS are practical for construction site applications. Some are very complex and expensive, while others are more user-friendly. Based on our research and experience with sUAS on construction sites, we found some of the commercially available and less expensive systems have most of the features needed for construction sites today and in the near future. The DJI Phantom series and the 3D Robotics Solo system are two systems we have found to be suitable for most industry applications. These range in price between $900 and $1,500, and in addition to video recording and still photography capabilities, they have most of the sensors that can allow easier flight such as GPS, accelerometers and vision positioning. The ground station, or more commonly known as the radio control, is complemented by a mobile application that allows the operator to receive the image that the sUAS is capturing and control many of the features related to the camera. In addition, these applications provide telemetry information important for the operator such as battery life, altitude, distance, signal strength between the controller as well as GPS satellites. Once you have experience with the simpler sUAS type, these recommended sUAS are the next level to practice with. As with the simpler versions, it's important to still practice in wide open spaces, within visual line of sight from the sUAS and at an altitude below 400 feet. Also, unless you have a Section 333 exemption and comply with the requirement of a private pilot license, you should not fly a sUAS at your jobsite. However, if you do have a Section 333 exemption and meet all the requirements for commercial use of the UAS, below are some ways you can use it on your jobsite.

Using a UAS on my jobsite

Given the capabilities of the mentioned sUAS, many uses take advantage of images obtained with the sUAS. Uses such as recording progress, monitoring site activities, and quality inspections would be low hanging fruit. Currently, we can use aerial photographs of the jobsite for this, but they are taken at intervals that may not be frequent enough for continuous monitoring or close enough for detailed analysis. Also, aerial photographs are usually taken from the same angle to allow for comparisons over time. With a sUAS, the images can be obtained more frequently and from any viewpoint that you need. You could

even establish a routine where the sUAS uses semi-autonomous navigation to visit the same locations and take images. Owners frequently consider these types of images for other purposes such as marketing and evaluation of change orders or claims. With the increased availability of easy to use photogrammetry software such as Pix4D, Agisoft Photoscan, Autodesk Recap 360 and others, it is now easier to use sUAS based images for surveying applications. With these programs, you can develop point clouds that can be used to measure quantities and even develop 3D models of the work in place. With additional sensors such as infrared cameras, sUAS can be used to perform detailed inspections of assemblies, for example, detecting issues with moisture intrusion. In our research, we have investigated the use of sUAS for safety monitoring on the jobsite, and the results are promising. sUAS allows safety managers to view the jobsite from an overall perspective and allows them to evaluate hazards in relation to all jobsite activities. It also allows them to view work areas from viewpoints not previously possible. Of course, there are issues that must be resolved before sUAS is implemented on jobsites such as privacy concerns as well as the distraction that they may cause to workers. It is also important to note the use of this technology requires developing a workflow that ensures safe use and compliance with existing and future FAA regulations.

In conclusion, the promise of UAS technology to improve the way construction is performed is real. As with every new technology, there are many barriers to adoption that must be overcome. Given the advantages we have on construction sites in terms of access control to the site, existing safety standards to protect workers, and very specific applications of the technology, it may not be long before the regulatory environment permits widespread adoption of the technology on jobsites. ■

About the author: *Dr. Irizarry is an associate professor in the School of Building Construction at Georgia Tech and director of the CONECTech Lab. His research interests include technology use for construction safety, human computer interaction issues in mobile applications for architecture, engineering, construction and facilities management (AEC+FM) information access, interactive visualization systems, Building Information Modeling based augmented reality, and UAS use in construction and facility management environments. He is a licensed professional engineer and holds a BS in civil engineering from the University of Puerto Rico, a masters in engineering management from the Polytechnic University of Puerto Rico and a PhD in civil engineering from Purdue University.*

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