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Introduction to Small Unmanned Aircraft Systems

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Drones, also known as unmanned aerial vehicles (UAVs), have seen many technological advancements in recent years. Today's drones are more lightweight, more agile, and can stream live video, all while being operated from the ground by a pilot. Concerning my field of study, Construction Management, drones are and will continue to be a very useful tool for many reasons. In fact, in 2018, the construction industry saw a 239% increase in the use of drones. This is because drones can be used at literally any stage of a project. "Drones provide construction teams with an overhead view of job sites, materials, machinery, and people. Contractors are using the autonomous flying machines to record images and videos that help optimize everything from grading plans and operations to identifying differences between as-designed and as-built site plans (Goodman, 2020)." Therefore, how and why the drone will be used will be dependent upon what stage in the construction process the project is in.

Before a building can be constructed, it must be digitally modeled to make sure all areas align together. An architect usually does this with computer software alone, but advancements in technology have made this an area where drones can be beneficial. Using the data collected, architects can take information and create blueprints that will be used by everyone associated with the job. These people would include the owner, myself as a project manager, structural/civil/mechanical engineers, and all the subcontractors. "Drones/UAVs provide construction stakeholders with expansive, accurate, and precise spatial data. The data obtained

through a drone can be analyzed with engineering software and can be overlaid on construction drawings. The data captured via each flight is processed through photogrammetry software which is then used to create digital elevation models (DEMs), orthophotos, and 3D point clouds. A variety of secondary data products such as shapefiles, contour lines, and raster products are created when imported into a geographic information system (GIS). Furthermore, the overlaying of spatial data on CAD/construction drawings allows professionals to compare ‘as designed’ to ‘as-built’, thus enabling the identification of spatial mistakes well before they are executed on-site (Verma, 2020).”

As a project manager for a commercial construction company, it will be my sole responsibility to bring a project from concept to reality for owners and architects. To do this, I must bring the building to life, literally, by managing all the trades of work that are required to construct a building. Before construction can even begin, however, I must know the layout of the land that I will be working with. A surveying company will be able to give me the information I need to know such as the elevation and location of the proposed building based on coordinates. These are called topographic points and they are critical for the layout of the building. “With a drone, surveyors can capture many more topographic data points, hence more accurate volume measurements. They can also do this in a much safer way than if they had to manually capture the data by going up and down a stockpile (Wingtra).”

Once the land has been cleared, construction of the building can begin. Owners are especially interested in seeing the progress that is made at regular intervals. They can either stop out at their convenience or they can join in progress meetings that are also held with subcontractors. During progress meetings, details regarding the schedule are discussed along with coordination between trades or changes the owner would like to see happen. Those who are not on-site receive emailed copies of what was discussed during the meeting. It is beneficial to

have photos of the progress made attached to these meeting minutes. But once you start to build up beyond say 5' in height, it is harder to get photos that encompass the project as a whole. To get more than the typical first-person point of view photos, in my experience I would have to climb to a higher elevation or possibly stand on a ladder. Additionally, there are just some areas of a site that cannot be accessed for simply taking photos because of safety reasons. With drones, we can capture these moments. "Photos, videos, 3D models, and orthomosaic maps created with drone data can be used to provide clients with detailed, real-time reports on how things are progressing on-site (Dukowitz, 2020)." In addition to just simply seeing the progress, as a project manager, I can use these visual details to see how we are comparing to our proposed schedule. "Drone imaging can be used to show erection sequences, crane locations, and perimeter security (i.e., gaps in fencing), and these sequences can be viewed regularly to pinpoint where projects are starting to get congested or delayed (Dukowitz, 2020)." Being able to prevent issues or at the very least be able to address them early on is critical to my reputation as a project manager and my company's reputation. There will always be hiccups in construction, but the ability to make it appear seamless to owners and subcontractors equals success in my book. "There is a seamless integration and collaboration of resources and stakeholders, with data being shared in real-time (Verma, 2020)." And one project's success has the capability of bringing in more work, whether by that same owner, the same architect, or simply word of mouth.

From one project to another it is important to learn from your experience. Archived records are a great resource when working on a project. For example, say I built a 4-story apartment building for a retirement community 10 years ago and now that same owner would like to make another addition on their property. I can now look back through aerial video footage or photos of the sequences of events to remind myself what I would do differently this time

around. This is especially important information to share with my team of co-workers. “A complete rendering of a job site helps in evaluating the flaws and loopholes well in advance. This, in turn, ensures a better project management approach with reduced project timelines, accurate site inventories, improved communications, and improved safety (Verma, 2020).” And say my company wants to manage a project in another state by the request of that same owner, drone footage can give me real-time footage of the ongoing work. In the past, this would have been outsourced to a monitoring company that would place cameras on poles around the construction site. I can bypass these fees and save the company and owner money by having someone on-site trained and skilled at taking this footage. “A report created by Skyward in 2019 found that construction work had the biggest piece of the commercial drone market. A whopping 35% of the companies surveyed reported using drones in their operations (Dukowitz, 2020).”

Drones can also be used to track the safety procedures on a job site. My company has a full-time safety director, but she cannot be at all our different projects at one time, and sometimes it is dangerous for her to even inspect the areas she needs to. “Drones can help with employee safety in a variety of ways. Drones allow access to dangerous areas (working at height, chemical exposure, heat exposure) which were previously deemed as high risk to personnel and cost-intensive. For example, an inspection of a rooftop would utilize scaffolding and harnesses, which take time and effort to set up, whilst a drone could capture a wealth of data in a fraction of the time and cost (MRINetwork, 2020).”

When a project has been completed, it is only normal that my company and I will want to showcase it. Pictures that hang on the wall in our offices and videos or pictures on our social media websites are just a few places we would place such items. With the technology we have today you don't want to be counted out just because your images are not crisp or artfully posted.

We must catch the attention of a potential client at any moment. Videos from drones provide an engaging experience for clients and the unique footage makes an impression on clients that will last a long time. “Bottom line: drone video is cool. Whether you’re filming a majestic landscape, a construction site or you’re capturing a birds’ eye view of your big event, people are eager to see drone video footage. If you want to attract people to your website and you want them to stick around long enough to get a good feel for what you have to offer, video is by far the most efficient way to do that. Drone video is even more compelling. If you hope to capture— and keep— your audience’s attention, consider incorporating drone video (Bevan, 2018).”

Drones are used for surveying, pre-planning projects, they are used to document progress, and they can adequately monitor safety hazards. They are used to capture unique images that are then used especially as a marketing tool. In conclusion, from my research and personal experience, drones are and will continue to be a very useful tool for many reasons in the construction industry.

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