BIG DATA THAT FLIES: DATA ACQUISITION WITH AERIAL DRONES

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Unmanned Aerial Vehicles (UAVs), or drones, have moved from "cool toy" to "essential workhorse" in the minds of many businesspeople – particularly those in the construction, oil and gas, mining, and aggregate industries. Along the way, drones are helping to chart new territory not just on the ground, but in the speedy gathering and analysis of large data sets.

Meeting a Real Need

About three years ago, our engineering and environmental consulting firm started to see the benefit that drones might offer to our clients. They wanted access to fast, reliable maps, and images of the ground. This stemmed from their need to know the topography of a planned construction site, how much soil and rock would have to be moved to build a road or widen a rock cut, or how to avoid having an impact on an environmentally sensitive area.

Traditionally, they'd employ a crew of surveyors who might take several weeks to produce a map of the site. Or, they would commission a manned aircraft to capture images – a process that might require a month's lead time or even a rescheduled flight time due to weather delays. Then, it could take at least another month to process the data.

We figured that drones could get our clients the data they need quickly to support good decision-making, and we could do so cost-effectively. And maybe we could also provide site-specific information our clients couldn't obtain any other way.

The right equipment and processes are essential

The devices used for this kind of work are far from the backyard toys made popular by the big-box electronic stores. They require significant training and qualifications to fly.

We use two types of drones: some are equipped for photogrammetry (the science of making measurements from photographs) and some equipped with LiDAR scanners. (LiDAR, a combination of "light" and "radar," can create an image of the surface that cuts through vegetation such as trees)

We've hired an FAA-certified commercial aircraft pilot as part of our team to help us plan our flights in a safe way that avoids obstructions, such as transmission lines, cellular towers, and manned aircraft in controlled airspace.

A typical project might involve flying over a 300-acre site to map it. The points we measure are less than a millimeter apart, and each data point contains information on its color as well as its position in three dimensions. There can be millions of data points acquired during each drone flight. Those data points are what we use to create a point cloud, which is the foundation for most of the deliverables requested by clients.

The resulting files can range from several hundred gigabytes up to about a terabyte in size. Server space is quite costly, so in addition to investing in a $10,000 supercomputer, we have invested in an array of Solid State Drives (SSDs). We can store the data and process it on the SSDs, and then house the data off-site for disaster recovery purposes.

Our firm's survey teams are key to our process in that they establish ground control points – points on the survey area whose exact location is established using ground surveying techniques. This helps to establish the accuracy of the drone-generated data.

We take all of the drone-generated data and post-process it through programs like Pix4D drone mapping and photogrammetry software, among others. We then import the data into AutoCAD® Civil 3D®, where we can manipulate and utilize the data for a number of purposes, such as to prepare volume calculations or as the basis for our engineering designs.

THERE CAN BE MILLIONS OF DATA POINTS ACQUIRED DURING EACH DRONE FLIGHT, WHICH ARE USED TO CREATE A POINT CLOUD TO OFFER THE DELIVERABLES REQUESTED BY CLIENTS.

In addition to acquired data, we can integrate survey data and publicly available GIS data for a property. This allows us to identify existing site features, such as property boundaries or rights-of-way, and overlay that information with our acquired geo referenced data. Other key data, such as the location of wetlands, endangered-species habitats, and water bodies, provided by our firm's environmental and ecological professionals, helps to create a more robust and complete deliverable.

The resulting deliverables depend on the needs of the client. Some want a 3D model of their site, others want help determining the amount of material in a stockpile, and some just want an aerial photo of their property. A 3D model can even be presented using augmented or virtual reality to help stakeholders visualize a completed project in context. The information provided is often key to our clients' decision-making.

Flying Right

A few of our lessons learned along the way:

Fly legally and safely: Always follow commercial FAA regulations with certified FAA drone pilots.

Don't fight the weather: Drones are not at their best during high winds, and rain or snow can produce low-quality data. We help manage our clients' expectations in the case of bad weather.

Consistency is key: It's best to complete a data acquisition exercise in one flight, if possible, so that there are no problems with sites that look different under cloud than they do on a sunny day.

Don't fly during blasting: If blasting is going to be performed nearby, pick another time to fly.

Pick a good place for controlling the drone: Find a spot where you will have a line of sight to the drone over the whole mapping area.

Big data, big storage: Make sure your organization has the server space to accommodate the amount of data that will be acquired, and, if not, find an alternative storage solution. CA