5 THINGS TO CONSIDER BEFORE USING DRONES IN CONSTRUCTION
According to a McKinsey report, the construction industry remains one of the least productive and least digitized industries. If construction productivity were to match the total economy, the sector could be looking at $1.6 trillion in added value worldwide. Part of the solution is to digitize the industry, but many companies are reluctant to do so.

The hesitation to adopt new technologies arises from insufficient internal processes and risk aversion. However, there are recent improvements on the adoption of the use of drone technology. According to DroneDeploy, a leading drone software platform, the use of drones on construction sites increased by 239% from 2017 to 2018, with the most common activities being job progress tracking and communications. According to Goldman Sachs, by 2020, spending on drones in construction will increase to $11.2 billion, part of a global commercial drone market of $100 billion.

For the construction industry, drone technology can help to drive decisions and complete tasks more quickly, with lower costs and increased safety. These factors are powerful ways to increase productivity.
Is a drone the right tool for the job?

Many organizations have fallen prey to what some experts call the “shiny object syndrome” which is when users get caught up in the novelty of the technology at the expense of legitimate questions about whether or not a particular technology can add real value. Unfortunately, using a drone in the construction industry isn’t as simple as buying one and acquiring a software solution to plan automated missions. Before that, there are various subjects that need to be taken into consideration about which technology to use, its potential application, and its overall purpose.

Determining whether adding drones to a project would add real value to the type of work being done is critical. To do this, a company needs to understand and evaluate whether or not some of the tasks being performed on a construction site could be made easier with a drone. What would it mean for a superintendent to plan their morning meetings based on the drone information they received the day before? Will utilizing a drone to determine grades and contours vs the cost of traditional survey? Answers to these specifics are going to vary from one organization to another, as will the approach to integration when it comes to creating a drone program or outsourcing.

The question of “build or outsource” is one that many organizations work through once they decide they want to leverage the technology. While it’s often not a case of either/or, decisions about whether internal or external resources are going to be flying the drone can be more about timing and policy than the technology itself. That desire to have control over the drone and information but to also be able to utilize the insights of service providers has led many to a hybrid model that utilizes both approaches, although even this model has disadvantages.
If outsourcing is the answer, there are various services available that can help companies get set up with what they need. PrecisionHawk’s pilot network makes it easier for construction companies to scale across all their projects without being dependent on a few internal certified drone pilots. DroneBase is a trusted go-to platform for worldwide enterprise commercial clients that helps insurers inspect structural damage, construction sites monitor progress, mines assess their stockpiles, and real estate professionals take aerial images of properties around the country. These types of companies can be leveraged for their existing infrastructure or expertise, which can contribute to cost savings. They may be especially useful for unique or one-time projects that would benefit from drone use but may not (yet) be worth investing in a suite of new technology for the construction company to own.

For a company that wants to implement its own drone program, Sappington, an enterprise technology marketing firm, recommends creating a vision and a roadmap as the first step. The idea is to help a company to develop a vision for how they want to use technology. This can then be used to create a digital roadmap that lists and priorities the technology investments required to achieve the vision, including choosing the right drone solution for the job.

Choosing a drone solution

Although choosing the right drone solution may sound simple compared to assessing its potential to add value to a product, it can be a daunting task. The ever-growing variety of drones available in the market today, such as multirotor, single rotor, and fixed-wing, from many different manufacturers, might make choosing the right platform and software a complicated process.
Multirotor drones (a drone with more than two rotors) are most commonly used in the construction industry. Their advantage is that they are easier to fly, offering more control over positioning, and can hover for long periods with ease. Within this group are quadcopters (4 rotors), which are usually the simplest and least expensive option. Solutions such as hexacopters (6 rotors) and octocopters (8 rotors), can carry heavier loads with greater stability, but their bulk leads to a trade-off in flight time.

If finding a drone and its software is too challenging, there are some companies that provide all-in-one solutions – a complete package with the hardware and software needed to start flying.

Skycatch’s High Precision package is an all-in-one solution a completely automate operations for the enterprise. Komatsu, a Japanese multinational corporation that manufactures construction, mining, forestry, and military equipment, is using Skycatch’s solution to automate operations for their bulldozers, excavators, and other types of heavy equipment. This is “helping them meet their business objectives, but it’s also serving to define what it means to digitize the entire world and digitize as many of the job sites out there as possible”, according to Christian Sanz, CEO at Skycatch.

Airobotics created the “drone in a box”, a fully automated solution. In 2018, the company partnered with a major joint venture, Shapir-Ashtrom, formed by Israel’s top construction and civil engineering companies, Shapir Civil and Marine Engineering Ltd., and Ashtrom Properties Ltd, to survey the construction of Haifa’s new seaport. The solution assisted in keeping track of the construction progress and surveying the area on a daily basis.

Photogrammetry or Lidar?

Just as important as defining the “roadmap” and choosing a drone is to select the right type of sensor or sensors for the job. For the construction industry, this usually opens a debate as to which is better for a given project: “Photogrammetry vs LiDAR”. Choosing the right is a necessary step because when a survey goes well, the construction project goes well, ultimately leading to a reduction in cost from mistake corrections or extra time needed to correct problems. When a survey goes poorly, a construction company could have to delay potentially every aspect of the project.
Photogrammetry uses images to transform 2D information into 3D maps and models. Most would argue that photogrammetry is enough for most projects. It has the benefit of being the most affordable solution of the two, with costs ranging anywhere from $2,000 – $20,000. Photogrammetry is capable of generating full-color 3D and 2D models, including raw images, orthomaps, Digital Surface Models and 3D point clouds. This is ideal for imaging large, clear areas and environments that have already been developed. It can also be used to keep track of the progress and changes on a daily/weekly/monthly basis.

The downside of using photogrammetry is the specific weather condition requirements – you do need to be able to “see” what you are mapping. There is often the need to place a large number of ground control points (GCPs), and it takes a long time to process the data, though the end result may be easier to interpret, depending on what is being scanned. However, software, cloud-based solutions, such as DroneDeploy’s Live Map, demonstrate how well this technology has evolved, and how powerful they are in providing actionable insights in real-time.

Lidar, on the other hand, doesn’t depend on weather conditions, does not require the placement of GCPs, and processing the generated data is faster. This technology can cut through brush and vegetation to properly map the ground and can create extremely precise 3D maps of a region. This ideal for environments that have a significant amount of overgrowth. Lidar is best used when precision matters and there may be interruptions between the aerial system and the ground.

The data produced by lidar can be imported directly into construction and architectural software solutions, allowing for detailed simulations of the construction build. This streamlined workflow can contribute to cost and time savings for large and complex projects.
On the downside, lidar can cost significantly more ($50,000 – $350,000). It produces non-colored images on the RGB scale, and the generated maps can be difficult for human eyes to read, especially if workers are not as familiar with their interpretation. In some cases, there may be little distinction between mapped objects aside from their physical texture.

Then, there’s the possibility to use both lidar and photogrammetry together with a Direct Georeferencing system. This is something YellowScan has been exploring in the past few years, and it ends up offering better results. Direct Georeferencing (DG) consists in using high-grade IMUs resulting in a centidegree accuracy in rolling, pitching, and heading. This means it’s possible to get the full accuracy of both the platform’s position and orientation, and accurately position each point of your lidar or photogrammetry pixel.

How are drones being used in construction?

See what a building will look like before it’s even built

In 2014, Layton Construction, started using three drones to capture progress on-site, and have now adopted them for use in all stages of their construction projects, including 3D modeling and mapping during the preconstruction phase.

With the help of the Mavic 2 Pro, Mavic 2 Zoom, and DroneDeploy, Layton uses the drones to collect BIM information to see what the building will look like upon completion. This allows them to identify issues on the digital model and address them before they become problems on the physical job site. The tools also make it easier to communicate with sub-contractors and clients.
“By taking a few different flight paths, we can make a 3D model, import it into a video, and show that to the owner so they can see how their building will sit on the site before it is ever built,” explains Austin Lay to UAVCoach, Visualization Coordinator and Drone Operations Coordinator at Layton.

**Keeping track of stockpile quantities**

To measure and manage their stockpiles, report on inventory, and share easy-to-understand visual information for planning and tracking work, Boral, a multinational manufacturer and supplier of building and construction materials, is using Propeller’s drone-mapping and analytics solutions.

Previously, the company used a third-party contractor to conduct six-monthly manned aircraft flights to gather this information. Craig Burr, the quarry support manager for Boral’s Victorian Metro region (consisting of six quarries) said the low frequency of the flights could cause errors to multiply.

“It would take weeks or even months, between data being collected and results being available,” says Burr, “By this time, the inventory levels had changed, so reconciling the survey against what was on site was challenging”.

Now, Boral flies drones regularly and can validate their stock in real time, allowing teams on site to adjust the algorithm and stock to get an accurate reconciliation to production rates.

Another advantage of switching to Propeller’s custom base tool, is that the company can adjust the base to correctly reflect the ground underneath, instead of having to assume it is flat.
“This results in a considerably less commercial impact on the business, then one big write-down come reconciliation time,” Burr added.

In a survey performed in January 2019 the company ended up with about $25,000 variance across the Victorian Metro region by using Propeller’s solution.

Reducing time and costs

Colin Romberger, a licensed pilot, the owner of PrecisionAerial, and Chief Instructor and sUAS Operations Consultant at DARTdrones, is using drones to map or survey construction sites, inspect projects and create aerial thermography reports. Romberger provides clients with real-time aerial footage, which saves them time, but also cuts traveling costs that regular site visits would require.

During a project in central Pennsylvania, a client storing aggregate used by other construction companies would measure it every year with the help of a surveyor team, which could take up to a week and cost $75,000. By using a drone, the same volumetric assessment could be performed on their site for about six hours in a day, with rest of the day used to process the imaging and build a report. In the end, the total cost was about $5,000.

Uplift Data Partners, which PrecisionHawk acquired in November 2018, once saved one client $300,000 by overlaying the drone’s aerial images on the building’s blueprints, discovering a misalignment in the piping and pouring of a building’s foundation.
Improving health & safety

In 2015, nearly 1,000 workers died in the construction industry. Scaling a roof to check for damage, climbing up scaffolding to complete vertical inspections on the face of a newly built project, or accessing hard-to-reach locations are some of the dangerous tasks workers need to perform on a construction site. According to OSHA estimates, workplace injuries and illnesses cost employers in the US almost $1 billion per week in worker’s compensation alone. With UAVs, these tasks only require one or two persons to do the job, and that’s the drone pilot and an observer, if needed.

To avoid sending a worker inspect a roof at the University of Texas, Dallas, during the night, the Beck Group performed a series of thermal inspections using DroneDeploy.

“Rather than searching for a needle in a haystack, you have a map to tell you right where to look,” Grant Hagen, a VDC manager with the Beck Group, told DroneDeploy. “This reduced the time spent on the roof and helped keep workers out of harm’s way.”

In the UK, during the construction of a £86 million coastal defense scheme across a 2.7-km stretch of coastline to protect 12,500 homes from the risk of flooding, Balfour Beatty adopted drone technology to control the supply and placement of rock armor. Teams of two operators, one to control the drone’s camera and another to fly the drone, used it to survey each stockpile and record which material had been used and where. Additionally, the drone also helped to inspect the groins that stretch out into the sea from the beach.

“Prior to using the drone would have meant using either cherry-pickers or clambering across the rocks which obviously, potentially presents some health and safety issues”, said Craig Matthews, Principal UAS Manager at Balfour Beatty.

Policing construction sites

On a construction site, it’s not easy to keep track of every worker’s position, what he’s doing, or if any violations are occurring. Agmis, a Lithuanian company, is working on a software solution, EasyFlow CV, to provide construction companies with a way to easily keep track of site progress and worker safety.

By using computer vision, the software can identify if workers are wearing the required personal protective equipment (PPE) including hardhats, safety goggles, high visibility vests, protective boots and other required safety equipment. It can also recognize if workers are wearing protective harnesses when working at height. It can even examine worker actions, such as a worker asking for help.

In addition to these safety aspects, EasyFlow CV can recognize certain work processes, measure how long each process takes, and monitor worker productivity. It can also identify how long each section of a scaffold is worked on, and tracks worker movement around the construction site. This data can be used to optimize the layout of building materials and to track quantities of materials stored on site.

Whenever the software detects a violation, it is stored in a database with the video footage, and an alert is sent to the site safety officer in real time. ➤
Is your business ready to explore adoption?

Here is a checklist of big-picture items to consider:

✓ What business problem are you trying to solve with drone technology?
✓ How will adoption impact established protocols and workflows?
✓ Can this workflow be easily or sensibly integrated into an existing department or workflow?
✓ Can this solution scale beyond a single project?
✓ How will the differences be measured?
✓ Will it be a challenge to sort through regulatory considerations?
✓ What do ongoing training and maintenance costs look like?
✓ What do the bottom line costs of drone adoption look like when considered in terms of building a program or outsourcing?
✓ What kind of competitive advantage will adoption enable?
✓ If you don’t move forward with adoption this year, will the same factors drive your decision next year?

João Antunes, Author

Technology in general makes João Antunes tick, but the specific ways it has created and changed the landscape in IT, gaming and computers ignited curiosity that’s turned into a passion for him. As the son of a journalist writing about how these industries have emerged and evolved, he has an incredible perspective when it comes to understanding the kind of disruption new technologies can create in a given space. He’s committed to showcasing what that disruption will mean for professionals as they work to utilize brand new pieces of hardware, software, systems and processes.