

SPECIAL REPORT

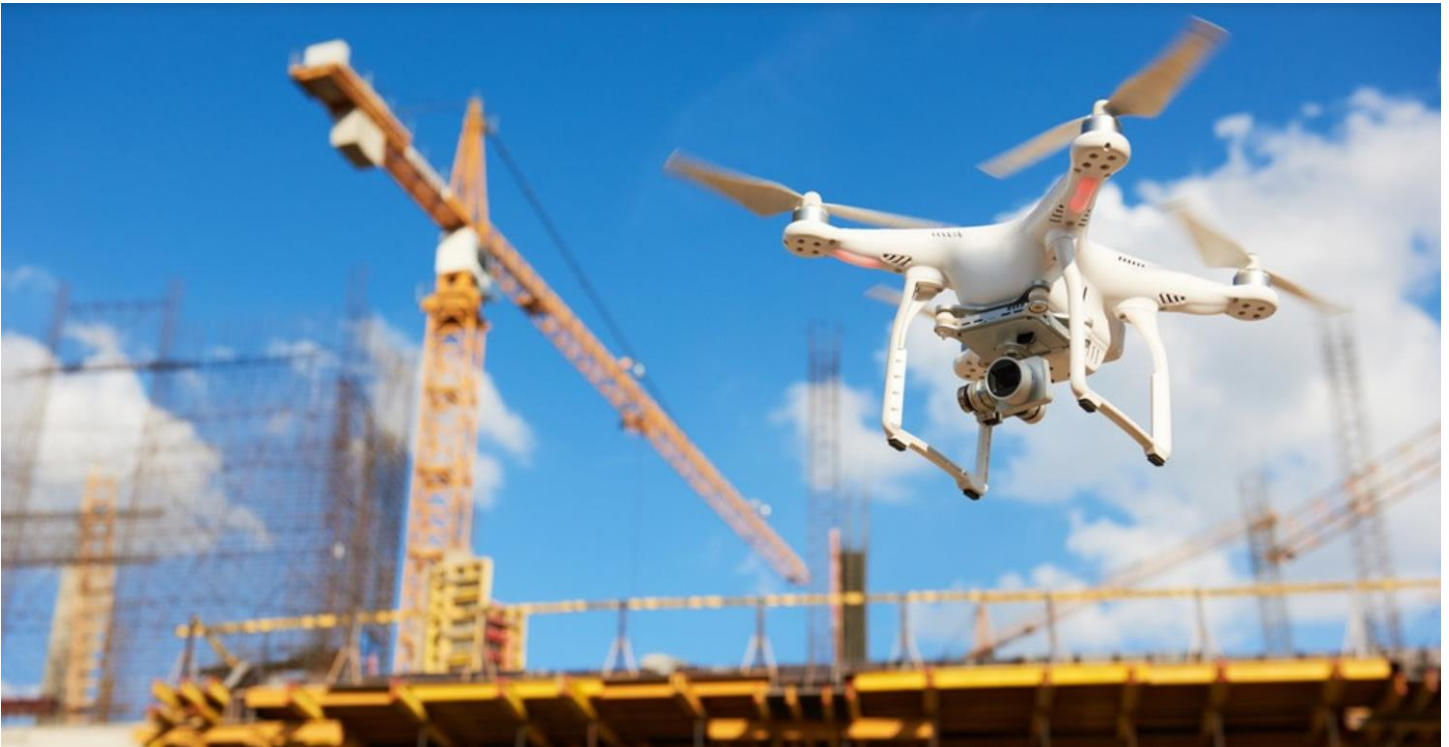
## Giving a Lift to Construction's Tech Stack

What can we learn from building's quick adoption of drones?

by *Joe Bousquin*

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**If things are going right on a construction site, nothing stands still. Construction done well means a constant state of motion and change, until the last finishes are put in place and the certificate of occupancy is signed.**

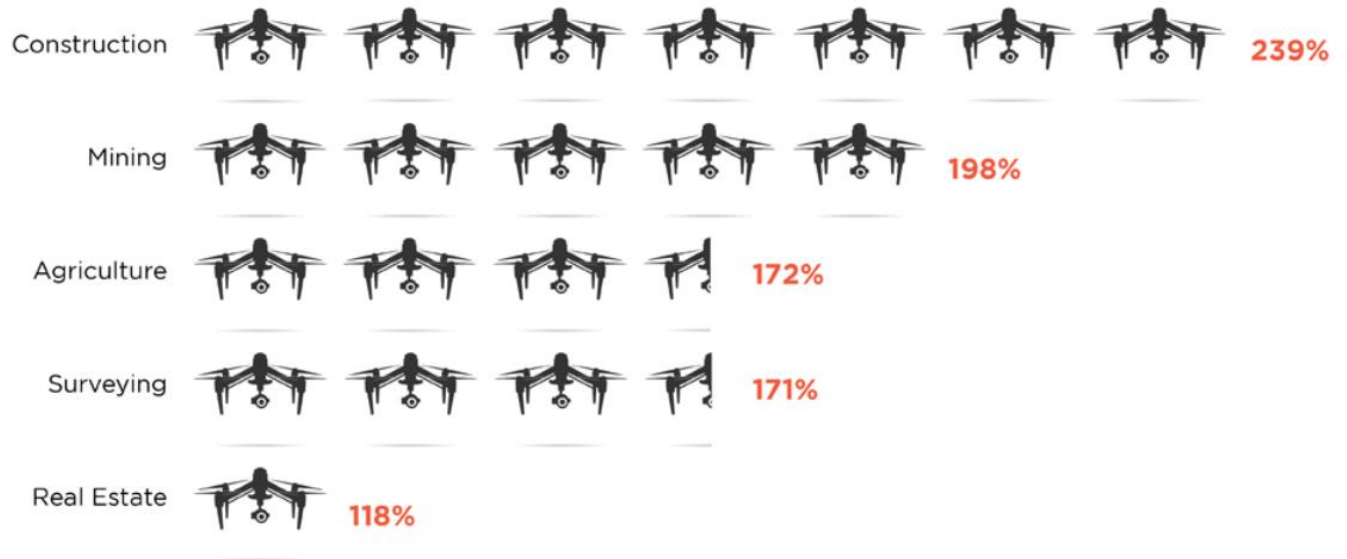
“Construction sites are dynamic environments,” says Teri Voss, director of marketing at Boston-based AiRXOS, a drone traffic management venture owned by GE. “Changes happen by the hour, if not by the minute.”

Maybe that’s why drones, which can arrest, capture, and document that perpetual motion from a bird’s eye view with lucid clarity as often as desired, have taken the construction industry by storm.

“Drones have been a game changer for us,” says Trey Garner, CEO of San Antonio, Texas-based Garner Homes, who uses drones to inspect his homes’ roofs to see how water drains. “We’re able to plan better and build better. We’re catching potential mistakes quicker and using that information to change the way we design future projects.”

## Up, Up, and Away: Drones Rise in Construction

Growth in Adoption of Drones by Industry (Year-over-Year)



Source: DroneDeploy

Drone adoption in construction has been on a juggernaut trajectory, surging 239% in 2017 and 250% in 2018, according to San Francisco-based DroneDeploy, a leading commercial drone software platform that enables drones to build 3D maps of construction sites.

While construction is often lambasted as a laggard in technology adoption compared to other industries, when it comes to drone usage the sector has flown ahead of all others. Construction now ranks as the fastest growing industry in the use of drones, according to DroneDeploy's [2018 Commercial Drone Industry Trends](#) report, and that growth is only accelerating.

"I think we're just starting to scratch the surface," says Andrew Dennison, director of enterprise services at DroneDeploy. "There's a lot more value to be mined from all the data drones collect."

Because construction is often cast as an industry of sagging productivity with a resistance to adopting technology, the quick uptake in drones by construction pros stands out. The aspects of drones that made them a rapid fit for construction also provide a roadmap for other solutions to work in the built environment. The learning curve construction pros went through when launching this new form of tech offers a preview for what lies ahead—or will be flying ahead—in the rapidly growing construction technology stack.

### **Drones excel at providing real-time visual project status.**

According to DroneDeploy's survey, construction companies are using drones during the bid process to survey sites and get a more accurate picture of what the project will entail; for preconstruction and site planning once they win the bid; for safety and risk mitigation on-site once construction is

underway; to track daily progress against a project's original schedule and design; and, once tasks are complete, to inspect for quality control and assurance.

"We use drones to get topographic information at sites, then compare it to land surveys to help select the best location to start building," says Edmo Guitierrez, director of process technology at Houston-based concrete manufacturer CEMEX USA. "During construction, we use drones to gauge how progress is following the original design and create a future record for where wires, tubing, and other key elements are located. With thermal cameras attached to drones, we can also track the ready-mix concrete's reaction."

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**SPECIAL REPORT**

**SPECIAL REPORT: CAN CONSTRUCTION BE DISRUPTED?**

by *Joe Bousquin*

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But for many construction pros, the rapid uptake in drones by the industry comes down to a simple, paradigm-shifting application. In an industry that produces products with a scale that sometimes can't be appreciated until

they're seen from afar, drones provide an instant way to capture the real-time status of a project that's simple and intuitive to understand.

"All of a sudden, you were able to grasp the entire scope of a complex construction project in one large image," says Tomislav Žigo, vice president, virtual design and construction, at Chicago-based design-build firm Clayco, which started using drones in 2014 on a large healthcare project in St. Louis in partnership with San Francisco-based drone image processing platform Skycatch. "We very quickly realized this was a technology that would give us an additional level of data and insight into our jobs, to help them run better and faster."

That type of aha moment is something pros across the industry say was apparent as soon as drones hit the construction site. "You get an instant snapshot of everything," says Jim Greenberg, a product manager who focuses on earth-moving applications for drones at Sunnyvale, Calif.-based construction software and technology firm Trimble. "That's just something that wasn't available before."

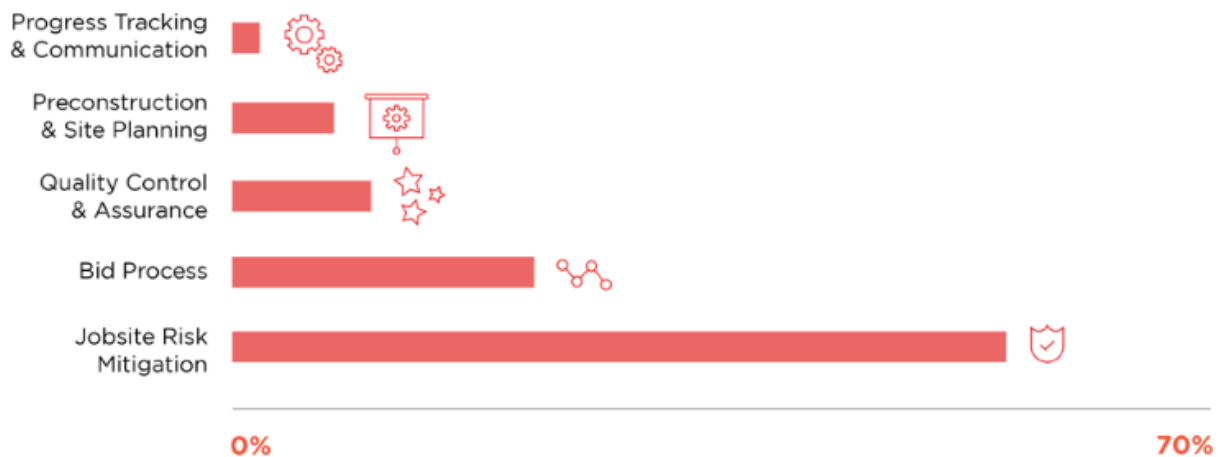
At San Rafael, Calif.-based design software giant Autodesk, strategic projects executive Tristan Randall says drones provide a perspective that lend intuitive understanding to projects, even for people who aren't in construction. "You can fly a drone over your site and immediately get situational awareness," Randall says. "It gives you the ability to understand what's happening on-site and to see changes over time in a very structured way."

## Drones revolutionize the speed of surveying and the productivity of project communications.

The speed with which drones can map sites has also been a critical aspect of their quick adoption by the industry. While industry pros say they don't replace professional surveyors, they do enable them to do their work a lot faster and at a scale that was never practical in the past.

"We do a lot of large-scale renewable energy projects," says Steve Hochart, principal at Encinitas, Calif.-based environmental engineering firm Dudek. "With conventional, on-ground surveys, it would take weeks to complete an average site. With drones, we do the same survey in a single day now."

### Primary Use of Drones in Construction



Source: DroneDeploy

But the real killer app for drones in construction—DroneDeploy found that 65% of pros use drones to communicate and collaborate on-site—also helps address one of the industry's age-old challenges: a construction site's constant state of change. It's an old saw in the business that you can plan and schedule your project down to the most infinitesimal detail, but as soon as the first shovel hits the ground, your schedule is automatically out of date.

Not only does flying drones give construction managers a real-time view into where the project is versus where it's supposed to be, it also provides a quick way to communicate to everyone on-site what needs to happen next.

"Drones really help improve communication," says Dennison. "Oftentimes now in the morning meeting in the trailer, they're bringing up the drone and zooming in to the part of the site they're working on and showing people visually what's going on. That's a big improvement. You can track progress a lot better when you can see the entire project at once, while letting more people know about it to make sure everyone's on the same page."

At San Francisco-based Skycatch, marketing director Jackie Guilbault says clients are using daily images captured by drones and tracking them against 3D building information modeling (BIM) plans. “They have a daily BIM coordination meeting, and they use the updated drone maps to look at everything for the day, from where to park to anything that’s out of alignment,” Guilbault says. “It’s just good to have eyes on it and talk to the team about the plan. It tells you what’s the reality against the original design.”

### **Detailed aerial images can help avoid costly rework.**

Having the ability to compare the reality of what’s happening on the ground to a project’s 3D model is also critical to avoid costly rework later on. For example, at Beverly, Mass.-based Windover Construction, the design for a mixed-use, 126-unit mid-rise apartment building called for the first two floors to be built on-site as a podium, using steel beams. But the apartments themselves were modular units manufactured off-site in a factory and designed to be stacked on top of the site-built platform.

To ensure that the mechanical chases on the site-built structure would line up with the chases in the modular units, director of virtual design and construction Amr Raafat used drones to capture detailed images of the steel base. He then overlaid the original 3D BIM model of the project on top of those images, along with the designs for the modular boxes, to see within a few centimeters of accuracy whether the chases lined up.

The result? He was able to make micro adjustments to the modular boxes—before they were built—to avoid about a dozen small clashes in the interface with the podium, while gaining the peace of mind that he had an exact match before the units even arrived on-site.

“Anytime you build something onsite, the as-built structure is going to be just a little bit different from what’s in the drawings,” Raafat says. “So after we built the first two floors, we scanned the steel using the drone, which gave us a very accurate 3D model and 2D map of the building. Then, we overlaid it with the modular plans of what was coming from the factory. With every phases of the building, we were able to place those modules virtually first, to make sure everything fit perfectly, before we brought them onsite. And that really helped us mitigate risk on that project.”

### **More drones means fewer people working at riskier heights.**

Aside from mitigating design risks, flying drones can also avoid putting people in harm’s way while reaching spots that otherwise would be inaccessible. “You can’t walk on a slate roof, so, traditionally, you’d need to rent a boom to do a line of sight inspection,” says Victor Cruz, reprographics manager at Rochester, N.Y.-based design firm SWBR. “A drone lets you see that roof from every angle.”

Then there are swing stages, the platforms that dangle from the sides of tall buildings for maintenance or to inspect building envelopes once they're complete. Flying drones eliminates the need put actual human beings on those platforms, let alone taking the time to rig one to the side of a building.

"That's where the drone really, really shines," says Robert Fish, vice president, commercial division, at Fort Lauderdale, Fla.-based Marker Construction. "It's a safety factor for the workers. Instead of being on a scaffolding or swing stage, you've got somebody on the ground using a remote control."

**Drones are easily incorporated into existing workflows, whether in-house or through subcontractors.**

The easy learning curve of drones has also helped with adoption. Typically able to run off a smart phone or tablet, users don't need to learn complicated software. "I started using my drone to take jobsite photos after a very short learning curve, navigating with my phone," says Garner, the homebuilder. "It lands itself—usually in the bed of my truck."



Clayco

Drones also fit into construction's traditional workflows so people don't have to relearn their jobs to use them. "You can leverage drones on a construction site without really changing anything else about your existing processes," says Autodesk's Randall. "You can buy a drone and software without ever interacting with a salesperson, get it delivered, and, with very little technical expertise, fly over your site."

To do that as part of a commercial enterprise, though, you do need to obtain a commercial drone license under the Federal Aviation Administration's Part 107 rule for remote pilot certification. While some firms designate staff to take the Part 107 test—as Raafat did at Windover—others choose to outsource the job just like any other subcontractor.

“We work with a company called Hanger Technology out of Austin,” says Brian Webster, president of Addison, Texas-based multifamily builder KWA Construction. “They’re a third-party drone operator that captures our jobs with quality and production in mind.”

Webster took that route to further mitigate his own risk on-site, as well as to avoid the specific insurance needed to cover drones used onsite. “It’s just not a risk I’m comfortable taking on myself,” Webster says.

Attorney Maura Krause says construction firms want to make sure their drone-flying subs have the right certifications and insurance to work on-site. “A lot of general liability policies don’t include coverage for drones, and many policies actually have a drone exclusion,” says Krause, a partner at Buffalo, N.Y.-based law firm Goldberg Segalla. “Contractors who subcontract out drone operations should make sure their subcontractors have the appropriate coverage in place, with the contractor added as an additional insured on the policy.”

### **Drones are a low-risk investment.**

The low cost of drones has also helped them proliferate throughout the industry. Indeed, according to DroneDeploy’s 2018 report, 90% of commercial mapping is done with drones that cost \$1,500 or less. “They’re basically job disposable,” says Marker’s Fish. “We’re not in the business of throwing money away, but if you go through a few drones on a job, it’s not going to put you under.”

### **Make strategic use of flights to avoid data overload.**

While all of these aspects helped lots of construction companies get up and running with drones quickly, it also means they had to learn when *not* to use them.

“Because of the extreme cost effectiveness of drones, it’s a bit like when digital cameras first came out—you end up just taking 10,000 pictures,” says Fish. “The more frequently you take these flights, the more you risk getting data overload. You should have a plan for exactly what you’re trying to capture each time you fly.”

Indeed, many early users of drones in construction became so enamored with the possibilities of stunning client presentations and marketing shots that they missed the broader application of the technology. But that’s beginning to change.

“Construction companies are now seeing opportunities to do more with the data,” says Jason Nichols, senior product marketing manager at Menlo Park, Calif.-based aerial intelligence firm Kespry, which helps its users measure stockpiles of material on-site to ensure that what’s billed on an invoice matches what’s on the ground. “They’re not just using drones to take pictures or provide an update for their marketing material.”

**Drone technology’s easy meshing with construction’s tech stack provides a road-map for other productivity-enhancing technology.**

Honing in on drone’s further applications in construction is where the evolution of this technology is headed in the industry today. “The more we use this technology, the more we learn how to apply it in a very targeted way,” says Clayco’s Žigo. He says going forward, as drone technology continues to progress, drones will only become more useful in construction and, indeed, start to fuel the emerging construction technology stack with the data it needs to evolve itself.



Clayco

“When drones were first introduced, there was a huge hype associated with this technology in terms of it being a game changer,” Žigo says. “But I think that initial adoption was more about keeping up with the Joneses. Now I think there are a handful of companies, Clayco among them, that are taking a more mature approach to how we use this data from multiple perspectives.”



Construction firms' ability to process the data is now catching up to the hype, Žigo says. "We are getting more and more drone data into project management software and project analysis software to help us make decisions more quickly."

It's this mixing and combining of technologies with data that is leading to the true game-changing effect of drones for construction. "The most important thing to get a good return from drones is to evaluate what other technologies you can use it with," says Windover's Raafat. "Can you use it with virtual reality, augmented reality, BIM? It's not about the detail you capture with the drones, it's about how you're going to use the data you capture."

Sounds like a clear (flight) path for the future adoption of multiple types of technology in construction.

**Joe Bousquin** has been covering construction since 2004. A former reporter for the Wall Street Journal and TheStreet.com, Bousquin focuses on the technology and trends shaping the future of construction, development, and real estate. An honors graduate of Columbia University's Graduate School of Journalism, he resides in a highly efficient, new construction home designed for multigenerational living with his wife, mother-in-law, and dog in Chico, California.