



UAV COMPLIANCE 101

HOW TO USE DRONES ON JOB SITES

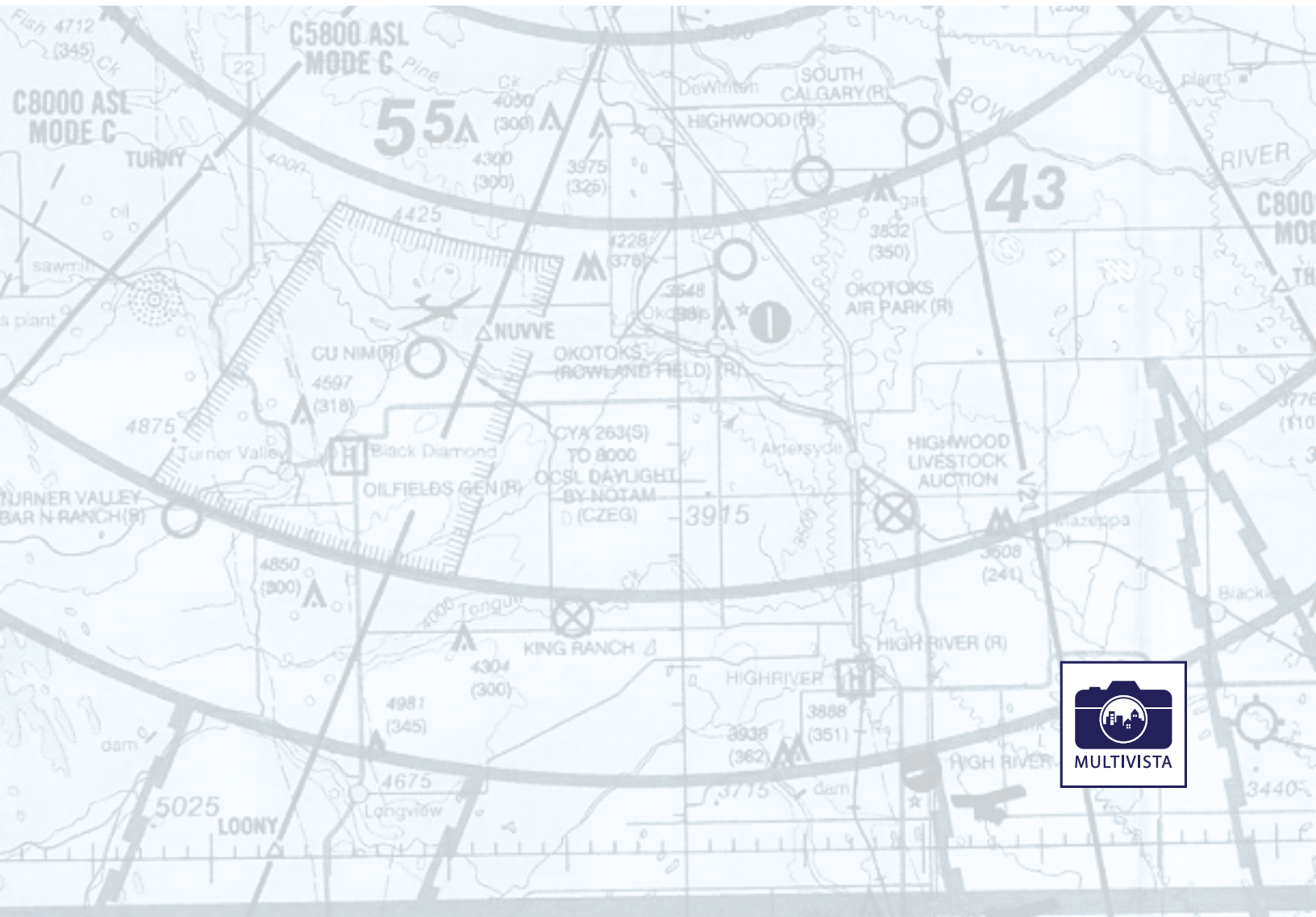




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INTRODUCTION

Drones, unmanned aerial vehicles, UAS, UAVs, RPVs, RPAS, quadcopters, [“robo-planes”](#), — the technology has gone by many names. From their beginnings as futuristic military technology to their emergence at the top of pre-teens’ Christmas lists, these aircraft have undergone a rapid ascent in the last decade. We’ve heard them buzzing around our local parks, watched them perform at the Super Bowl halftime show, and said a collective “the future is now” at the prospect of them delivering our [Amazon packages](#).

Drones have been the subject of excessive speculation, but one thing’s for sure: the commercial drone industry is booming. [Goldman Sachs](#) predicted in 2016 that \$100 billion would be spent on drones by 2020, and construction was predicted to be the leading commercial sector, accounting for more than 10% of that spending.

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For all their current buzz, drones didn’t exactly have a smooth takeoff. Regulatory questions and complications continually harassed commercial UAV operators, with various agencies and jurisdictions struggling to develop rules that would restrict dangerous flying. These regulations have begun to smooth out, but navigating the world of drone compliance still requires significant knowledge.





USE CASES FOR DRONES ON CONSTRUCTION SITES

- CONCEPT AND DESIGN PHASES
- BUILDING PHASE
- FACILITIES MANAGEMENT PHASE



USE CASES FOR DRONES ON CONSTRUCTION SITES

The construction industry is at the top of the list for commercial drone spending, but where will all that spending go? How useful could unmanned vehicles possibly be for your average project?

In truth, drones can improve almost every part of the building lifecycle, from concept and design to ongoing management and maintenance.

CONCEPT AND DESIGN PHASES

Developers and architects have found creative ways to make use of drones before the first speck of dirt is touched on a building project. For example, developers might fly a camera-equipped drone over a prospective job site to identify potential hazards or inconveniences they might not see otherwise, like hidden ditches or large rocks. Drone footage can also be used to create an accurate map of the site in order to ease the transition into the construction phase.

Architects will sometimes integrate UAV photographs into BIMs and other models, giving users a realistic perception of the landscape that will surround a structure. Using the drone camera in place of a building occupant's eyes, architects can also plan for windows that capture the best views from upper floors. Some developers have even used realistic views from yet-to-be-built penthouses to market buildings to future tenants.

"Drones allow visual documentation service providers to photograph angles of a building the team on the ground can't capture with handheld cameras."

BUILDING PHASE

After construction begins on a project, drones can play an even more vital role.

Visual documentation is the most established (and possibly the most important) use for UAVs on job sites. Many owners, builders, and developers already understand the need for comprehensive photographic documentation of a project during key construction milestones. Drones allow visual documentation service providers to photograph angles of a building the team on the ground can't capture with handheld cameras. In addition, they enable documentation of areas that are potentially unsafe for human operators to get to.



GET YOUR MONEY'S WORTH

The aerial videos captured for documentation purposes can also double as marketing materials. Impressive flyover shots of a building in progress can help sell a building before it's even complete.

This kind of visual documentation can mitigate liability and helps owners and future workers cut costs for improvements or repairs. However, UAV photography during construction also has more immediate benefits. On large job sites, for example, contractors can use drones for inventory and equipment control. In other words, with an eye in the sky, contractors can make sure their valuable materials and equipment are where they should be, protecting against loss from theft or carelessness.

FACILITIES MANAGEMENT PHASE

When a building is complete, drones continue to be useful to building inspectors and facilities managers.

UAVs have become indispensable for inspectors while examining roofs, building envelopes, and other architectural features which are difficult to see clearly from the ground or interior. Using drones, inspectors are able to check these areas for safety and quality assurance faster than ever before.

Drones are capable of carrying many kinds of imaging equipment, not just conventional cameras. One promising area of development is the use of infrared cameras on UAVs. [Infrared cameras](#) are a type of thermal imaging device, meaning they capture the heat levels of different areas of a building. This technology has many applications for building maintenance, including the identification of windows and doors which may be letting excess air in or out, and pinpointing the exact location of water or air leaks.



SPECIAL CONSIDERATIONS FOR UAVS IN CONSTRUCTION

- WIND SHEAR
- OUT-OF-CONTROL AIRCRAFT HAZARDS
- PROFESSIONAL CONSIDERATIONS



SPECIAL CONSIDERATIONS FOR UAVS IN CONSTRUCTION

Taking a look at the current state of drone technology, one can be forgiven for assuming they are low-maintenance and easy-to-use. After all, anybody can walk into a big box electronics retailer and leave a few minutes later with a flight-ready quadcopter. However, anyone who has actually flown a drone can tell you it's not as easy as it looks, and they're usually talking about recreational drones being flown in empty fields. Commercial drones on professional job sites are a different matter entirely.

The differences between recreational flying and commercial flying go beyond regulations (which we will cover in detail in the next section). There are key differences in the realities of these two spaces which must be considered before deciding to implement drone technology on your job site.

WIND SHEAR AND OUT-OF-CONTROL AIRCRAFT HAZARDS

In a big empty field, it can be simple to calculate and adjust for wind. A construction site, however, is not a big empty field. Buildings, large equipment, mounds of materials, and other features sticking up from the ground disrupt wind patterns and cause wind shear, defined by the [FAA](#) as “a change in wind speed and/or direction over a short distance.”

“Experienced commercial drone pilots can attest to the fact that sharp corners and other structural features can cause winds to rapidly double or triple in speed.”

Experienced commercial drone pilots can attest to the fact that sharp corners and other structural features can cause winds to rapidly double or triple in speed. Turbulence caused by wind shear can send a drone way off course, and leave an inexperienced pilot struggling to adjust.

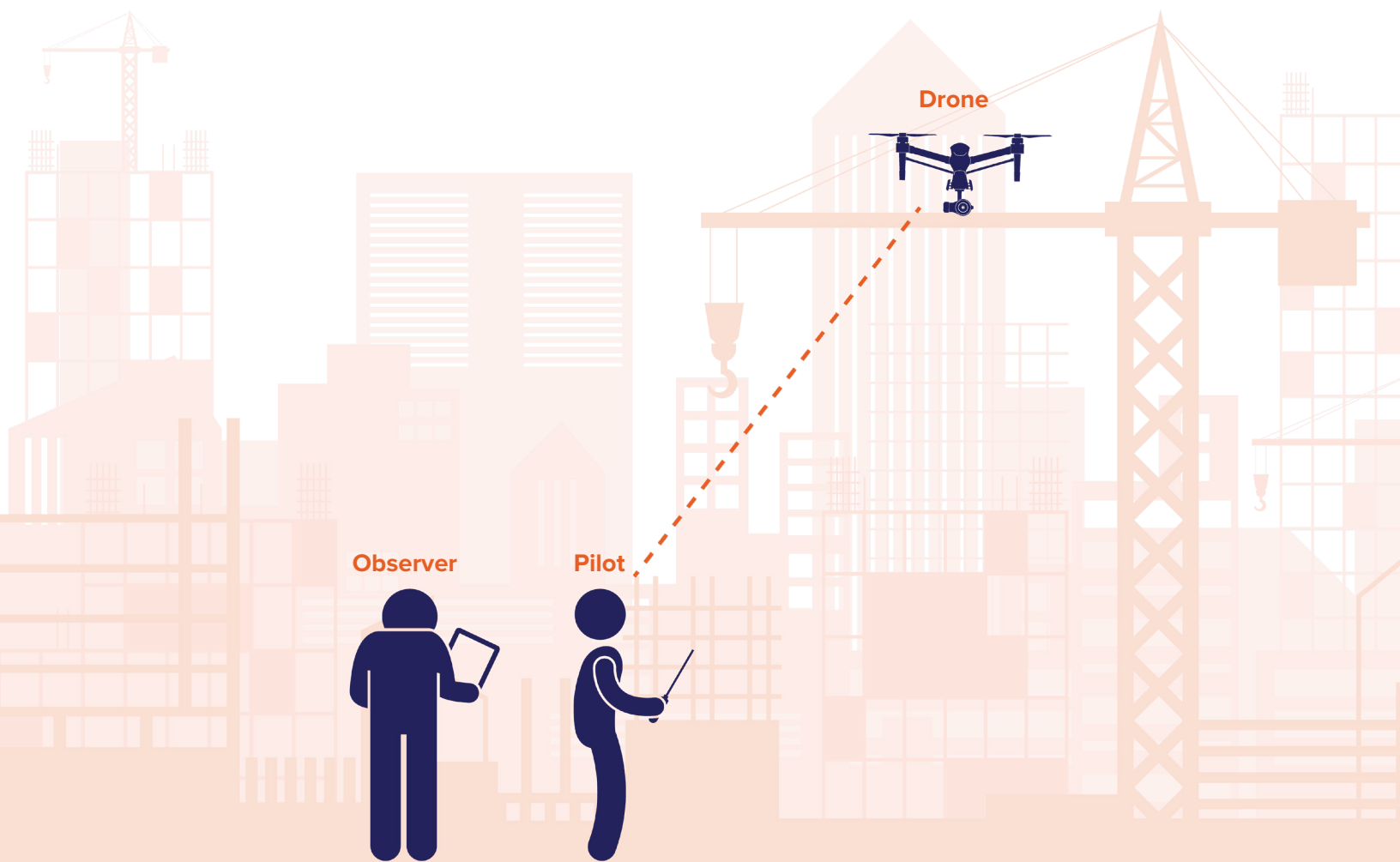
Overcoming wind shear requires skilled operators and construction-grade equipment. Drones flown on a construction site should be larger and heavier than your average recreational models, and come equipped with more safety features and redundant systems.



PROFESSIONAL CONSIDERATIONS

As a commercial drone operator, safety is the most important thing you have to worry about, but it isn't the only thing. One key difference between recreational flying and commercial flying is the simple fact that commercial operators are experts being paid to perform a service.

UAV technology has come a long way, but it is still vulnerable to the unexpected errors that plague any complex technology. While it is possible for one person to operate a commercial drone on their own while maintaining a visual line-of-sight at all times, it's not best practice. The highest-caliber UAV companies employ two people to operate each drone. As the pilot focuses nearly all of their attention on flying the aircraft, a visual observer stands nearby, monitoring the drone's telemetry on a tablet. This data includes battery level, controller signal strength, and any alerts sent out by the aircraft's onboard sensors. In addition, the visual observer might operate the camera, allowing the pilot to dedicate more attention to keeping the drone aloft and on-course.





DRONE REGULATIONS: STAYING COMPLIANT

- FEDERAL REGULATIONS
- STATE AND LOCAL REGULATIONS
- LICENSING AND WAIVERS
- AIRSPACE MONITORING
- DOCUMENTATION
- INSURANCE
- SAFETY EQUIPMENT
- PRIVACY
- ENFORCEMENT



DRONE REGULATIONS: STAYING COMPLIANT

Before you can legally fly a drone, you must ensure you are complying with federal, state, and local aviation regulations.

FEDERAL REGULATIONS

In the United States, the [Federal Aviation Administration \(FAA\)](#) makes the rules for flying UAVs. In Canada, that responsibility belongs to [Transport Canada](#), and in the UK the regulations are set by the [CAA](#). Whatever country you plan on operating in, the federal authority is the first place to look when creating a compliance checklist, as their rules supercede state and local regulations in cases where they might conflict.

STATE AND LOCAL REGULATIONS

The FAA is the trendsetter for UAV regulations, and within the U.S. and across the globe, other regulatory agencies are beginning to take their lead. In this way, drone laws are becoming more even across different boundaries. However, that process still has a long way to go, and certain areas still have their own rules regarding the operation of unmanned aircraft. It's vital that prospective commercial drone operators familiarize themselves with all applicable rules for the area in which they plan to fly.

"Many states have defined specific facilities, such as airports, prisons, and power plants, as off-limits to UAV flying."

In the U.S., [each state](#) has taken a different stance on drones. Some have deferred to the FAA, some have developed their own regulations and prohibited municipalities from doing the same, and some continue to allow local communities to develop their own rules. In extreme cases, these local communities can be as small as a single neighborhood.

It's important to keep in mind that areas which have special designations, such as national and state parks, could have their own rules. In addition, many states have defined specific facilities, such as airports, prisons, and power plants, as off-limits to UAV flying.



LICENSING AND WAIVERS

In most cases, people who wish to fly a drone for commercial purposes need to be licensed by the government.

At the time of this writing, receiving a license to fly a small UAV in the U.S. requires passing a written exam, known as the [Part 107](#) test, as well as passing a criminal background check. In Canada, commercial drone operators need a Special Flight Operations Certificate (SFOC), which they can attain by sending Transport Canada a detailed plan for their use of UAVs and the safety precautions they intend to follow. The UK has their own set of [regulations](#), which are included in Air Navigation Order 2016 (ANO 2016). There are indications that these rules are in flux, so be sure to look up the current licensing requirements of your federal authority.

A UAV license like part 107 allows a pilot to operate however they'd like as long as certain conditions are met. In the U.S., these conditions include flying during the day, flying under 400 feet, and keeping the aircraft within the pilot's visual line of sight.

On a construction site, it's very possible that these restrictions will inhibit the ability of the drone operator to do their job properly. In these cases, operators must receive special waivers/authorizations from the federal government giving them express permission to "break" certain rules.

AIRSPACE MONITORING

UAVs are aircraft, like passenger jets or helicopters. Commercial UAV operators need to be aware of their airspace, and, in many cases, need to communicate with air traffic control (ATC) to receive flight clearance.

In the U.S., the FAA has designated [different airspace classes](#) with names like A, B, C, and G. Which airspace you're in depends on your elevation, your proximity to airports or helipads, and the amount of traffic at those airports or helipads.

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In class G "unrestricted" airspace, drone operators can fly without air traffic control permission (as long as they are following the rules). In all other airspaces, drone operators will need to contact air traffic control before they can fly, and in some airspace classes, maintain contact with ATC whenever their UAV is in the air. Canada and the UK also have systems for classifying different airspaces, and each comes with its own set of monitoring practices and regulations which must be carefully adhered to.



DOCUMENTATION

In the U.S., Canada, and the UK determining the class of your airspace requires the use of a visual flight rules (VFR) chart, provided by the government. In addition, commercial drone operators should also keep a terminal area chart (TAC) on-hand. TACs provide more detail about flight traffic and are updated every six months.

In the U.S., the FAA has conveniently made some of this information available in a smartphone app called [B4UFLY](#). However, drone pilots should always have hard copies of their charts as well.

In addition to aeronautical charts, compliant UAV operators are expected to carry additional documentation with them, including their licenses and any waivers/authorizations, a detailed flight log, equipment safety checklists, and proof of insurance.

INSURANCE

In many jurisdictions, including Canada and the UK, drone operators are required to have liability insurance. Even in countries like the US where liability insurance is not strictly required by the FAA, it's still best practice to carry a robust policy and often a requirement set by the construction stakeholders. Aircraft are often exempt from conventional business insurance policies, so it's imperative that a commercial drone business obtain aviation insurance to protect themselves in the event of an accident.

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Drone insurance involves two categories: General liability (GL) coverage covers operators for property damage or personal injuries that occur as a direct result of a drone accident. Hull insurance reimburses policy owners for damage to the drone equipment itself.

SAFETY EQUIPMENT

Many jurisdictions require certain materials be present on-site wherever a drone is being flown commercially. Even in those that don't regulate it, it's a good idea to be prepared with certain safety items, including a fire extinguisher, a VHF radio for air traffic monitoring, an air horn for warning people who may be wearing ear protection, a landing pad, signage, and safety cones.



PRIVACY

Many of the state and local regulations concerning drones were driven by privacy concerns. Some communities have implemented rules which restrict the use of cameras on unmanned aerial vehicles.

ARE DRONES SPYING ON YOU?

UAV technology naturally leads to privacy concerns, but according to most commercial drone operators, these fears are unfounded. The noise of an average quadcopter has been described as “an angry swarm of bees,” and it’s likely you’d hear one from a ways away. Commercial construction drone operators are paid professionals with specific data-capture requirements - their work is carefully supervised by jobsite managers.

Since construction UAV services will almost always involve aerial photography, it’s imperative for operators to check local privacy regulations in order to ensure compliance. In addition, it’s important to be aware that any privacy rules that apply to a photographer on the ground also apply to a photographer in the sky.

ENFORCEMENT

With commercial drone usage on the rise and limited regulatory resources, how is it possible to enforce all these rules? Couldn’t a commercial pilot get away with using common sense and not getting caught?

The answer is no. Commercial drone operators will tell you that they often receive visits from local police during flights. In many places, police are being actively educated by national law enforcement authorities about drone regulation. Commercial operators should always

be prepared with the proper documentation when an officer comes to check, and they should always follow the relevant rules set forth by their certifications and authorizations.

If an operator is caught flying out-of-compliance with local, state, or federal regulations, they face significant fines, and in some cases, jail time. These fines are much higher for commercial pilots than they are for recreational flyers. In addition, the federal authority may revoke the license of the pilot in question.

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Basic Commercial Drone Compliance Checklist

- ☐ I have an up-to-date license to fly a UAV commercially.
- ☐ I have active general liability and hull insurance policies.
- ☐ I am aware of all federal regulations that pertain to flying my drone.
- ☐ I am aware of all state and local regulations that pertain to flying my drone.
- ☐ I am aware of all privacy regulations which pertain to taking photographs with my drone.
- ☐ I have received waivers/authorizations for any planned activities outside of normal usage.
- ☐ I have reviewed the VFR and TAC charts for the area in which I plan to fly.
- ☐ I have informed air traffic control of my flight, if required.
- ☐ I have completed a safety check of my equipment.
- ☐ I have entered my flight information into my flight log.
- ☐ I have scanned the area for people and other potential hazards.
- ☐ Take-off!



OPERATING ON YOUR OWN VS. OUTSOURCING

- TRAINING
- COST
- DATA MANAGEMENT
- COMPLIANCE AND LIABILITY



OPERATING ON YOUR OWN VS. OUTSOURCING

For many construction-related businesses, getting into the world of UAVs seems like a logical step. Most have already explored their extraordinary usefulness on building projects, and have seen the numbers which indicate their usage will continue to increase in the future.

Those businesses have also likely explored the extensive and dynamic regulations which govern the flying of UAVs, and attempted to understand some possible risks that come along with flying a drone on a construction site.

Keeping all that in mind, is it a good idea to perform construction related UAV tasks yourself? Or should you rely on third-party companies that operate these aircraft full-time?

TRAINING

Becoming licensed to fly a drone commercially only requires a good grade on a written exam, and sometimes even less than that. However, savvy professionals wishing to perform well, protect their investment, and safeguard their reputation will want to put their pilots through additional hands-on training.

Unfortunately, the modern drone training landscape is more focused on teaching operators how to take good photographs than teaching them how to fly safely and effectively. The ability to navigate a busy construction site unfortunately isn't covered on the written exam.

For this reason, some professional construction drone services have opted to design their own internal training programs, at significant expense, to ensure their pilots have the necessary skills to lead a flight operation.

WHAT DOES GOOD TRAINING LOOK LIKE?

Multivista is an industry leader in UAV construction documentation, with thousands of flight hours logged. They developed a custom training program, which consists of:

- An online knowledge course
- Five days of intensive hands-on flight training
- Logging and documentation training
- Aircraft inspection training
- Safe materials handling training, including batteries
- Certification based on skills and emergency procedures tests



COST

To an outsider, getting into the drone arena can seem relatively inexpensive. After all, drones are something you buy at the mall, right? Not quite.

Commercial drones are considerably more expensive than their recreational counterparts, but that's just the beginning. Extra aircraft, batteries, controllers, tablets, and cameras all drive up equipment costs.

"Altogether, a professional drone operator that is compliant and aligned with best practices typically arrives on-site with at least \$15,000 worth of equipment."

Additional costs must be factored in for equipment maintenance. Like any aircraft, it's important that the machine is carefully inspected before each use, and parts replaced when there are any signs of wear, as well as at regular intervals. Batteries must be charged in a dedicated safe area, and all equipment needs to be stored within the manufacturer's recommended temperature ranges. This upkeep requires an additional investment of skilled labor.

Altogether, a professional drone operator that is compliant and aligned with best practices typically arrives on-site with at least \$15,000 worth of equipment.

DATA MANAGEMENT

Another overlooked component of running an aerial photography service is the time and cost associated with data management.

Each time a drone goes up to capture footage of a construction site, it might return with ten or twenty gigabytes of data. Transferring this data off of the UAV, organizing it meaningfully, and keeping it secure on backup drives or in cloud storage takes considerable time and effort. But coherently organizing the data isn't enough - it's essential to have a highly functional, easy to navigate platform in place for accessing the data at any time from anywhere in the world.

In other words, flying a UAV legally and safely is just half the battle. Getting from raw data to user-friendly deliverables is equally challenging and time-consuming.

COMPLIANCE AND LIABILITY

UAV laws are complex and constantly shifting. Keeping up with the latest regulations is a full-time job, and the risks for not following the rules can be enormous. For example, in 2017, [one company](#) was forced to pay \$200,000 to the FAA for failing to comply with flight regulations.

Flying commercial drones independently is definitely possible, but it requires a large investment of capital, extensive training, and the dedicated time and attention of a number of full-time employees. For most businesses, it makes more sense to leave this job to [professionals](#) who have an established track record of flying safely, capturing great data, and providing excellent customer service.



CONCLUSION



CONCLUSION

UAVs are more than toys, more than tools, more than aircraft, and more than construction equipment. Drone technology is a unique force that has already proven its worth in the construction industry, and promises to become even more useful in the future.

In part because of drones' multi-faceted and evolving place in the market, the regulations which govern their usage are complex and disjointed. Keeping up with these regulations requires careful attention. The data-collection payoffs, however, leave no doubt in their lasting value to the construction industry.

**The information collected in this guide should not be construed as legal advice or legal opinion. This resource is intended to serve as a tool providing practical advice and references to busy construction professionals and other readers.*



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