

BUILDING AN AEC & SURVEYING DRONE PROGRAM

A step-by-step guide by DJI and Propeller Aero that covers everything you need to know about building a drone program



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INTRODUCTION

Everything about a major Architecture, Engineering, and Construction (AEC) project is vast. Physically, sites can stretch for miles. From a management perspective, they can feel just as extensive.

As we head into 2021, the challenges facing the industry are all too familiar. In construction, productivity growth has been stagnant for decades, while the majority of projects continue to run over budget and beyond the timeframes expected.

It's been argued that this is the nature of the beast. AEC projects are dynamic and multifaceted. With multiple stakeholders involved, external forces at play, and a broadly casualized workforce, things can and do go wrong.

But there are solvable challenges and gains to be made. A reliance on manual processes remains, leading to an under-digitization of data and unhelpful information silos.

Inefficient stakeholder collaboration has been another long-term issue for the industry. At best leading to schedule disruption and at worst to disputes, costly downtime, and projects overrunning.

And then there's 2020, which has come with unprecedented challenges. The COVID-19 pandemic has made life more complicated for AEC stakeholders. Prioritizing employee safety without construction sites and engineering projects grinding to a halt has been a delicate and in some cases unworkable balancing act.

If there's a silver lining, it's that in the search for safer, contactless solutions, many AEC organisations have discovered the efficiency benefits of drone-enabled remote asset inspections.

Construction is an [\\$8 trillion](#) industry beset by labor shortages. Now more than ever, technology is needed to speed up manual processes, bridge the gap between on-site and off-site teams, prevent mistakes, and help AEC projects run smarter.

All of which explains why you're reading this. An effective drone program has become a critical part of the AEC equation.

The aim of this guidebook is to help you take the next step, whether you've realized the value of using drones from your own experience or seen what it's brought to your competitors. If you have been working with drone service providers or are considering committing to a fully-fledged in-house program, this guidebook will cover the necessary steps to realize your drone ambitions.



THE ROLE OF DRONES IN ARCHITECTURE, ENGINEERING, AND CONSTRUCTION



Drones are adaptable, accessible tools that are proving their worth across every stage of AEC projects. The technology streamlines the planning process, simplifies site management, and dramatically reduces the time required to gather data. Applied correctly, that data solves the problems caused by information silos and increases site awareness, while improving safety and productivity across the board.

The role drones play in AEC can be broadly placed into one of three categories:

PLANNING

At the start of an AEC project, there tend to be more questions than answers. Drones offer a competitive edge for architects and contractors from day one, gathering the data and insights they need in a fraction of the time compared to manual methods.

PROJECT MANAGEMENT

Once complex works are underway, the tasks of multiple contractors need to be carefully coordinated to reduce downtime, maximize productivity, and ensure budgets are kept to. With regular inspections and aerial surveys, drones can provide comprehensive, ongoing awareness for site managers.

RISK MITIGATION

Keeping your workforce safe and mitigating risk on-site are top priorities. Drone technology is in its element when inspecting hard to reach areas, gathering data in dangerous environments, and minimizing the time people need to spend in danger.

The benefits of drone adoption in Architecture, Engineering, and Construction include:



IMPROVED COLLABORATION: SIMPLIFIED & SITE-WIDE

From planning to ongoing site monitoring, drones and their accompanying software enable the digitization of complex projects in a way that allows stakeholders to schedule, plan, and more easily work together.

Aerial surveys give architects and contractors a clear understanding of the project environment. Then, as work begins, 3D models can be updated and navigated to help site managers ensure resources are effectively deployed.

EFFICIENCY GAINS: REDUCED DOWNTIME AND FEWER COSTLY ERRORS

Schedule disruption and downtime are expensive headaches for any site manager. Flying robots can make a significant impact by taking site visibility to new heights. Regular aerial inspections and surveys reinforce accountability, minimize mistakes, and provide shareable data that can be used to settle disputes, avoid mistakes that require rework, and generally deploy resources more effectively.

Having said that, some of the main savings that come with drone adoption result from the replacement of time-consuming manual processes. In many cases, site surveys and spot inspections can be carried out in a fraction of the time compared to traditional methods.

POWERFUL INSIGHTS, ON DEMAND

Drone technology is constantly evolving. Flight times are being extended across the board and

safety features are iterated with each passing year. The payloads that do the data-gathering are becoming increasingly sophisticated, and the software that handles data analysis and site-wide collaboration is growing smarter every day.

All of which is contributing to powerful insights that make a significant impact, from navigable 3D models and thermal inspections to detailed or thomosaic maps.

COMPELLING ROI

The use of drones results in savings across a project's lifecycle. Aerial surveys and inspections use up less of your resources than traditional methods, widening profit margins, and increasing safety in the process. Beyond that, drones are proven to reduce opportunity costs.

Depending on where and how you deploy drone technology, you'll likely see reduced downtime, fewer costly mistakes, and powerful insights. All of which contribute to a compelling business case for any AEC drone program.

ENHANCED SAFETY

Complex construction and engineering projects are among the most dynamic working environments in the world. With hazardous materials, perilous heights, dangerous tools, and industrial machinery, a priority for any AEC company is the safety of its workforce.

Using drones to automate manual tasks that typically require working at height or in dangerous environments is one way to reduce risk.

DRONES IN ACTION: AEC CASE STUDIES



INSPECTIONS

Hensel Phelps is one of the largest construction contractors in the US. The company has benefited from [unprecedented efficiency gains](#) since the inception of its in-house drone program.

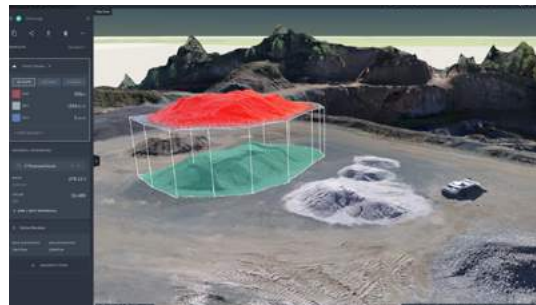
Hensel Phelps uses drones for infrastructure inspections, among other things. The technology drastically reduces the cost and time required and in many cases removes the need to put crews in harm's way.

“ For an exterior inspection of a 15-story building, we would traditionally have spent a lot of money hiring workers to set up scaffolding and then the inspection crew would do their job. It would have taken weeks...With drones, it took us only 4 hours to complete the flying, 8 hours to process the data, and another 4 hours to analyze it ”

*Richard Lopez
Virtual Design and
Construction Manager
Hensel Phelps*



Source: [Propeller Platform](#)



Source: [Propeller Platform](#)

VOLUMETRIC CALCULATIONS

Scheffer Andrew Ltd provides engineering and municipal planning services in western Canada.

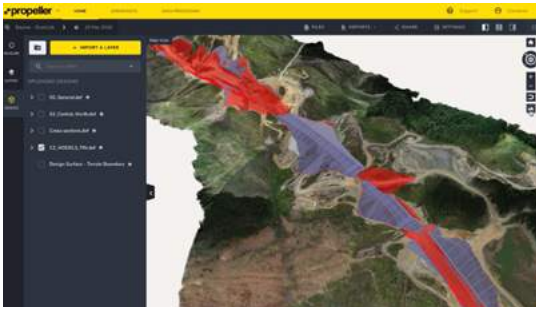
Volumetric estimates are vital to AEC operations, providing accurate stockpile measurements as a build progresses and a clear idea of how much debris needs to be removed.

The company was [tasked with calculating the volume of tires on a recycling site](#) in Saskatchewan. Using a drone to carry out an aerial survey and Propeller's AeroPoints solution and platform for flight planning and data analysis, they were able to generate accurate inventory data that informed the scope and quantity of the proposed recycling tender. The speed and accuracy were such that another job was secured with the client within a couple of days.

“ Scheffer Andrew Ltd provides engineering and municipal planning services in western Canada.

Volumetric estimates are vital to AEC operations, providing accurate stockpile measurements as a build progresses and a clear idea of how much debris needs to be removed. ”

Ray Penner, Scheffer Andrew Ltd



Source: [Propeller Platform](#)

MAPPING & 3D MODELLING

The Beck Group is a US-based architecture and construction general contractor. In 2017, Beck was tasked with building the Dickies Arena, a 14,000-seat venue at the Will Rogers Memorial Center in Fort Worth, Texas.

The \$540 million-project [relied on an in-house drone team from day one](#) for BIM, 3D mapping, progress monitoring, documentation, and inspection tasks.

The technology ensured site-wide situational awareness, keeping all stakeholders up to date with advancements, setbacks, and potential risks.

BUILDING INFORMATION MODELLING (BIM)

Wills Bros is a Civil Engineering Contractor operating in the UK and Ireland with a reputation for staying ahead of the digitization curve.

Wills Bros recently started work on a [\\$40 million by-pass project in Scotland](#). The company's use of drones has already proved critical in its shift to using a Building Information Modelling (BIM) methodology. Wills Bros is digitizing with the help of drones, saving time and providing clarity on a 3.75-mile project that involves more than 900,000 cubic meters of earth removal.

With works of this scale, a rapid, cost-effective, and collaborative information management process is key to remaining on schedule and on budget.

" Using the drones has enabled our superintendents to view the installation of piers, utilities, underground MEP, etc., and compare to contract CDs, which means image overlay on design plans on a daily basis... and allows us to detect any layout and routing deficiencies sooner. "

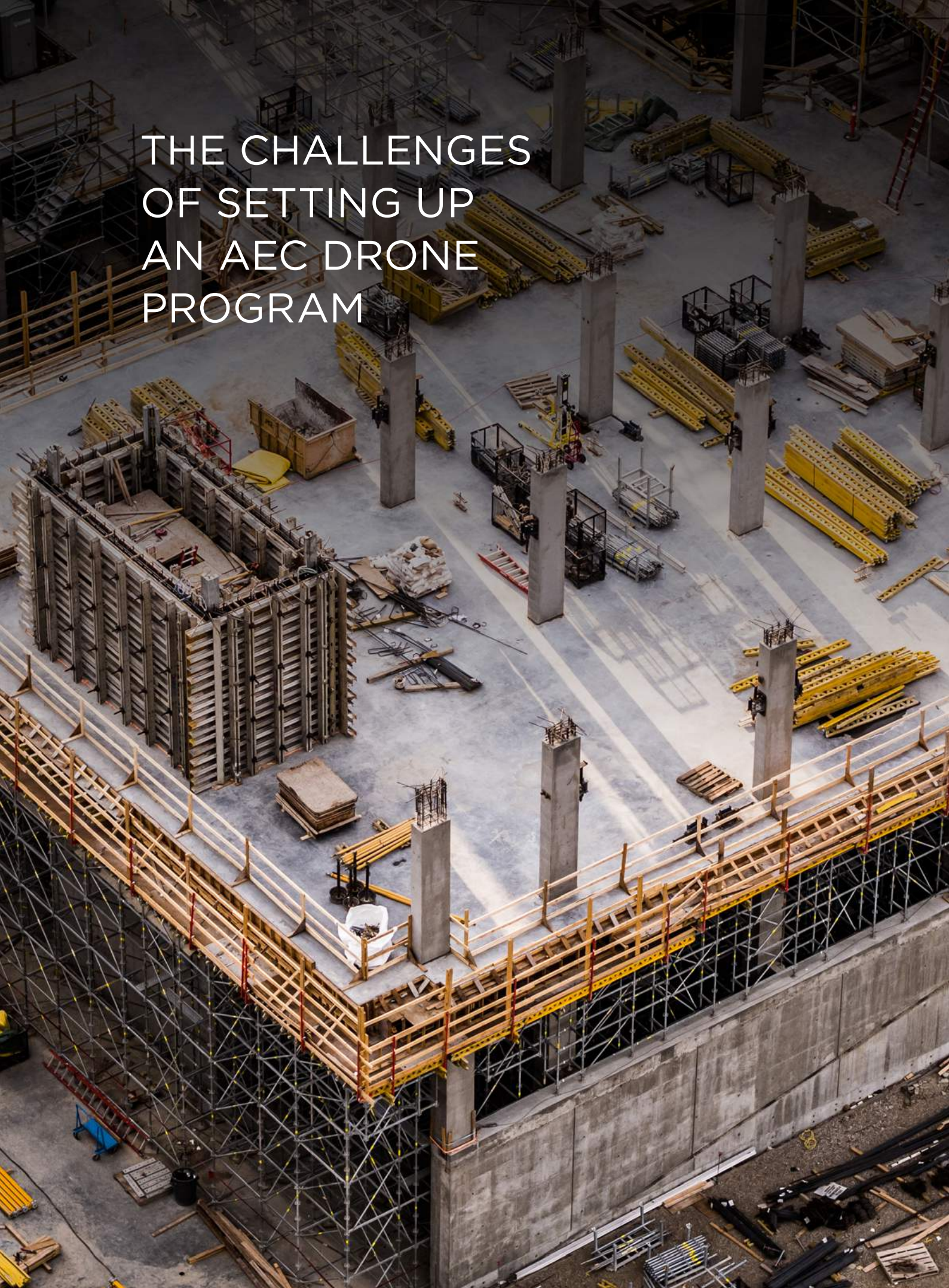
*Gary Pille,
Project Executive of Dickies Arena*

" Savings on labor costs alone have been considerable...on so many occasions we can now obtain detailed project data within a second rather than sending a man on-site to survey for information. The drone comes in a backpack and is up in the air doing its thing within minutes. From the outset, the time savings are immense. "

Jonathan Wills, Wills Bros



THE CHALLENGES OF SETTING UP AN AEC DRONE PROGRAM



FUNDING & MANAGEMENT BUY-IN

Although the cost of drone hardware is falling, investing in a fleet of drones, sensors, new hires, and the pilot training you require can amount to significant expenditure. This explains why many organizations choose to avoid those upfront costs and work at first with a third-party [drone service provider](#).

It makes sense to validate your aerial ambitions before investing heavily. In fact, it may be a necessary step to getting the management buy-in for an in-house program.

If you want to scale and/or tailor your drone operations to meet your organization's exact requirements, you'll need approval and funding from the top to bring things in-house.

The benefits drones provide in terms of safety, efficiency, and cost savings are easy enough to point out. But challenges remain over the availability of concrete ROI figures. Because of that, it's worth pitching your plans in terms of drone technology's impact across an entire project lifecycle, as we'll come to later on.

For more details on drone program ROI, take a look at our [AEC resources](#) and [user stories](#).

For more information on budgeting, take a look at the budgeting section later in this guidebook.

NAVIGATING REGULATIONS

It's vital the solutions you have planned comply with the relevant regulatory landscape.

Operating drones for commercial purposes as part of your AEC operations will likely fall under existing regulations, meaning you'll need qualified pilots to carry out your operations.

If you plan on flying at night, over people, in controlled airspace, or beyond visual line of sight, a waiver may be necessary.

Regulations around commercial drone use are likely to shift as aviation bodies around the world attempt to keep up with hardware and software advances. You'll need to closely monitor these updates and ensure a member of your in-house team is responsible for compliance.

DEFINING & ADAPTING WORKFLOWS

Whether you've been working with a third party drone service provider or are setting up an AEC drone program from scratch, robust policies, safety manuals, and standard operating procedures should all be in place before you take to the skies.

In detailing these steps, you'll have to define exactly how drone operations fit into your AEC workflows. Getting the best of drone technology in such a dynamic working environment isn't easy. You'll need to consider every step and how it will impact all stakeholders involved in your project.

When it comes to scaling out your drone ambitions, having established solutions and defined workflows will make the process far easier.

DEVELOPING IN-HOUSE EXPERTISE

Aside from the investment required in hardware and software, your drone program will require a program manager and trained pilots. The cost of hiring and training will of course depend on the scale of your operations.

It's worth bearing in mind that these training costs will be ongoing. Licenses expire and the technology is still evolving, so you'll need to upskill your drone team and adapt as time goes on.

PUBLIC PERCEPTION

The reputation of drone technology is improving as positive applications attract media attention and their presence in the workplace becomes more standard. But flying robots are still mysterious in the eyes of the public.

Extracting the proven benefits of these game-changing tools is a methodical process. Keeping the local community on-side while doing so is a less exact process that will require strong communication and outreach efforts.

FINDING TIME TO INNOVATE

There's a reason why many construction companies have been doing the same things the same way for so many years: time.

Major construction projects run on tight deadlines with pressure to complete tasks in a linear fashion. Space to iterate and innovate new solutions is a luxury many in the industry don't have. Building a drone program is a long-term necessity that will free up more time and resources for further Innovation.

A change of mindset is needed for the industry to see widespread productivity gains.



DEVELOPING A SUCCESSFUL AEC DRONE PROGRAM



IDENTIFY THE PROBLEMS YOU WANT TO SOLVE

The use of drones can cut costs, speed up data collection, and reduce your staff's exposure to dangerous environments. But you'll need to drill down into the detail of some big questions before your plans are commissioned.

These include...

How does your organization stand to benefit from enhanced data collection and better situational awareness?

Defining what constitutes success for your program is a crucial first step. Consider what data you can gather, how it will benefit decision-making across the different layers of your organization, and how easy it will be to gather and analyze.

How will using drones cut costs compared to existing data collection methods?

The answer to this question will almost certainly be yes. But an apples to apples comparison doesn't do justice to the complexities of an AEC drone program. Take the time to evaluate how drone technology will be a force multiplier during the planning and construction phase of a project and consider the hardware, software solutions, and training costs involved.

How can the use of drones reduce workers' exposure to risk?

The safety of staff is a leading priority for any AEC organization. The use of drones will certainly prevent accidents and improve safety. Quantifying the extent to which that could be the case will give you a compelling point of argument when it comes to getting the green light from management.

What level of accuracy does your drone data need to make an impact?

The requirements of your drone applications are likely to change from one site to another. But it's important to establish a baseline and think about the simple ways drone technology can make an impact.

This process will give you an idea of the initial outlay required but also allow you to build a future-proof fleet, capable of taking on tasks you haven't thought of yet.

What key applications do you have in mind?

Drones can support AEC projects in several ways, from aerial surveys and stockpile measurements to infrastructure inspections. Pin down what's most compelling for your organization and look at how your competitors are using the technology.

How many pilots will you require and how much training will they need?

Whether you are upskilling existing members of staff or bringing in new hires, consider the scope of your drone program and the degree to which you want it to be scalable.

How will the data be stored and processed?

AEC projects invariably involve working with multiple contractors across several business areas. Drone data can make a huge impact as a collaborative tool, providing you have plans in place for data storage, processing, and data security.

CONVINCING MANAGEMENT

Drones remain a relatively new technology and pushback is to be expected when pitching a drone program to AEC management. Justin Russell, now the head surveyor at Colorado-based heavy civil contractor Fiore & Sons, [went through the process](#).

“Upper management is old school, so getting new technology through with them is always a difficult thing,” he explains.

“They wanted to see proof in the pudding. It took me a couple of months to get them sold on it and they were questioning it every time I flew. Even though I would also do a ground topo for either the entire site or a chunk of the site, they were still questioning the data.”

In a matter of months, management’s scepticism was no more.

“They’re not asking me if my drone data is good anymore,” says Russell. “They’re becoming way more reliant on it. I’m giving access to the site they can go in and see it for themselves.”

START SMALL

The key to getting your drone ambitions off the ground is to start small. Usually this begins with developing a proof of concept for a single application. Identify the hardware and software you plan to use for data-gathering and analysis, including any specialist payloads, and formalize your Standard Operating Procedures (SOPs).

Measure and Document Success

Define the parameters of success, measure your results, and compare those records to your traditional data-gathering methods.

Get Input From All Stakeholders

Work closely with your pilot(s), those tasked with processing the data, any stakeholders who receive the end result, and management. Iron out pain points and iterate your processes until your drone application becomes a seamless part of your AEC workflow.

Start Where Drones Will Make an Impact

Starting small doesn’t mean making a small impact. Choose a business area or project stage that will clearly benefit from easy, fast, and safe digitization. 3D models for virtual designs, stockpile measurements, and structural inspections are three solid examples.



PROGRAM MANAGEMENT

With a proof of concept certified, management buy-in secured, and funding approved, it's time to map out day to day management of your AEC drone program and your ambitions for the future.

You'll need to devise and iterate your solution's workflow. But broadly it should include the following steps.

Mission Initiation: Ensure a process is in place to accept a request for drone data and all the detail that entails.

Fleet Logistics and Maintenance: Devise a method that allows missions and flights to be scheduled with the right payloads for the job. Include a process to ensure equipment is maintained and upgraded as necessary.

Pilot Management: The processes by which pilots are assigned tasks, trained, and supervised.

Compliance Management: Design processes to ensure local airspace and flight regulations are adhered to during every mission.

Mission Planning: Put in place a pre-flight checklist that includes a schedule and flight plan covering altitude, the route and any external factors.

Data Collection and Storage: Define and prepare data collection methods, including sensor, payload and software procedures.

Logging Flights: Collect operational and telemetry data to document and learn from each flight.

Data Analytics: Devise a method to process captured data into something useful.

Ongoing Program Development: Ensure that stakeholder feedback is sought and incorporated to iterate applications and workflows as time goes on.



DELEGATING DRONE PROGRAM RESPONSIBILITY

Incorporating daily drone data into your AEC workflows requires effort and coordination. This may involve creating the role of Drone Program Manager, hiring an established pilot or upskilling current crew members, and delegating extra responsibilities to your existing geomatics team.

Whether or not your drone program is starting small, two things are vital. First is the presence of a trained and certified pilot to carry out your data-gathering missions. Second is somebody who can take that data, manipulate it using the relevant software, and make those insights available to stakeholders promptly.

The importance of the Drone Program Manager role shouldn't be understated. You'll need someone familiar with the latest in drone technology, that also has a deep understanding of the technical, economic, and operational challenges your organization faces.

This person will be responsible for implementing new workflows and operating procedures, and for evolving the program on a day to day basis. Drive and good people skills are a must.

DATA STORAGE AND MANAGEMENT

Data is at the core of every drone program. Safeguarding it should be as much a priority as its analysis.

Efficient and secure data management is critical if you want to reap the full benefits of an AEC drone program.

On the one hand, drone data from various sensors can be both detailed and large in size. Ballooning data storage requirements are something you'll need to account for, particularly if you want to track project progress over time and compare past data to current data.

On the other, you'll need to ensure that data is secure at every stage. Have measures in place to protect your data security, and consider using DJI's [Local Data Mode](#) to keep sensitive data confidential.

You may opt to keep data in secure servers at your headquarters. There are several enterprise cloud solutions to choose from that simplify the process of managing, sharing, and organizing your drone data.

SCALING UP

Once your drone program and its ROI is established, it's time to think about scaling up. If you're not ramping up your autonomous ambitions and planning for growth, you're going to remain stagnant.

Scaling up might mean expanding your existing drone program - including workflows and SOPs procedures - to multiple sites. Or it might focus on the expansion of your applications to explore the value of drones across different areas of your AEC projects.

Whether it's one option or a combination of the two, it's likely that you'll need to bolster your fleet, hire/train more pilots, and upscale existing data storage and management solutions.



CHOOSING THE RIGHT AEC DRONE SOLUTIONS



The commercial drone ecosystem is growing all the time. New hardware and software solutions are hitting the market every year. But not all drones are created equal and not every drone will perform the tasks you have in mind to the standard you require.

Likewise, some software solutions have a better track record than others, with AEC customers queuing up to offer endorsements.

Choosing the right AEC drone solutions is key to getting your project off the ground and into action. Below is DJI's range of AEC solutions, which boast both an unparalleled safety record and testimonials from some of the AEC industry's biggest names.

DJI SOLUTIONS



AN INTRODUCTORY MAPPING SOLUTION

An intuitive surveying solution that captures centimeter-level accurate data to create georeferenced 2D maps and 3D models of project sites, the P4 RTK has been a trusted workhorse of the construction industry for years.

- [1/10ft accuracy](#)
- [Real-time geotagging](#)
- [Less expensive than alternates](#)



M600 PRO

SPECIALIZED MAPPING OPERATIONS

With a maximum payload of 6kg, the M600 Pro is the go-to heavy lifter for specialty and third-party payloads, such as multispectral cameras, hyperspectral cameras, oblique systems, high-res cameras, and LiDAR.

- [HD live streaming](#)
- [Dual-RTK GNSS system](#)
- [Intelligent battery management system](#)



MATRICE 300 RTK + ZENMUSE P1

A COMPLETE AERIAL PHOTOGRAMMETRY SOLUTION

A complete aerial photogrammetry solution, the M300 RTK + P1 can generate orthomosaics that meet the 1:500 and 1:1000 accuracy requirements without GCPs. Perfect for capturing highly-detailed 2D and 3D information in medium to large-area operations.

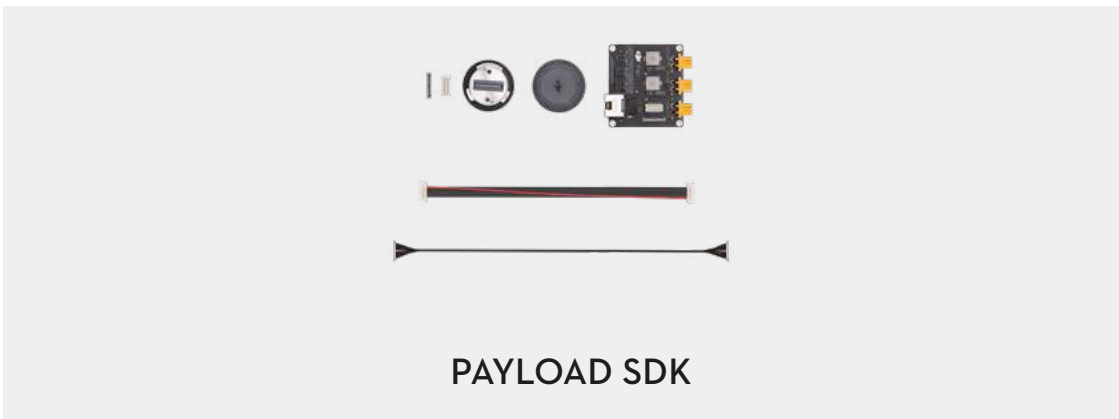
- [Centimeter-level precision](#)
- [45 MP full-frame sensor](#)
- [Automated inspections](#)



SOPHISTICATED LIDAR SOLUTION FOR AERIAL SURVEYING

DJI's first LiDAR solution for aerial surveying, the M300 RTK + L1 can render centimeter-accurate reconstructions, thanks to its high-accuracy IMU, a vision sensor for positioning accuracy, and the incorporation of GNSS data.

- Real-time true color point clouds
- All-weather, nighttime operations
- Automated inspections



FULL ECOSYSTEM COMPATIBILITY

This is the developer kit you need to integrate any third-party payload – sensors, robotic components, and more – with DJI drones. Supports the Matrice 300 RTK via a standard adapter and a ready-to-build standard gimbal.

- Mobile SDK communication
- Custom widget integration
- Aircraft state data

Choosing the right tools for your operations is vital. For an in-depth look at the use of drones in surveying, check out our [buying guide](#).

PROPELLER SOLUTIONS

The release of DJI's Phantom 4 RTK (P4R) inspired Propeller Aero, a global leader in 3D mapping and drone analytics solutions, to harmonize hardware and software for the first time.

After working closely to test and validate the accuracy of a full-integrated drone surveying workflow, DJI and Propeller brought easy, affordable, and highly accurate maps to the wider commercial drone industry with a solution called Propeller PPK.

PROPELLER PPK COMBINES:

AeroPoints: High-precision, wifi-connected ground control points that operate on any coordinate system (including locals).

Phantom 4 RTK: The first affordable RTK drone built for survey mapping.

And the Propeller Platform: A cloud-based data analytics and processing platform that heavy civil and resource operations use to measure material movement, track progress, and visualize their survey data.

This combination of ground control, PPK/RTK-enabled hardware, and data processing delivers centimeter-grade accuracies to users in a tenth of the time (and nearly tenth of the cost) of traditional methods.

Today, civil contractors around the world use Propeller's PPK workflow to survey faster, more frequently, and more accurately.

And the benefits do not stop at collection—and in fact, transcend the world of surveying altogether. Armed with up-to-date data, worksites are able to reduce instances of rework, resolve conflicts, and remove the communication silos that debilitate collaboration. Keep reading to learn how worksites are turning drone data into hard dollar figures.



Source: [Propeller Platform](#)

HOW MUCH DOES AN AEC DRONE PROGRAM COST?



BUDGET CONSIDERATIONS

To set a budget and determine your drone program costs, there are two things you'll need to account for before anything else:

- **Hardware** (the tools you require to collect your drone data)
- **Software** (the solutions you need to process and analyze it)

Typically, the cost of drone hardware is a one-off investment. Choosing the right platform(s) is vital. The decision will depend on the type of sites you are flying, the type of data you want to capture, and the degree to which you want your hardware to be future proof.

Software solutions used for analysis tend to work on a subscription basis, which can be charged monthly or annually.

If you plan on starting small with a low number of earthwork sites and low flight frequency, \$10k is a reasonable starting point that should cover the cost of hardware (we recommend the DJI Phantom 4 RTK for introductory programs), training, processing, and analytics software licenses.

You can expect the costs to rise from there as your program grows and further investments in training, hardware, and maintenance are required.

The important thing to bear in mind is that there are cost-effective options for operations of all sizes.

After the initial outlay on the hardware and software required, there are several questions you'll need to answer in order to reach a concrete cost.

These include...

What type of sites will you be flying?

To get the most out of your drone program, you'll need the right tools for the job. The type of sites you are flying will play a major role in determining what those are.

Fixed-wing drones are preferred on sites that span large areas, as they can cover ground fast and stay airborne for longer. For more dynamic environments where obstacles are present and detail really matters, multirotor options provide greater manoeuvrability, versatility, and ease of use.

Size isn't the only site factor, of course. Weather, elevation, and site complexity should all be accounted for when deciding on a drone platform.

You can read more about deciding between fixed-wing and multirotor solutions [here](#).

Do you have a drone pilot?

There's also a human cost to setting up and running an AEC drone program. Pilots need to be certified and training should be ongoing as your solutions and hardware choices develop.

The cost will depend on what's required for your use case and by the relevant aviation authority. Speaking of which, you'll also need to invest in adhering to local regulations, whether you are operating in the [EU](#) or [Australia](#), or [the United States](#).

How many sites do you want to fly?

An important factor in estimating a drone program budget is how many sites you want to fly. If you have a single drone covering multiple sites, the efficiency and cost gains of introducing the technology may be lost in travel time and scheduling issues.

To give you an idea of what's feasible, [Utah-based Grade Tech Services](#) typically have five to seven jobs running at any one time and operate with two drones. Used alongside Propeller Aero's PPK solution, the company is saving 10-20 hours a week and tens of thousands of dollars a year.

How often do you want to fly?

You'll also need to consider the expected frequency of your drone flights. The amount of surveying and inspections you need to carry out will impact your hardware and software investments.

How will you process your data?

Data processing is arguably the most important part of your drone program. Without tackling this step effectively, you risk losing insights and wasting money on a solution that doesn't provide what you need.

One of the single biggest questions you'll need to answer is [whether to carry out this step in-house or outsource it](#).

The decision will largely depend on your budget, required turnaround times, data security needs, and the functionality you want from your data.



REDEFINING ROI FOR YOUR AEC DRONE PROGRAM



PROVING ROI

Sweeping claims that drone technology saves time and money across AEC projects are true but ultimately unconvincing. Corporate will need something more concrete before signing off on your drone program.

But here's the problem: solid ROI figures are hard to come by.

The digitization of worksites is a relatively new concept. Over the years, minimal technology adoption has led to a data shortage.

Plus, worksite managers aren't necessarily used to thinking about ROI on technology adoption in a way that accounts for the new information it can provide. What you're left with are simplistic comparisons of drones versus traditional data gathering methods - which isn't particularly insightful.

We recommend conducting a study on your pre-drone AEC data gathering methods and comparing that to the new workflows enabled and time and cost savings that come with adopting drone technology.

We also recommend Propeller Aero's [ROI Calculator](#) which can help you see how much time and money you would save by adopting drone solutions for your business.

It's helpful to look at ROI in terms of a drone program's impact across a project lifecycle. The ripple effects can add up to substantial savings and returns, as we'll see from the following examples.



BRIDGING COMMUNICATIONS GAPS & AVOIDING MISTAKES

When communication isn't carefully managed, intelligence can't be adequately shared across sites and between teams. The challenge is exacerbated when your project spans a large area and multiple crews.

Construction management specialists Lendlease, The Northern Road Stage 3 were [grappling with this problem](#) during a complex road reconstruction project in Sydney, which included adding lanes to existing roads and bridge replacements. The lack of visibility was leaving their construction teams vulnerable to utility strikes.

Lendlease, The Northern Road Stage 3 turned to drones, alongside Propeller's Crew solution, to provide more fluid communication between the office and the field, delivering maps based on the most recent aerial surveys to those who needed them.

Having visibility on linework at all times enabled them to avoid utility strikes and, as a result, save money in repairs and rework. Plus, as the data became more accessible, office personnel and the surveying team were able to spend less time bridging information gaps and more time performing other tasks.

THE VALUE OF ELIMINATING DOWNTIME

Project schedules are often put together to ensure crews are present - whether or not the site is ready for them. This costly downtime has long been impacting the bottom line of contractors, who waste time and money while waiting for materials to be staged and other contractors to finish their work.

Grade Tech Services is a family-owned excavation and grading specialist based in Utah. Since adopting Propeller's PPK workflow and a DJI Phantom 4 RTK, the company has seen a 10x ROI - largely thanks to the elimination of downtime from the equation.



Source: [Propeller Platform](#)

Grade Tech uses a DJI Phantom 4 RTK drone to fly sites 1-2 days before they arrive. If a site isn't ready for them, they have the data to prove it in the form of easy-to-read 3D orthomosaic models that can be shared with all the relevant stakeholders.

By saving \$3500 a day through downtime reduction, [Grade Tech has effectively gained half a crew.](#)

When projects run smoothly, you gain labor to deploy elsewhere.

According to Rory Hall, Grade Tech's operations manager, they effectively went from having four crews to four-and-a-half and earned \$1.5 million in additional revenue in just over a year of using Propeller.

CONFLICT RESOLUTION

The same aerial intelligence has also removed finger-pointing from the equation. Hall can now call upon interactive 3D maps when there are disputes and squash any conflict before it arises. Since he's been armed with documentation of exactly who's accomplished what and where, customers have been even keener to work with Grade Tech.

"Sometimes, you find yourself in a finger-pointing match. Propeller takes all of that away. We have a picture of the site from two days ago to prove we're not behind. Once that caught hold, we haven't been thrown underneath the bus in a very long time", he says.



Source: [Propeller Platform](#)

SAVING THOUSANDS OF DOLLARS WITH DRONE DATA

California-based [Sukut Construction decided to use drones](#) as soon as the technology became a feasible alternative to manned aircraft. The cost and turn-around times of traditional aerial surveys were stark in comparison.

“Not only does an aerial survey cost upwards of \$20,000, but it’s also a minimum of three weeks to a month before you get a contour map back. If something’s going wrong, you don’t want to know a month later. You want to know the next day, if possible. It allows red flags to go up earlier and you can make changes earlier. So, with respect to that, it’s saving money.”

*Matt Eklund
GPS Program Manager*

With drones providing daily data, Smolik can give on-site teams the information they need to work more efficiently and avoid rework and maintain close visibility on the project’s progress.

“It’s huge time savings, and it allows me to closely monitor a project in real-time and make sure that we’re on track for schedule and budget,” he says.

Smolik gives one example of better site intelligence preventing a costly mistake. With a crew preparing to move material across the site to fill in a hole, they were able to check the previous day’s progress against their final design. Seeing they still had thousands of square feet worth of material to excavate before they were ready to move on to that next stage of the project, Smolik was able to step in and prevent expensive rework.

The ability to check quantities in real-time turned half a day of rework into a fifteen-minute operation.

RETHINKING CONSTRUCTION WORKFLOWS

Maintaining visibility across the moving parts of a construction project is never easy. It’s even more difficult when your role includes business development alongside everyday site management responsibilities.

This was the challenge facing Gary Smolik, construction manager at infrastructure development company Integrated Sustainability.

Integrated Sustainability [began using Propeller’s PPK solution to accelerate and improve the accuracy of data collection](#), and to provide interactive, actionable 3D site models every 24 hours.

REGULATIONS



The regulatory picture is beginning to align, no matter where in the world you want to build an AEC drone program.

EUROPE

In the European Union, the [European Aviation Safety Agency](#) (EASA) is in the process of building a continent-wide framework of aviation policies for member states.

There are set to be three categories of drone users: [Open, Specific, and Certified](#).

Rather than categorize operations by purpose (commercial or recreational) the EASA has determined operational categories based on risk.

- The 'open' category addresses operations in the lower risk bracket, where safety is ensured provided the drone operator complies with the relevant requirements for its intended operation. This category is subdivided into three further subcategories called A1, A2, and A3. Operational risks in the 'open' category are considered low, and therefore no authorization is required before starting a flight.
- The 'specific' category covers riskier operations, where safety is ensured by the drone operator obtaining an operational authorization from the national competent authority before starting the operation. To obtain the authorization, the drone operator is required to conduct a safety risk assessment, which will determine the requirements necessary for safe operation of the drone(s).
- In the 'certified' category, the safety risk is so high that certification of the drone operator and the aircraft is required to ensure safety, as well as the licensing of the remote pilot(s).

EU regulations represent the first harmonised regulatory framework for risk-based operation worldwide. It's being rolled out across the 27 EU Member States as well as Iceland, Norway, Switzerland and the UK.

In practice, this approach will help AEC drone programs scale without having to undergo new registration processes, training and go through multiple authorizations.

NORTH AMERICA

UNITED STATES

Commercial operations in the United States take place under the FAA's Part 107 Rule, which means:

- You must hold a Remote Pilot Certificate issued by the FAA
- You must register your UAV with the FAA on the [FAA DroneZone](#) website
- Your UAV must weigh less than 55 pounds, including payload, at takeoff
- You must fly in Class G airspace
- You must keep your UAV within visual line-of-sight
- You must fly at or below 400 feet
- You must fly during daylight or civil twilight
- You must not fly at speeds exceeding 100mph
- You must yield right of way to manned aircraft
- You must not fly directly over people
- You must not operate a drone from a moving vehicle, unless in a sparsely populated area

Many above restrictions can be eased with a Part 107 waiver from the FAA.

CANADA

Drone rules in Canada also rely on a risk-based distinction with Basic and Advanced Operations categories for operators.

Basic Operations

If you meet all 3 of these conditions, you're conducting basic operations:

- You fly it in uncontrolled airspace
- You fly it more than 30 meters (100 feet) horizontally from bystanders
- You never fly it over bystanders

You will need to:

- [Register your drone](#) with Transport Canada before you fly it for the first time
- Mark your drone with its registration number
- Pass the [Small Basic Exam](#)
- Be able to show your Pilot Certificate – Basic Operations and proof of registration when you fly

Advanced Operations

If you meet any 1 of these conditions, you are conducting advanced operations:

- You want to fly in controlled airspace
- You want to fly over bystanders
- You want to fly within 30 meters (100 feet) of bystanders (measured horizontally)

You will need to:

- Register your drone with Transport Canada before you fly it for the first time
- Mark your drone with its registration number
- Pass the [Small Advanced Exam](#)
- [Pass a flight review](#) with a flight reviewer
- Be able to show your Pilot Certificate – Advanced Operations and proof of registration when you fly your drone
- Seek permission from air traffic control (likely NAV CANADA) to fly in controlled airspace (request an [RPAS Flight Authorization](#) from NAV CANADA)
- Fly within the operational limits of your drone



TRAINING



UTC

Initial and ongoing pilot training are both key to the success of your AEC drone program. If you're using DJI hardware, it makes sense to sign up for one of our Unmanned Aerial System Training Center (UTC) courses, which combine practical experience behind the controls of our latest technology alongside all the knowledge you need to use them in the field.

Our UTC program spans over 200 training centers, worldwide, including the United States, Mainland China, Hong Kong, Taiwan, Japan, Malaysia, and the Netherlands.

Trainees get access to:

- A professional curriculum that includes standard drone operation procedures using the latest DJI drone technology
- UTC's global training network, delivering high-quality service to all trainees
- DJI's ecosystem, including continuous skills training, extensive drone knowledge resources, and more
- An official manufacturer training certificate provided upon successful completion of the course

Join the global community of certified, professional drone pilots [here](#).



DATA & REPORTING



CHOOSING THE RIGHT SOFTWARE

There are plenty of options when it comes to AEC drone hardware and most of them can be tailored to suit your needs. But choosing the right software solution is a more delicate procedure.

Some companies work with multiple software suites. For example, you might want to use one application for flight planning and another for data analysis.

Other organizations may gather the data and work with a third party to have it analyzed.

Having said that, the separation of flight planning and analytics isn't always necessary. The decision will depend on your budget, the frequency of your drone operations, and the level of expertise you have in-house.

ALL-IN-ONE FLIGHT PLANNING AND DATA PROCESSING WITH DJI TERRA

DJI Terra is an all-in-one drone mapping solution that contains everything you need to plan, visualize, process, and analyze aerial data.

Terra is fully compatible with the most compact and accurate low-altitude mapping solutions by DJI: the Phantom 4 RTK, the P4 Pro and the Matrice 300 RTK.

Terra is intuitive and easy-to-use, with sophisticated mission planning, mapping in real-time and highly efficient data processing.

You can use Terra to generate 2D orthomosaic maps as the drone flies, or quickly render and visualize a 3D point cloud of the mapped area to determine if more flights are needed.

Toppen Co, a pioneer in the preservation of historical buildings, recently discovered the powerful capabilities of DJI Terra while mapping the 400-year-old Karatsu Castle, Japan. [Read more](#) about how Toppen embraced DJI's mapping solution.

OUTSOURCING YOUR DATA PROCESSING

Having in-house photogrammetrists is not the only option.

For example, Propeller customers simply drag and drop flight files into the uploader. Within 24 hours, they'll have your data back to you, processed into an interactive 3D model of your latest survey.



MAINTENANCE



DJI MAINTENANCE

Keeping your fleet in good condition is key to getting the most out of drone technology.

The DJI Maintenance Program provides lifetime support for your aircraft, ensuring you achieve peak performance every time you fly and keep your operations as safe as possible.

There are three DJI Enterprise Aircraft Maintenance Programs to choose from.

BASIC SERVICE

Through detailed inspection, deep cleaning, firmware updates and calibration, the impact of...

- ✓ Deep Clean
- ✓ Parts Inspection
- ✓ Update & Calibration

STANDARD SERVICE

Apart from the detailed inspection, deep cleaning, firmware updates and calibration, the...

- ✓ Deep Clean
- ✓ Parts Inspection
- ✓ Update & Calibration
- ✓ Easily Worn Parts Replacement

PREMIUM SERVICE

In addition to the Standard Service, the Premium Service includes the core components...

- ✓ Deep Clean
- ✓ Parts Inspection
- ✓ Update & Calibration
- ✓ Easily Worn Parts Replacement
- ✓ Core Components Replacement

DJI CARE ENTERPRISE

Our technology has an outstanding safety record. But this is aviation, and sometimes things go wrong. With DJI Care Enterprise, you can secure comprehensive coverage across our Enterprise product range, with unlimited replacements or free repair services in the case of accidental damage.

CONCLUSION



The AEC industry represents a huge part of the global economy. And yet, for many years there has been little to no productivity growth. The majority of projects continue to fall short of their stated budgets and deadlines.

Just like AEC projects, the way to tackle this under-performance challenge is multifaceted. Avoiding mistakes, optimizing workflows, and digitizing sites are all important parts of the equation. Drone technology has a central role to play in each of those.

Integrating drones into your workflows will improve safety, drive project performance, and boost productivity.

Flying sensors are no longer new. But with a more hospitable regulatory environment and a steady trend towards BIM methodologies, there's never been a better time to set up your drone program.

CONTACTS AND FURTHER READING

Dig deeper into the use of drones in construction with our guidebook on the Digitization of Construction Workflows.

To talk through the options with your local DJI dealer, [click here](#).

To learn more about Propeller Aero, visit www.propelleraero.com.



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