Let Your Projects Fly

How drone data collection powers new possibilities in surveys, inspections, site assessments & more

Needing to determine the suitability of a 200-acre site for a series of new structures, a construction company conducted a survey to collect topographical data of the complex terrain. Ordinarily, that process would have taken multiple teams at least a couple of weeks to collect the data across such an expansive area. Even then, they would have needed additional time to prepare their data for input into AutoCAD and the creation of a topographical map consisting of a few thousand points (collected every 25 feet).

That's not what happened.

Instead, they completed the survey in *less than a day*. Even better, they were able to generate a densely detailed map populated with nearly 30 *million* points.

That's because they used drones.

Inspections, surveys, and other forms of terrain-related data collection have long suffered from inadequate automation, scalability, and repeatability. Those limitations not only render these efforts expensive and time- and labor-intensive, they constrain what's even feasible in data collection.

Drones solve these problems. They procure more data faster (doing in one hour what would take 25 hours manually) at lower cost (sometimes as much as one-sixth of the cost). They work in situations that would be prohibitively difficult or dangerous (and sometimes outright impossible) for manual data collection. Moreover, drones can achieve an accuracy rate that can exceed manual methods.

That's the power of drone and aerial data collection today. It's enabling organizations in almost every sector and market to harness advanced technology to gather invaluable data in eye-opening ways.

Indeed, drones aren't just problem-solvers, they're opportunity-enablers. Data collection using unmanned aerial vehicles (UAVs) – including photogrammetry and advanced LiDAR technologies – doesn't just replace previous survey techniques one-for-one. It can drive innovative, previously unthinkable use-cases.

But because drone technology is relatively new to most industrial applications, most organizations aren't even aware of just how much they can do with drones – and how much more efficiently. Those few who have tried a DIY approach may not understand their full potential, facing skill and technology gaps. Many organizations have not even begun to tap into the potential at all.

Altogether, drones are poised to carry the data collection effort to dizzying new heights of possibility and performance. Here's how.

What is drone data collection?

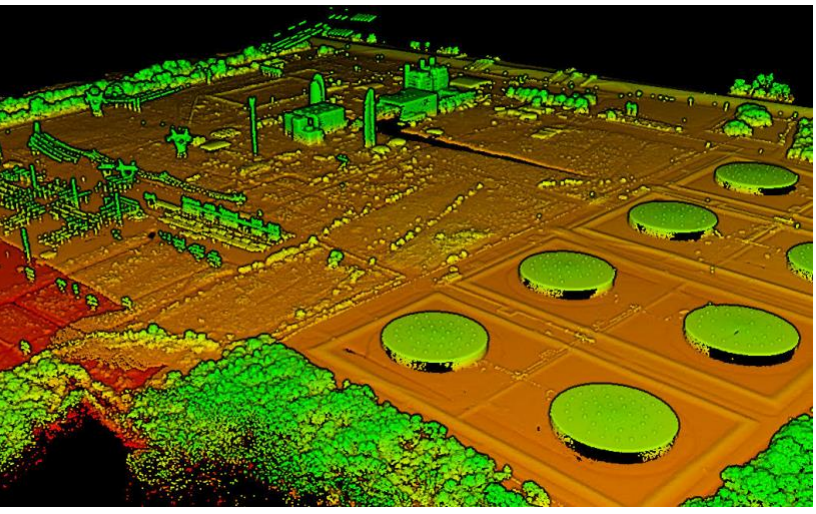
Drones or UAVs are designed to replace some terrestrial surveying equipment. As with manual data collection methods, organizations in a variety of industries (*see chart on the next page*) can use drones for project progress monitoring; to prepare for or to conduct site inspections; to assess sites and identify problems; to procure footage or information for marketing and reporting purposes; to conduct research; and for other forms of analysis and processing. Indeed, drone data collection means far more than just launching a drone equipped with a camera and hovering it above the site to snap a few photos. They utilize distinct technologies to produce incredibly information-rich datasets.

Photogrammetry

With photogrammetry, the drone can collect high-resolution photographs covering an area of almost any size. Those photos can then be collectively pieced together to create a detail- and data-rich portrait of the site or object being surveyed or analyzed.

Instead of just focusing on a single point, photogrammetry uses the overlapping images to create a detailed 3D map of the world; and instead of just displaying elevation data, photogrammetry also collects texture, shape, and color information for every point on the map – leading to a high-definition 3D reconstruction. A drone system that uses photogrammetry is very useful for capturing 3D and 2D images. It can map large areas and collect data from multiple vantage points. It can get close and capture images, like inspecting a cell phone tower without having to send a worker up there. Altogether, with photogrammetry, operations can:

- Capture RGB footage
- Build a 3D model of an area
- Generate an orthomosaic (similar to a high-resolution Google earth image)



LiDAR

LiDAR, which stands for light detection and ranging, has been around for decades. However, it's only recently been widely used by drones. A sort of light-based form of echolocation, a LiDAR sensor uses mirrors to send out laser pulses in different directions and then determine the exact time it takes for the beams to return. It also uses an algorithm to determine the intensity of the light. By measuring the intensity and timing, a LiDAR sensor can provide near-instantaneous, highly accurate readings of terrain and points on the ground. Repeated millions of times, the process can generate an incredibly data-rich point cloud.

In general, LiDAR can produce higher resolution, more accurate scans than photogrammetry can generally achieve. Indeed, LiDAR excels in use-cases that would confound traditional photogrammetry or human operators:

- Scanning terrain populated with vegetation and brush
- Scanning small, narrow, otherwise hard to see objects (like power lines)
- Working in poor lighting conditions.

With LiDAR, operations can:

- Create a highly detailed topography (one-foot contours) that can effectively penetrate through vegetation to see the ground underneath, which is not possible through almost any other means.
- Focus on the vegetation and classify areas of high, medium, or low vegetation.

Industrial Applications of Drones

The sheer mobility, flexibility, and variability of drones means they can produce valuable datasets in a huge variety of applications and use-cases across virtually every industry that conducts surveys, inspections, and more.

Agriculture

Drones help farmers, growers, and ranchers to reduce costs, increase yields, and better manage both crops and livestock through collecting data about crop and soil conditions, water levels, plant health, and more.

Towers

Inspecting cell phone towers is a necessary but time- and labor-intensive process that can also put human workers at risk. Drones can collect data in a fraction of the time with no danger to human operators.

Energy & Solar

Drones can provide thermal data as well as RGB data and aerial imagery to determine how solar panels are working, verify overall condition, assess environmental impact, and check on any right-of-way encroachments.

Construction

Drones provide almost any kind of survey and monitoring data for use in site planning, progress monitoring, safety inspections, and even thermal imaging to detect problems like electrical hotspots or heat loss.

Emergency Services

From helping in search-and-rescue operations through aerial imaging, thermal imaging, providing surveillance for law enforcement, and more, drones can speed up and ease emergency response.

Your Industry?

The most interesting applications of drones are the ones still being invented.

The sheer flexibility of drone-based imaging and data collection enables use-case scenarios that were simply impossible or prohibitively difficult when relying on manual, ground-based or satellite-based data.

There are likely data gathering applications you've never even considered because they simply weren't feasible or possible … until drones.

Oil & Gas

Prevent plant shutdowns, reduce operational delays, pinpoint structural weaknesses, assess performance, and speed up inspections, maintenance, and other functions by using drones to gather real-time imaging data.

Real Estate

Not only is ground level photography time-consuming and labor-intensive, but it can also miss features aerial drones can capture. Drones thus facilitate property inspections, appraisals, management, and more.

For more industry-specific information, see our white paper "Drones: Driving a New Standard of Operational Efficiency," which takes a more in-depth look at what drones can do within specific industries like those described above.

FlyGuys LiDAR Tree Extraction, Before and After

What's different about drones? It's all about the data.

Drones are fundamentally about data collection, improving on traditional and manual data collection in almost every measurable dimension: time and speed, cost, manpower, quantity of data, accuracy of data, and more. But the core improvement is in the richness of the dataset. The combination of the drone's sheer mobility and automated data collection means it becomes much easier to gather a broad range of data points from almost any location and perspective, including those that may not be feasible when humans are performing the survey or inspection. The result is a data set that includes more information and produces a more comprehensive and informative picture, map, or assessment.

More data

Drones produce exponentially more information than is otherwise possible. Instead of measuring survey points in feet or meters, they can be measured in centimeters or millimeters. That yields datasets with millions of points. Further, a drone survey will produce a comprehensive data set that can be used repeatedly. For example, a single dataset will include both trees and roads. If at first you only need to assess vegetation, it has that information. Then, if you later need to review roads, you already have that data; there's no need to send another team out. That minimizes costly and time-consuming site revisits.

More accurate data

In a study published in the *Journal of Big Data*, drones were able to achieve an accuracy rate of 98.53% at an altitude of 40 m, with only minor accuracy drop off even at an altitude of 100 m.[i] Survey points were as precise as within 0.68 cm (0.022 ft) – that's how drones produce so many more points. In another study, drone data collection in ecology was found to be as much as 96% *more* accurate – roughly twice as accurate, in other words – than traditional ground-based collection methods.[ii] LiDAR in particular was able to provide point density between 50 and 200 points/m^2 even from elevations as high as 2000 m (6600 ft).

More data possibilities

These improvements don't just quantitatively improve the process; they qualitatively transform *what* operators can do. They can collect information that might have been inaccessible previously or undertake projects for which the sheer volume of data needed would have made them infeasible. Drones can monitor multiple locations simultaneously. They can completely replace missions previously flown by helicopter. They can create a historical record that, when used in combination with current data or existing site plans, allow organizations to conduct change analysis and possibly predict future needs.

LiDAR-based data collection in particular drives unprecedented possibilities.

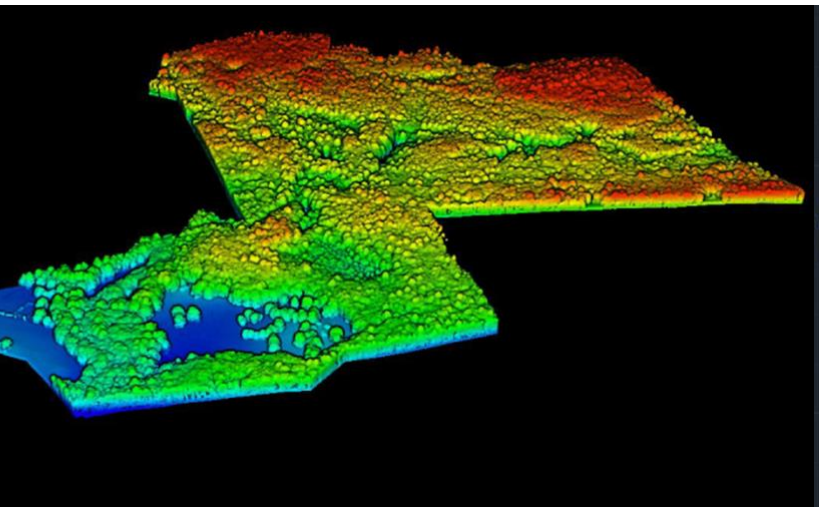
LiDAR technology especially offers some notable strengths in data collection: improved accuracy in measuring distances, an ability to penetrate ground cover, and an ability to function well even in low light conditions. Photogrammetry can give you a high-resolution view, but LiDAR can give you even more detailed information like accurately determine how far away an object is and, potentially, what's beneath it. As a result, the richness of data presented by LiDAR opens up use-cases that aren't possible using photogrammetry alone.

Example: 250-Acre Forest

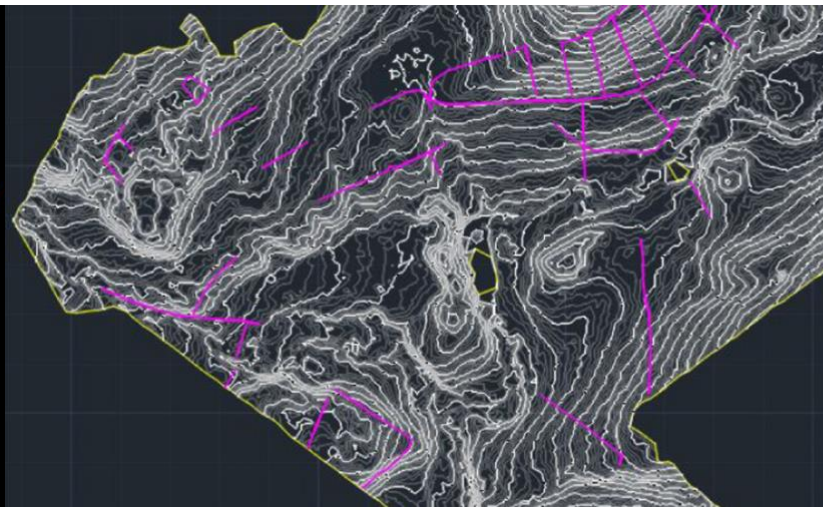
One property owner wanted to collect vegetation data, as well as find still-standing 200-year-old walls, across 250 acres of forested land. Normally, such a survey would have taken weeks. With LiDAR-equipped unmanned aerial vehicles, the process required only 2 days, generated over 211 million total points (including heavy vegetation), and likely saved $35,000 to $45,000.

	Manual Inspection	Drones
Workers Required	4-person crew	Only 1 operator required
Time To Complete	3 to 5 weeks total	2 days on site
Number of Visits	Multiple visits	One visit
Total Cost		
Total Costs	**Conservative Estimate $41,600**	**Actual Cost $7,000**

Est. $34,600 in total cost savings



Forest Elevation Map (Heights Color-Coded)



Mapping 200 Year-Old Walls Inside Forest (in Purple)

Drones also power unbeatable time, labor, and cost efficiencies.

Beyond data, the primary purpose and strength of a drone is to make projects more efficient and cost-effective. These efficiencies are also key to opening up new data collection possibilities. Drones' flexibility isn't just about what they can achieve on a technical level. They can also make projects logistically feasible that would otherwise be too time-consuming, labor-intensive, or costly to undertake.

Time savings

Drones collect more data faster by capturing more visuals per second than human operators can typically capture in a minute. They can also collect multiple types of data at once and, in some applications, collect data on different parcels of land simultaneously (especially from higher altitudes). For example, drone video can reduce golf course treatment time **by 96%** due to faster detection of issues like fungal outbreaks and water leaks, both of which can be hard to spot at ground level.[iii] Similarly, it might take a technician around 25 hours to inspect 1MW of solar on foot. A small 5MW solar farm would thus take 125 manhours to inspect what could be completed in **a few hours by drone**.

Labor savings

The labor reduction in some applications can be massive. If you don't have to send a worker (or a team of workers, or multiple teams) to manually collect data across a vast parcel of land (or up a tall height like a cell phone tower), you can reduce overall labor required **by 50% to 80%**. Photogrammetry and LIDAR thus both serve as a way to acquire needed data at a quicker pace with reduced crews or in a way that supplements the crew that they have internally.

Cost savings

Both time and labor savings translate directly into cost efficiencies, and across the board, drone data collection is less expensive than its manual alternatives. *Power Engineering* reports that a series of trials found that drones were **40% less expensive** than manual solar inspections.[iv] Similarly, The New York Power Authority, in partnership with Ontario Power Generation, used drones to inspect an ice boom between Niagara River and Lake Eerie. In just 20 minutes, the drone found a damaged cable. Their team estimates that drones **saved fully 90% of the cost** of inspections.[v]

Cost savings can come from additional sources, as well, like identifying problems and maintenance issues *before* they turn into expensive crises. One large solar farm was able to identify defective modules that "likely would not have been discovered during on-foot inspections." That generated an estimated **$383,127 in savings**.[vi] LiDAR in particular offers potentially exceptional cost benefits. A study commissioned by the Florida Department of Environmental Protection assessed LiDAR's use in bare-earth ground elevation surveys, inland bathymetry, and nearshore bathymetry. They project more than **$28 million in annual net benefits**, with a benefit-to-cost ratio as high as 5.1-to-1.[vii]

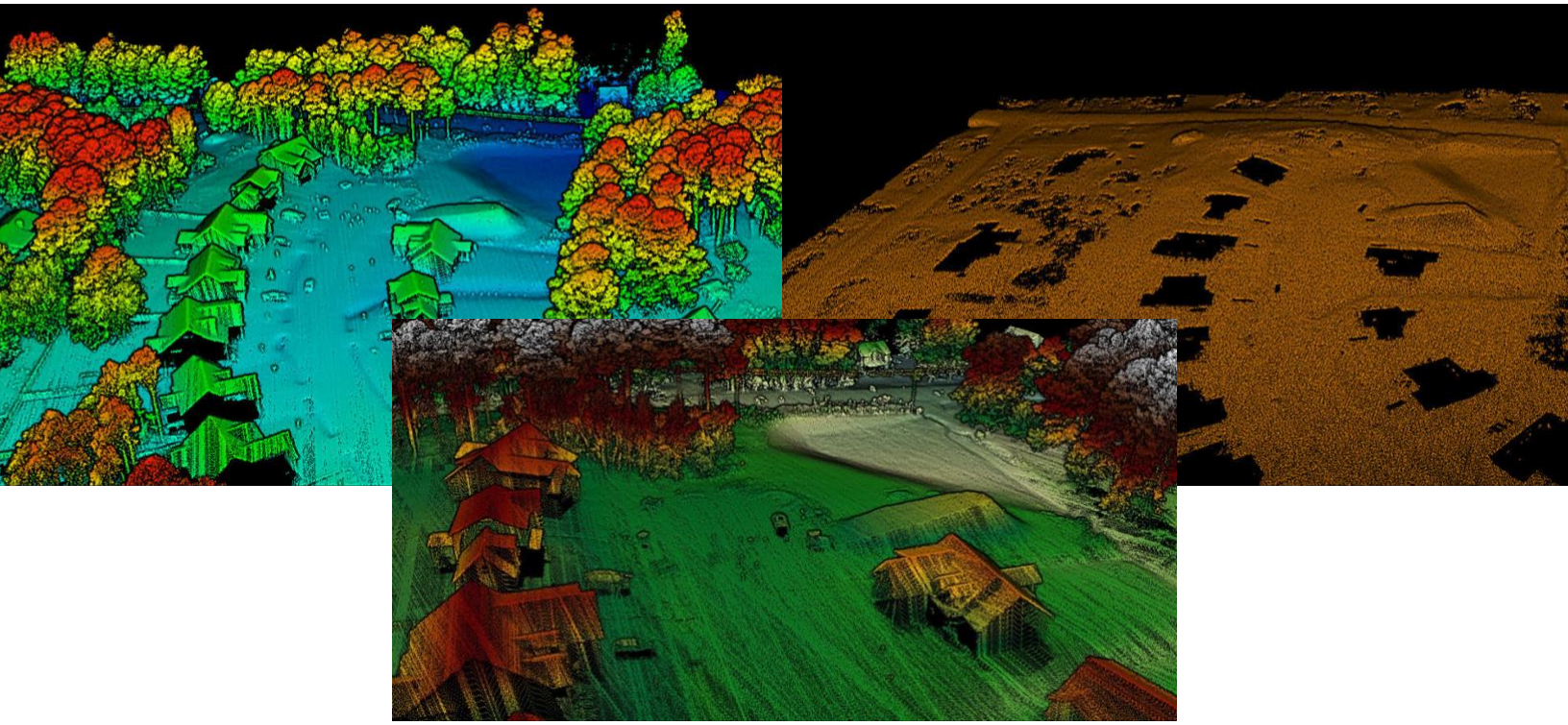
Drones are safer, too.

Many surveys, inspections, and other data collection functions require workers to place themselves in hazardous conditions. Searching for a methane leak could leave the worker exposed to dangerous chemicals; inspecting a cell phone tower would require the worker to face the risk of falling from a height; conducting railway inspections that require people to traverse tracks potentially puts them in harm's way; etc. Drones remove the need to place people in potentially risky situations; and the drones themselves typically stay out of the way of moving equipment and vehicles.

Example: Drone Operational Efficiencies & Net Cost Savings, 4 Solar Farm Sites

One study of four utility-scale solar farm sites found that operational efficiencies increased by up to 98% (nearly double) compared to manual inspection methodologies. Specifically, researchers compared how long it took to collect all relevant data using drone data collection versus manual inspection methodologies such as clamp testing, hand-held IR scanning, curve tracing testing, and more.[viii] Drones simply blew other methodologies out of the sky.

	Site 1	Site 2	Site 3	Site 4
Size	74MW	30MW	21MW	12.5MW
Manual Inspection Time	778 Hours	293 Hours	208 Hours	195 Hours
Drone Inspection Time	24 Hours	6 Hours	7 Hours	4 Hours
Hazardous Manhours Avoided	754 Hours	287 Hours	201 Hours	191 Hours
Increased Efficiency	**97%**	**98%**	**97%**	**98%**
Net Cost Saving	**$68,399**	**$25,485**	**$17,063**	**$19,552**



Full Point File (left), Overview (center), Stripped of Vegetation & Buildings (right)

Drones Alone Are Not Enough

A word of warning, though: *how* the drone services are rendered make a *big* difference. In other words, you can't necessarily buy a drone off the shelf and expect outcomes like those detailed above. In particular, many organizations think they can just buy a drone and enact a DIY drone survey program and immediately realize time- and cost-savings, but that's not necessarily the case. That's because drones don't exist in isolation. The strategy and skillsets required for drone and aerial data collection matters too, and a drone program that's handled inefficiently or poorly will erase or constrain all of the potential gains from using drones in the first place.

- First, the technology matters. Not all drones are made equal, and this is *especially* true of LiDAR-equipped drones and vehicles. Off-the-shelf models may simply not provide the acuity, accuracy, or functionality needed to achieve the kinds of results described in this paper. Make sure you know the exact technologies and technical specifications that will meet your needs.

- Second, the relationship matters. Organizations may need help figuring what they need and how to use the data for maximal benefit. A relationship with a trusted vendor can prove invaluable here. Unfortunately, too many vendors default to automated approaches with little human interaction, leaving their clients unsure what to do with the data they've been handed.

- Third, the business model matters. Being able to deliver on high volume quickly (especially on a recurring basis) doesn't depend just on using drones, it depends on setting up a business model that maximizes the advantages of drone data collection. In other words, beyond the technical capabilities of the drones, the vendor needs to have the logistical flexibility to deploy them whenever and wherever they're needed.

Conclusion

It's no wonder that the drone business has been soaring, with an astounding annual CAGR of over 57.5% expected through 2028.[ix]

Like spreadsheets replacing paper ledgers and smartphones replacing rolodexes, the outsize ability of drones to improve upon traditional data collection methods virtually guarantees that drones are the future of site surveys, inspections, and more. With cutting-edge technologies like LiDAR further enabling even more exciting applications and use-cases, drones are allowing surveyors and inspectors to do more, work faster, and shrink costs.

But it's important to realize that not all drones, and not all drone services, are equal. Maximizing beneficial outcomes relies on operators skilled and practiced in drone use, equipment that incorporates the right technological capabilities, and business models that can conquer the logistical hurdles inherent in getting the drones where they need to go, when they need to be there.

But equipped with the right drones, powered by the right operators, and deployed with the right business strategy, it's clear that drones are truly elevating the possibilities inherent in industrial and commercial data collection.

Next Steps

→ Learn more about industry-specific applications by downloading the white paper, "Drones: Driving a New Standard of Operational Efficiency."

→ Review the accuracy and comprehensiveness of drone-procured data first-hand by requesting a sample dataset at info@flyguys.com.

→ If you already have a project in mind, get more information and request a quote here.

About

FlyGuys is a nationwide drone services company that acquires aerial imaging data so you can make more informed, accurate decisions. Our aim is to make aerial data more accessible and affordable, so you can overcome challenges efficiently and safely.

From RGB and Infrared, to LiDAR and Hyperspectral sensors we can collect it all. With our geospatial experts and vast network of drone pilots, we are ready to deploy when and where you need us, using drones, helicopters, manned fixed-wing aircraft, and terrestrial collection methods in order to provide you with the resources you need at an affordable cost. We deliver aerial data collection solutions for many commercial industries and public sector entities including Energy, Agriculture, Construction, Engineering, Transmission & Distribution, Transportation, and more.

We are committed to providing excellent client service and quality professional solutions to meet and exceed our client's expectations. Our attentiveness to project requirements, combined with the experience we have on our team means that we are able to take on projects of any complexity.

If you need a quote for a drone imaging project, we'd be happy to help here.

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