

THE MOST ACCURATE UNMANNED SURVEYING SOLUTIONS



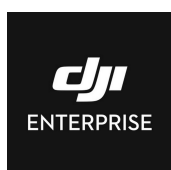
dji ENTERPRISE

DRONE SOLUTIONS AEC & SURVEYING

EPOTRONIC

INTERGEO 2022

SOLUTIONS FOR SURVEYORS & MANY MORE



The world's leading enterprise drone manufacturer



Trusted Surveying consultant and DJI Enterprise Reseller



Provides latest technology sensors for specialised applications



Your tool to get from DRONE to CAD



Provides next generation software for digital twins

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ABOUT DJI ENTERPRISE

Driven by a relentless pursuit of innovation, DJI has revolutionized the way people create and is now ushering in a new generation of work by helping people understand and adopt drone technology. Thus, came DJI Enterprise – a global team dedicated to fostering an ecosystem for businesses to empower individuals, enhance jobs and digitize operations. DJI's drone technology and the DJI platform provide a new way for the surveying and mapping industry to optimize project management, streamline workflows, and minimize risks.



DRONES IN ARCHITECTURE, ENGINEERING, CONSTRUCTION, AND SURVEYING

Drones are adaptable, accessible tools that are proving their value across every stage of architecture, engineering, construction, and surveying projects. Applied correctly, drone data solves the problems caused by information silos and increases site awareness, while improving safety and productivity across the board. From streamlining processes, to simplifying site management, to reducing overall project durations, drones are quickly establishing themselves as essential tools for surveying and construction operations.

Here are some of the ways drones are game changers for AEC and surveying professionals:



Improved Collaboration

Drones can digitize complex projects and produce 3D models of your worksite which allow stakeholders to schedule, plan, and more easily work together.



Efficiency Gains

Quickly capture aerial data of large worksites and re- place tedious or time-consuming manual processes with drones.



Powerful Data

Drone technology is constantly evolving. From navigable 3D models and thermal inspections to detailed orthomosaic maps, drones give access to highly valuable data.



Compelling ROI

Drones and the data they capture lead to improved work- place efficiency, reduced downtime, fewer costly mis- takes, and result in savings across a project's lifecycle.



Enhanced Safety

Keep your team from harm's way and deploy drones to automate inspection tasks that otherwise would require working at height or in dangerous environments.

Portable Mapping Solution Without GCPs

Aircraft	Mavic 3 Enterprise
Payloads	Integrated camera
Apps/Software Supported	Flight Control: <ul style="list-style-type: none">• GS RTK• DJI Terra• GS Pro• DJI Pilot 2
Training	DJI Flight Simulator

Full-frame Photogrammetry Solution Without GCPs

Aircraft	Matrice 300 RTK
Payloads	DJI P1
Flight Control Apps/Software Supported	DJI Pilot
Data Processing Apps/Software Supported	DJI Terra

Versatile Lidar Solution

Aircraft	Matrice 300 RTK
Payloads	DJI L1
Flight Control Apps/Software Supported	DJI Pilot
Data Processing Apps/Software Supported	DJI Terra

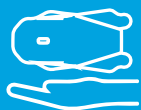
Multispectral Imaging Solution

Aircraft	P4 Multispectral
Payloads	Integrated mulispectral camera array
Flight Control Apps/Software Supported	DJI GS Pro
Data Processing Apps/Software Supported	DJI Terra

DRONES



MAVIC 3E



Compact and portable



4/3 CMOS Wide Camera



56x Hybrid Zoom



45min Max Flight
(Without RTK module)



DJI 03 Enterprise
Transmission



Centimeter-level
Positioning with RTK

Premium camera performance

- HD wide camera
- Smart low-light
- photo
- thermal
- Synchronized split-screen zoom

Compact and portable

- Light 15g/920g airframe
- Compact body that fits in the palm of your hand
- Perfect for beginners and veteran pilots alike

Ultra-long battery life

- 45-min max flight time
- 100w charging hub for fast charging batteries
- 88w drone direct charging

Flagship flight safety

- Wide-angle lenses for omnidirectional obstacle sensing with zero blind spots
- Advanced RTH
- APAS 5.0 for automatic rerouting around obstacles

Abundant accessories

- DJI RC Pro enterprise
- RTK module
- Loudspeaker
- D-RTK 2 mobile station

Full software suite

- DJI Pilot 2
- DJI Flighthub 2
- DJI Terra 2
- Data 3.0



P4 MULTISPECTRAL

Gather precise plant-level data using the P4 Multispectral – a high-precision drone with a seamlessly integrated multi- spectral imaging system built for agriculture missions, environmental monitoring, and more.



Live NDVI View



5-Band Multispectral Imaging System



RTK Module



TimeSync

Specs

Diagonal Distance
(Propellers Excluded)

350mm

Takeoff Weight

1487g

Max Flight Time

Approx. 27 minutes

Differential Data Format

RTCM 2.X/3.X

Max Ascent Speed

6 m/s (automatic flight); 5 m/s (manual control)

Max Service Ceiling
Above Sea Level

19685 ft (6000 m)

Operating Temperature

0° to 40°C (32° to 104° F)

Max Transmission Distance

7 km

Filters

Blue (B): 450 nm \pm 16 nm; Green (G): 560 nm \pm 16 nm; Red (R): 650 nm \pm 16 nm; Red edge (RE): 730 nm \pm 16 nm; Near-infrared (NIR): 840 nm \pm 26 nm

Sensors

Six 1/2.9" CMOS, including one RGB sensor for visible light imaging and five monochrome sensors for multispectral imaging. Each Sensor: Effective pixels 2.08 MP (2.12 MP in total)

Image Position Compensation

The relative positions of the centers of the six cameras' CMOS and the phase center of the onboard D-RTK antenna have been calibrated and are recorded in the EXIF data of each image.

Mapping Software Supported

DJI Terra Third-party software

Flight Control Software

DJI Ground Station Pro (DJI GS Pro)



MATRICE 300 RTK

The Matrice 300 RTK is DJI's latest commercial drone platform that takes inspiration from modern aviation systems. Offering up to 55 minutes of flight time, advanced AI capabilities, 6 Directional Sensing & Positioning and more, the M300 RTK sets a whole new standard by combining intelligence with high-performance and unrivaled reliability.



15 km Max Transmission¹



55-min Max Flight Time²



6 Directional Sensing & Positioning



Primary Flight Display



IP45 Rating



-20°C to 50°C Operating Temperature

Specs

Dimensions

Unfolded, propellers excluded : 810×670×430 mm (L×W×H)
Folded, propellers and landing gears included : 430 × 420 × 430 mm (L×W×H)

Service Ceiling Above Sea Level

5000 m (with 2110 propellers, takeoff weight ≤ 7 kg) / 7000 m (with 2195 propellers, takeoff weight ≤ 7 kg)

Diagonal Wheelbase

895 mm

Supported DJI Gimbals

Zenmuse XT2/XT S/Z30/H20/H20T

Max Takeoff Weight

9000 g

Supported Gimbal Configurations

Single Downward Gimbal, Dual Downward Gimbals, Single Upward Gimbal, Upward and Downward Gimbals, Triple Gimbals

Max Descent Speed (tilt)

7 m/s

Ingress Protection Rating

IP45

Max Ascent Speed/Max Descent Speed (vertical)

6 m/s; 5 m/s

GNSS

GPS+GLONASS+BeiDou+Galileo

Max Wind Resistance

15 m/s

Operating Temperature

-20°C to 50°C (-4°F to 122°F)

* [1]Unobstructed, free of interference, when FCC compliant. Maximum flight range specification is a proxy for radio link strength and resilience. Always fly your drone within visual line of sight unless otherwise permitted.
[2] Actual flight time may vary because of the environment and payload configurations.

PAYLOADS



DJI P1

Efficiency through Flexible Full-frame Photogrammetry.



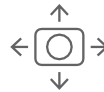
Accuracy without GCPs
3 cm horizontally / 5 cm vertically ^[1]



High Efficiency
3 km² covered in a single flight ^[2]



45 MP
Full-frame Sensor



3-axis Stabilized
Gimbal Smart
Oblique Capture



Global Mechanical
Shutter ^[3] Shutter
Speed 1/2000 Seconds



TimeSync 2.0 -
synchronization
at the microsecond level

Specs

Dimensions	198×166×129 mm	Shutter Speed	Mechanical Shutter Speed: 1/2000*-1 s Electronic Shutter Speed: 1/8000-1 s <small>*Aperture value no larger than f/5.6</small>
Weight	Approx. 800 g	Aperture Range	f/2.8-f/16
IP Rating	IP44	ISO Range	Photo: 100-25600 Video: 100-25600
Supported Aircraft	Matrice 300 RTK	Supported Lenses	DJI DL 24mm F2.8 LS ASPH(ENTERPRISE) (with lens hood and balancing ring/filter), FOV 84° DJI DL 35mm F2.8 LS ASPH(ENTERPRISE) (with lens hood and balancing ring/filter), FOV 63.5° DJI DL 50mm F2.8 LS ASPH(ENTERPRISE) (with lens hood and balancing ring/filter), FOV 46.8°
Absolute Accuracy	Horizontal: 3 cm, Vertical: 5 cm * * Using Mapping Mission at a GSD of 3 cm and flight speed of 15 m/s, with an 75% front overlap rate and a 55% side overlap rate.	Video Resolution	16:9 (1920×1080) 16:9 (3840×2160)* <small>*Only 35mm lens supported</small>
Sensor	Sensor size (Still): 35.9×24 mm (Full frame) Sensor size (Max video recording area): 34×19 mm	Stabilized System	3-axis (tilt, roll, pan)
Effective Pixels	45MP		
Pixel size	4.4 μm		
Minimum photo interval	0.7 s		

* [1] Using Mapping Mission at a GSD of 3 cm, with an 75% front overlap rate and a 55% side overlap rate.
At a GSD of 3 cm, with an 75% front overlap rate and a 55% side overlap rate.
The global shutter is achieved with a central leaf shutter.



DJI L1

The Zenmuse L1 integrates a Livox Lidar module, a high-accuracy IMU, and a camera with a 1-inch CMOS on a 3-axis stabilized gimbal. When used with Matrice 300 RTK and DJI Terra, the L1 forms a complete solution that gives you real-time 3D data throughout the day, efficiently capturing the details of complex structures and delivering highly accurate reconstructed models.



Integrates a Lidar module, an RGB camera, and a high-accuracy IMU



High Efficiency
2 km² covered in a single flight ^[1]



High Accuracy Vertical Accuracy: 5 cm /
Horizontal Accuracy: 10 cm ^[2]



Point Rate:
240,000 pts/s



Supports 3 Returns ^[3]



Detection Range: 450 m
(80% reflectivity, 0 klx)



IP44 Ingress
Protection Level



-20°C to 50°C
Operating Temperature

Specs

Dimensions	152×110×169 mm	System Accuracy	Horizontal: 10 cm @ 50 m; Vertical: 5 cm @ 50 m
Weight	Approx. 900 g	FOV	Repetitive line scan: 70.4° × 4.5° ; Non-repetitive scan: 70.4° × 77.2°
IP Rating	IP44	Yaw Accuracy	Real-time: 0.18° , Post-processing: 0.08°
Supported Aircraft	Matrice 300 RTK	Pitch / Roll Accuracy	Real-time: 0.03° , Post-processing: 0.025°
Detection Range	450 m @ 80% reflectivity, 0 klx; 190 m @ 10% reflectivity, 100 klx	Sensor Size	1 inch
Point Rate	Single return: 240,000 pts/s; Multiple return: 480,000 pts/s	Effective Pixels	20 MP

* [1] Over 30 minutes, at a speed of 10m/s, a flight altitude of 100 m, with a side overlap rate of 20%, point cloud density > 200 points/m².
2 Flight altitude: 50 m
3 In operations with two or three returns, the point rate is 480,000 pts/s

SMART DRONE TECHNOLOGIES ARE NOT JUST INNOVATIONS – THEY ARE OUR PASSION

SPH Engineering is a global provider of UAV software solutions, integration services, consulting and custom development to expand drone applications. Its innovations support UAVs of different manufacturers and advance drone technologies for surveying, data collection, and entertainment. The company has a global customer and partner network in 150+ countries.



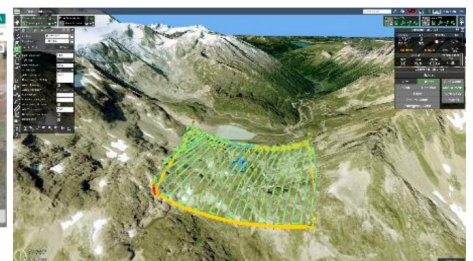
UgCS by SPH Engineering is one of the world's leading flight planning software solutions for drones. Since 2013 the team has constantly been working to make UgCS better and meet the requirements of even the most demanding professional drone pilots and surveyors. What sets UgCS apart from other flight planning solutions is that flight planning is done on PC/Mac, it is installed locally and can be used offline. UgCS is also fast, gives a 3D environment built on a gaming engine to plan flights in, and comes with other important features such as terrain following and LiDAR flight planning tools. UgCS supports the most popular UAV platforms on the market such as DJI M300 RTK, M600, Phantom 4 RTK as well as Ardupilot and PX4-based platforms and many others.



UgCS Integrated Systems is one of SPH Engineering's business lines enabling the advanced technological integration between a drone, various sensors, the UgCS SkyHub hardware, and the UgCS software. Within 5 years in geophysics, SPH Engineering has developed an in-house sensor test field. Starting out with the integration of Ground Penetrating Radars (GPR) for archeological expeditions in Greenland and Peru, UgCS Integrated Systems has been constantly testing and supporting new types of sensors. Integration of Echo Sounders, Methane detectors, Magnetometers, and Metal detectors, enriched with radar altimeters, is supported across a wide range of industries worldwide.



SPH Consulting & Development is one of the business lines of SPH Engineering. It combines unique drone and software development experience and multiple products for UAV solution and service providers. The expertise of SPH Engineering team in implementing, integrating, and developing technologies for the drone industry support companies to unleash the potential of unmanned systems.



SOFTWARE

Twinsity is fundamentally changing the way we look at our infrastructure. Our technology assists human experts in doing their jobs - detecting and analyzing structural defects and taking the right decisions when it matters. From anywhere at any time.

The cloud platform of Twinsity brings all stakeholders of an inspection process together in one hub and makes inspection, communication and documentation easier than ever before.

Twinsity relies on the power of digital twins and supports all leading photogrammetry solutions, including DJI Terra. The tight integration with DJI Terra provides DJI drone customers an efficient and simple 3D inspection workflow.

Digital Twin & Inspection Images

Interactive digital 3D twins, intelligently linked to the corresponding original images, provide a comprehensive understanding of the object. This way, damage can be detected at an early stage and observed over time.

Intelligent Annotations

The observations are automatically marked in the 3D model and all inspection images containing the findings. In this way, damage can be assessed from different angles and the images are automatically double-checked without the need for the inspector to do this work.

Precise Measurements

In the 3D model, precise measurements with millimeter accuracy can be carried out as if being on site. The digital twin, which is accessible interactively, enables measuring even in hard-to-reach and inaccessible spots.

Automated Inspection Reports

Standardized and customizable inspection reports contain all relevant information about the object, damages and observations.

Sharing made simple

Effective data delivery and sharing in a browser-based hub - securely hosted in the Cloud. Cluttered project structures are a relic of the past.

Streamlined collaboration

We bring all project parties together into a single platform that is easy to use and accessible from anywhere - enabling collaborative off-site inspections.



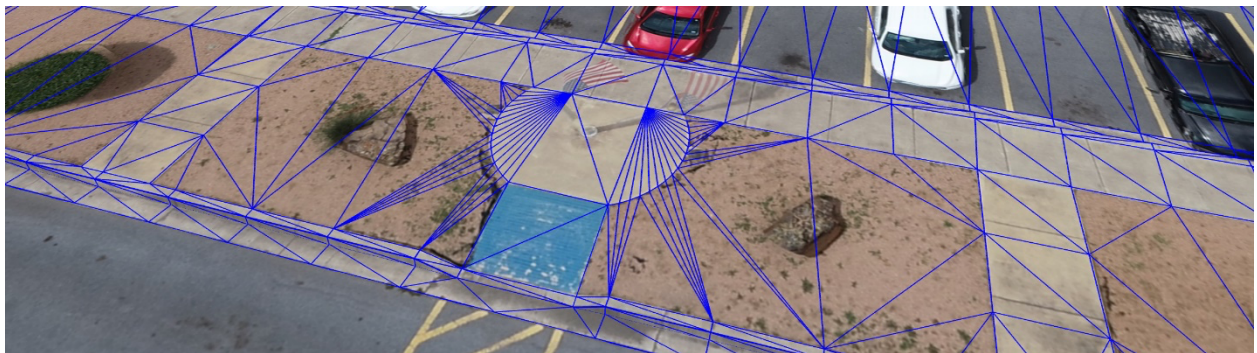


Create survey deliverables from drone data in a smart way.

Working with drone data is completely different than what surveyors are used to. Surveyors typically work with points and lines in small CAD files, while drone data provides large pixel files, which is a very different data type. Virtual Surveyor brings both worlds together by creating a virtual environment from the drone data, while also bringing the known surveying process into that environment, speeding up the surveying process in a smart way.

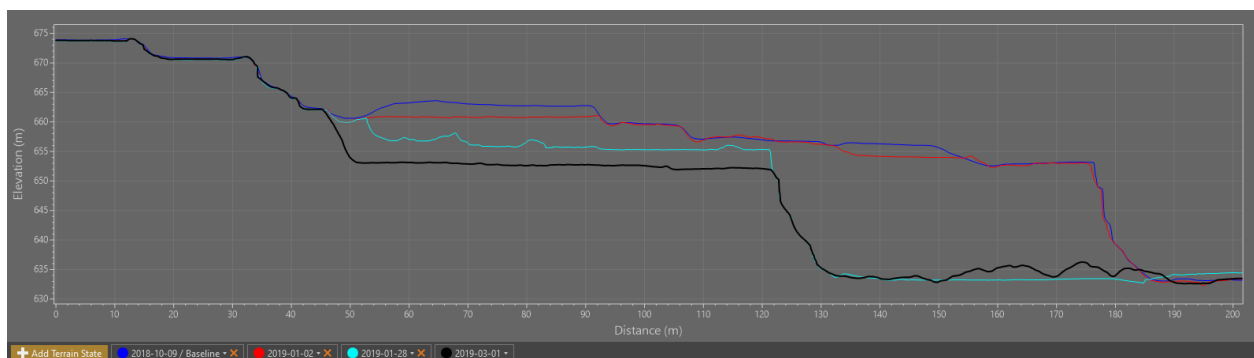
Topographic surveys

Create light-weight CAD models in short time frames by combining the power of your brain's ability to interpret complex topographies and use smart survey tools.



Mining

Compare excavations over time with the profile tool. Create cut-and-fill maps between drone data, a baseline survey, and the topographic design.



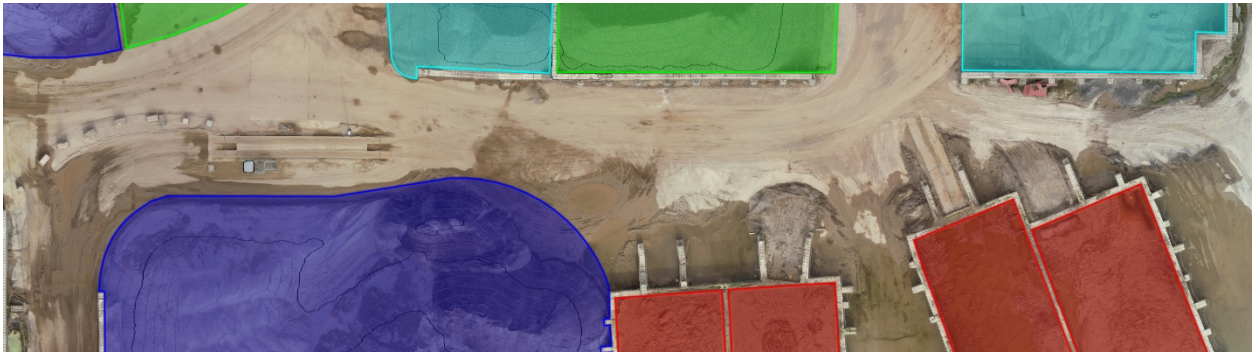
Construction

Keep track of your construction sites and easily generate cut-fill maps with drone data.



Stockpile inventory

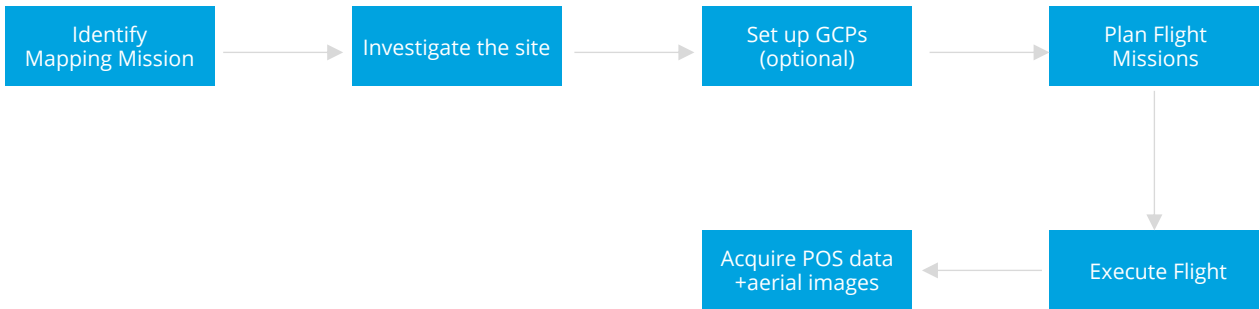
Know the true value of your stocks with drone data. Calculate tonnages and monetary value by linking volume with a material and generating a PDF report in a single-click.



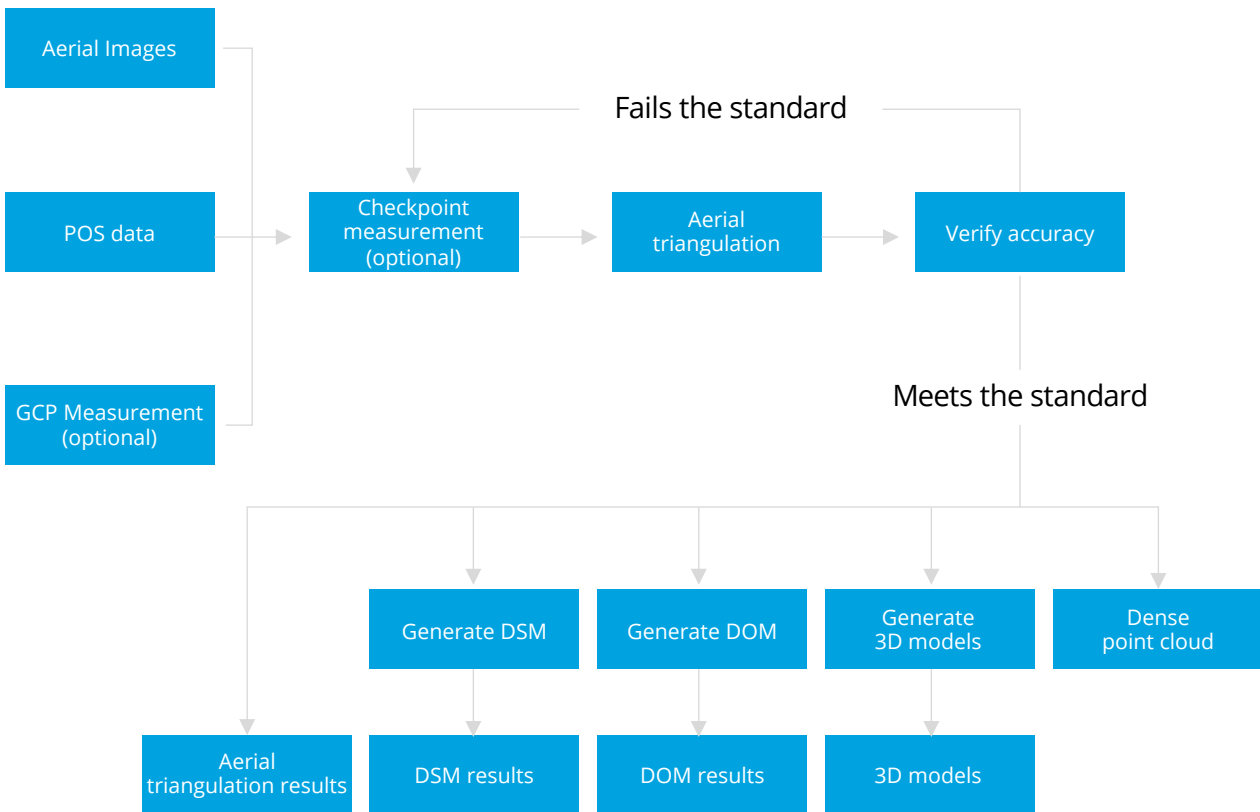
WORKFLOW

AERIAL MAPPING WORKFLOWS

Onsite Data Collection



Data Processing



USE CASES

01

Drones in structure inspection

Historical preservation of Karatsu Castle with Toppen Co., Ltd

Historic preservation is very important in Japan. However, the country is prone to natural disasters that often damage ancient buildings. One such structure is Karatsu Castle in Japan's Saga Prefecture. The original stone walls that make up the castle tower are buckling due to the effects of water seepage caused by earthquakes and heavy rains. Toppen, a local printing technology company, have been tasked to create a high-resolution 3D model to both honor and preserve the castle. They selected DJI's Phantom 4 RTK as an all-in-one drone mapping solution, utilizing DJI Terra; mapping software that transforms real-world buildings into digital assets.

Work Challenges

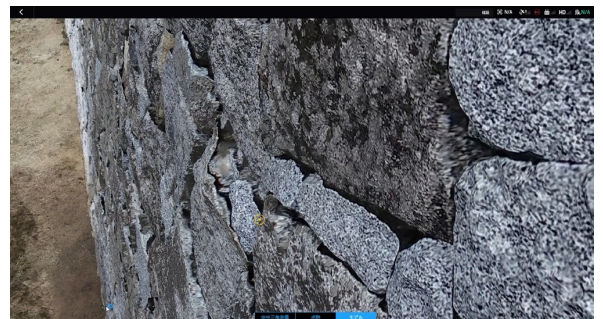
1. The damage to the stone walls means that mapping, and the subsequent preservation, is extremely urgent.
2. Traditional techniques are inadequate and incredibly accurate maps and models are required.

Drone Advantages

1. The DJI Phantom 4 RTK is a compact, affordable and accurate low-altitude mapping solution.
2. DJI Terra supports oblique mission planning which covers any possible gaps in the model.
3. Terra is very efficient, requiring only 1GB RAM to process 400 images from the P4 RTK.
4. This efficiency means that work takes minutes and not hours - vital for the urgency of the project.



1. Karatsu Castle beside Karatsu Bay.
2. Toppen engineers survey the walls of the castle.
3. The DJI Phantom 4 RTK uses its 20-megapixel CMOS sensor to map the castle.
4. The castle rendered into an accurate 3D model.
5. Capturing precise 3D models of the stones will help maintain the structure of the wall.



02

Drones in infrastructure construction

Infrastructure and construction project management with Strabag

The German Federal Ministry of Transport intends to invest €270 billion by 2030 due to a considerable increase in traffic. STRABAG, a construction group with 9,100 construction projects across Europe, has been engaged to construct and renovate around 600 km of highways. Drones have been used on sites to make surveying missions faster. However, existing drone solutions can mean the placement of up to 40 ground control points (GCP) per square kilometer, which is a lengthy undertaking. So, STRABAG is using the new DJI Phantom 4 RTK which records position, altitude and other data onto each photo and uses the RTK positioning module that potentially reduces the required amount of GCPs to 0.

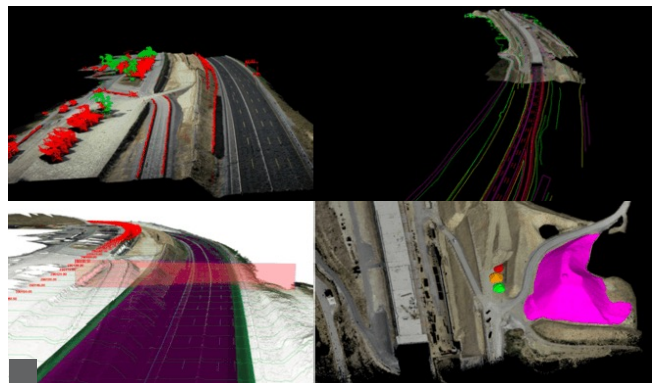
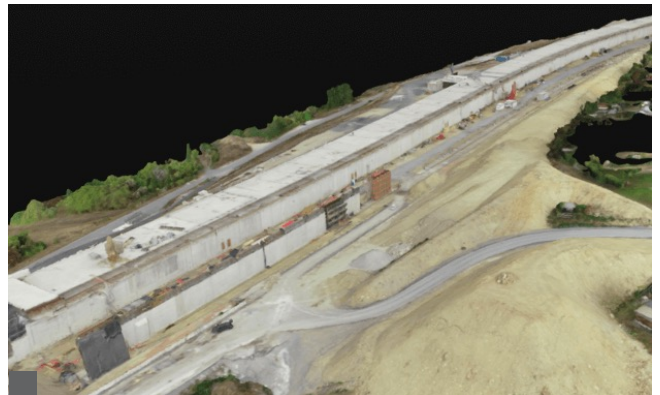
Work Challenges

1. Germany is a main transit country for millions of people across Europe with many highways needing repair.
2. Hundreds of miles of totally new highways are also required.
3. Construction needs to be accurately and quickly planned and tracked during progress.

Drone Advantages

1. Digital terrain models created from drone data provide a higher point density.
2. Using the RTK positioning module drastically reduces the required amount of GCPs.
3. Surveyors can achieve an increase in accuracy and save at least 75% in GCP set-up time.

1. A drone assisting in highway construction planning.
2. The remote control has an integrated flight planning app.
3. A detailed 3D model of a highway construction site.
4. Phantom 4 RTK image data can be used to create a variety of deliverables.



03 |

Drones in construction management

Improving worksite safety and efficiency with Hensel Phelps

Construction companies are utilising drone innovation in large and often complex projects. Hensel Phelps, one of the largest general contractors and construction managers in the United States, is one such business and has witnessed unprecedented growth in productivity with its in-house drone program. Traditionally, aerial photographers would be hired at great expense with disappointing results from basic camera equipment. Exterior inspections of buildings would also require costly scaffolding and could take weeks. Employing drones means that flying, analysis, and data processing can be done in a matter of hours. They allow access to accurate, up-to-date and detailed visual data and mean companies gain project visibility at an unparalleled level.

Work Challenges

1. Traditional methods have proved costly and time consuming.
2. The construction manager needs to keep multiple teams, especially offsite stakeholders, informed about every level of site progress.

Drone Advantages

1. Drone data can be used for a variety of purposes including site planning, site inspection, building inspection, and safety surveillance.
2. Site progress can be captured and the photos sent to project owners. This speeds up the process of getting budget approval from investors and financial institutions.
3. Safety protocols are easy to adhere to as drones are equipped with obstacle detection and collision avoidance sensors.



1. A drone being operated onsite in Pensacola.
2. DJI drones are equipped with obstacle detection and collision avoidance sensors.
3. The DJI Phantom 4 RTK provides enhanced site surveying efficiency and accuracy.

04

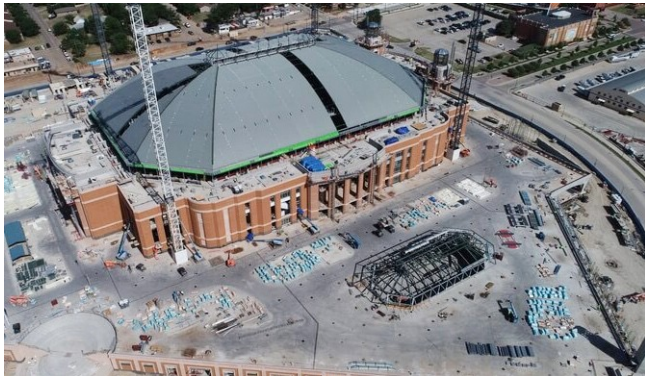
Drones in construction management

3D modeling and progress monitoring in stadium construction with Beck Group

Dickies Arena, a new cultural landmark in Fort Worth, is a multi-purpose facility that costs \$540 million. The Beck Group, general contractor of the facility, decided to utilise the latest drone technology to keep the project on track. DJI drones aided the process throughout construction, acting as enhanced platforms for BIM, 3D mapping, progress monitoring, documentation, and inspection tasks. The drones greatly reduced operating times whilst optimizing workflows throughout the construction phase.

Work Challenges

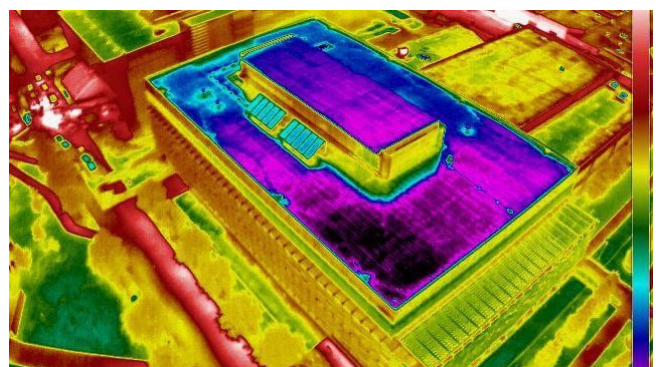
1. A 14,000 multipurpose arena is a complex construction project.
2. Being able to detect a problem early is essential in order to save the time and resources that would otherwise have to be spent on remedy or rework.



Drone Advantages

1. Aerial footage from drones help streamline project management, meaning construction crews only take a few days to complete comprehensive site mapping using DJI drones.
2. Having a drone to monitor progress on a daily basis ensures project teams are aware of real-time advancements, setbacks and potential risks, allowing them to make informed decisions based on a comprehensive set of tracking data.

1. Dickies Arena is a 14,000-seat multipurpose arena, located within the Will Rogers Memorial Center in Fort Worth, Texas.
2. Dickies Arena construction in numbers.
3. DJI drones allowed the construction crews to complete comprehensive site mapping in just a few days.
4. Site planning with photogrammetry.
5. Thermal inspection visualization.



05 |

Drones as a surveying solution

Deploying drone surveying solutions for increased safety, speed and scalability

Surveying dangerous sites entails several safety risks for the workers who are involved. That's why Altametriz, an SNCF company, deployed a drone surveying solution using the DJI Matrice 300 RTK and Zenmuse P1 camera at one of their test sites around a railway track. Not only were they able to eliminate any potential risks associated with moving GCPs around and over the railway tracks. The whole operation also took a mere 20 minutes as opposed to more than three hours using traditional methods. As a result, Altametriz generated an incredibly detailed 3D map of their test site in significantly less time than before while being able to operate their equipment from a safe distance to any potential hazards.

Work Challenges

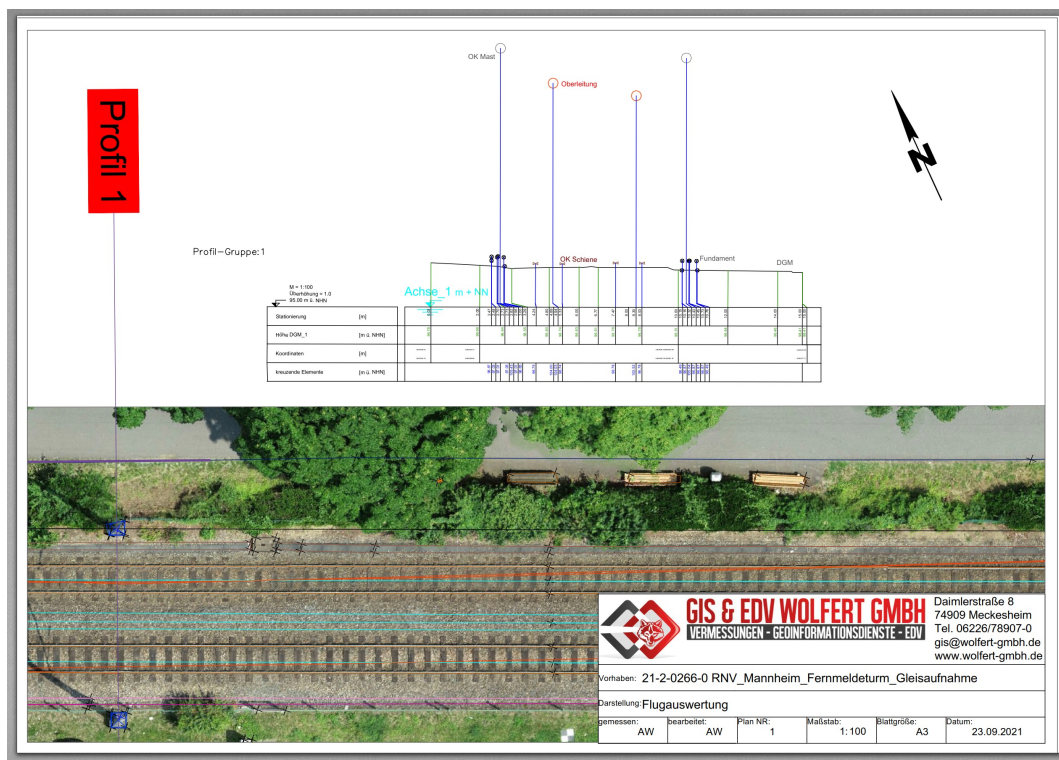
1. Moving around the railway tracks entails significant safety risks for the surveying personnel
2. Traditional techniques are very time consuming during the setup phase
3. It is nearly impossible to efficiently survey larger sites using GCPs

Drone Advantages

1. The DJI Matrice 300 RTK is a professional drone equipped with state of the art navigation and positioning systems
2. The DJI Matrice 300 RTK supports oblique mission planning for automatic imaging and flight routes
3. The Zenmuse P1 takes images with an incredibly high resolution utilizing its full-frame sensor



1. Traditional surveying and mapping alternatives usually need two to three people as opposed to just one drone operator which leads to significant cost savings.
2. The DJI Matrice 300 RTK is easily transported in its case. Deployment only takes a few minutes.
3. Surveying operations often involve significant safety risks for workers. Using the DJI drone surveying and mapping solution, they no longer need to move around the railway tracks.



Rhein - Neckar - Verkehr GmbH

- Location: Mannheim and surrounding
- 301 km tram line
- 189 trams
- 112 Mio passengers per year
- 370 000 passengers a day

Project description:

Flying with a drone (P4RTK) over a track section of the RNV GmbH.

We have the data of a classic surveying (Total Station) and want to know whether we can measure more economically with the drone in the future.

In addition, the survey would be safer, since no one has to step onto the track and the track does not have to be closed.

We flew over a section and after processing we take measurements from the generated 3D model. We compared the results with the classic measurement templates. For example, the foundations of the overhead line masts. (The comparison can be seen in the cross section). Road edges, upper and lower edges were also picked out. In addition, all kinds of desired objects could be measured out. Because you are not under time pressure, like when you are occupying the track. For example, the track height could also be measured easy.

The great advantage of the contactless measurement was that the transport operations for light rail service could continue without any problems. This makes operations management much easier, as there are no delays in the timetable. In addition, no extra security personnel or further permits have to be requested. A simple factual information to the driver was sufficient.



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