WELCOME!

Drone *and associated* Technology Use in Architectural Design, Construction, and Facilities Management

9:30 & 10:30 AM Breakout Session: Drone Technology Use in Architectural Design, Construction, and Facilities Management @ Avalon 24- 25-26 (1.0 CEU)

PRESENTERS

- **Luis Rosario, CEFM**
  Senior Project Manager
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  Vice President, Educational Projects
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Getting started

- Register Your Drone
- What Kind of Drone Flyer Are You?
- B4UFLY
- LAANC
- Temporary Flight Restrictions (TFRs)
- Remote ID
- Traveling with Your Drone

Recreational Flyers

- Recreational Flyers
- The Recreational UAS Safety Test (TRUST)
- Where can I fly?
- Recreational Flyer Airspace Authorizations

Recreational Flyer

- **If you fly for fun and personal enjoyment or as an educational institution you must:**
- *Learn the rules for recreational flyers*
- *See a list of FAA-Recognized Community Based Organizations*
- *Take The Recreational UAS Safety Test (TRUST)*
- *Register drones greater than 0.55 pounds (250 grams) and less than 55 pounds at FAADroneZone*
- *Learn more about drone registration*
- *Where can I fly?*
- *Learn about educational users*

Where can you fly your drone?

- Drone pilots can fly in controlled and uncontrolled airspace. There are different requirements to you as a pilot depending on which airspace you fly in.
- These resources below will help you determine where you can legally fly and if you need an authorization before doing so:
- Download FAA's *B4UFLY Mobile App*, which provides real-time information about airspace restrictions and other information to help you fly safely
- Use the *Low Altitude Authorization and Notification Capability (LAANC)* applications, which provide real-time information about airspace restrictions and near-real time airspace authorizations
- *Airspace 101 – Rules of the Sky*

Flying at Night

- Drones flying at night are required to have certain lighting. Drone pilots must also continue to follow all rules such as keeping their drone withing visual line of sight, staying below 400 feet, and avoiding restricted or prohibited airspace.
- Recreational flyers flying at night must operate in accordance with a *community-based organization's (CBO)* set of safety guidelines that have night procedures detailing required lighting.
- Part 107 Certificated Remote Pilots flying at night must *equip their drone with anti-collision lighting* visible for three miles.

How to create a business account on FAA DroneZone

- you're starting a drone business, organization, or a new drone program (including public safety) that will fly for any purpose other than recreation, you will need to create a Part 107 account on FAA DroneZone.
- Register your drones in the UAS inventory in the Part 107 dashboard.
- If you need to, you can add additional "Part 107 Users" through a two-step verification process.
- Note: A certificated remote pilot operating on behalf of this account must carry a copy of the registration for the drone they are flying and any applicable authorizations/waivers needed for the operation.
- If you have questions or comments, *contact the UAS Support Center*.

Where can you fly your drone?

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- *Where can I fly?*
- *Learn about educational users*

Certificated Remote Pilots including Commercial Operators

- Become a Drone Pilot
- Operations Over People
- Part 107 Waiver
- UAS Facility Maps
- Part 107 Airspace Authorizations

FAA-Recognized Identification Areas

- *FAA-Recognized Identification Areas (FRIAs)* are locations where drones can be flown without *Remote ID*. Educational institutions, including primary and secondary educational institutions, trade schools, colleges, and universities are eligible to request the establishment of a FRIA.

Part 107 Waivers

user identification tool

- Some operations will require a waiver. Here are the regulations specified in §107.205 that are subject to waiver:
- *Operation from a moving vehicle or aircraft - §107.25*
- *Operation at Night - §107.29(a)(2) and (b)*
- *Visual line of sight aircraft operation - §107.31*
- *Visual observer - §107.33*
- *Operation of multiple small unmanned aircraft systems - §107.35*
- *Yielding the right of way - §107.37(a)*
- *Operation over human beings - §107.39*
- *Operation in certain airspace - §107.41*
- *Operating limitations for small unmanned aircraft - §107.51*
- *Operations Over Moving Vehicles - §107.145*

Easy Steps

- Step 1: Learn the Rules
- Step 2: Become an FAA-Certified Drone Pilot by Passing the Knowledge Test
- Step 3: Register your Drone with the FAA
- **Registration costs $5 and is valid for 3 years.**
- Remember
- **Always fly your drone safely and within FAA guidelines and regulations.**
- **It is up to you as a drone pilot to know the rules of the sky, and *where it is and is not safe to fly*.**
- **Aren't sure if Part 107 is right for you and your operation? *Contact us* for more information.**

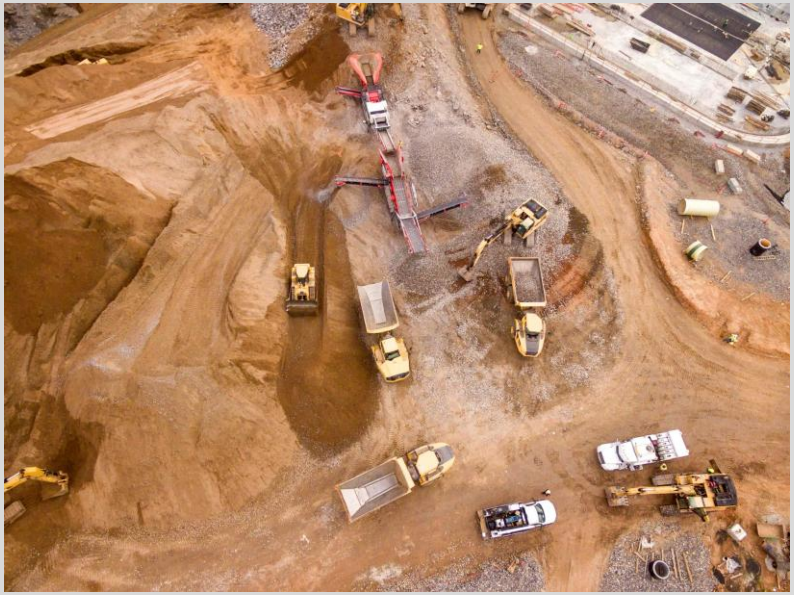
How are drones being used today?

- The top industries for drone applications are Energy, **Construction**, and Agriculture, in that order.
- The top drone applications are ***Drone Mapping & Surveying***, Drone Inspections, and Drone Photography & Filming, in that order.

What Are the Main Benefits Drones Provide?

- We hear about drone benefits all the time—they make inspections cheaper, faster, safer, and often better, for instance.
- These benefits are touted so often that we may run the risk of forgetting how remarkable it is that one tool can make a variety of work not just faster, safer, and cheaper—but also actually of better quality, all at the same time.
  - Reducing the time needed to do a given job
  - Reducing the costs associated with a given job
  - Improving the quality of the output for a given job
  - Improving worker safety for a given job
- All four of these benefits work together, creating a powerful combination of value for any industry using drones, regardless of its specific needs.

EXAMPLES



Drones for Surveying and Mapping

(Hey Luis! Show video) – 01

Documenting Construction Progress with Drones

Advantages of Using Drones for Architects

- When it comes to architecture, the deployment of drones brings several advantages, including improved efficiency and reduced costs. One of the foremost advantages is the improvement of design. Drones can take high-resolution photographs, and 3D designs, which make it easy for architects to design from the perspective of their surroundings. This leads to a more comprehensive design process since new buildings do not stand alone but rather take into consideration the architectural landscape. Drones have also made it easy for architects, clients, stakeholders, and contractors to communicate effectively.

- An effective way of presenting a design or condition is with the help of aerial pictures and videos, which aid in reducing confusion and improving teamwork. Also, in the field of architecture, drone usage promotes green practices by cutting down the need for multiple site visits and minimizing the effects that traditional methods of surveying have on the environment. This is in tandem with the current trends in the construction industry that focus on the need for environmental consideration in the designed structures.

Advantages of Using Drones in Construction

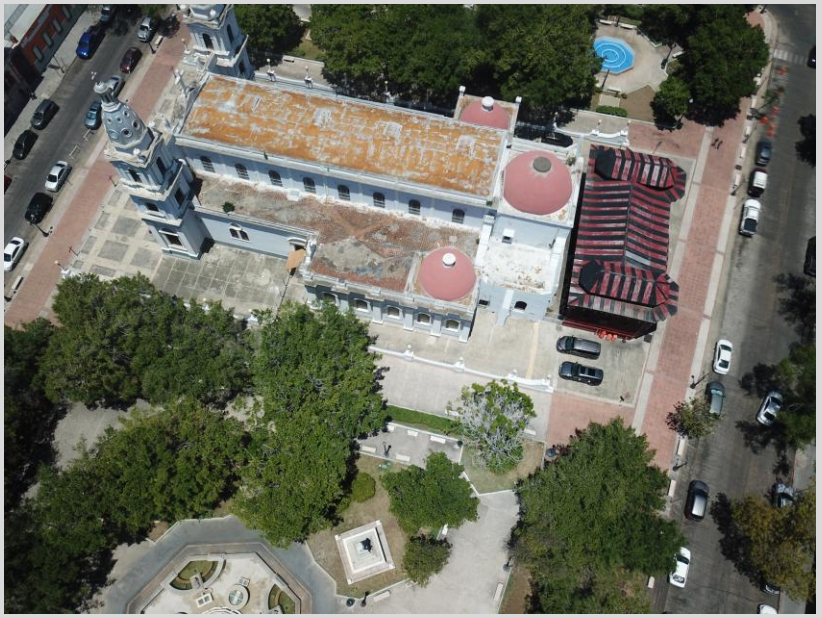
- *Drones are used in construction to*[1][2][3][4][5]:
- Assist with pre-construction site review
- Aerial surveying and mapping
- Measurement of excavation depths and material stockpiles
- Monitoring and documenting jobsite progress
- Productivity, safety and security
- Inspecting work that is difficult or dangerous for human inspectors to reach
- *Survey land, monitor construction assets, provide progress updates, and have even been used to deliver resources to remote parts of a construction site*[3].
- *Collect real-time data about projects and understand what's happening on site*[5].

Types of Drones

- 1. Single-Rotor Drones
- 2. Multi-Rotor Drones
- 3. Fixed-Wing Drones
- 4. Fixed-Wing Hybrid Drones
- 5. Small Drones
- 6. Micro Drones
- 7. Tactical Drones
- 8. Reconnaissance Drones
- 9. Large Combat Drones
- 10. Non-Combat Large Drones
- 11. Target and Decoy Drones
- 12. GPS Drones
- 13. Photography Drones
- 14. Racing Drones

Site and Rooftop Inspections

- Automated drone flights allow teams to seamlessly capture data without time consuming and dangerous manual processes.
- Aerial data is automatically processed and transformed into maps and models for teams to remotely measure distances, calculate volumes, and visualize the site in 3D
- Compare to designs and share with project stakeholders to collaborate on inspection results and details using embedded links for individual projects



Use aerial data to safely inspect the progress of site work and perform rooftop inspections for maintenance and repair.

Walkthrough for Interior and Ground Inspections

(Hey Luis! Show videos) – 03 & 04

- Frequently walk the interior of buildings, facility yards, and alongside assets for maintenance inspections and documentation of as-built conditions for construction.
- Remotely inspect automatically uploaded and processed 360 data from the safety of an office – from anywhere in the world
- Compare current conditions to maintenance plans, floor plans, and previous walkthroughs for documentation and immediate corrective action and share results with key stakeholders.

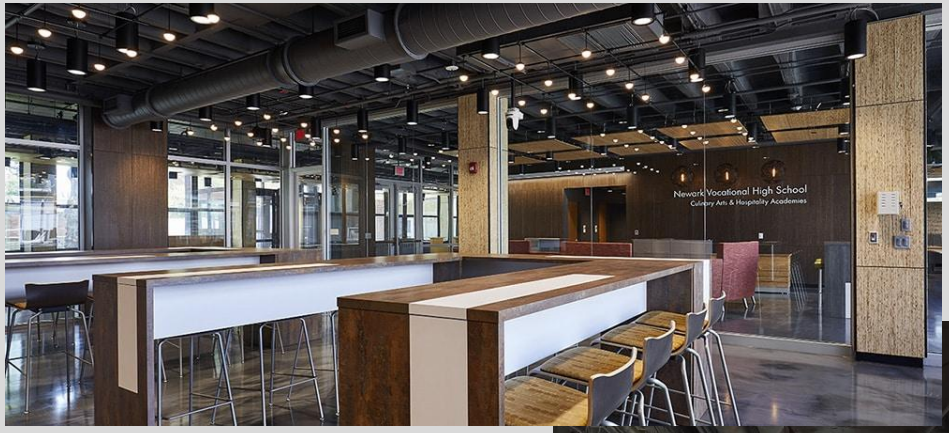
Using Walkthrough, easily capture each step of the project to coordinate planning, visualize site progress, and conduct inspections from ground level.

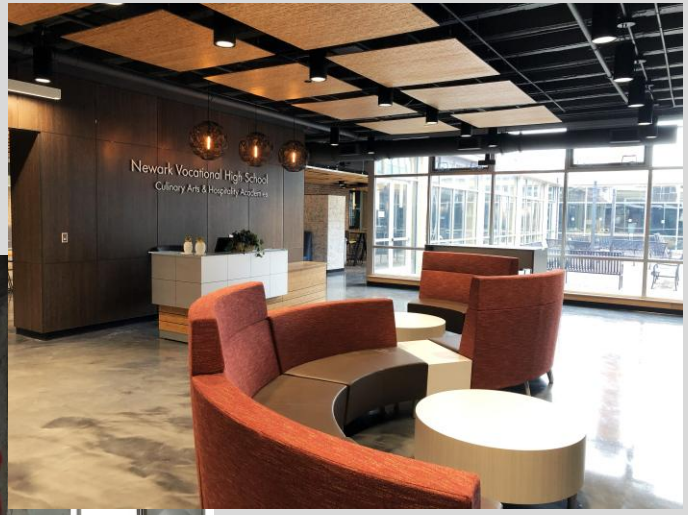
Vertical Flight for Facade and Vertical Structure Inspections

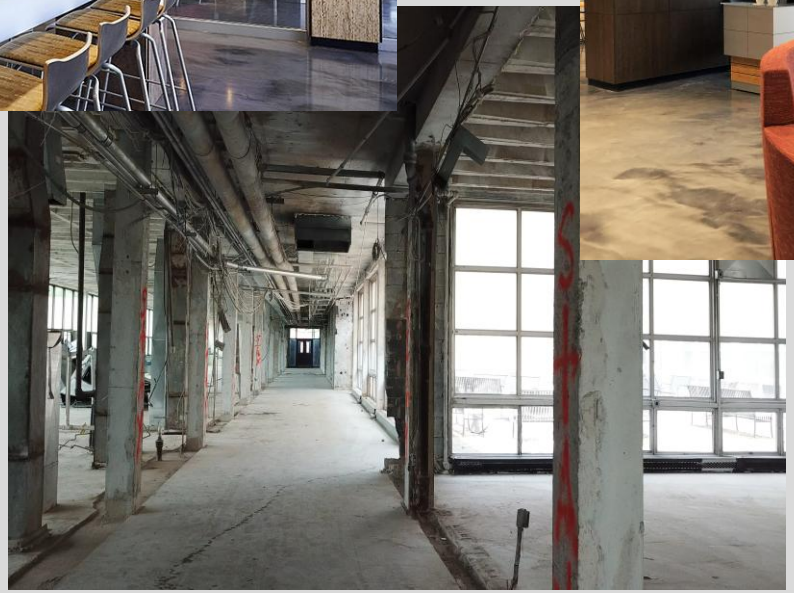
(Hey Luis! Show video) - 05

- Improve efficiencies and workflows with drone-based inspections for dangerous and challenging inspections on vertical structures.
- Perform pre-construction inspections with drones and win more bids with high resolution 3D models of existing facade conditions
- Complete punch lists and as-built documentation, and safely inspect sheathing, waterproofing, and finishes without placing workers at risk
- Document existing conditions for regular maintenance inspections on structures with high resolution Skydio 3D Scans and DroneDeploy

Before and After







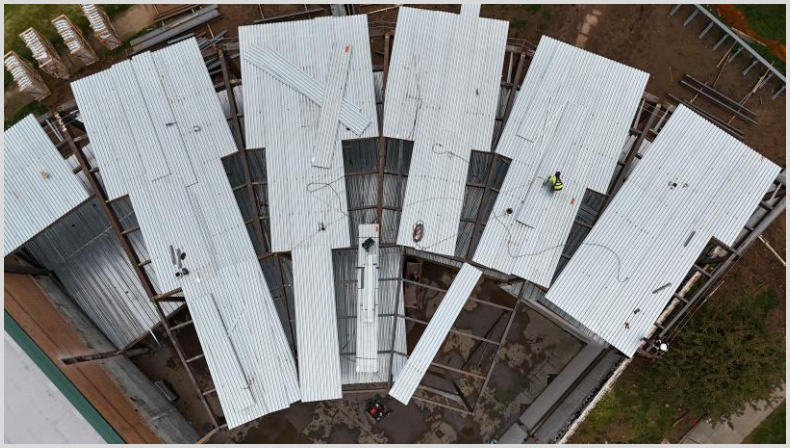
- Matterport is the leading spatial data company focused on digitizing and indexing the built world.

- Our all-in-one 3D data platform enables anyone to turn a space into an accurate and immersive digital twin which can be used to design, build, operate, promote, and understand any space.

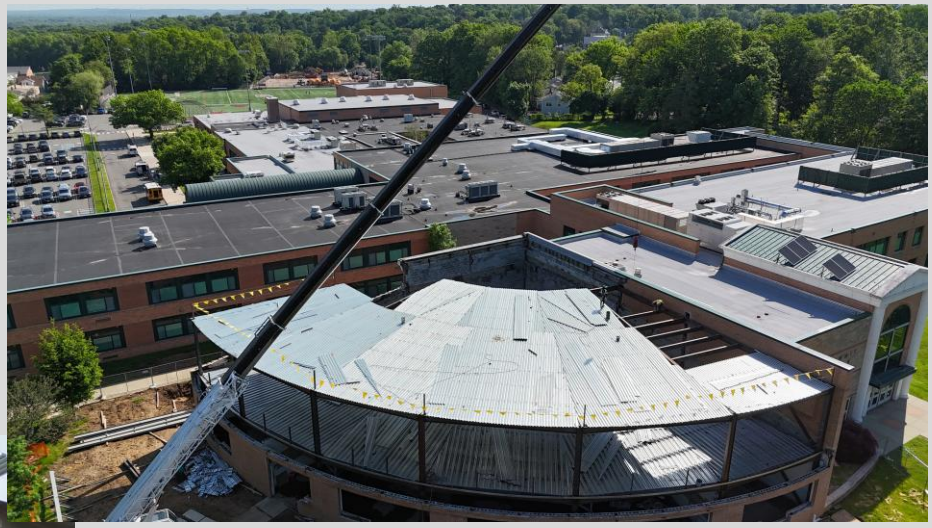
Matterport for Education

School Under Construction

(Hey Luis! Show video) – 07



School Under Construction



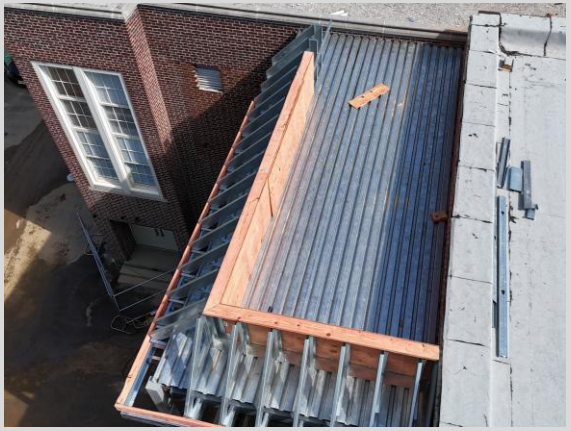
School Under Construction

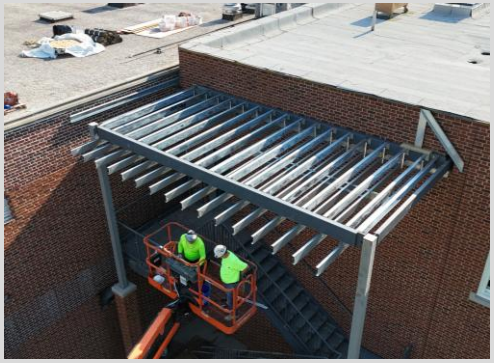
School Under Construction

(Hey Luis! Show video) – 02

School Under Construction

School Under Construction





School Under Construction

(Hey Luis! Show video) – 06

Drone use for Thermal Imaging

Image showing heat loss (yellow, red)

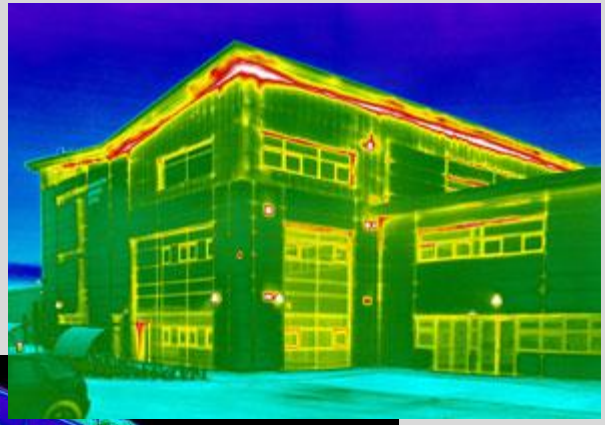
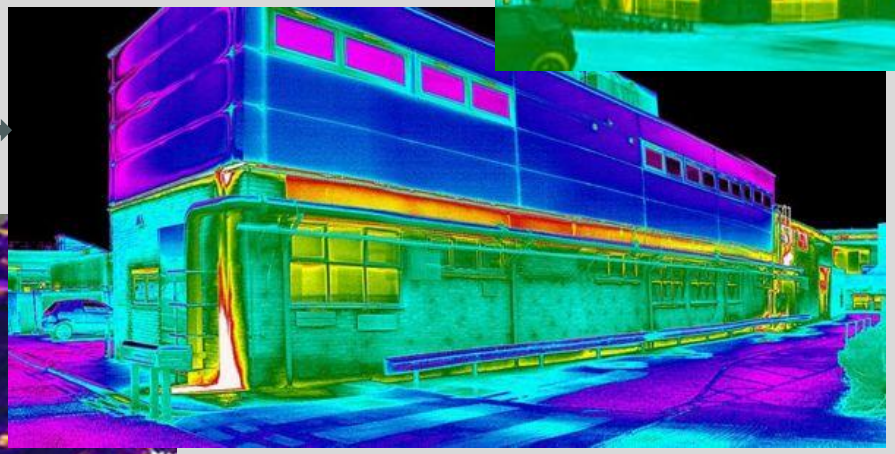


Image showing heat loss (yellow, red, pink)



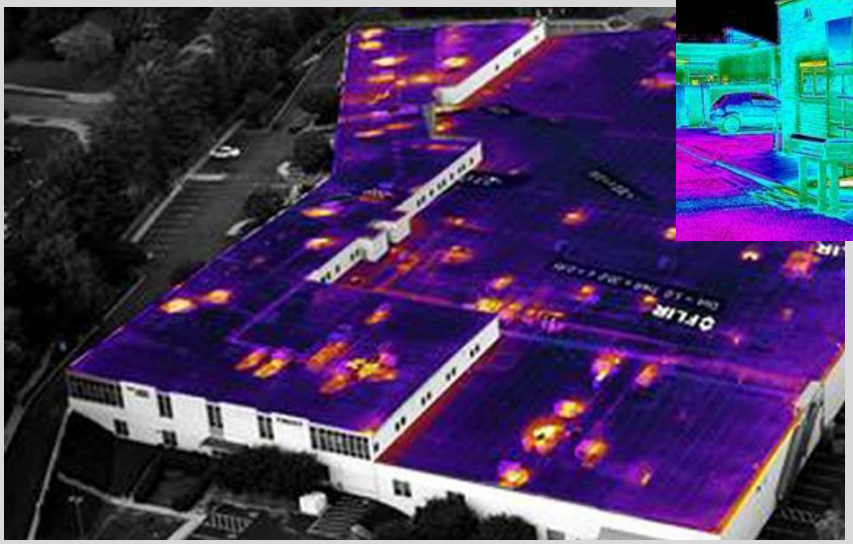
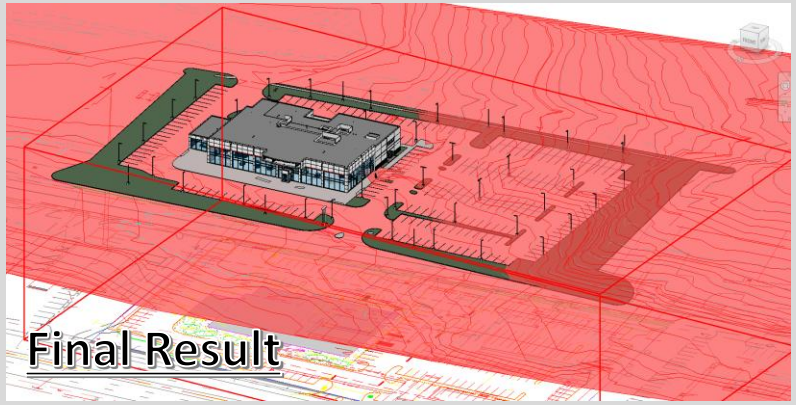
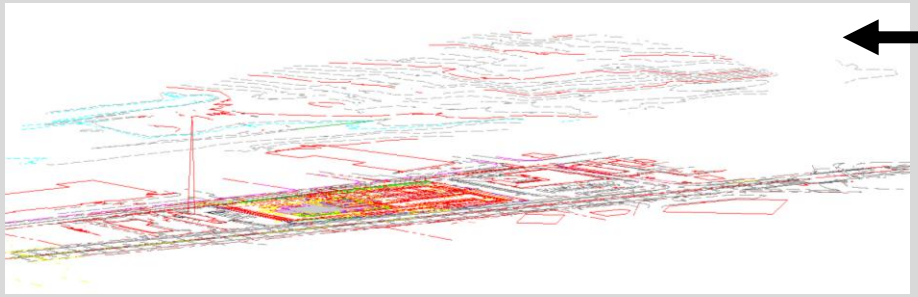
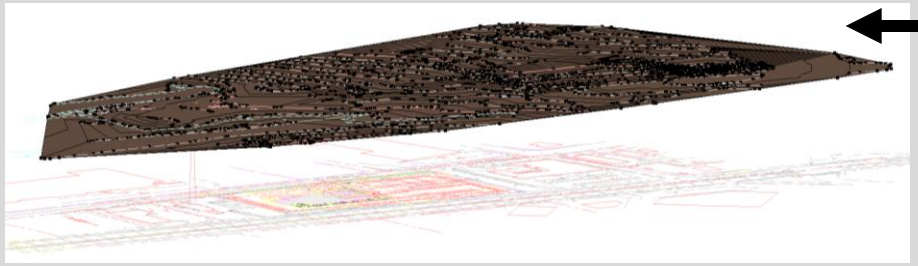


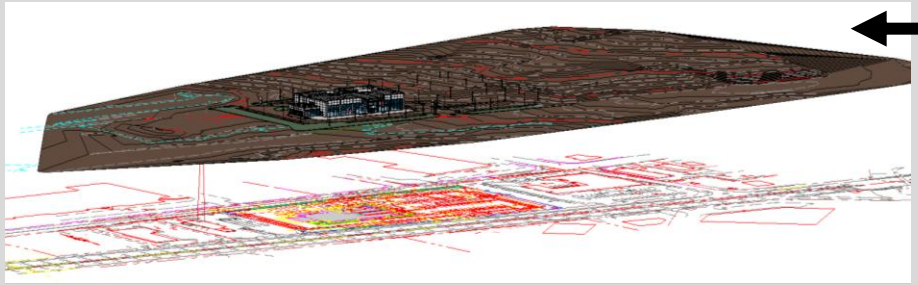
Image showing heat loss through roof insulation via water infiltration (yellow, red)

3D topographic capture used in AutoCad & Revit design







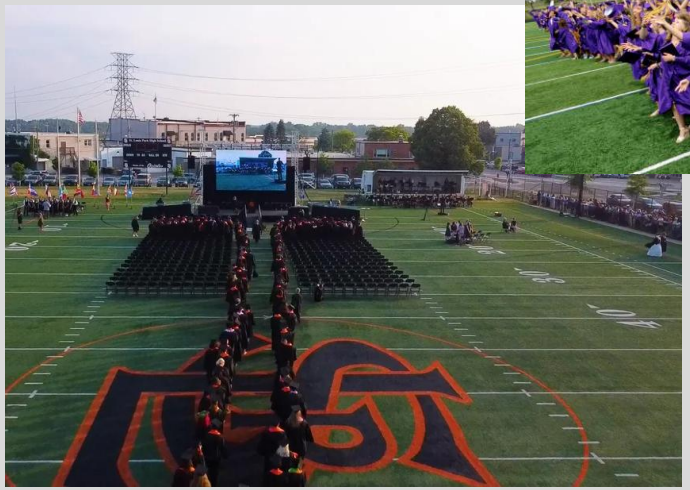


Step 1
Importing topography and surface conditions via 3D scan

Step 2
Generating 3D surfaces from 3D import to be used in locating project

Step 3
Architects and Engineers design projects using 3D models around 3D site import

Graduation



- *Drones can be used during graduation ceremonies, but there are safety hazards and security risks to consider[1].*
- *Some institutions require prior approval for drones that they don't own and operate[2].*
- *Drones are also used in education and for research and development on college campuses[3][4].*
- *However, privately-owned drones are not allowed during graduation ceremonies at certain institutions[5].*

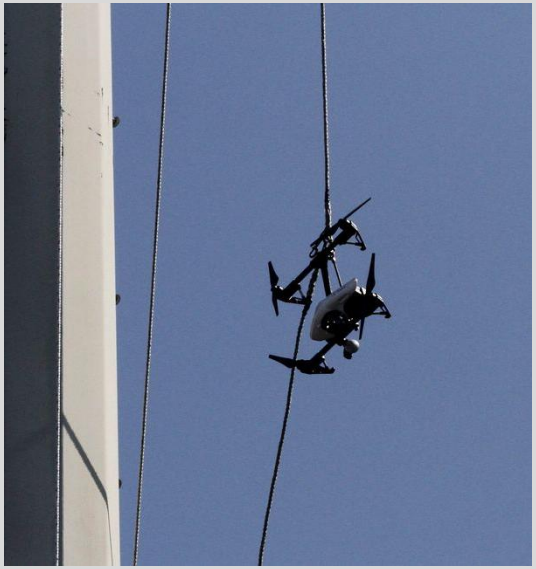
Federal Rules Commercial Operation

- Must weigh less than 55 lbs.
- Must remain within the line of sight of the operator or visual observer.
- May not operate over any persons not directly involved in the operation.
- Daylight-only operations.
- Must yield right-of-way to other aircraft.
- First-person view camera cannot satisfy “see-and-avoid” requirement but can be used as long as requirement is satisfied in other ways.
- Maximum airspeed of 100 mph (87 knots).

Federal Rules Commercial Operation (continued)

- Maximum altitude of 500 feet above ground level.
- Minimum weather visibility of 3 miles from control station.
- No operations are allowed in Class A (18,000 feet & above) airspace.
- Operations in Class B, C, D and E airspace are allowed with the required permission (Operations in Class G airspace are allowed without permission).
- No person may act as an operator or controller for more than one unmanned aircraft operation at one time.
- No operations from a moving vehicle or aircraft, except from a watercraft on the water.
- Requires preflight inspection by the operator.

Federal Rules Commercial Operation (continued)



No careless or reckless operations

Air Space classification

- Class A airspace generally begins from 18,000 feet mean sea level up to and including 60,000 feet. Operations in Class A are generally conducted under Instrument Flight Rules and primarily used by higher performance aircraft, airline and cargo operators, etc.

- Class B airspace utilizes the space surrounding the nation's busiest airports and begins from the surface to 10,000 feet MSL. Class B is made up of several layers of varying sizes and shapes, is individually tailored for the needs of the airspace, and often resembles an upside-down wedding cake, with the airspace widening as altitude is increased.

- Class C surrounds busy airports that are not quite as busy as Class B airports. It is also made up of layers tailored to the needs of the airspace but is not as elaborate as Class B.

- Moving on to lesser and lesser restricted airspace, the Class D airspace exists around airports that still have an operating control tower but are not as busy as the Class C airports.

Air Space classification

- Class E airspace is any controlled airspace not classified as the airspaces surrounding airports. Most of the airspace in the United States is designated Class E airspace. The level of control within Class E airspace is meant for air traffic operating on Instrument Flight Rules, while aircraft flying under Visual Flight Rules usually have the freedom to move throughout the airspace as they wish. Where Class E begins and ends can be complex, but in most areas, Class E airspace begins at 1,200, while others may have Class E beginning at the surface or at 700 above ground level (AGL). The airspace extends up to but not including 18,000 feet MSL, and also excluding any other overlying airspace. Class E begins again above 60,000 feet. There are areas where the base of Class E is depicted on the sectional as starting at different altitudes than standard, such as offshore surrounding the contiguous United States.

- Uncontrolled airspace is known as Class Golf (G), and is the portion of airspace not designated as any of the previous airspaces. Class G extends from the surface to the base of the overlying Class E airspace. Pilots can operate as they choose, barring any regulatory requirements restricting their movement, such as low altitude aerobatics or conducting activities that may pose a hazard to people or objects on the ground. Most of the airports in the United States are uncontrolled, meaning they have no control tower and pilots must coordinate their own airport operations by utilizing onboard radio if equipped.

Drones can improve school safety

- Drones can improve school safety in several ways[1][2]:
- Surveillance and Monitoring: Drones provide real-time aerial surveillance of school grounds, enabling security personnel to monitor large areas efficiently.
- Rapid Response: Drones can swiftly assess emergency situations, such as intrusions or threats, and relay critical information to authorities for prompt response.
- Drones can be used in high schools for various purposes, including safety during emergency drills, locating missing students or intruders, and filming football or marching band practices[2][3]. However, there are legal considerations and guidelines for drone use on school property[4][5].
- Using drones to improve school safety

RECAP

- Drones are becoming more commonplace in schools nationwide. Schools use drones for a wide array of reasons. This includes inspecting facilities, observing sporting events, filming for marketing and admission, and education uses for science and art. Drones can also be used for safety, during an emergency drill, or for support in a real event, such as to locate a missing student or intruder.
- It's important to create a protocol about using drones at your school if your community wishes to use them. Follow federal, state, and local guidelines. Adopt a policy that makes sense for your school's location and community structure.
- The Federal Aviation Administration (FAA) regulates drone usage, but most drones can fly under the Special Rule for Model Aircraft as long as they meet the following requirements.
- Fly for hobby or recreation ONLY.
- Register your model aircraft.
- Fly within visual line-of-sight.
- Follow community-based safety guidelines and fly within the programming of a nationwide community-based organization.
- Fly a drone under 55 lbs., unless certified by a community-based organization.
- Never fly near other aircraft.

RECAP

- Notify the airport and air traffic control tower before flying within five miles of an airport.
- Never fly near emergency-response efforts.
- Fly no higher than 400 feet and remain below any surrounding obstacles when possible.
- Always keep your drone in eyesight. Use an observer to assist, if needed.
- Remain clear of, and do not interfere with, manned aircraft operations. Always avoid other aircraft and obstacles.
- Do not intentionally fly over unprotected people or moving vehicles, and remain at least 25 feet away from individuals and property not owned by the school.
- Do not fly in adverse weather conditions, such as high winds or reduced visibility.
- Do not fly under the influence of alcohol or drugs.
- Ensure the operating environment is safe and the operator is competent and proficient in drone operation.
- Do not fly near or over sensitive infrastructure or property, such as power stations, water treatment facilities, correctional facilities, heavily traveled roadways, or government facilities.
- Check and follow local laws and ordinances before flying over private property.
- Do not conduct surveillance or photograph people in areas where there is an expectation of privacy without the individual's permission.

RECAP

- Fly the drone only during the day. It must be flown at or below 100 mph.
- Check with local authorities to determine if your school can restrict others from flying drones over your campus when this activity has not been sanctioned by your staff.
- Drones can certainly enhance the educational experience at your school, but safety is important. Feel free to incorporate aspects of this checklist into your school's drone protocol (if you use them on campus) to protect your students, faculty, and staff.
- Additional ISM resources:
  The Source for Private School News Vol. 16 No. 5 *Three Ways to Ensure Responsible Drone Usage*
  The Source for Business and Operations Vol. 11 No. 5 *Your School's Security*

Drone training and resources for School Districts

Schedule a Call:

DARTDRONES

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Sales Manager
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272-207-4710

Questions?

- Luis Rosario, CEFM
  Senior Project Manager
  EI Associates, Architects & Engineers