*Element # 1 Timely Survey and Inventory of Brownfields Sites*

# Drone Certification and Uses

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# Part 107 Small Unmanned Aircrafts Systems

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- The Part 107 License (Remote Pilot Certificate) from the FAA is required for an individual to legally operate drones for any commercial, work-related, or non-recreational purpose in the U.S.
- Where to start:
  - Learn the rules
  - Become an FAA-Certified Drone Pilot by passing the "Unmanned Aircraft General – Small (UAG)" Knowledge Test
  - Research different UAS to see what fits your use case best
  - Register Drone with the FAA

# Learning the Rules of Drone Operation

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- Remote Pilot – Small Unmanned Aircraft Systems Study Guide
  - Official study guide prepared by the FAA
  - Provides an overview of the content you will encounter on the test.
- Remote Pilot – Small Unmanned Aircraft Systems Airman Certification Standards
  - Best form of a checklist – Can review it and highlight topics that you need further work on.
- Additional Content
  - Study Courses – Paid material – Lessons and Mock exams – Self paced content – Typically a guarantee you pass, or they offer a full refund
  - Youtube Content – Free material – In depth guides on individual topics – you can choose what you want to focus on.
- Documentation of Flight Rules and Waivers
  - eCFR :: 14 CFR Part 107 -- Small Unmanned Aircraft Systems (FAR Part 107)
    - Deep dive into the specific regulations and rules you must abide by for certification and flight of a UAS.
  - Part 107 Waivers | Federal Aviation Administration
    - Website where you can find waivers for flying your UAS in specific situations
      - This may be more useful during flight planning after you have your license, but familiarizing yourself with the situations in which a waiver is needed will help you on the exam.

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# Part 107 Exam Layout

- 60 Question exam – 120 minutes
- Must score 70% or higher – Requires 42 correct answers.
- Format – Multiple-Choice: A, B, or C

- Specific Tips are highlighted in the accompanying Word PDF.

- UAG- Unmanned Aircraft General Sample Questions
  - Sample questions provided by the FAA catered towards the exam.

# Taking the Part 107 Test

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- You will need to be:
  - At least 16 years old
  - Able to read, write, speak, and understand English
  - Be in a physical and mental condition to safely fly a UAS
- Obtain an FAA Tracking Number (FTN)
  - You will need this profile to register for the test. A new user guide is available.
- Schedule an Appointment at an approved testing center.
  - The test costs $150 for each attempt.
- **Pass your test!**
- Complete FAA Form 8710-13 – Detailed directions in supporting document.
- After a background check is done, obtain your temporary license to begin operations while you wait for your official one in the mail.
- Licenses must be renewed every 24 calendar months by completing the online recurrent course which includes an open book final exam.

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# Drone Acquisition & Registration

- Large range of brands
  - Due to recent administrative decisions, the range of USABLE brands has been reduced greatly for some entities.
- DJI, a Chinese manufacturer often regarded as the best in the drone world, has been severely restricted.
  - As of December 2025, doing work for federal contracts with a DJI Drone is forbidden. Special exceptions are listed in the linked website.
- The Blue UAS List was created to show drones approved for use by the DOD for use by the federal government.
- When it comes to Tribal entities, the story is different..
  - As a sovereign nation, we can use DJI Drones without restriction. This comes with the drawback of future products being less easy to come by and future infrastructure being questionable unless there is policy change.

# What kinds of Drones are there?

- Fixed wing and Quadcopter, but what's more important is the equipment that can be used with each.
- Important characteristics to consider:
  - Battery life, do you need a drone with lots of battery life to fly very large areas?
  - Camera, do you only require RGB images? Or do you need a thermal camera? Multispectral? LiDAR?
    - Each payload offers a plethora of options, sometimes research for a payload is more important than the drone itself.
- By leading with what your specific use case and needs are, you can easily start to hone down on models

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# Fixed Wing vs. Quadcopter

- Long flight time (Hours)
- High speed
- Large area coverage
  - Good for large scale surveys like pipelines or roads. Fields as well.

- Requires lower wind speed
- More space to take off and land (Even with VTOL Models)
- No hovering
- Higher cost
- Less pilot influence – Routes are premade and pilot interference is more of a suggestion on where to go rather than directions.

- Moderate Flight time (30-60 Minutes depending on model)
- Able to hover and inspect areas from long range or close range.
- Easy maneuverability.
- Able to program flight routes and interrupt immediately if needed.
- Vertical takeoff and landing
- Simpler to fly
- Lower Cost
- Able to get into tight spaces with full control.

- Lower speed
- Lower battery

Both can be equipped with any compatible payload with your specific drone, giving you a range of what you can do depending on what manufacturer you end up going with.

# What to do once you purchase your Drone.

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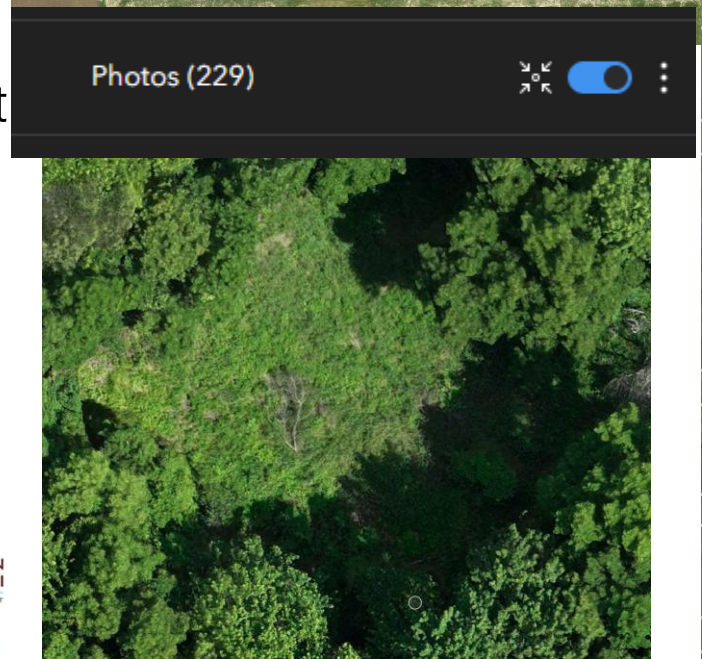
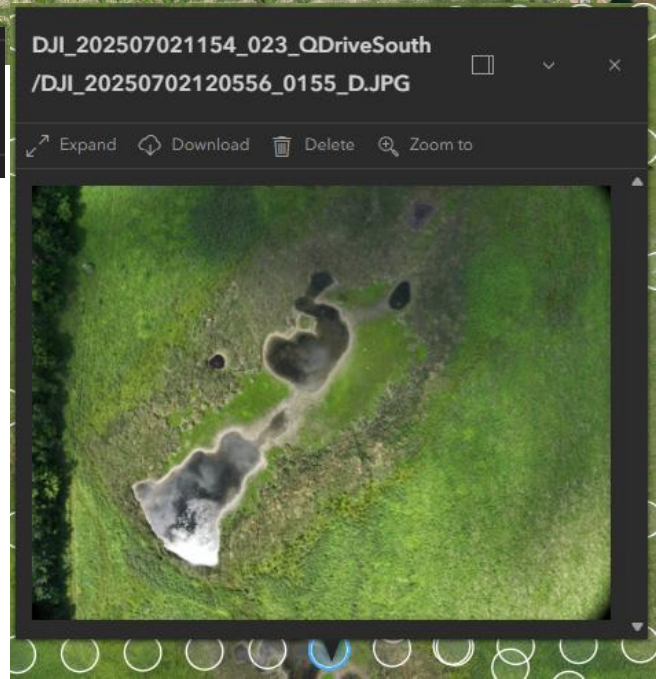
- **Register Drone with the FAA**
- Beginner's Guide for registering your Drone. With a list of information needed to register your drone.
- You will need to go to the DroneZone website and register your new drone for $5.
- This registration needs to be updated every 3 years.
- You will receive an FAA Registration Certificate and must have it in your possession (digital or paper) when you fly.
- Each drone will have a unique registration number that must be labeled on the drone.
- Once that is completed, you can fly your drone in accordance with the FAA Part 107 Guidelines!

# Surveying – Establishing Parameters

- Again, what is your use case?
  - Property Surveys, Repeated site monitoring, Multispectral or LiDAR work?
- On the surface, RGB imaging is adequate for Brownfields application.
- Flying the drone manually and inspecting a specific area is an easy way to look at certain AOIs.
- Orthophotos of properties can track changes over time depending on the frequency of flights. These are in TIFF format for easy GIS use.
  - An orthophoto is a collection of top-down photos that are stitched together to make one comprehensive layer for further analysis.
  - SiteScan is an Esri service that does this analysis and can be linked up with ArcGIS Online.
  - Additionally, SiteScan can be used to manage your organizations fleet and pilots.
- Before we get into what you can do with these, we should go over how to do these.



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# Orthophotos- How to Create

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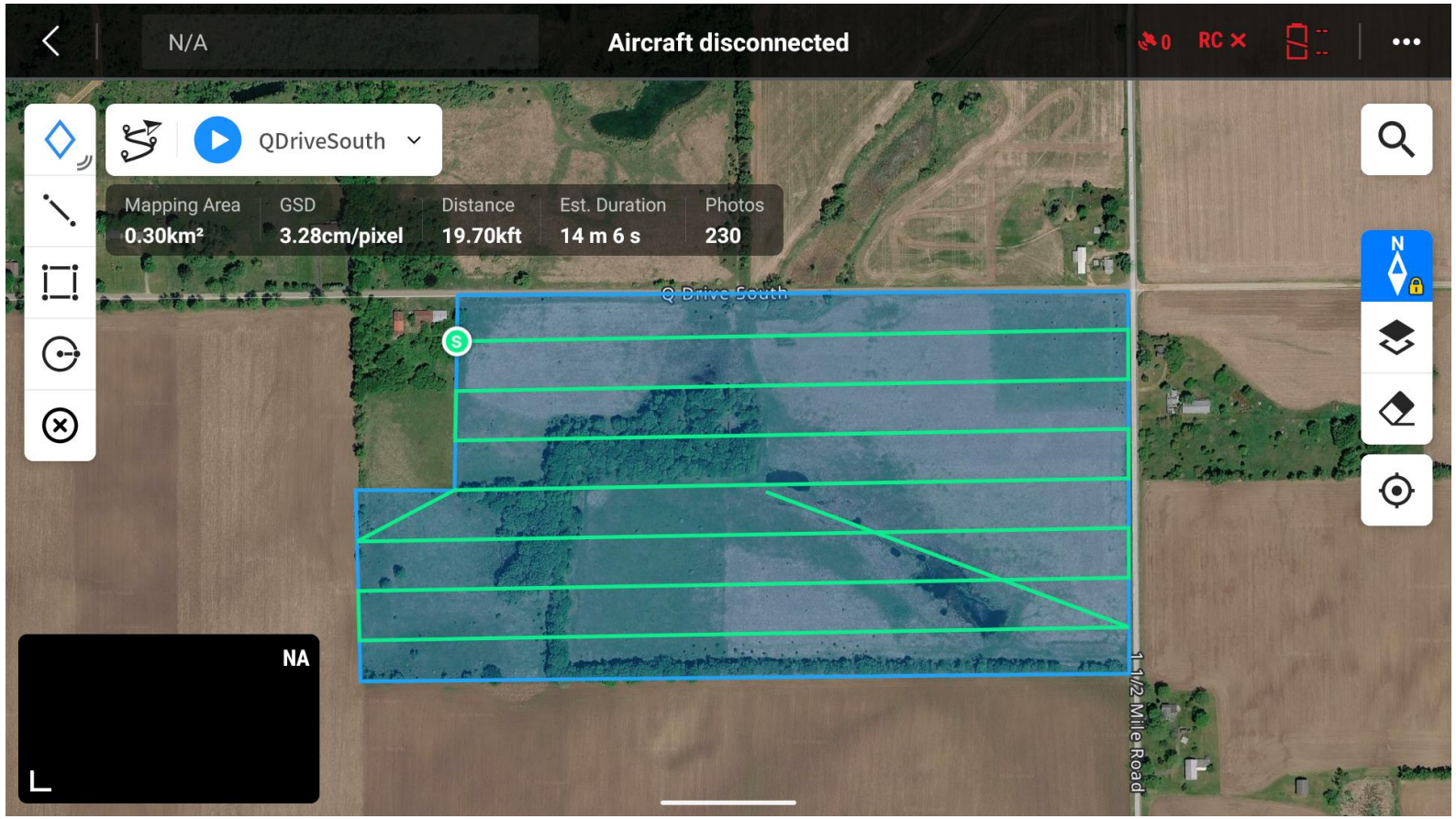
- Flight Planning-
  - Using either native or third-party software, you need to create a flight route.
  - In some flight planning apps, you can overlay your own layers. This can be useful when mapping a parcel such as this one.
  - When drawing your flight boundary, you want to make it larger than the parcel boundary to ensure good quality photos are taken for the full area. You can clip it later on.
  - When setting speed, you want to sit around 15 MPH to reduce blur and obtain quality photos.



# Orthophotos – Parameters: Overlap Ratio

- You can customize your flight altitude and photo overlap to fit exactly what you need.
- Overlap is needed for stitching together the photos, higher overlap gives a more cohesive product.
- **Overlap Ratios:**
  - Optimal/Standard – Forward 80% - Side 70%
  - Minimum for Flat Terrain – Forward 60% - Side 30-40%
  - High Detail/Urban – Forward 85% Side 75-80%

[How to Plan Overlap for Orthomosaic Maps | Anvil Labs]

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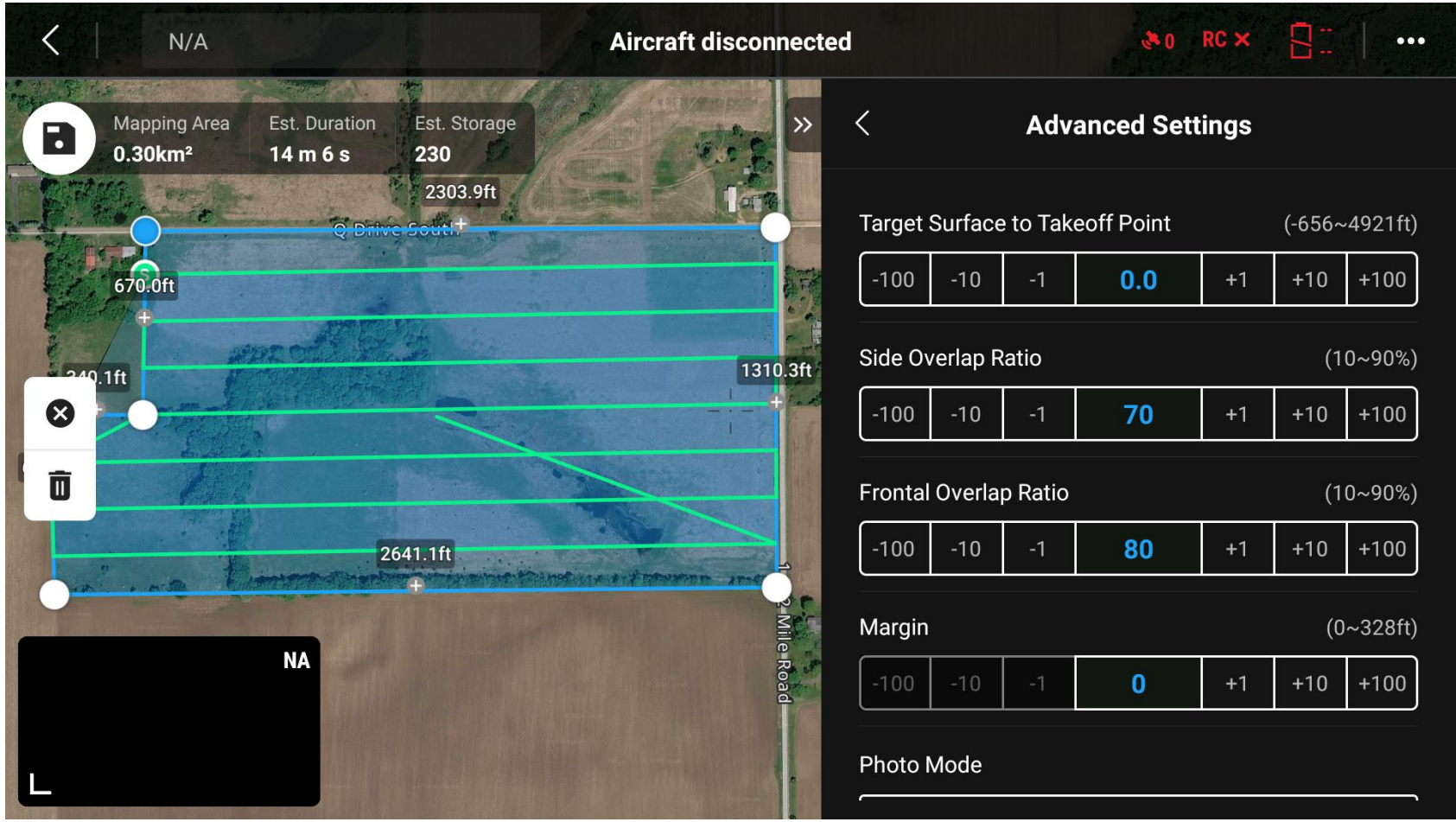

# Orthophotos – Parameters: Flight Altitude

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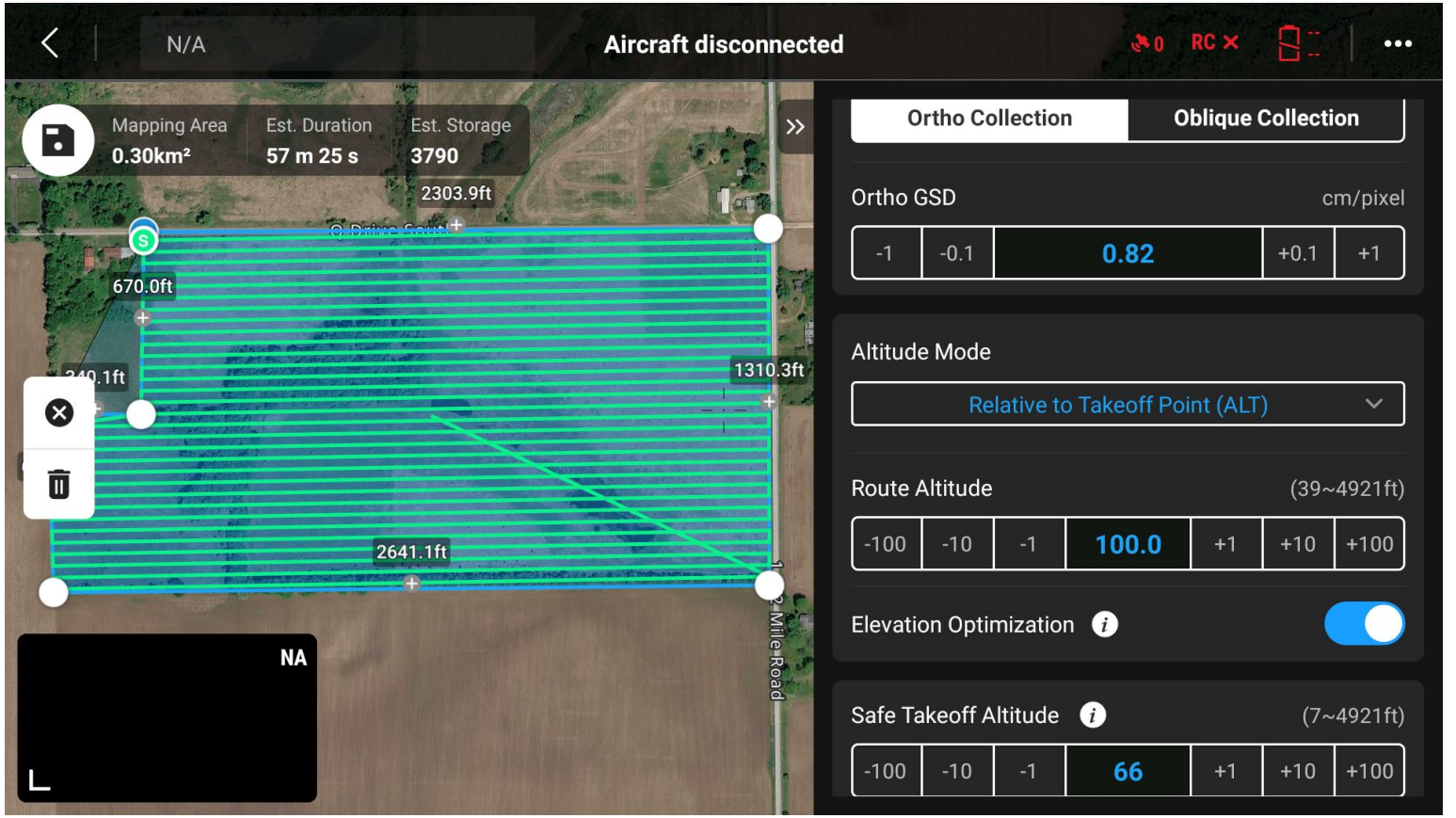
- Flight altitude can never go above 400 feet Above Ground Level (AGL)
- Altitude can alter your product.
- Higher Altitude = Quicker Flight but higher Ground sampling Distance (GSD)
- Lower GSD is ideal for high-detail inspections ("1 cm/px for high-detail inspections like roof surveys")
- 2-3cm/px is suited towards larger scale operations, such as topographic mapping
- Lower GSD also takes up more storage.

- **Specific Example: Flight altitude on a DJI Mavic 3 Multispectral for a ~75 acre parcel**
  - 400 ft – 3.28 cm/px (What I use generally)
    - This is enough for general mapping; some graininess can be noted when zooming in to the closest level. Good for overall land surveys.
  - 300 ft – 2.46 cm/px (Future testing)
    - Only a handful more minutes of flight time, almost a centimeter better.
  - 200 ft – 1.64cm/px (Previously Flown for a Brownfields Application, not this site though)
    - Flight time jumps up, but GSD is at a very good level for analysis.
    - Can lead to some stitching errors due to lower overlap on tall objects.
  - 100 ft – 0.82 cm/px
    - Not recommended
    - Kills storage, is very low to ground, takes forever.
    - Inefficient for such a large area.



# Products- Brownfields Applications

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Whether you just need some photos of an area or want to produce some maps, drone flights are a great method to investigate an area.

Some applications we have made include online maps for specific instances

- Interactive Web Map

Lots of opportunity to scout out and visualize a scene before you walk it yourself!

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