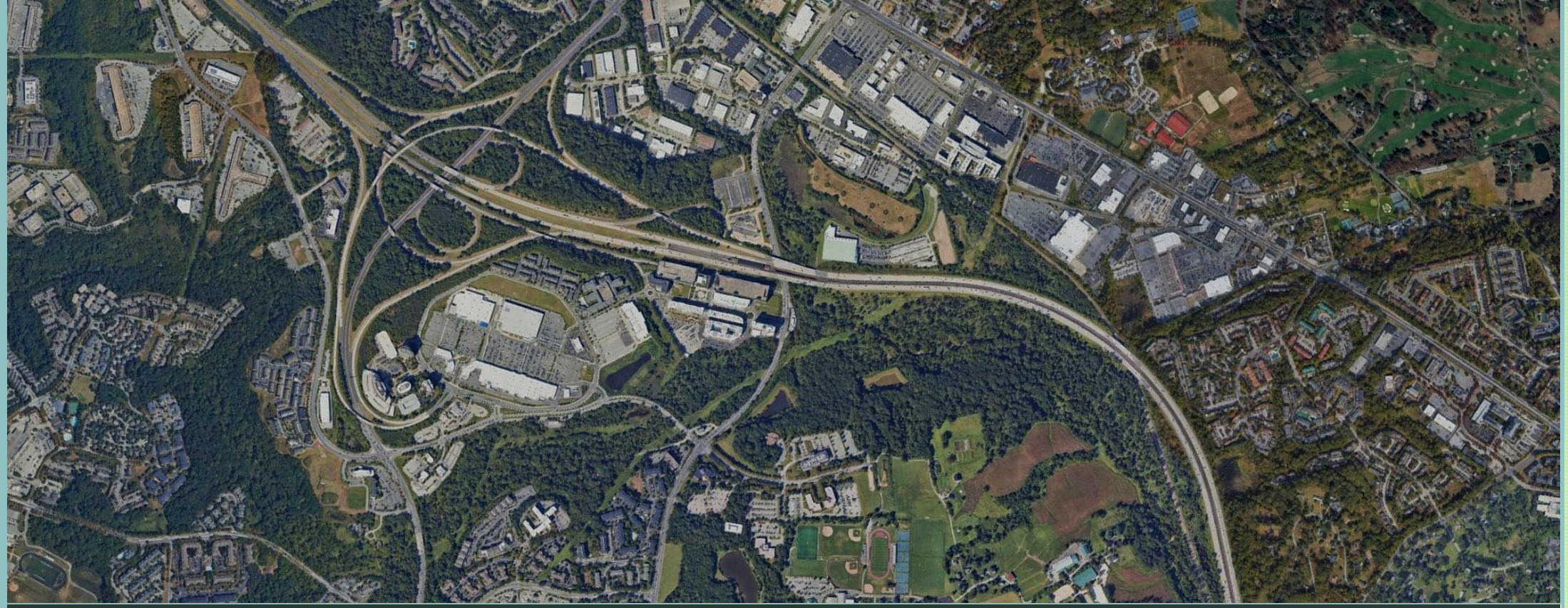


MSS Fall Conference 2025

Aerial Mapping for Small Firms

James M. Shaw, Jr., Prof.L.S.

Reality Capture Deputy Discipline Lead

Johnson, Mirmiran & Thompson, Inc.

- 21 Years as a Maryland Licensed Professional Land Surveyor (2004)
- 37 Years of Surveying Experience (1988)
  - 63% Small Business / 37% Big Corporate
- 18 Years of Reality Capture Experience (2007)
- 8 Years as an FAA Certified sUAS Remote Pilot (2017)
- 20 Years MSS Board Member
  - Past President (2014)
  - Technology, Chair
  - Education, Co-Chair
- 150+ Presentations in 8 States

No Discussing Task Fees & Labor Rates

Why Drone Mapping?

- Accelerates fieldwork and data collection
- Cuts labor costs
- Improves accuracy
- Reduces liability and risk
- Levels the playing field for small firms

DRONES vs UAS vs UAV

Are you leaving money on the table?

THE HIDDEN COSTS OF THE STATUS QUO

Symptoms of Failure to Modernize

- Competitive Disadvantage
- Throughput Limits
- Margin Erosion to Subs
- Safety & Liability
- Data Poverty

Symptoms of Failure to Modernize

- Weaker Evidence
- Higher Unit Costs
- Client Expectation Gap
- Environmental Impact
- Talent Risks

Data is king!

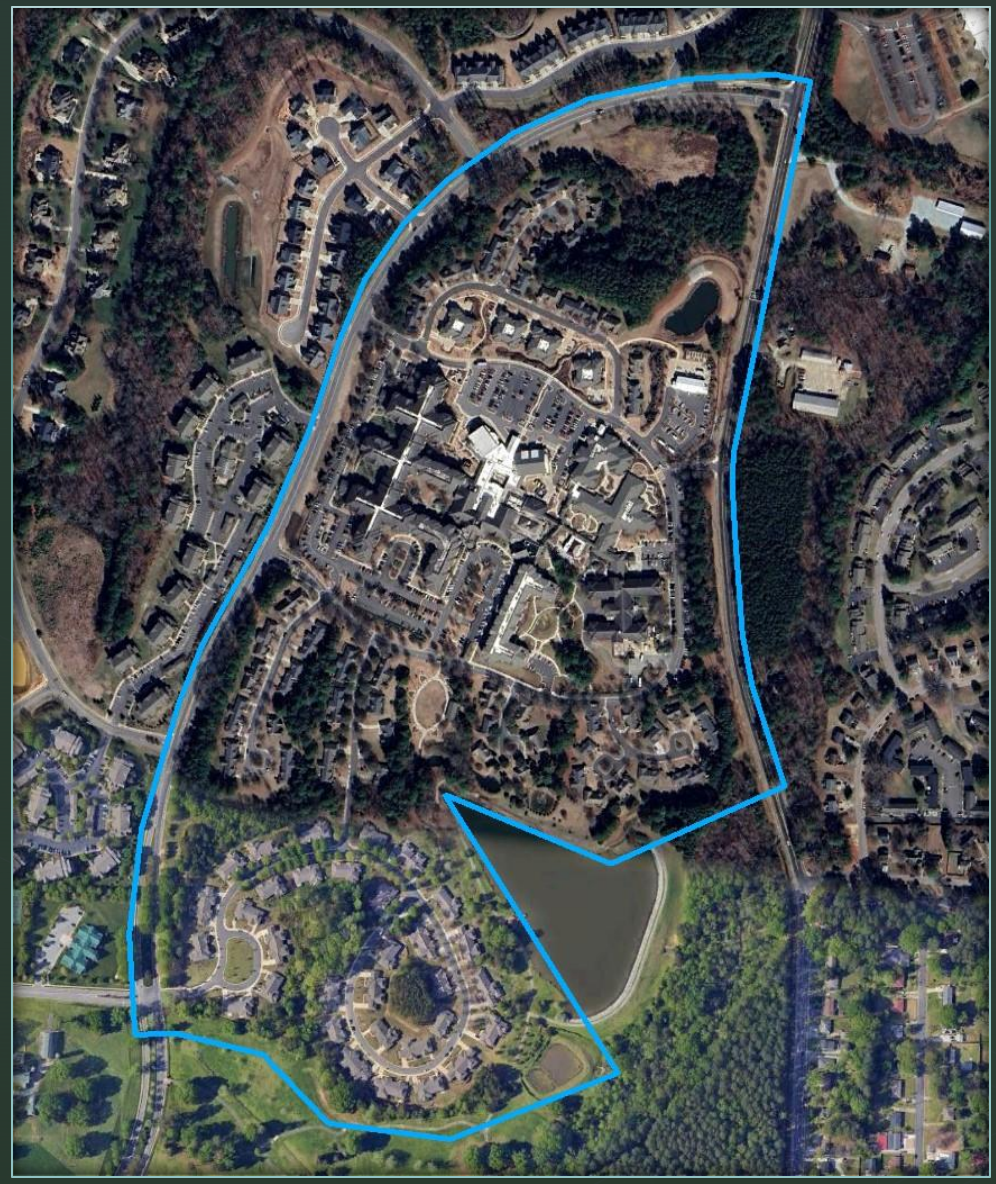
SENSOR PRIMER

Photogrammetric Payloads

- Megapixels matter (GSD)
- Full-frame sensor
- Global/mechanical shutter
- Fixed focal length
- Storage pipeline
- Rigorous EXIF
- RTK/PPP <1ms shutter sync

Case #1:
ALTA Survey

- 120 Acres
- Single Parcel Retirement Community
- 92 Buildings
- 3.6 miles of roads
- Table A, Item 15 (critical!)



Case #1: ALTA Survey

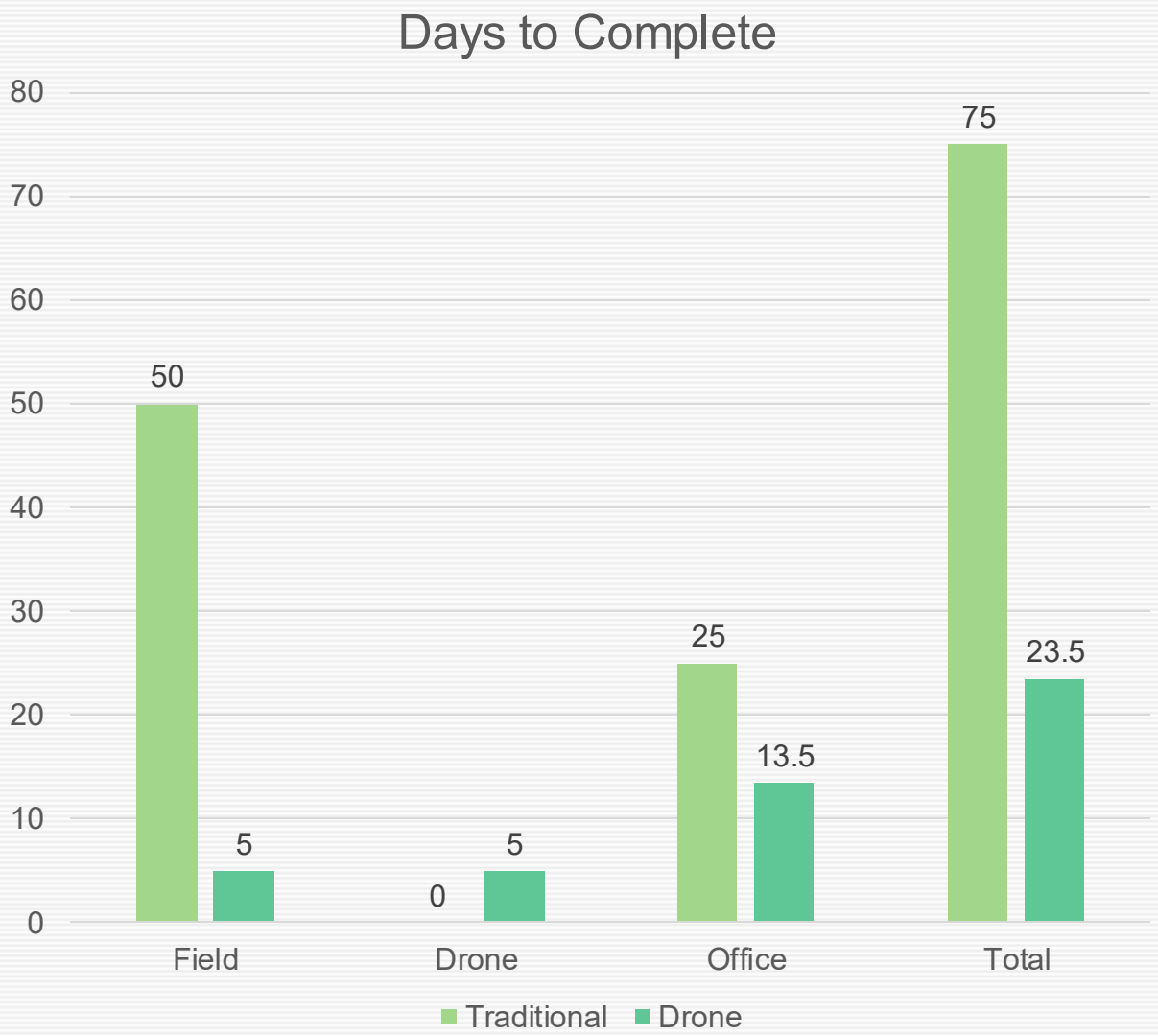


TABLE A

- 15. _____ Rectified orthophotography, photogrammetric mapping, remote sensing, airborne/mobile laser scanning and other similar products, tools or technologies as the basis for showing the location of certain features (excluding boundaries) where ground measurements are not otherwise necessary to locate those features to an appropriate and acceptable accuracy relative to a nearby boundary. The surveyor must (a) discuss the ramifications of such methodologies (e.g., the potential precision and completeness of the data gathered thereby) with the insurer, lender, and client prior to the performance of the survey, and (b) place a note on the face of the survey explaining the source, date, precision, and other relevant qualifications of any such data.

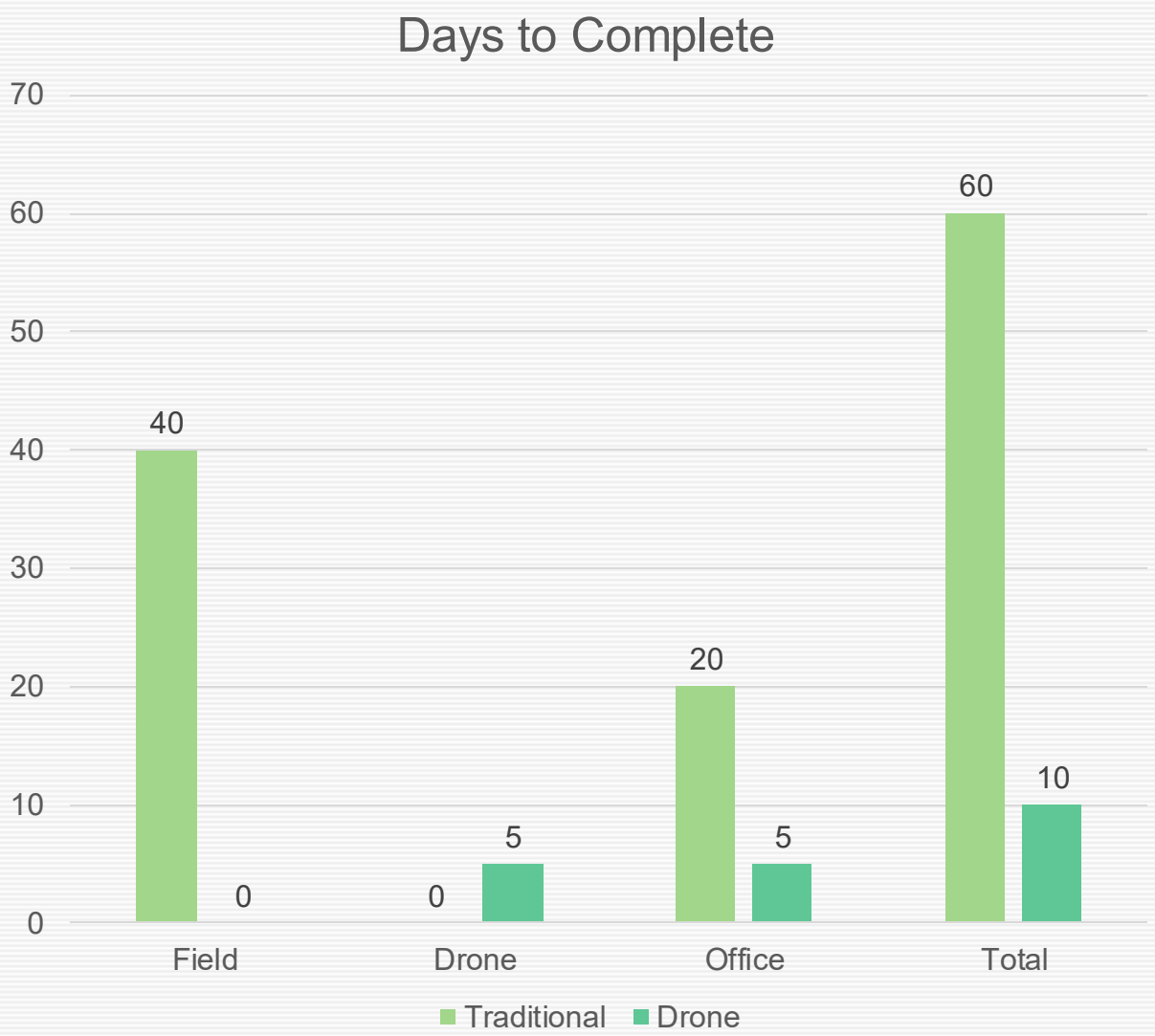
LiDAR Payloads

- Cost
- Weight
- Pulse rate
- Number of returns
- Beam divergence
- IMU grade
- Multi-sensor
- Post-processing software

Case #2: Sand Quarry

- 103 Acres
- Active Site
- Unstable Slopes
- Topo & Volumes
- 28 Acres Wooded
- 50-foot grid = 2,700 points

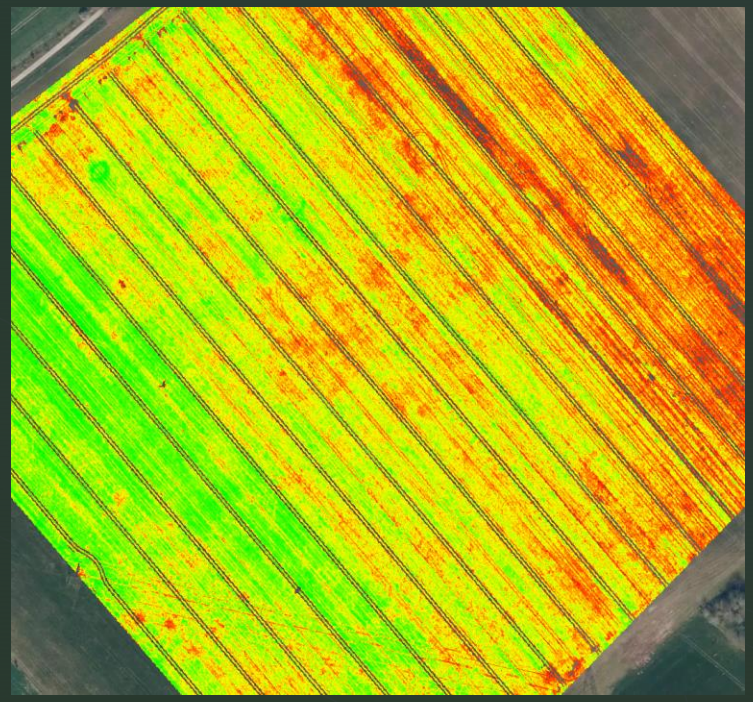
Case #2: Sand Quarry



Case #2: Sand Quarry

- Plot Twist!!!
- 27 Additional Acres
- Requested by client with crews onsite

Thermal / Multispectral



Why Drone Mapping? (Revisited)

- ☑ Accelerates fieldwork and data collection
- ☑ Cuts labor costs
- ☑ Improves accuracy
- ☑ Reduces liability and risk
- ☑ Levels the playing field for small firms

“I feel the need…the need for speed.”

SKILLS NEEDED

Starting a Drone Mapping Team

Aviation

- Part 107 Remote Pilot
- Capable Airframe
- Correct Sensors
- Geodetic Intelligence
- Aviation Insurance

Mapping

- Correct Software
- Geodetic Intelligence
- Spatial Awareness
- Data Storage
- High-End Computers

RETURN ON INVESTMENT

- UAS w/ LiDAR = $60,000
- Pilot Training = $325
- Flight Insurance = $4,000/yr
- Software = $4,500/yr
- Workstation = $7,000

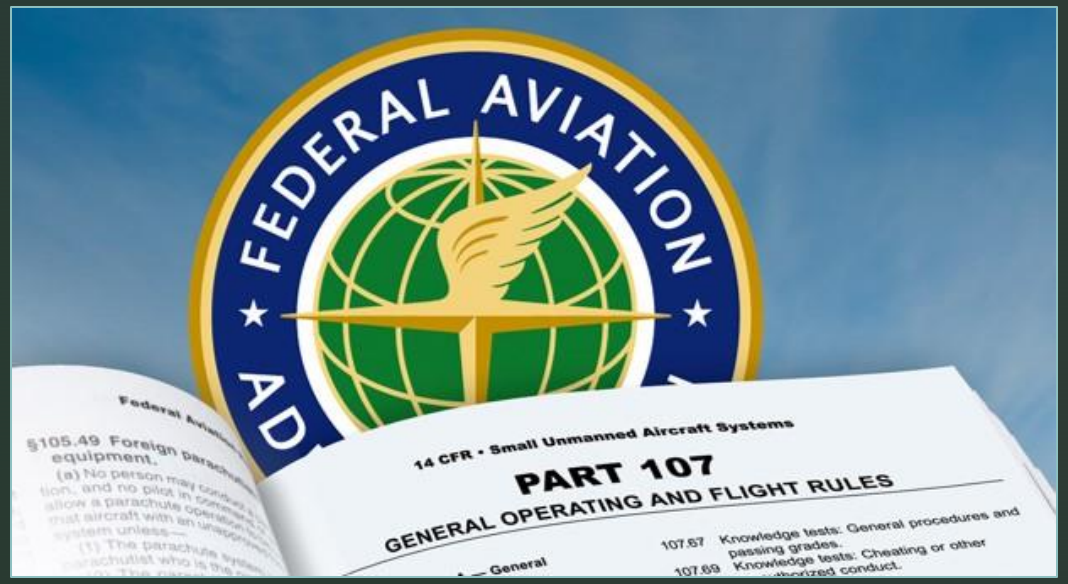
~$93,000 / 3 years = $31,000 * 10% profit = $310k/yr or ~$26k/month

* Technology fee reduces the burden

“Tower, this is Ghost Rider requesting a flyby.”

GETTING YOUR PART 107

All commercial UAS flights require FAA-certified small unmanned aircraft systems (sUAS) remote pilots.



FAA PART 107 INITIAL EXAMINATION

Knowing the Part 107 Rules

Airspace Understanding

Weather Knowledge

Aeronautical Knowledge

FAA PART 107 RECERTIFICATION (EVERY 2 YEARS)

Knowing the Part 107 Rules

Airspace Understanding

~~Weather Knowledge~~

~~Aeronautical Knowledge~~

FAA PART 107 HIGHLIGHTS

Maximum altitude is 400 feet (with exceptions)

UAS must weigh less than 55lbs

No flying over people.

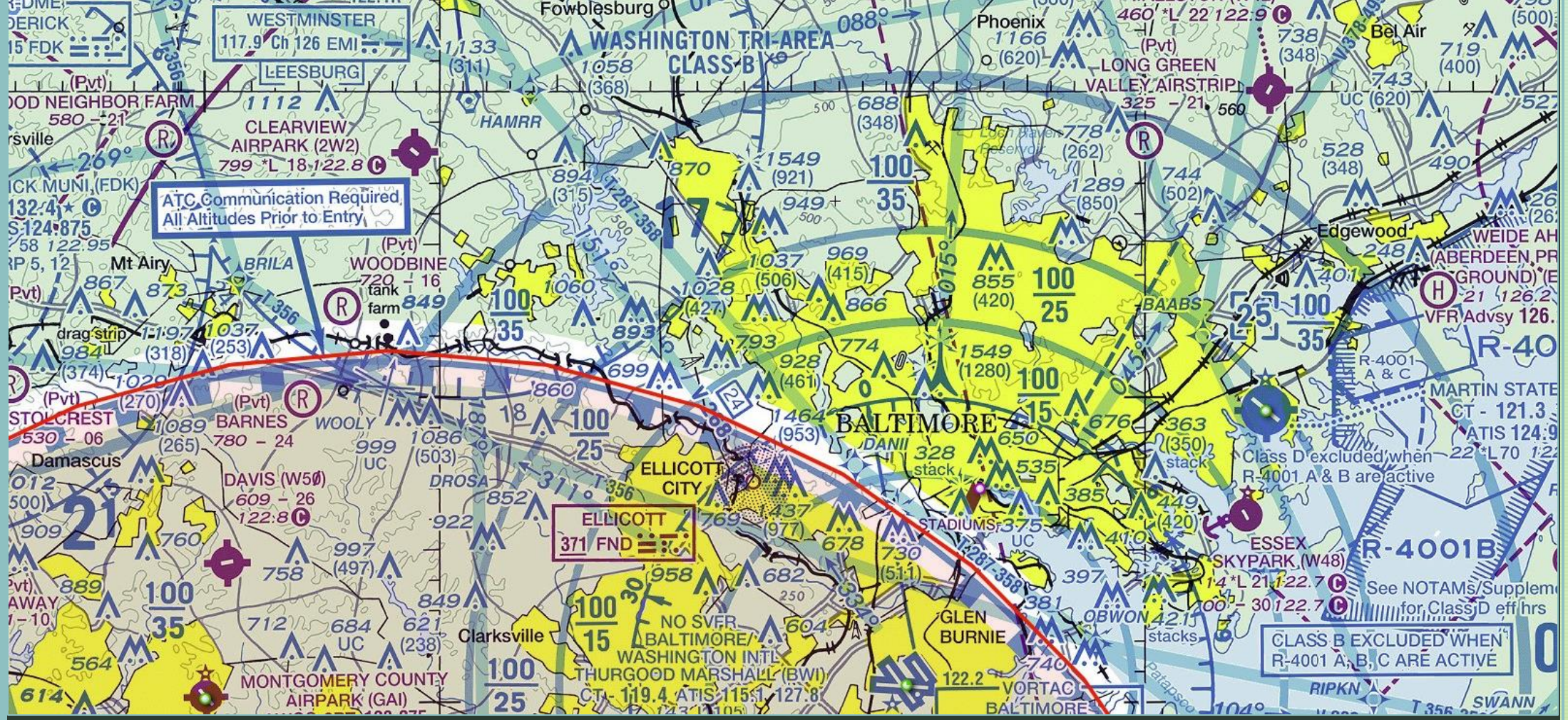
No flying over moving vehicles

Know your airspace and get permission.

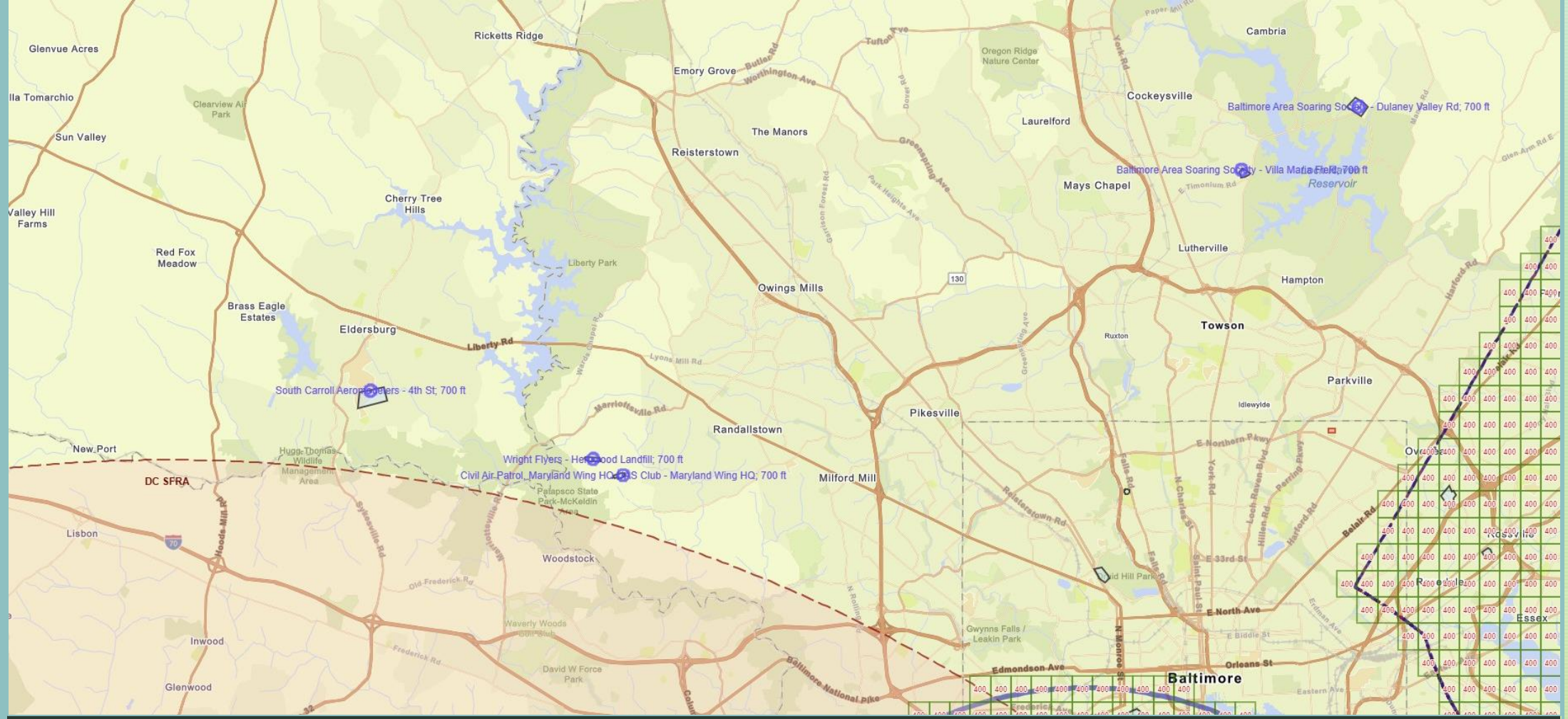
SAFETY!!!

“Negative, Ghost Rider, the pattern is full.”

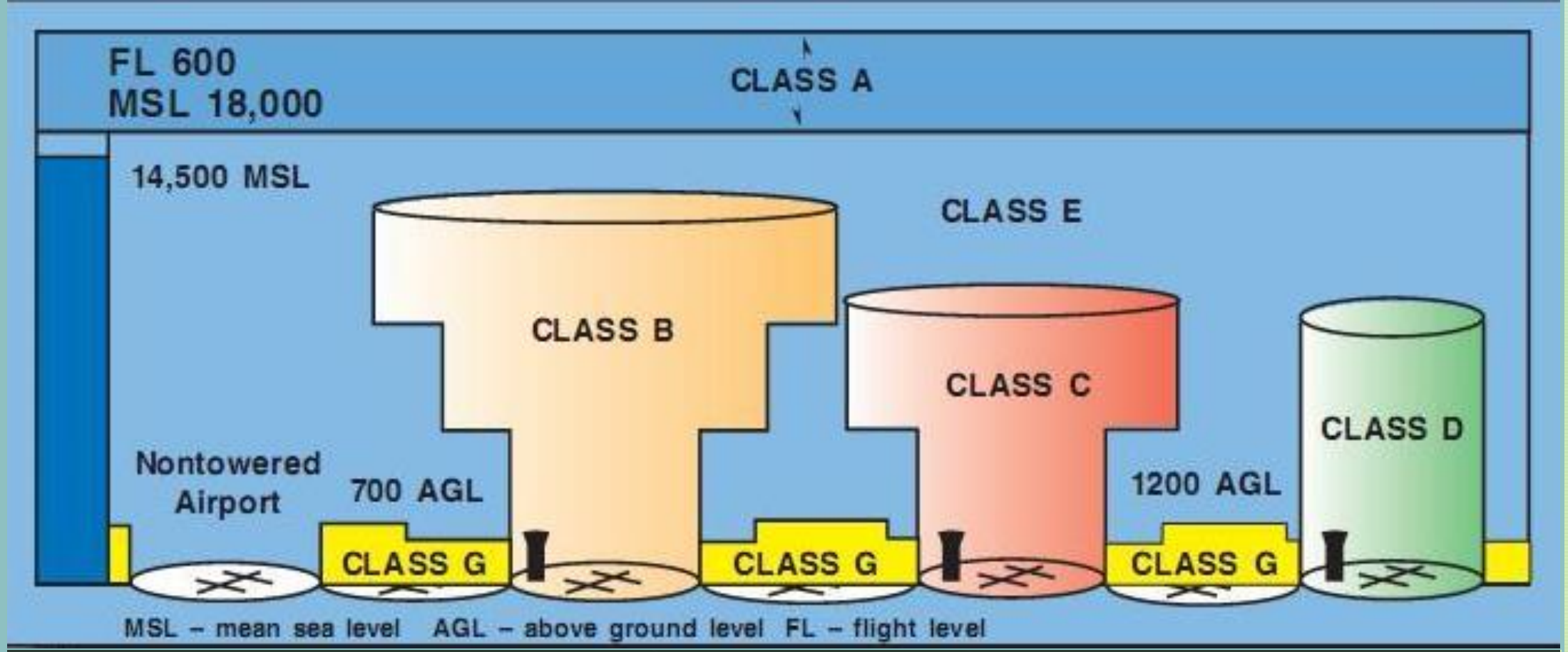
AIRSPACE REVIEW



Owings Mills Section Chart

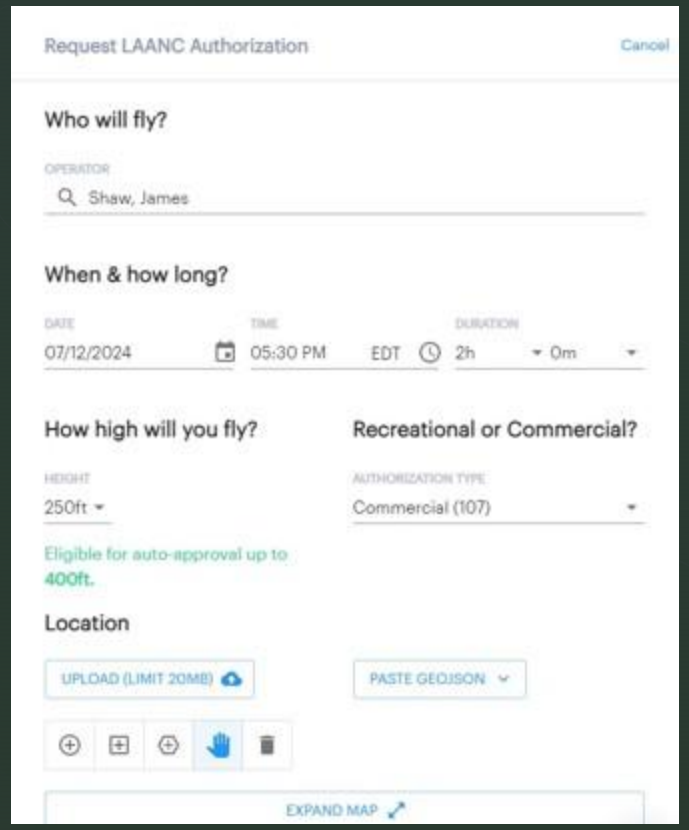


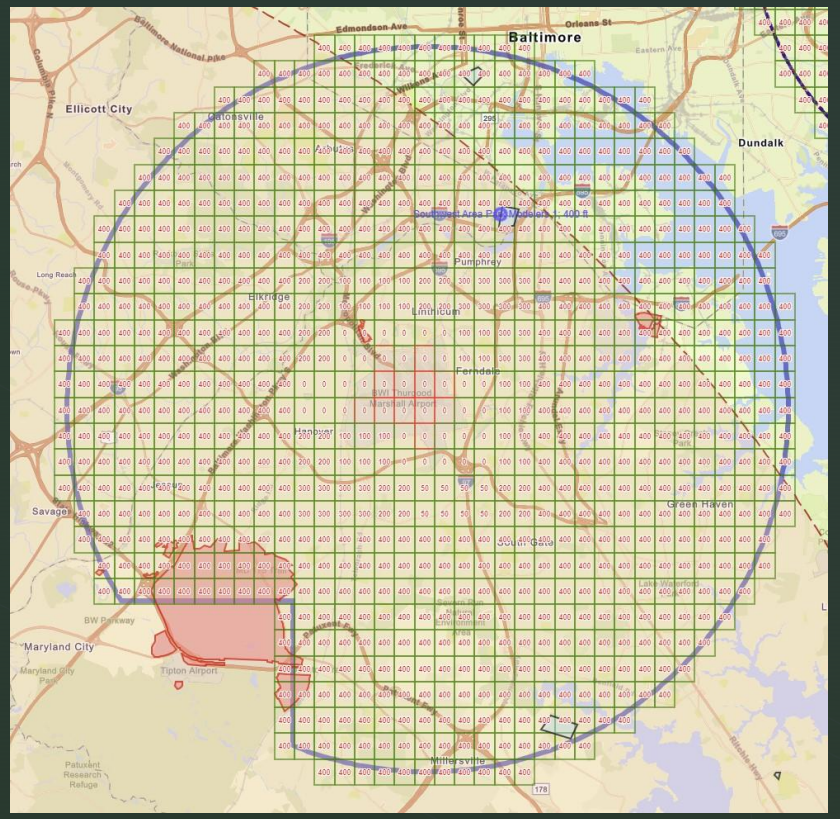
FAA Visualize It



Understanding Airspace

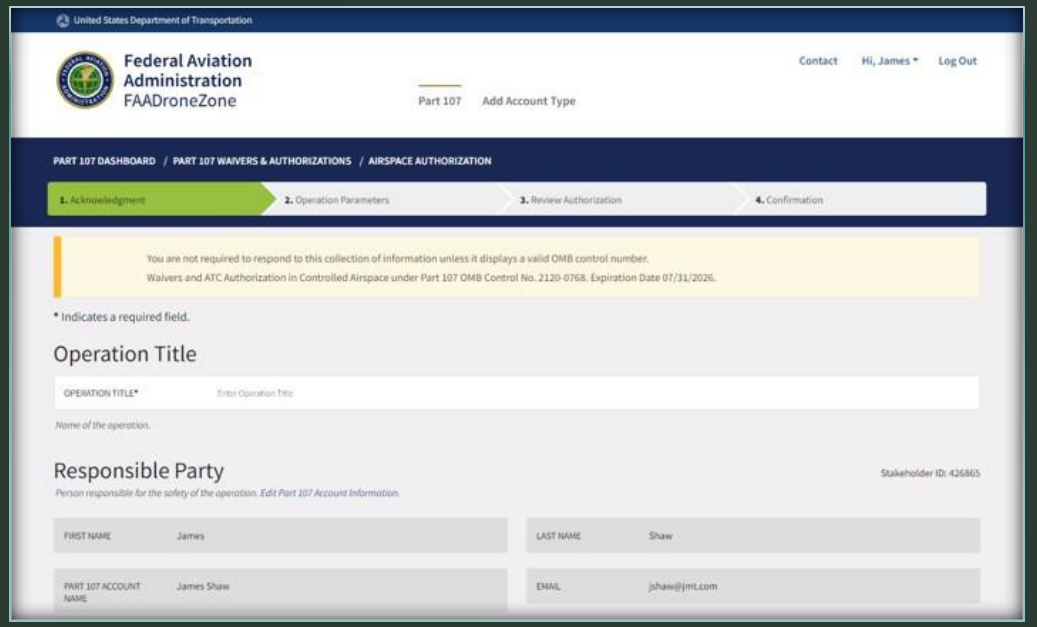
LAANC Authorization





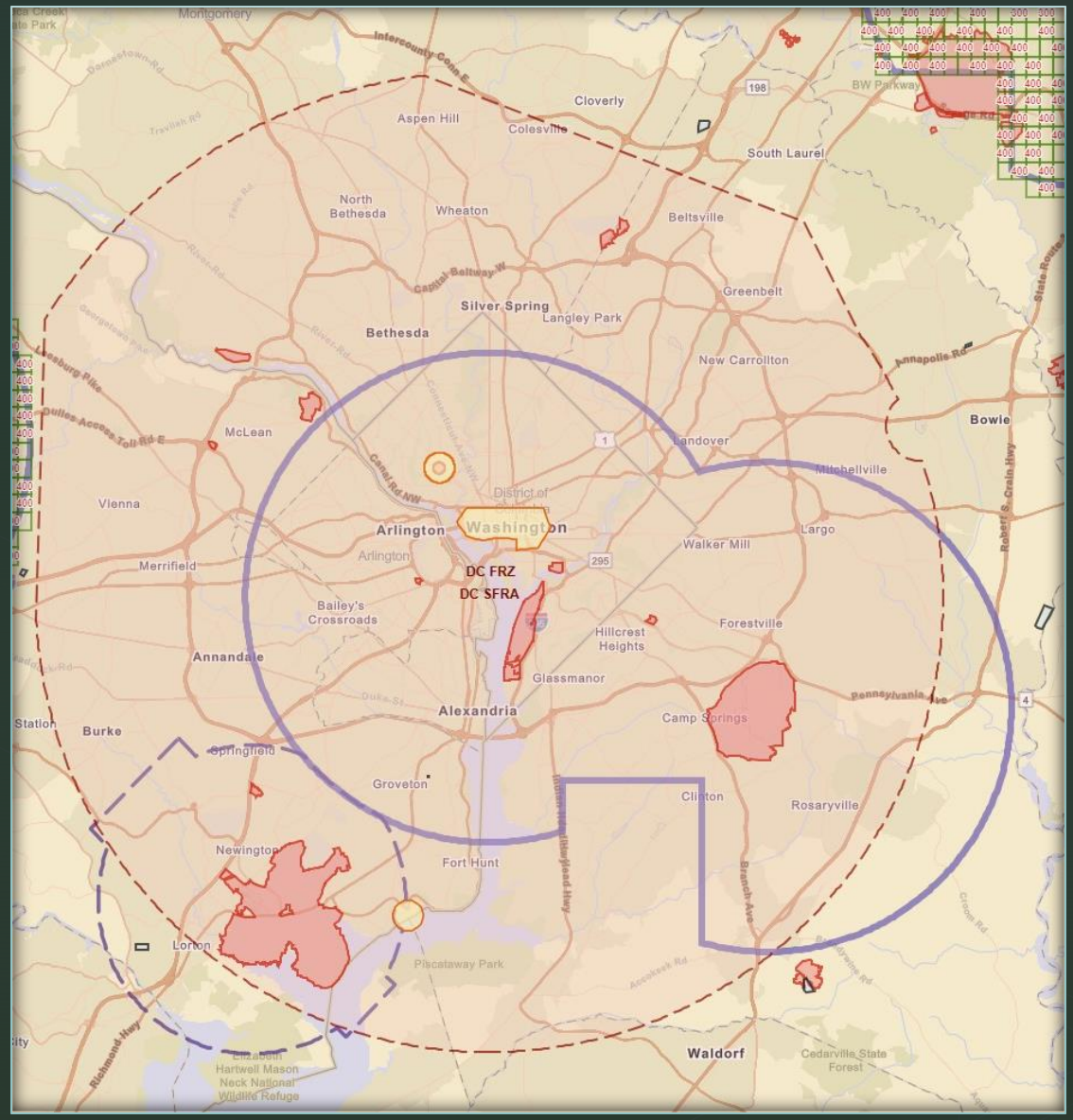
More Complex Air Authorizations & Waivers

- FAA DroneZone
- Outside LAANC Ranges
- Non-LAANC Airfields
- DOD NSURF
- Deviations from Part 107
- 3-12 Weeks



DC FRZ

(Flight Restricted Zone)

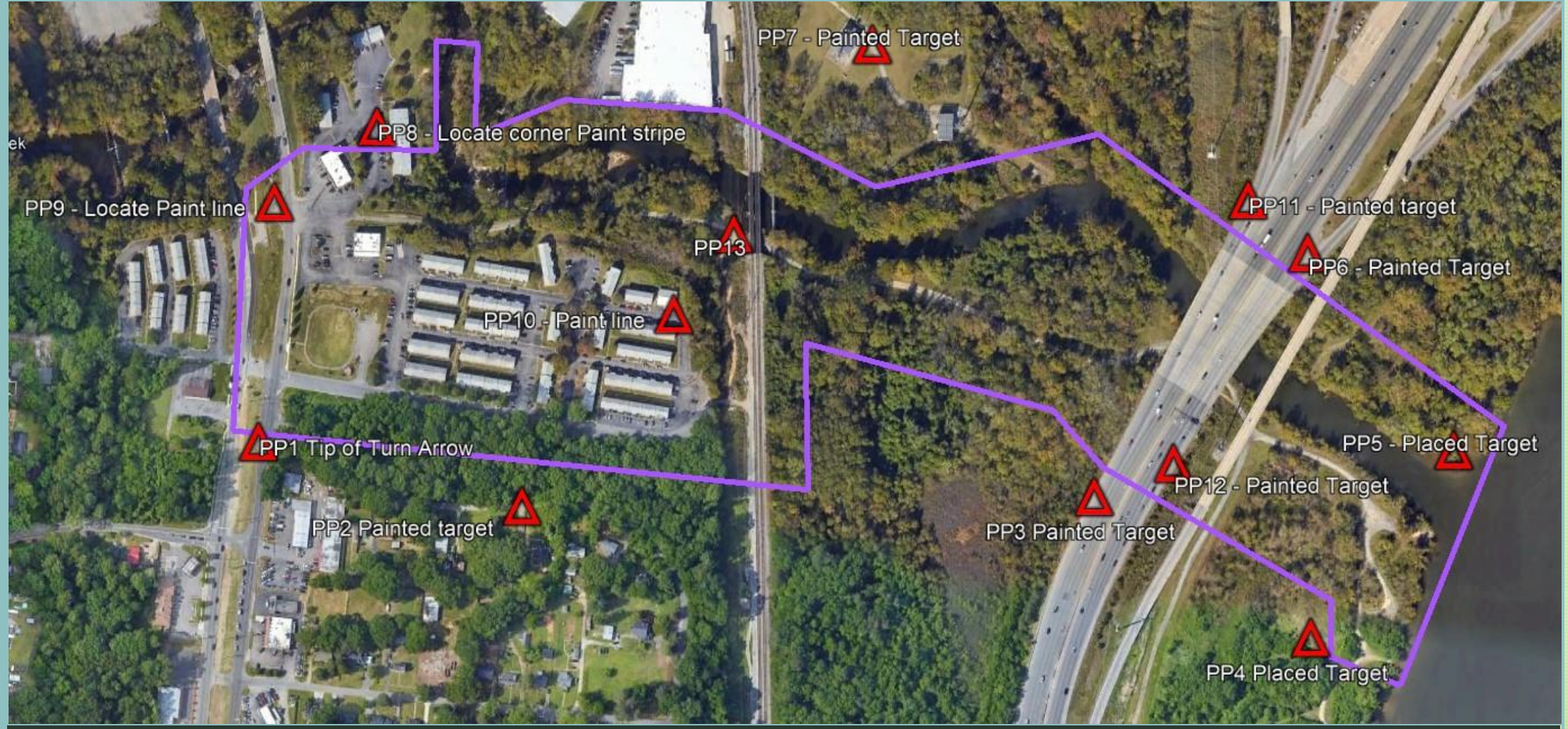


Simple Steps to Success

COMMON DRONE SURVEYING WORKFLOW

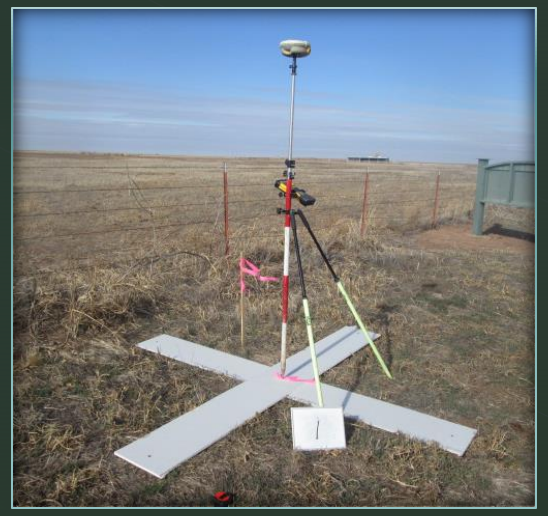
Drone Workflow

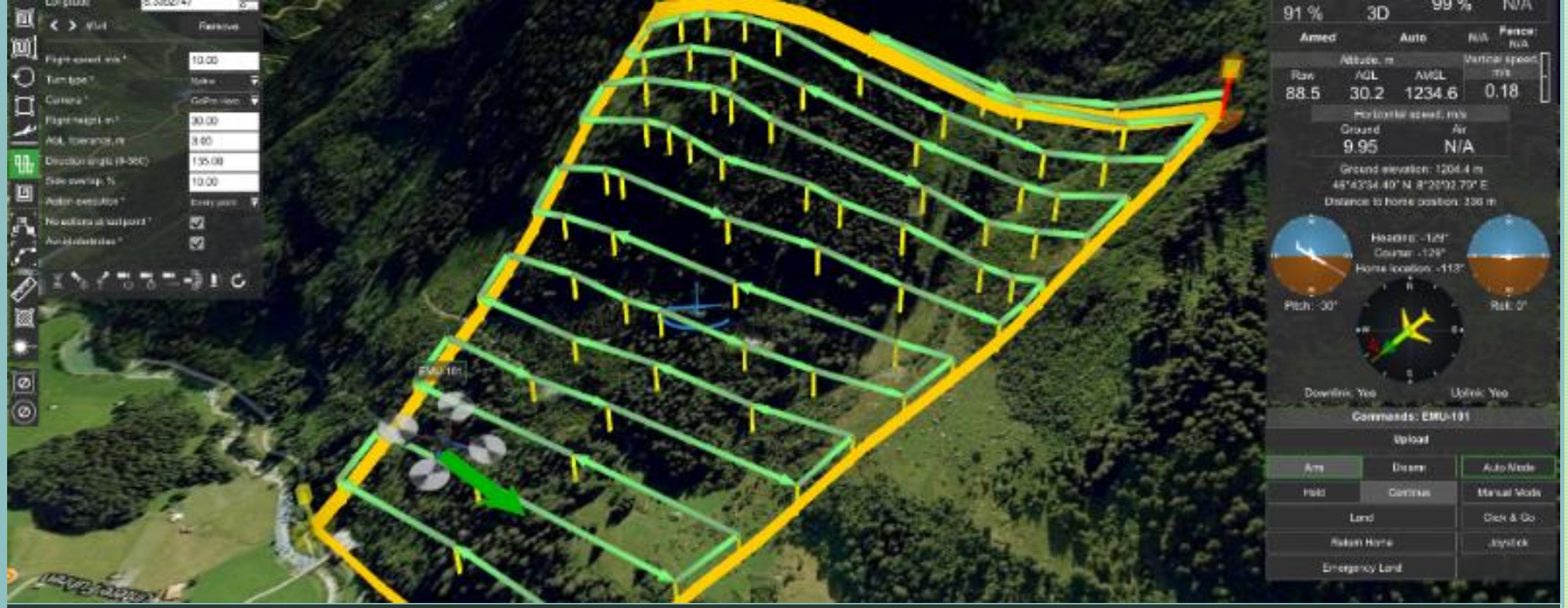
- Determine if project is suitable for a drone.
- Review airspace.
- Apply for authorizations or waivers if needed.
- Layout control & flight plans.
- Set and value control in the field.
- Fly site.
- Register flights to ground control.
- Output georeferenced data (points clouds / images).
- Extract additional data if needed.
- Deliver results.



Ground Control Points (GCPs)

GCP Examples





Flight Planning

Data Storage

You can always tell a beginner drone pilot.

They're the ones still trying to get their drone out of the tree.

DATA COLLECTION HAZARDS

Weather Restrictions

Vegetation

Cannot fly over people or moving vehicles.

Raptors (eagles, hawks, osprey, turkey vultures)

It’s not if…
it’s when.

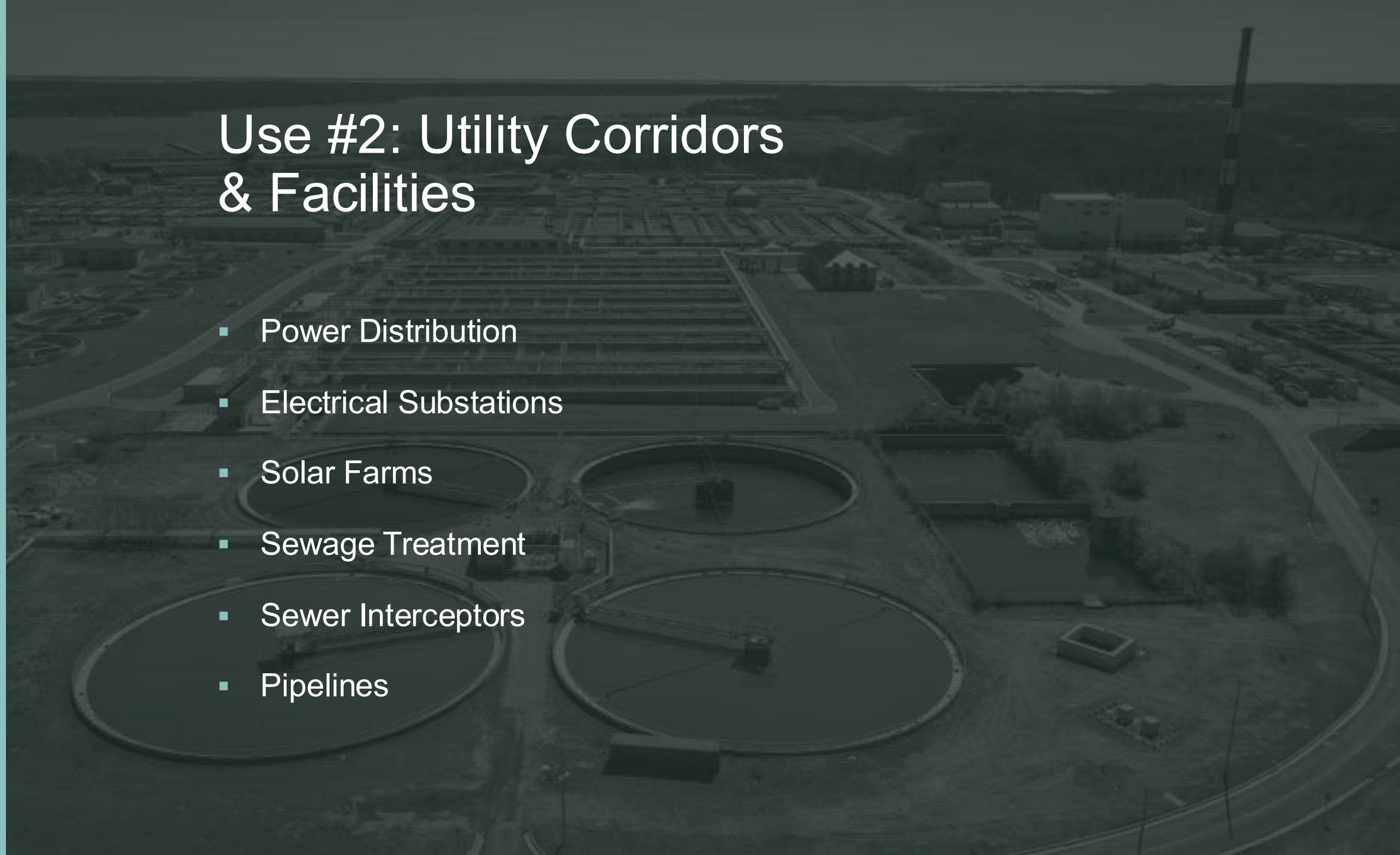
Putting Your Drone to Work

USE CASES & APPROACHES

Use #1: Site Development

- UAS for initial layout
- Traditional surveys at hard tie points
- Mass grading checks
- Construction progress documentation
- Soft surface as-built

Use #2: Utility Corridors & Facilities



- Power Distribution
- Electrical Substations
- Solar Farms
- Sewage Treatment
- Sewer Interceptors
- Pipelines

Use #3: Right-of-Way Surveys

- Highways
- Railways
- Elevated Trams
- Canals
- Ports

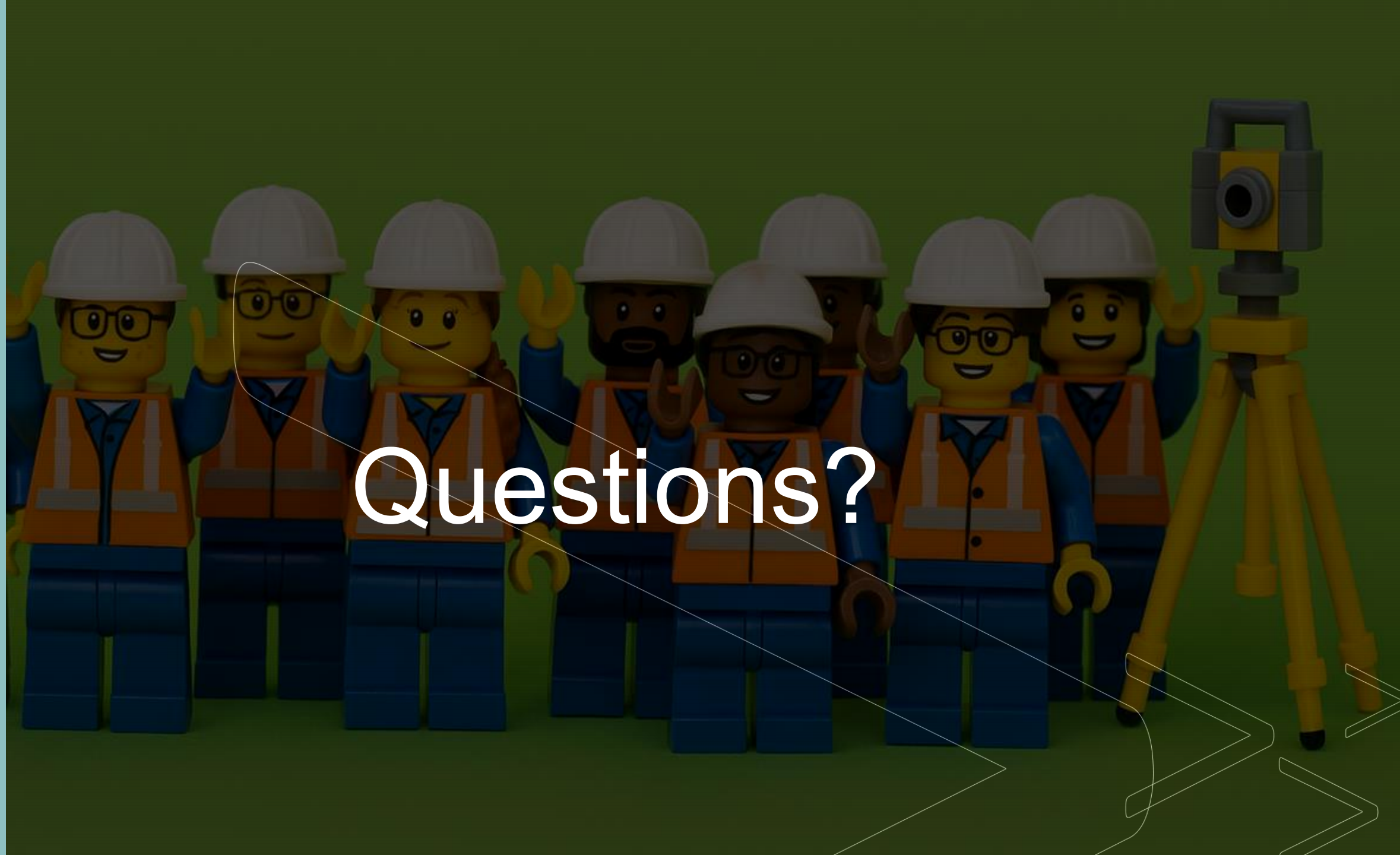
Case #4: Vertical Inspection

- Building Facades
- Bridges
- Cell Towers
- Water Tanks
- Dams
- Power Distribution
- Wind Turbines

Intelligence is the ability to adapt to change.

Stephen Hawking

REALITY CAPTURE IS ABOUT MANAGING EXPECTATIONS


Questions?