



MSS Fall Conference 2025

# Aerial Mapping for Small Firms



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*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

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Weaker Evidence

---

Higher Unit Costs

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Client Expectation Gap

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Environmental Impact

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Talent Risks

Data is king!

# SENSOR PRIMER

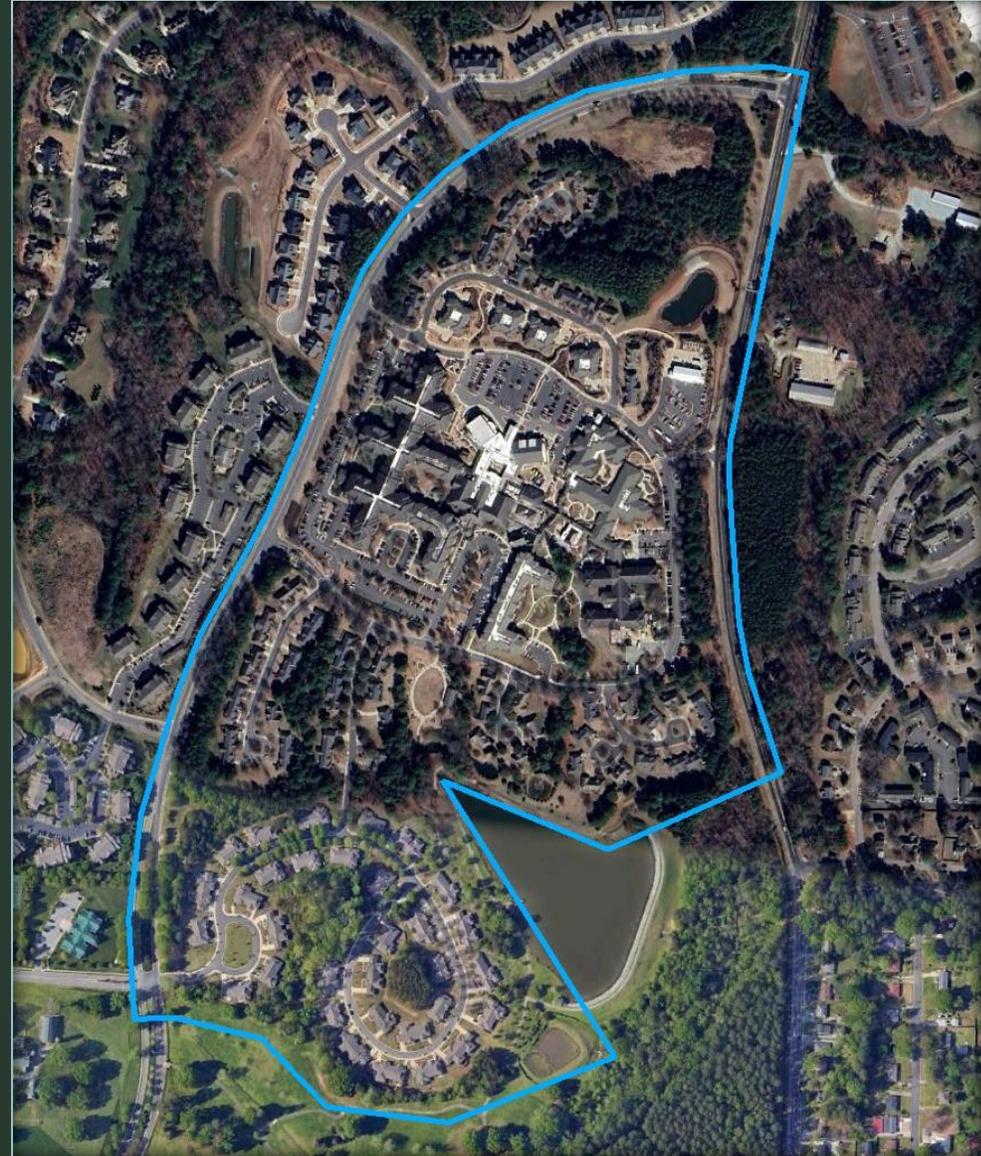


## Photogrammetric Payloads

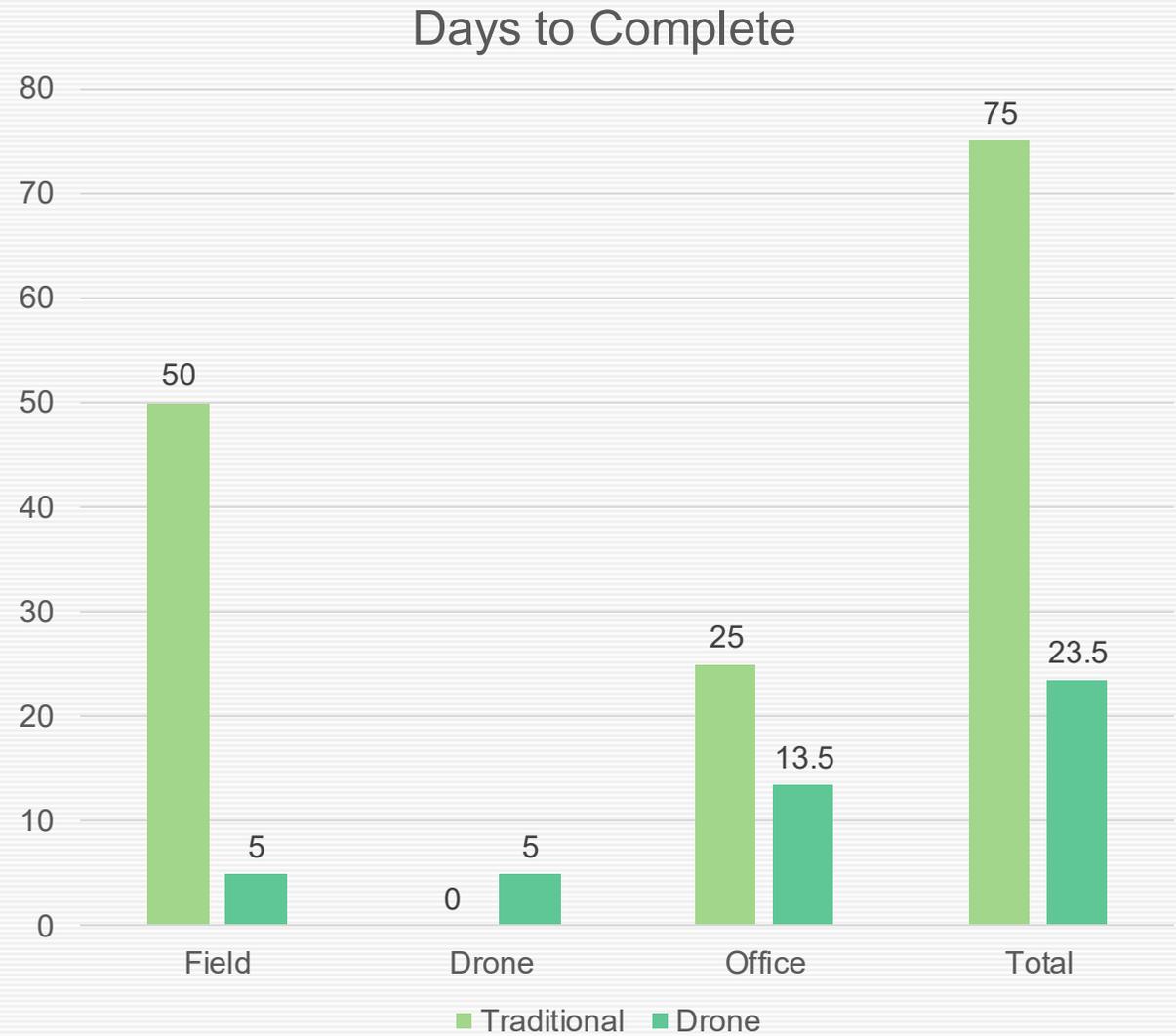
- Megapixels matter (GSD)
- Full-frame sensor
- Global/mechanical shutter
- Fixed focal length
- Storage pipeline
- Rigorous EXIF
- RTK/PPP <math>< 1\text{ms}</math> shutter sync

# 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

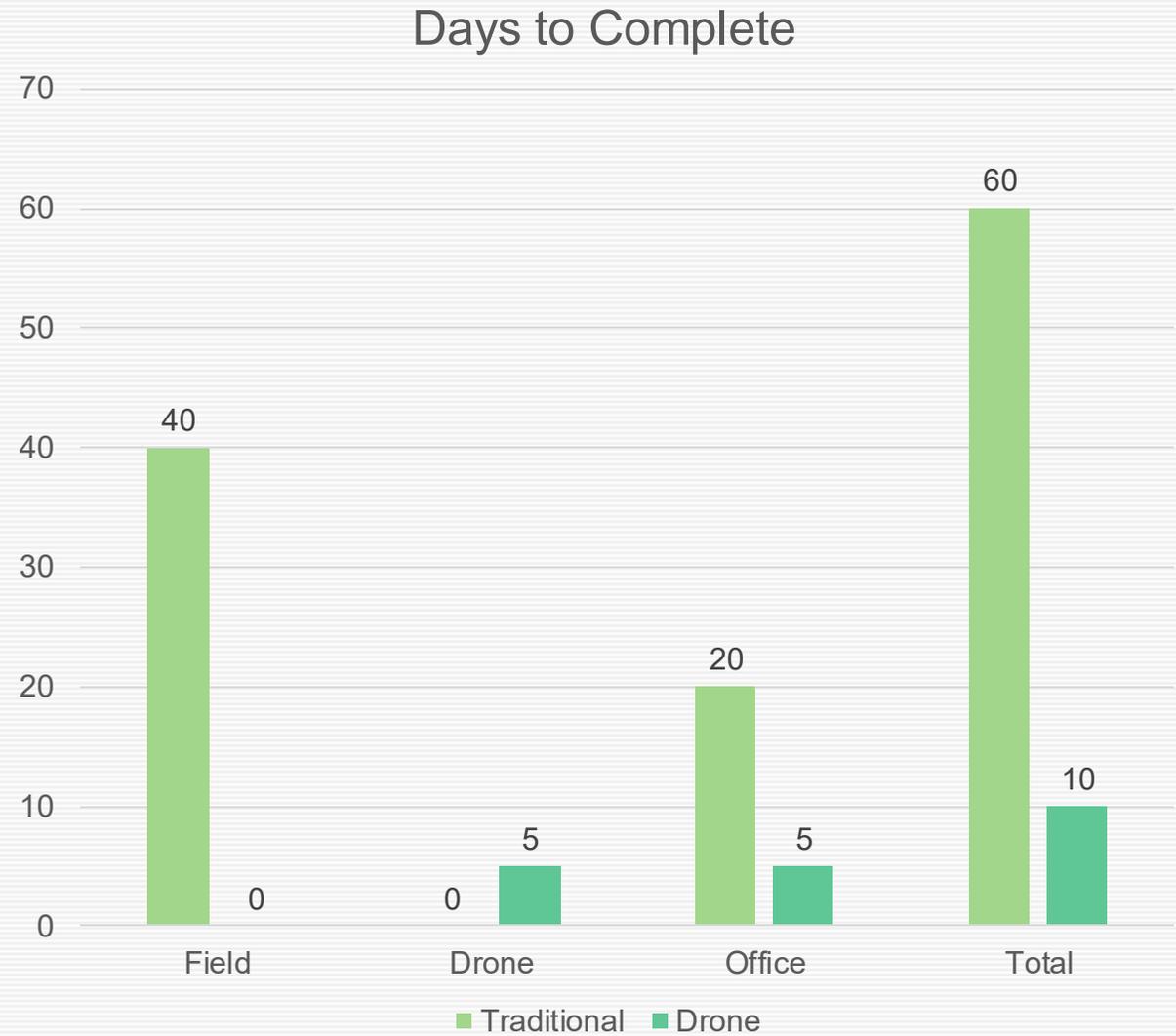
- Cost
- Weight
- Pulse rate
- Number of returns
- Beam divergence
- IMU grade
- Multi-sensor
- Post-processing software

## 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

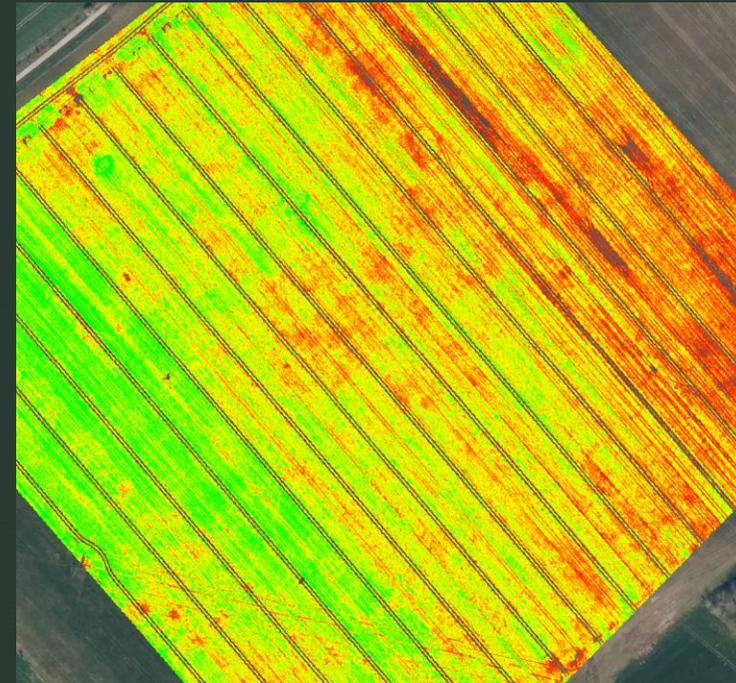


# Case #2: Sand Quarry

- 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

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~\$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.



**I UNITED STATES OF AMERICA XI**  
DEPARTMENT OF TRANSPORTATION • FEDERAL AVIATION ADMINISTRATION

**IV NAME**  
XXXXXXXXXXXXXXXXXX

**V ADDRESS** XXXXXXXXXXXXXXXXXXXX  
XXXXXXXXXXXXXXXXXXXXXXXXXX

**VI NATIONALITY** USA      **SEX** HEIGHT    **WEIGHT**    **HAIR**    **EYES**  
**IVa D.O.B.** XXXXXXXX      X    XX      XXX    XXXXX    XXXXX

**IX HAS BEEN FOUND TO BE PROPERLY QUALIFIED TO EXERCISE THE PRIVILEGES OF**

**II REMOTE PILOT**  
**III CERTIFICATE NUMBER**    XXXXXXXX  
**X DATE OF ISSUE**            XXXXXXXX

**XIV** *[Signature]* 

**UAS**

# FAA PART 107 INITIAL EXAMINATION



Knowing the Part 107 Rules



Airspace Understanding



Weather Knowledge



Aeronautical Knowledge

# FAA PART 107 RE-CERTIFICATION (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!!!**



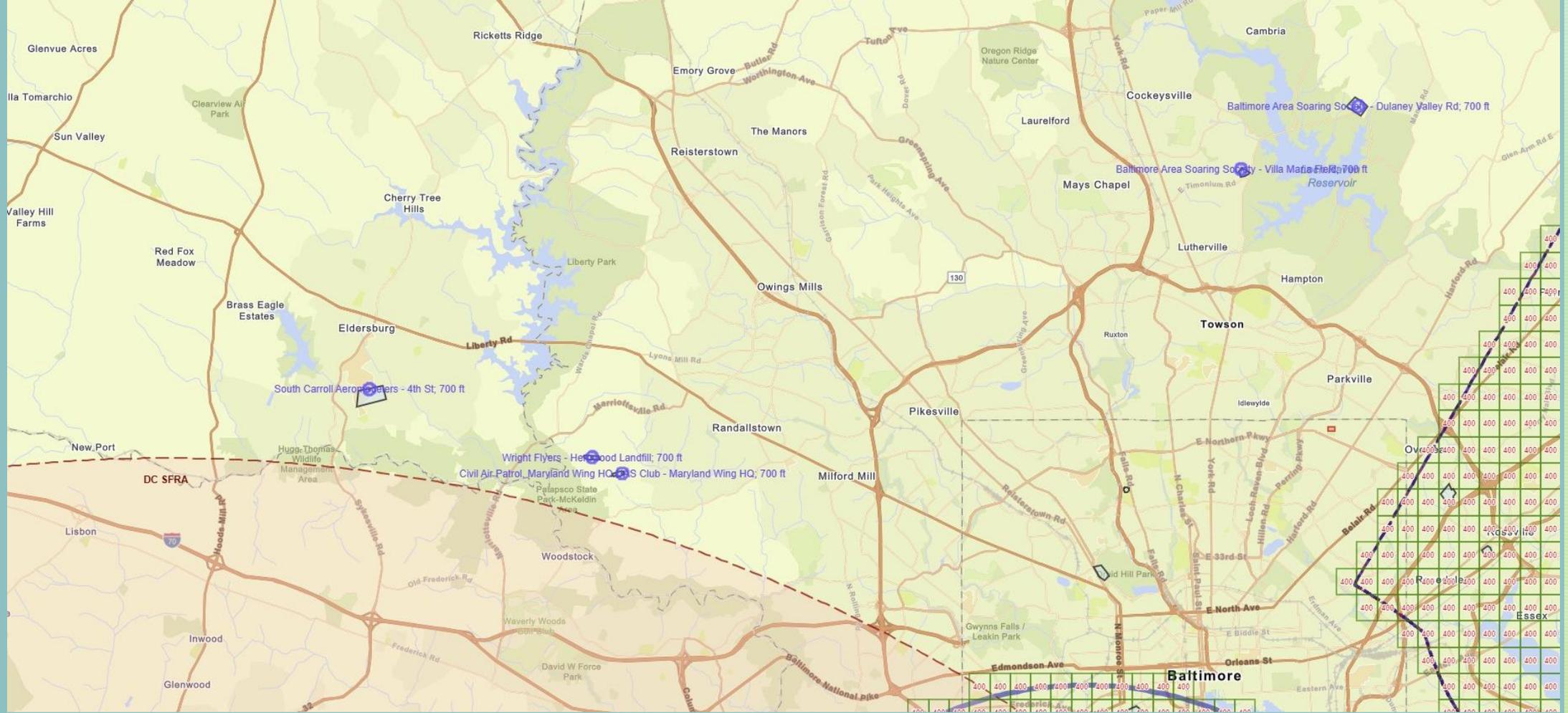
“Negative, Ghost Rider, the pattern is full.”

# AIRSPACE REVIEW

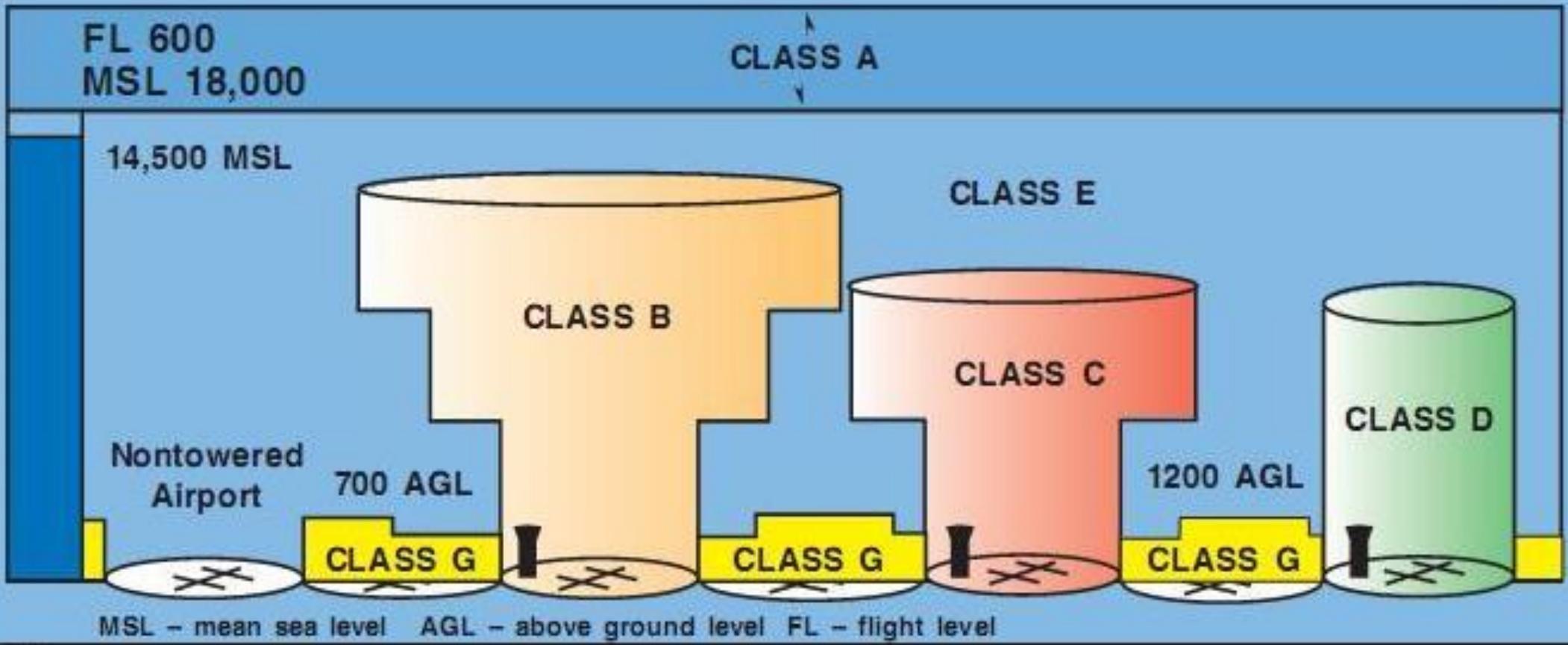




# Owings Mills Section Chart



FAA Visualize It



# Understanding Airspace

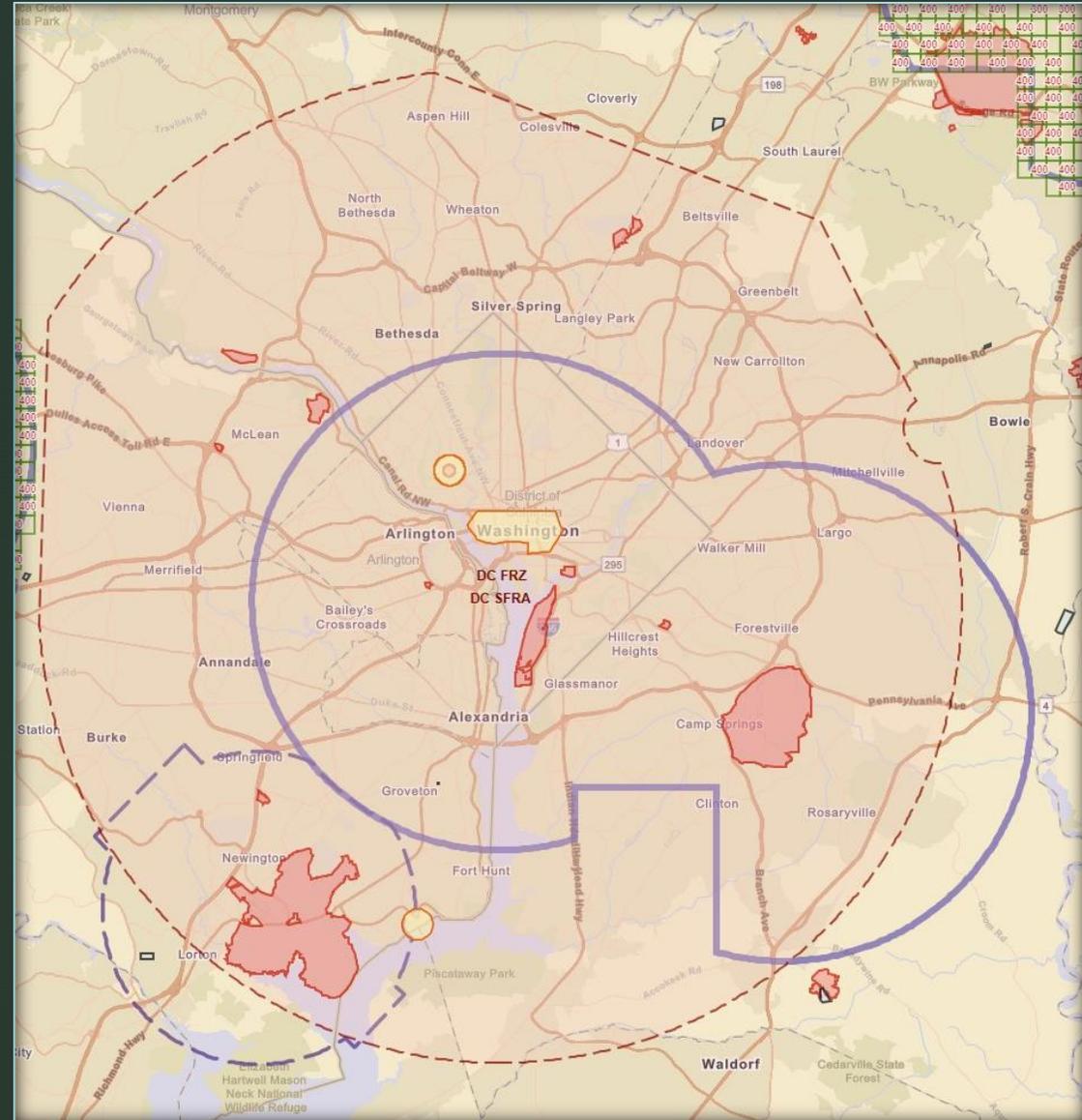


# More Complex Air Authorizations & Waivers

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

The screenshot displays the FAA DroneZone web application interface. At the top, it shows the United States Department of Transportation logo and the Federal Aviation Administration logo. The user is logged in as 'Hi, James \*' and can access 'Part 107' and 'Add Account Type' options. The main navigation bar indicates the current path: 'PART 107 DASHBOARD / PART 107 WAIVERS & AUTHORIZATIONS / AIRSPACE AUTHORIZATION'. A progress bar shows four steps: 1. Acknowledgment (highlighted in green), 2. Operation Parameters, 3. Review Authorization, and 4. Confirmation. Below the progress bar, a yellow banner contains a disclaimer: 'You are not required to respond to this collection of information unless it displays a valid OMB control number. Waivers and ATC Authorization in Controlled Airspace under Part 107 OMB Control No. 2120-0768. Expiration Date 07/31/2026.' A note states '\* Indicates a required field.' The form fields include: 'Operation Title' with a sub-label 'OPERATION TITLE\*' and a placeholder 'Enter Operation Title'; 'Name of the operation'; 'Responsible Party' with a sub-label 'Person responsible for the safety of the operation. Edit Part 107 Account Information' and a 'Stakeholder ID: 426865'; 'FIRST NAME' with the value 'James'; 'LAST NAME' with the value 'Shaw'; 'PART 107 ACCOUNT NAME' with the value 'James Shaw'; and 'EMAIL' with the value 'jshaw@jml.com'.

# DC FRZ (Flight Restricted Zone)





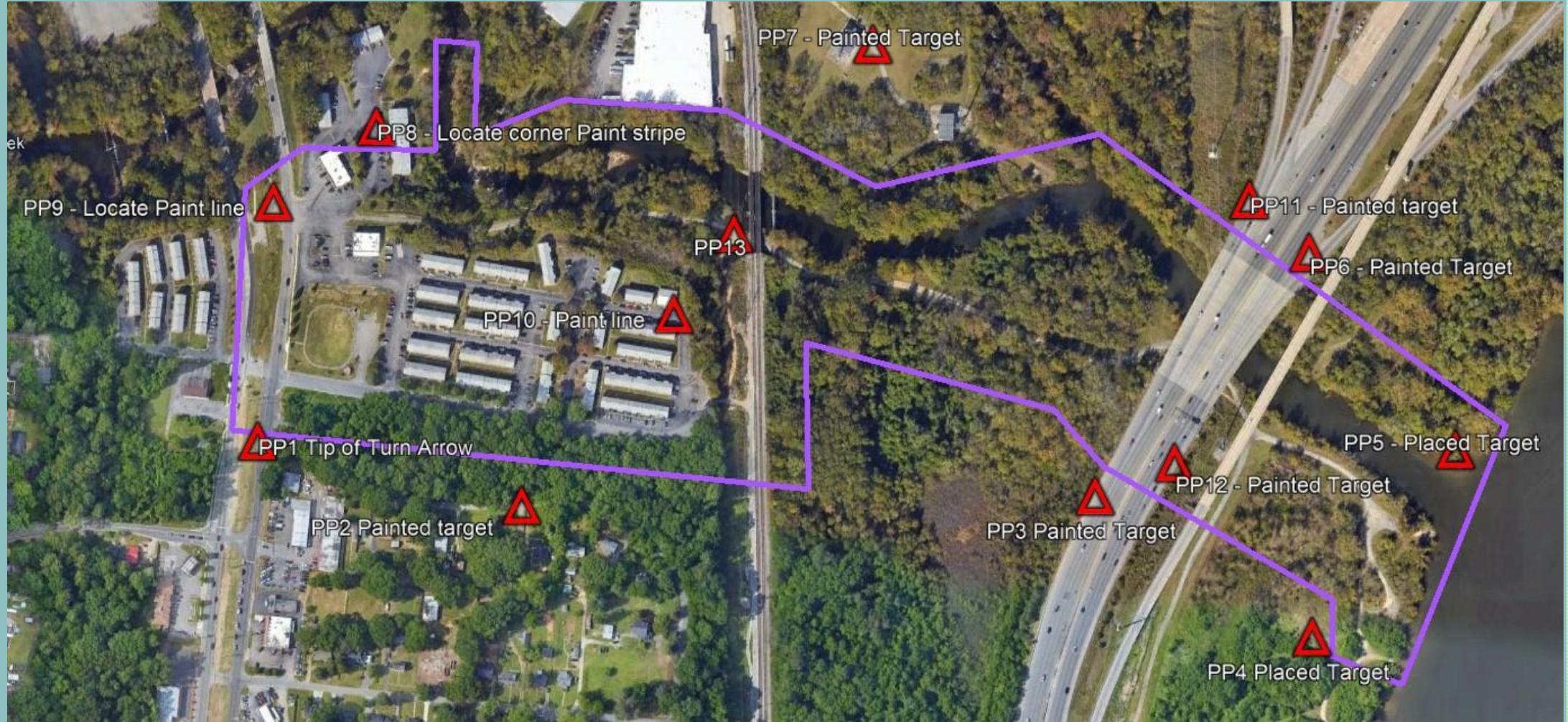
Simple Steps to Success

# COMMON DRONE SURVEYING WORKFLOW



# Drone Workflow

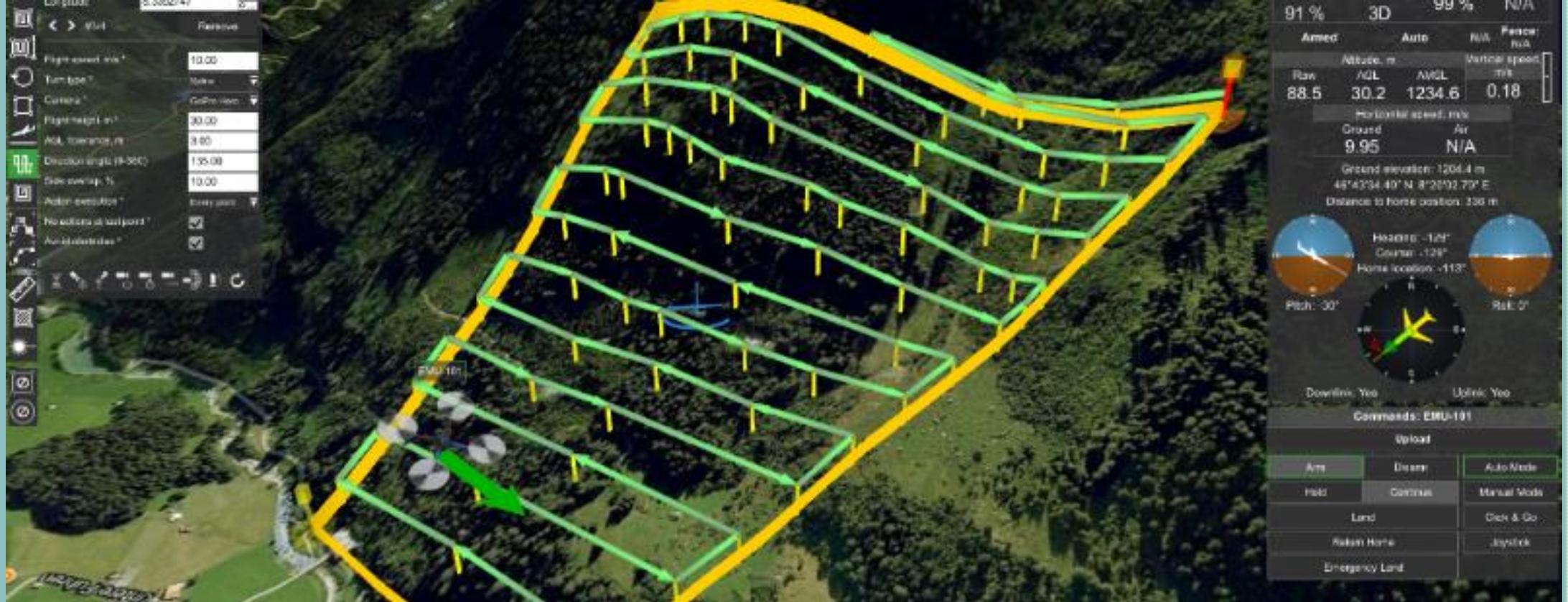
- Determine if project is suitable for a drone.
- Review airspace.
- Apply for authorizations or waivers if needed.
- Layout control & flight plans.
- Set and value control in the field.
- Fly site.
- Register flights to ground control.
- Output georeferenced data (points clouds / images).
- Extract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



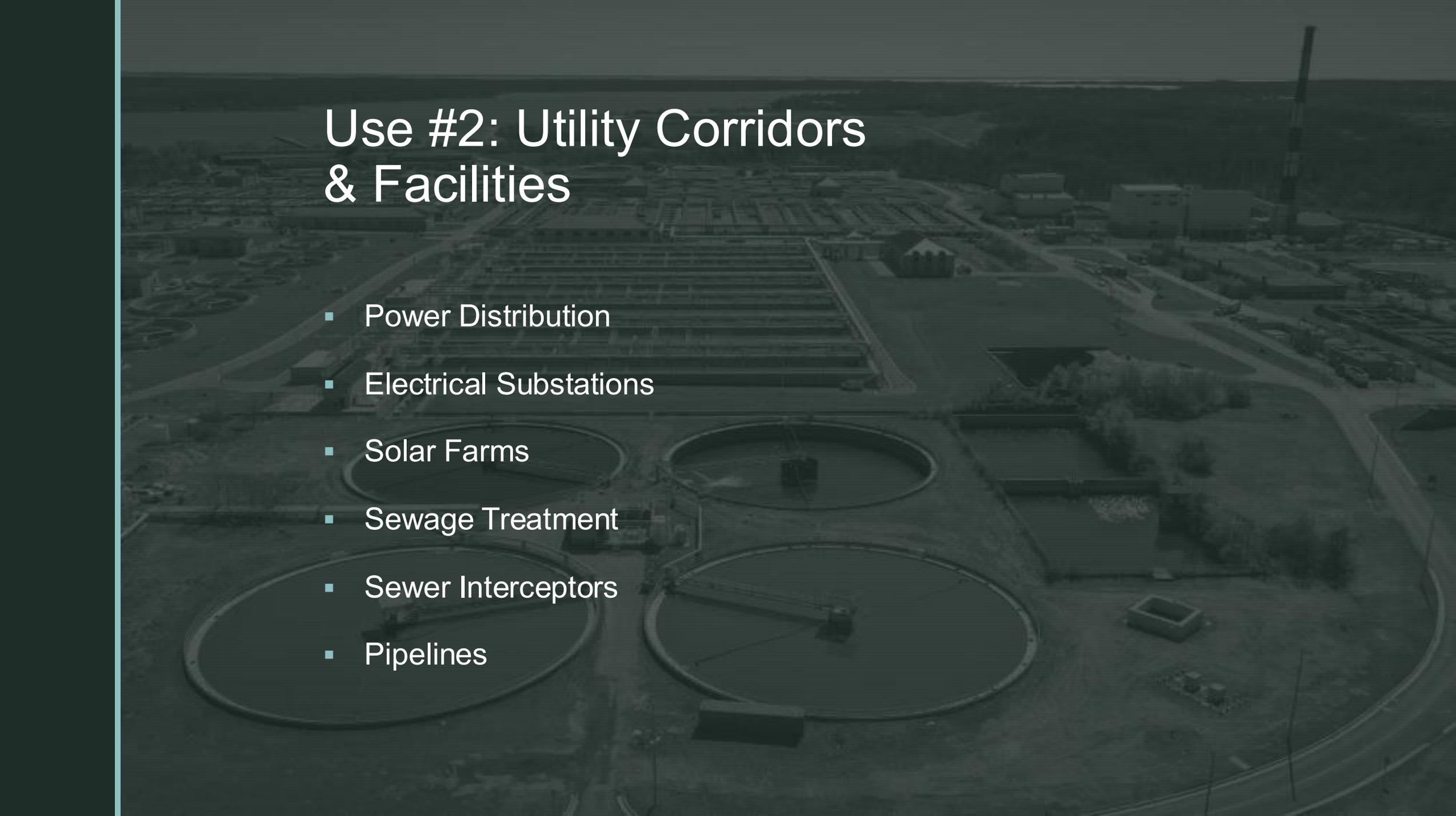
Putting Your Drone to Work

# USE CASES & APPROACHES

# Use #1: Site Development

An aerial photograph of a large-scale construction site, likely a residential or commercial development. The image shows extensive earthmoving and grading work, with numerous tracks from heavy machinery crisscrossing the terrain. The site is surrounded by dense trees and vegetation, and a road or driveway is visible in the lower-left corner. The overall scene is in grayscale, emphasizing the textures of the soil and the layout of the construction area.

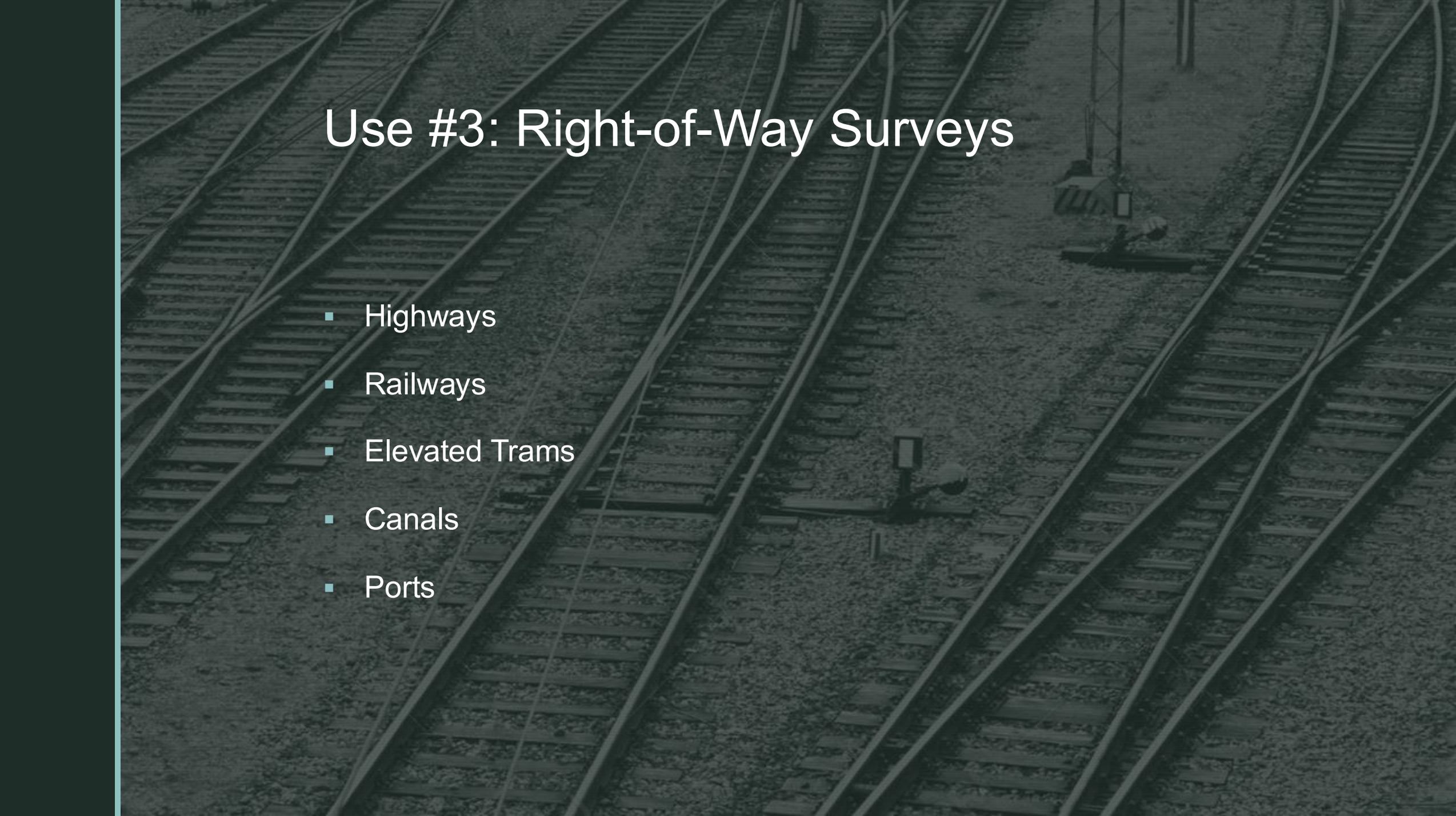
- UAS for initial layout
- Traditional surveys at hard tie points
- Mass grading checks
- Construction progress documentation
- Soft surface as-built



## Use #2: Utility Corridors & Facilities

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

# Use #3: Right-of-Way Surveys

An aerial, high-angle photograph of a railway yard. Multiple sets of parallel steel tracks run across the frame, with gravel ballast between them. In the center and right, surveying tripods with leveling heads are set up on the tracks, indicating a surveying operation. The overall image has a dark, monochromatic aesthetic.

- Highways
- Railways
- Elevated Trams
- Canals
- Ports

# Case #4: Vertical Inspection

An aerial photograph of a multi-lane highway stretching into the distance. In the foreground, a tall, grey cell tower stands prominently, equipped with several vertical antennas and a circular dish at its base. The surrounding landscape is a mix of trees and open fields under a clear sky.

- 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?

