# NORMALIZING FORESTRY COSTS USING DRONES FOR NEW CONSTRUCTION

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A Partnership of UAA + Arbor Day Foundation

# PRESENTER BACKGROUND

- ✓ Masters and Bachelors in Forestry/Forest Resource Management
- ✓ 15 Years of Remote Sensing Experience (13 years with DRG)
- ✓ Specialized in Remote Sensing and Geospatial Technology
- ✓ Led Hundreds of LiDAR and Imagery Analysis Projects
- ✓ Certified Geospatial Information Systems Professional (GISP)
- ✓ Association Society of Photogrammetry and Remote Sensing Member (ASPRS)

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# TALKING POINTS

I. Challenges and Considerations

II. Applying Drone Technology

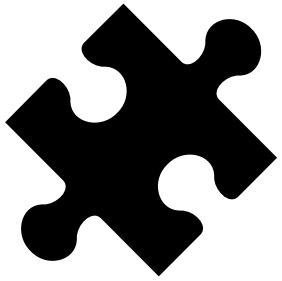
III. Implementation

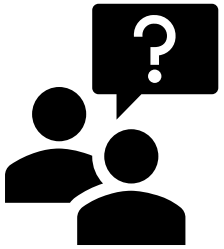
IV. Setting Expectations

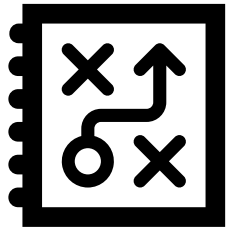
# CHALLENGES AND CONSIDERATIONS

# CAPTIAL FORESTRY CHALLENGES

A. Safety hazards
B. Delayed engineering designs
C. Unpredictable forestry costs
D. Bid packets could have inconsistent information
E. Limited time for timber marking
F. Estimating site lines
G. Waivers
H. Landowners







# DOMINION TRANSMISSION PARTNERSHIP

## PARTNERSHIP

Dominion sought a solution to address similar challenges to current capital forestry construction

DRG and Dominion agreed to conduct assessments for multiple circuits to apply LiDAR technology

Some circuits were flown with drone-based LiDAR and others were processed with existing LiDAR captured from a fixed wing plane

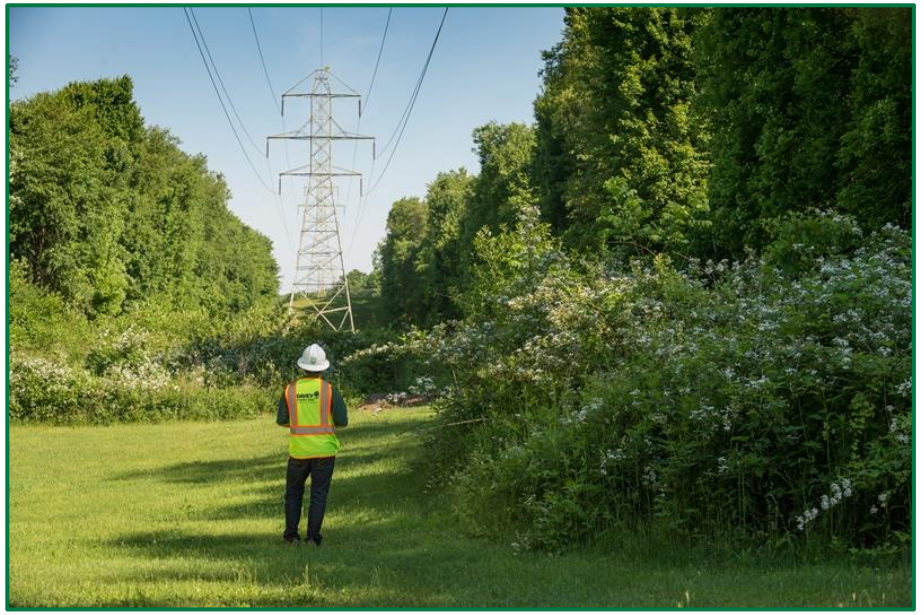
## GOALS

1. Better visibility into forestry costs to reduce unforeseen expenses
2. Adapt more quickly to shifting project schedules
3. Having fresh data to assess danger trees that need to be removed before construction begins
4. Provide accurate information to supply bid packets to contractors

# CONSIDERATIONS

## LOGISITICS QUESTIONS

a. What stage of build design?
b. How large is our project area?
c. Do we have permissions to use drones?
d. What is our timeline?

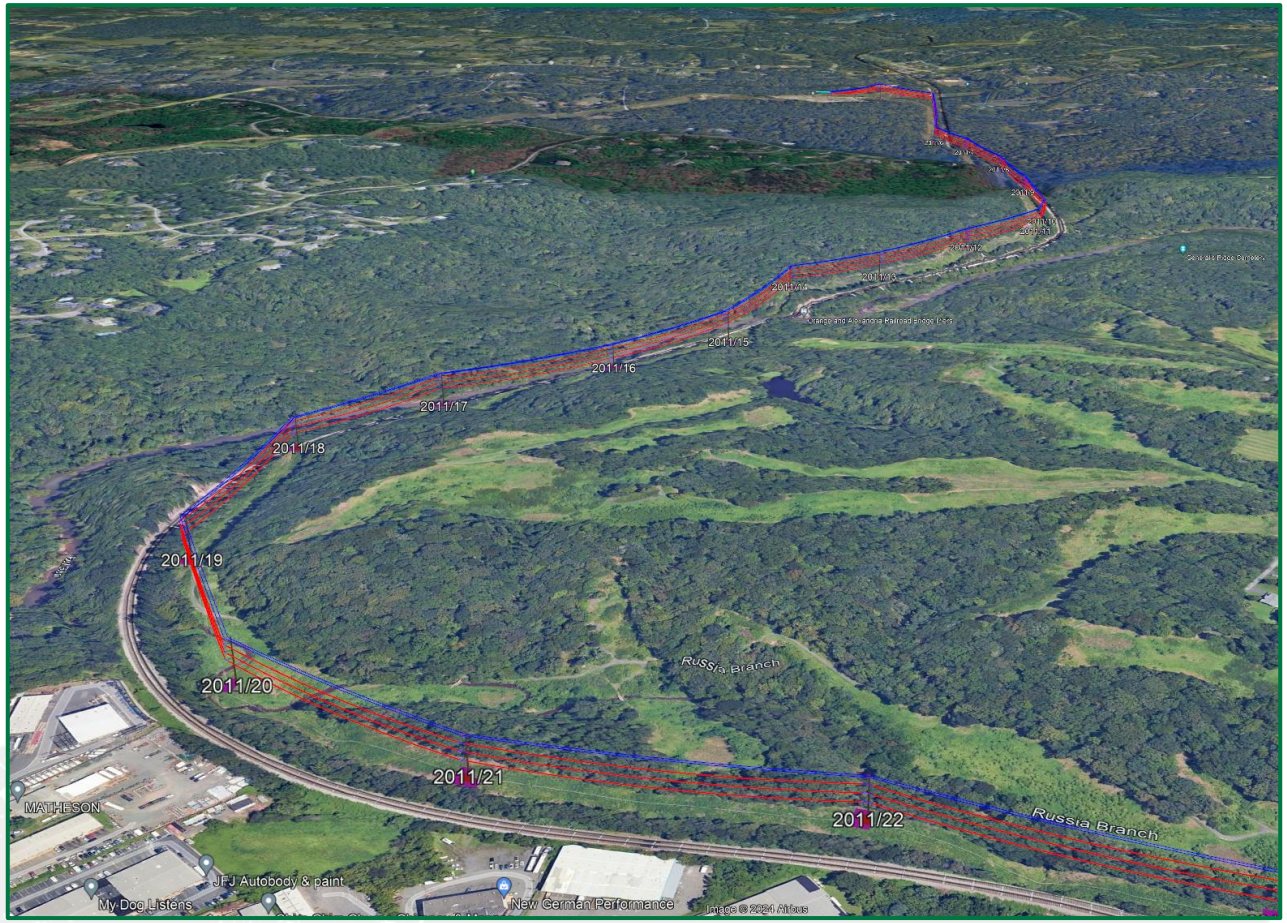


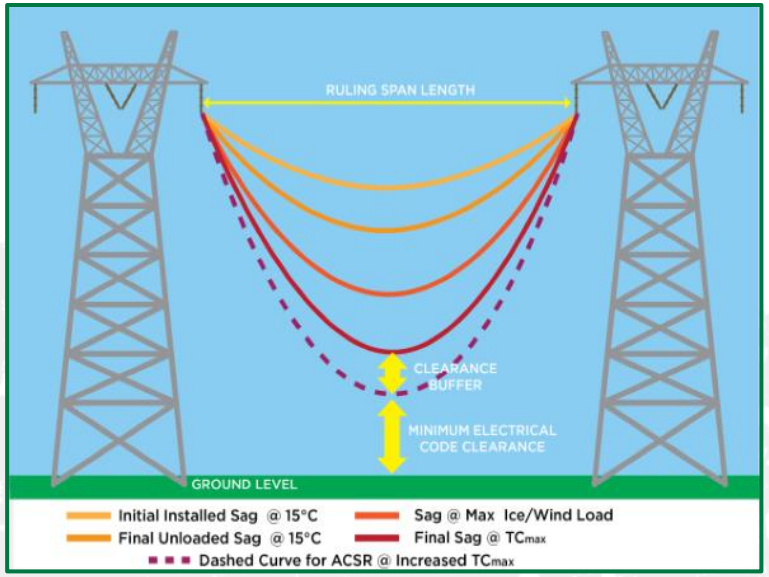
## OPERATIONS QUESTIONS

a. What's our long-term vision?
b. Can we make better decisions around maintenance planning?
c. How do we monitor tree growth?

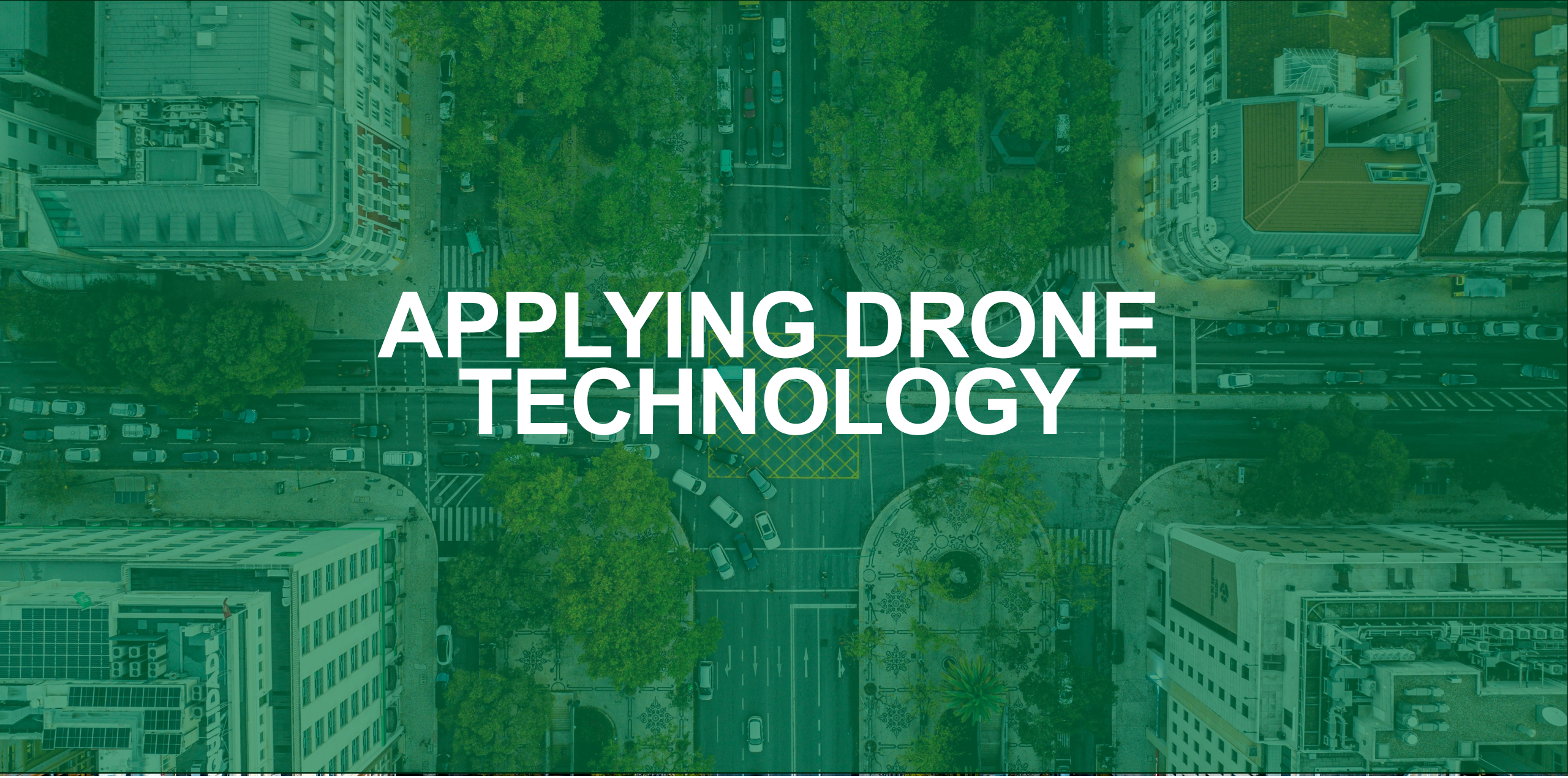
# REQUIREMENTS

1) Understanding scope and project location
2) Clearance specifications, voltage, environmental concerns
3) Engineering and easement data
4) Construction timelines and constraints




*Source: EPRI*



# APPLYING DRONE TECHNOLOGY

# SOLVING PROBLEMS WITH TECHNOLOGY


Airplane

Drone

Satellite

Helicopter

# BENEFITS OF UNMANNED AIRCRAFT

How can Remote Sensing and UAS Solutions provide **Value to your Operations?**

**Increase:**
Safety
Efficiency
Reliability




# PLATFORMS AND SENSORS

## Determining the "Right" Solution

### RGB/Multispectral Cameras


### Fixed-Wing/LiDAR

### Multi-rotor/LiDAR

### Key Impacts on Overall Results

- Experience and Expertise Matters
- Risk Mitigation and Situational Awareness
- Understanding Operations, Capabilities and Limitations Specific to each UAS Platform

# AVIATION AND UTILITY COMPLIANCE

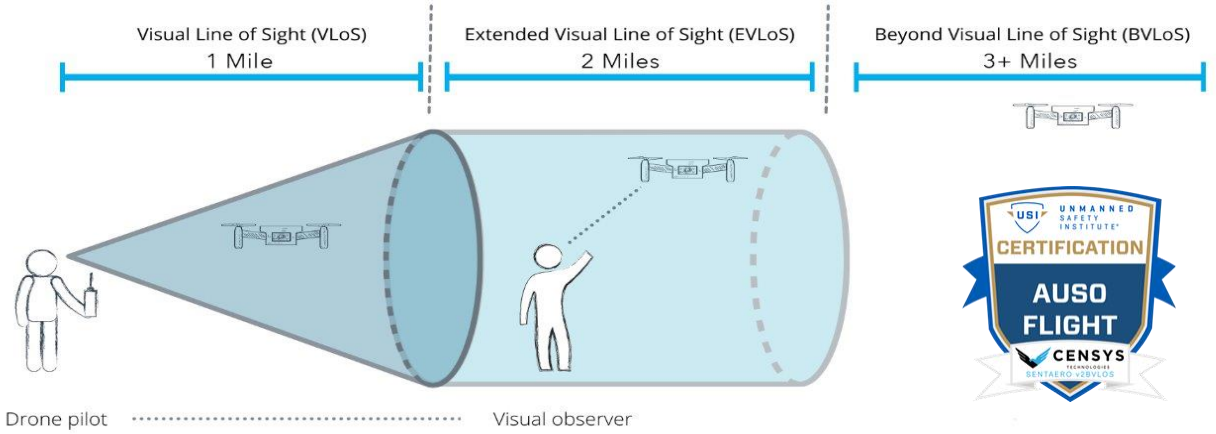
## Safety Procedures and Requirements

- Operational flight planning (Weather, Airspace, LAANC/Waiver requirements)
- Pre/Post flight safety checklists
- Fleet Management Software Maintenance, battery health and flight logs
- Minimum Approach Distance (MAD)

Federal Aviation Administration

## Aviation Industry Certifications

- FAA Part 107 - Remote Pilot Certification
- FAA Approved Exemptions and Operational Waivers (If Applicable)
- Photogrammetry and LiDAR Certificates



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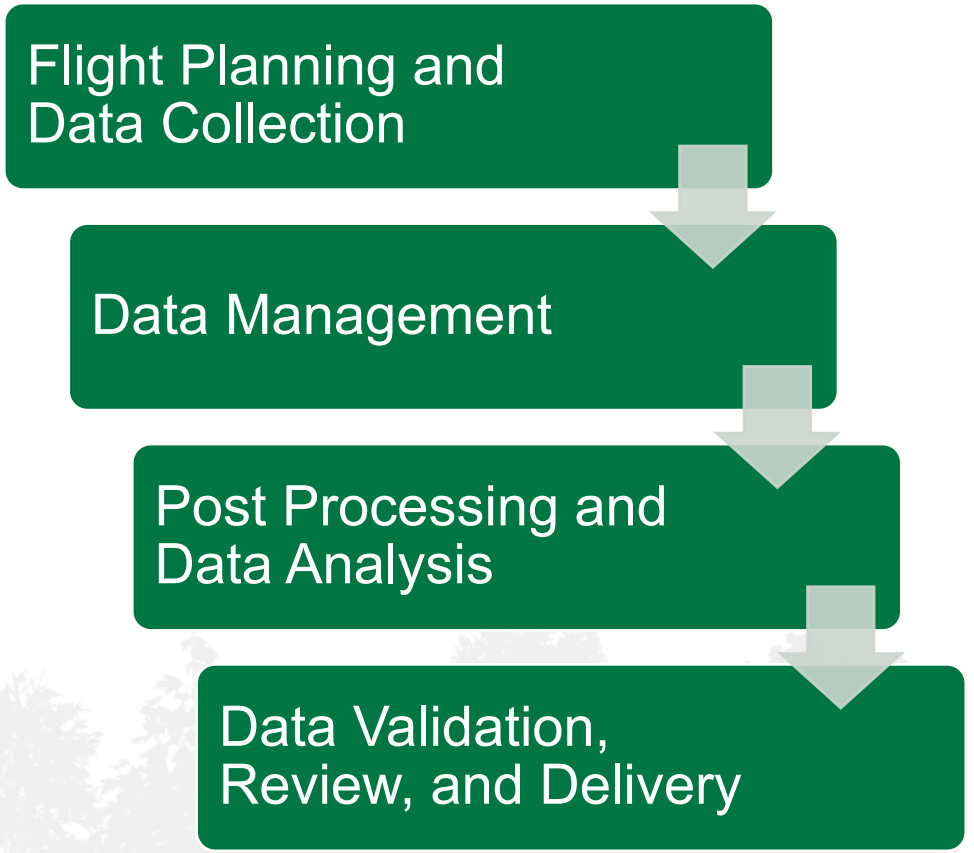
# IMPLEMENTATION

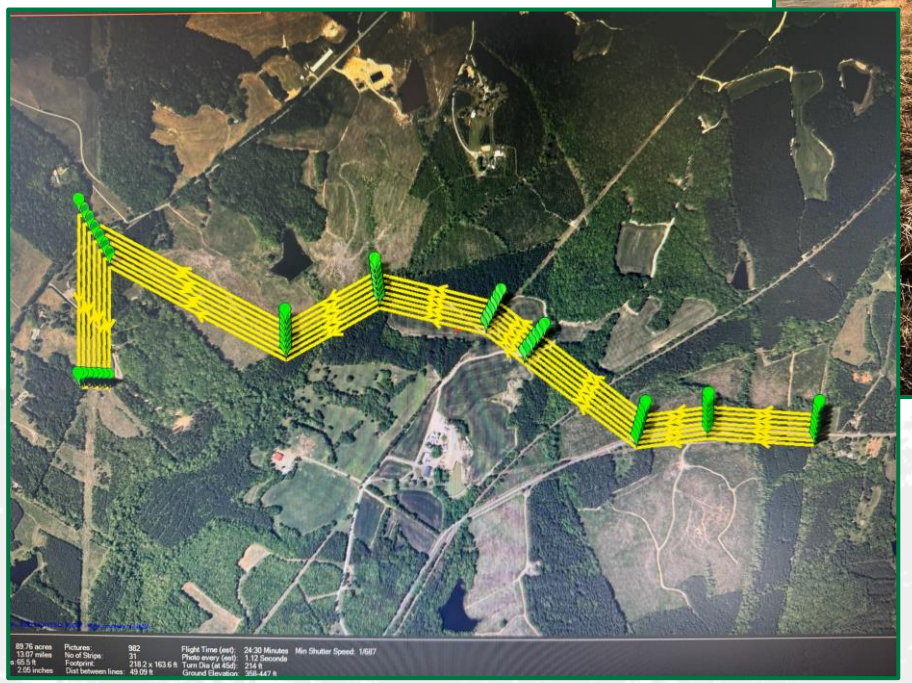
# UNDERSTANDING WORKFLOW

- Conduct a flight analysis, determine flight requirements from the FAA, submit paperwork, and collect data after FAA approval (flight times, flight speeds, LAANC submissions, airspace, waiver authorizations, deconfliction notices, etc.)
- Data management, large file sizes, secure FTPs, lengthy transfer times, reliable internet connections
- Post processing of sensor data to create analysis-ready point clouds that meet ASPRS standards for accuracy
- Run encroachment detection algorithms via AI and Machine-learning models. Perform QA/QC validation and prepare deliverable package
- Support digital data exports
- Upload data into Workflow Management software



# FLIGHT PLANNING AND COLLECTION

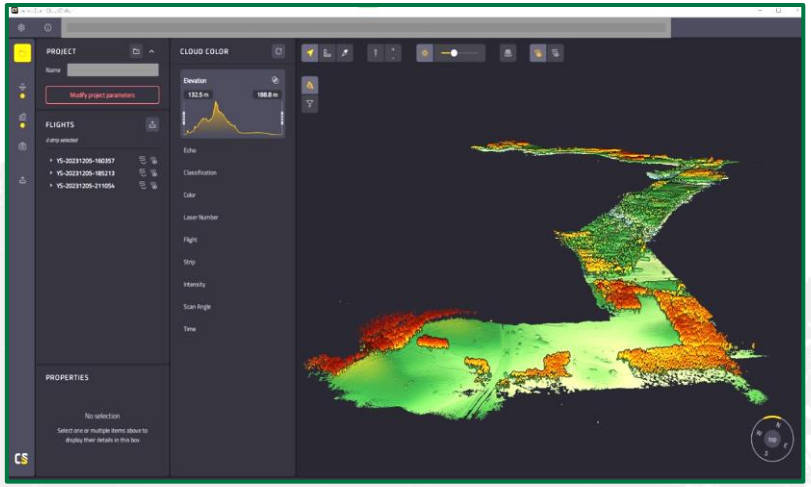
- Identify ROW Extents
- Import PLS-CADD Drawings
- Create Shapefiles from Centerlines
- Plan Take Off Points
- Collect Ground Control



# PROCESSING AND ANALYSIS

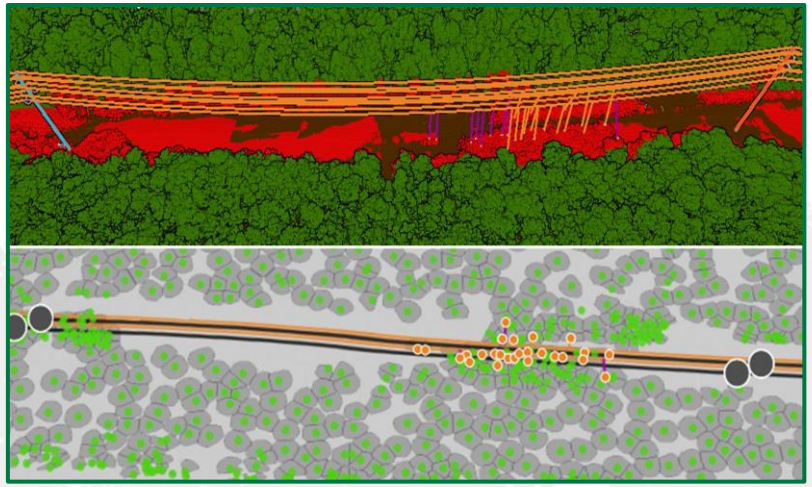
## POST PROCESSING

- Import Raw Data
- Create Point Clouds from Sensor Data
- Review Coverage
- Analyze Density
- Export LAS/LAZ



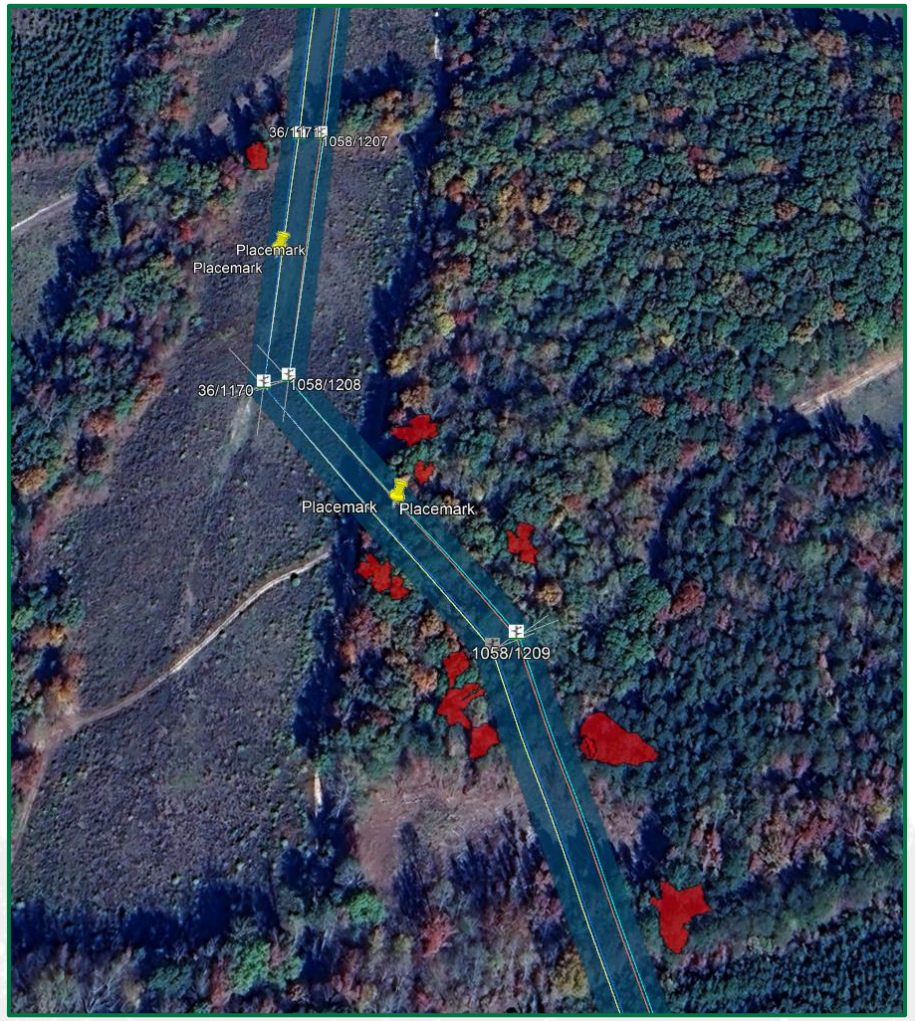

## DATA ANALYSIS

- Tree Height/DBH
- Distance to Conductor
- Strike Potential
- Overstrike
- Span, Segment, Circuit Level Counts



# ANALYSIS OUTCOMES

- Tree Segmentation
- Vegetation Acres within ROW to be cleared
- Identification of Danger Trees (Grow-In, Fall-In)
- Number of Dangers Trees Per Span and XY Location
- Distance to Conductor and Strike Potential
- Removal Volume Estimates
- Bid Packages
- Tree Health (optional)
- Workflow Management Software (optional)



# CREATING BID PACKETS

- Estimated Stem Counts
- DBH Ranges
- Clearances
- Stem Count by Span
- Removal Volume by Span
- Google Earth KMZ
- Maps

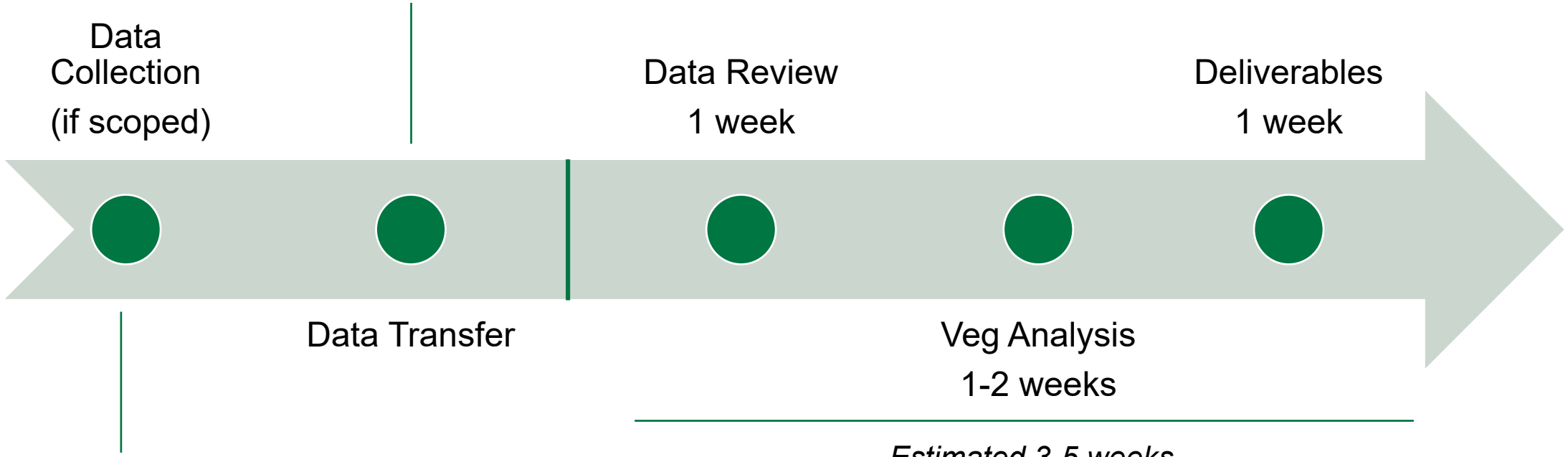
| Sum of STEM COUNT | Column Labels | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Row Labels | < 6 | 10-14 | 14-18 | 18-22 | 22-26 | 26-30 | 30-34 | 34-38 | 38-42 | 42-48 | 48-54 | 54-60 | 6-10 | Grand Total |
| **2011/1 (EX) to 2011/2** | **89** | | **3** | **3** | **2** | **2** | **1** | **3** | **3** | **1** | | | **3** | **110** |
| INSIDE - EASEMENT | 13 | | | | 1 | | | | 1 | | | | | 15 |
| OUTSIDE - EASEMENT | 76 | | 3 | 3 | 1 | 2 | 1 | 3 | 2 | 1 | | | 3 | 95 |
| **2011/10 to 2011/11** | **475** | **6** | **14** | **4** | **6** | **21** | **12** | **15** | **4** | **11** | **2** | | **19** | **589** |
| INSIDE - EASEMENT | 153 | 1 | 3 | | 1 | | 1 | | | | | | 7 | 166 |
| OUTSIDE - DANGER | | | | | 1 | 1 | 2 | 3 | 1 | 2 | 2 | | | 12 |
| OUTSIDE - EASEMENT | 322 | 5 | 11 | 4 | 4 | 20 | 9 | 12 | 3 | 9 | | | 12 | 411 |
| **2011/11 to 2011/12** | **466** | **11** | **12** | **7** | **13** | **8** | **14** | **9** | **11** | **5** | **3** | | **18** | **577** |
| INSIDE - EASEMENT | 152 | 1 | 1 | 2 | 4 | 2 | | 2 | | | | | | 164 |
| OUTSIDE - DANGER | | | | | | | 1 | 1 | 1 | | 2 | | | 5 |
| OUTSIDE - EASEMENT | 314 | 10 | 11 | 5 | 9 | 6 | 13 | 6 | 10 | 5 | 1 | | 18 | 408 |
| **2011/12 to 2011/13** | **528** | **14** | **15** | **20** | **7** | **9** | **18** | **12** | **11** | **3** | | | **7** | **644** |
| INSIDE - EASEMENT | 209 | 1 | 2 | 2 | | | | | | | | | | 214 |
| OUTSIDE - DANGER | | | | | | | 2 | 3 | 3 | 2 | | | | 10 |
| OUTSIDE - EASEMENT | 319 | 13 | 13 | 18 | 7 | 9 | 16 | 9 | 8 | 1 | | | 7 | 420 |
| **2011/13 to 2011/14** | **386** | **11** | **8** | **4** | **6** | **16** | **14** | **11** | **13** | **7** | | | **6** | **482** |
| INSIDE - EASEMENT | 179 | 1 | 1 | 1 | 1 | 1 | | | | | | | 1 | 185 |
| OUTSIDE - DANGER | | | | | 2 | 1 | 2 | 4 | 3 | 5 | | | | 17 |
| OUTSIDE - EASEMENT | 207 | 10 | 7 | 3 | 3 | 14 | 12 | 7 | 10 | 2 | | | 5 | 280 |

*Benefits include better visibility onto workloads, costs, and competitive bids*

# SETTING EXPECTATIONS

# SETTING TIMELINES

There can be variability in the data transfer process.




The timeline would vary due to FAA flight requirements and approvals, location specific requirements and permits as well as weather.

Once DRG has the LiDAR data the review, veg analysis and deliverables can be 3-5 weeks. Typical project less than 30 miles.

# PROGRAM EXPECTATIONS

## CONTINUING EVALUTION

1. Through the test pilots, does this technology help adapt to the drastically changing construction schedules?
2. Are accuracies improving over time with additional data?
3. Are the bid packets meeting the needs of the forestry contractors?
4. Is the program saving money by deploying drones for smaller mileage construction projects?
5. Does it reduce long term O&M costs by capitalizing work during construction?

# CONCLUSIONS

- ❑ Capital Transmission has many moving parts
- ❑ Demonstrated established processes using remote sensing are possible to address challenges
- ❑ Multiple circuits have been flown and analyzed. Results are currently being validated and models retrained
- ❑ Processing AI models are still improving and does give visibility to project managers
- ❑ Technology is proving to be increasingly nimble to deploy in many situations and timelines

# THANK YOU!

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