Esri Transmission Summit

July 19 | San Diego, CA

# Improved Vegetation Management with PhoDAR

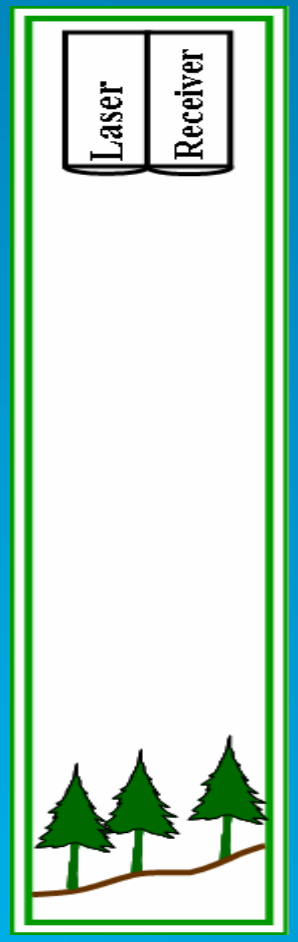
Dave Twichell, Brian Baldwin, David Shear

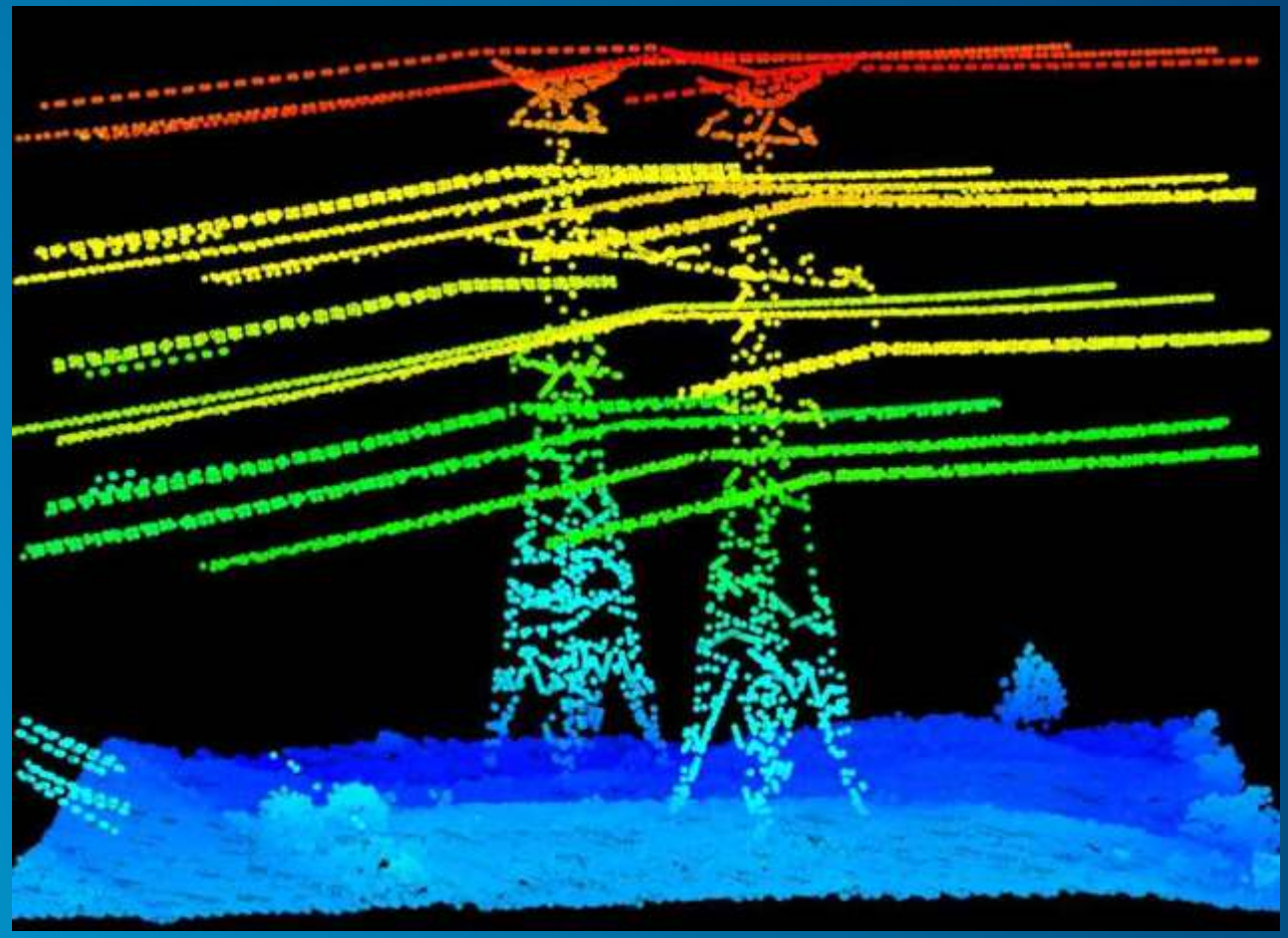
# August 14, 2003

# NERC Regulations

- **FAC-003**
  - **Improve Vegetation Management & Outage Reporting**
- **FAC-008 & FAC-009**
  - **Improve Line Rating Methodology & Reporting**

# Lidar to the rescue?

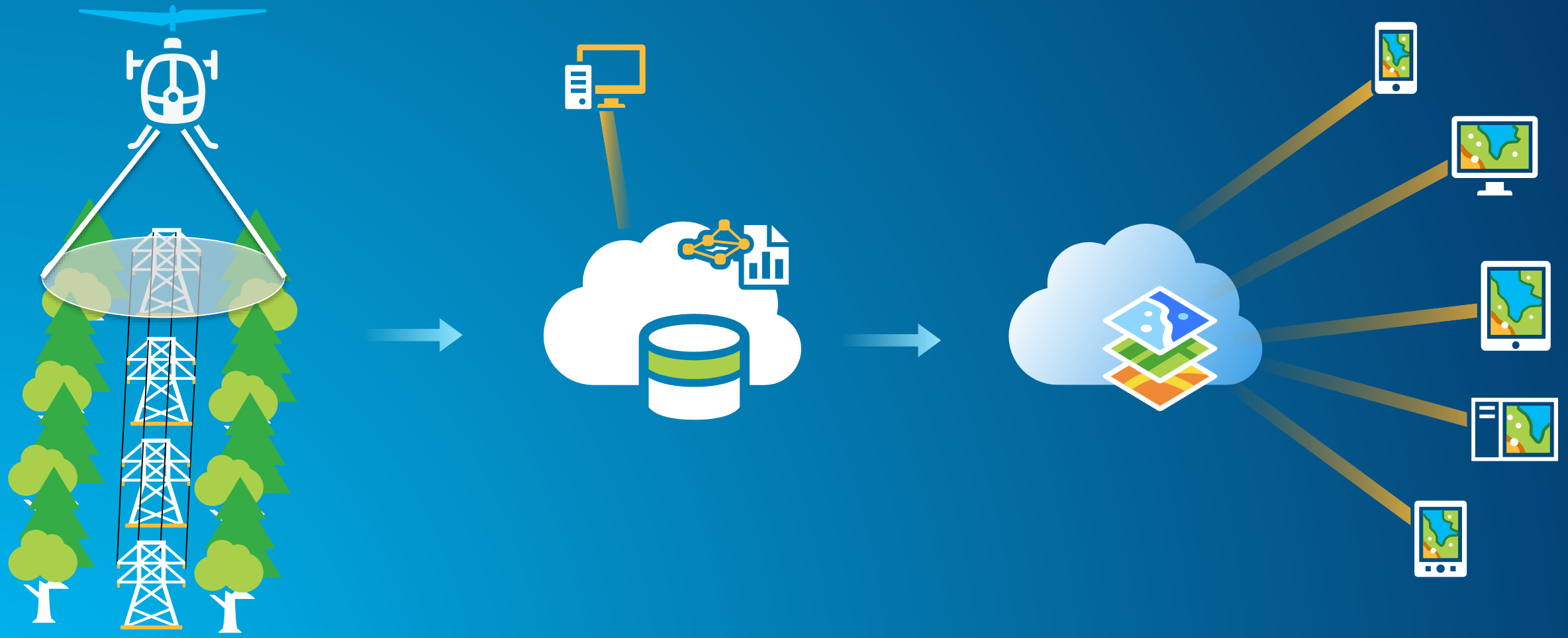


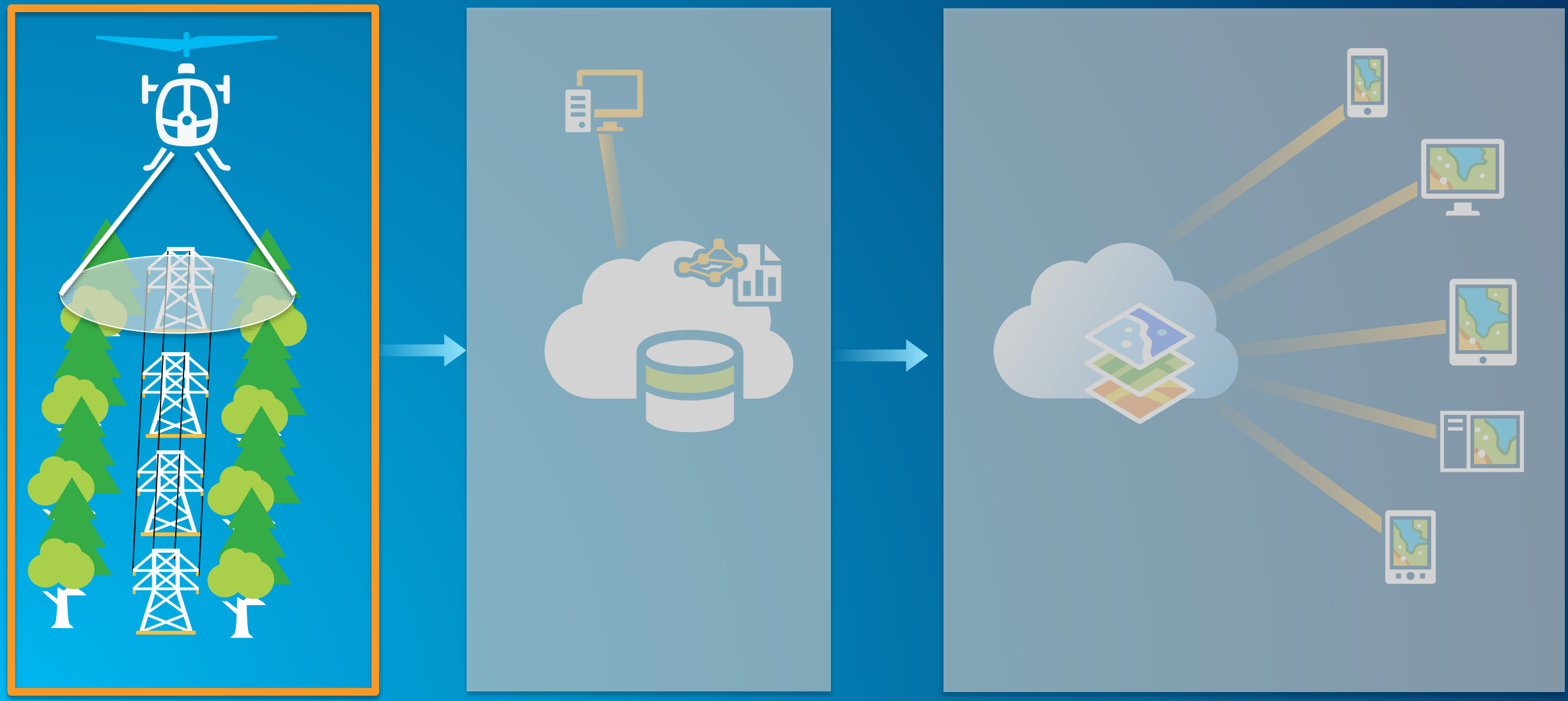
# The Data Management Problem

- Terabytes of Data
- Organized Locally

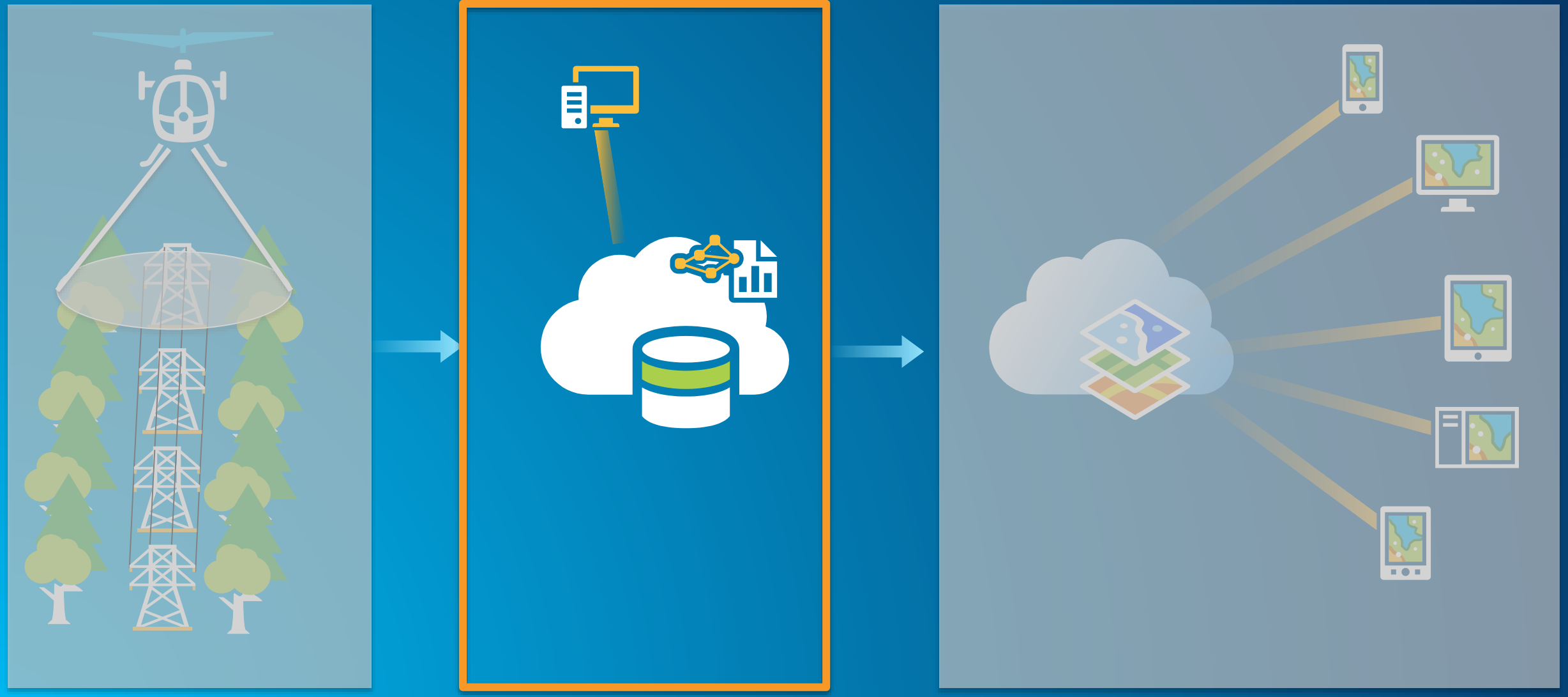
# ArcGIS for Imagery Management



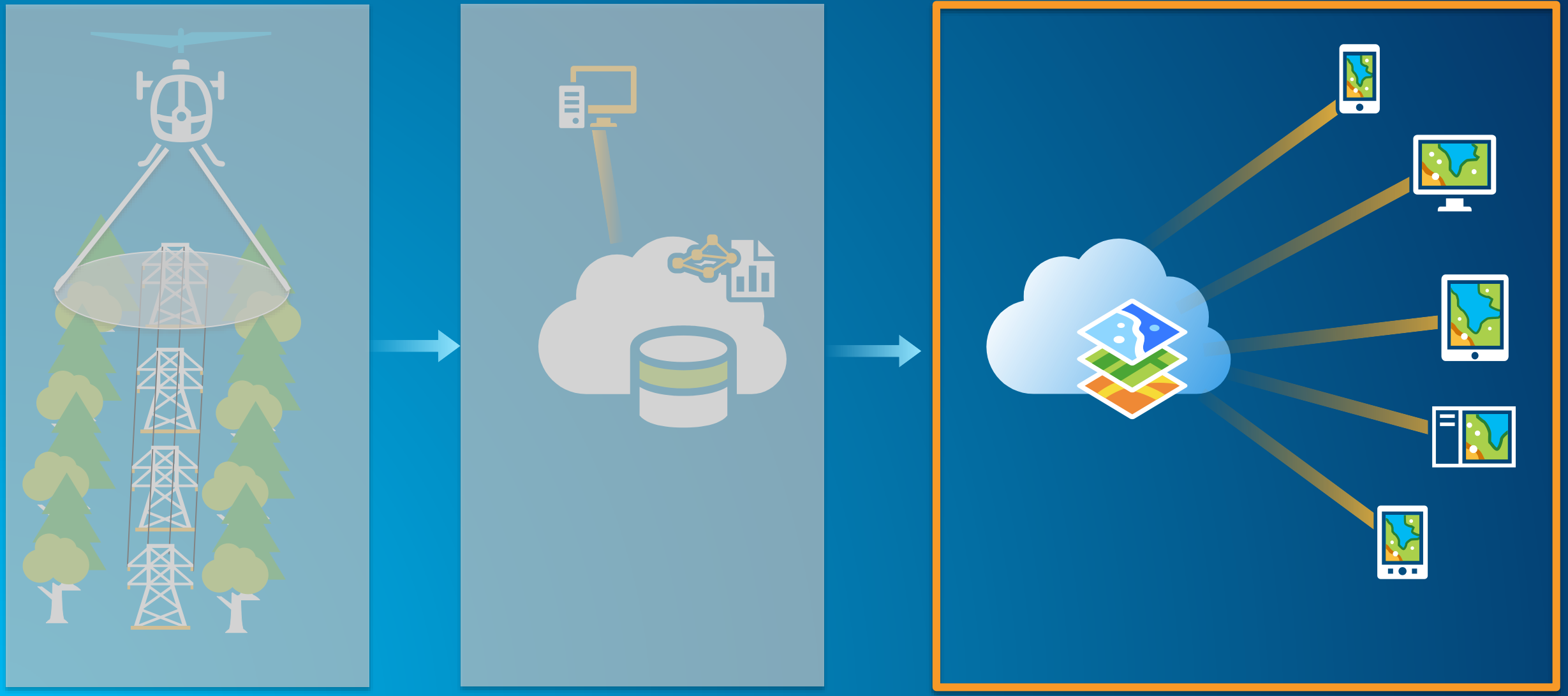
# ArcGIS for Imagery Management



# ArcGIS for Imagery Management



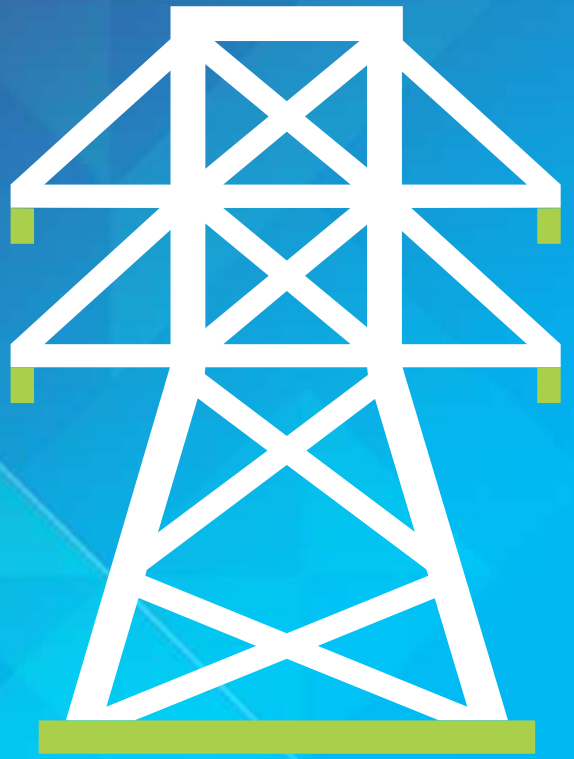
# ArcGIS for Imagery Management



# Demo

Brian Baldwin

# Benefits



# Not Cost Effective

Eagle
Digital
Imaging

# Phodar

David Shear, Eagle Digital Imaging

# Cost

- $150 to $200 per mile
- Depends upon
  - Time of year
  - Location
  - Contiguous miles
  - Linearity
- Assumes Lidar data is available

Eagle Digital Imaging

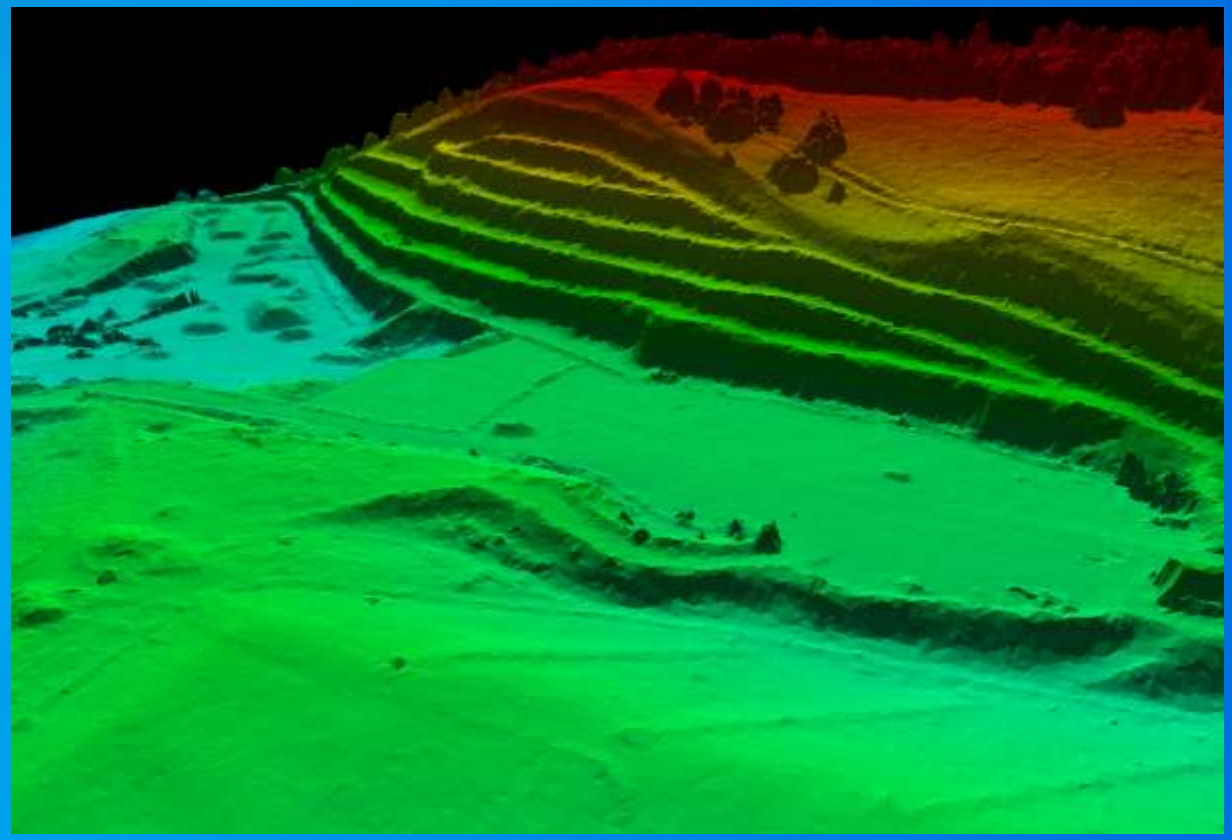
# What is Phodar?

- Derive a point cloud using imagery
- Each point
  - XYZ
  - RGB
- SGM – Semi-Global Matching Algorithm
- SFM – Structure From Motion
- PCDSM – Photo-correlated Digital Surface Model
- PPC – Photogrammetric Point Cloud

Eagle Digital Imaging

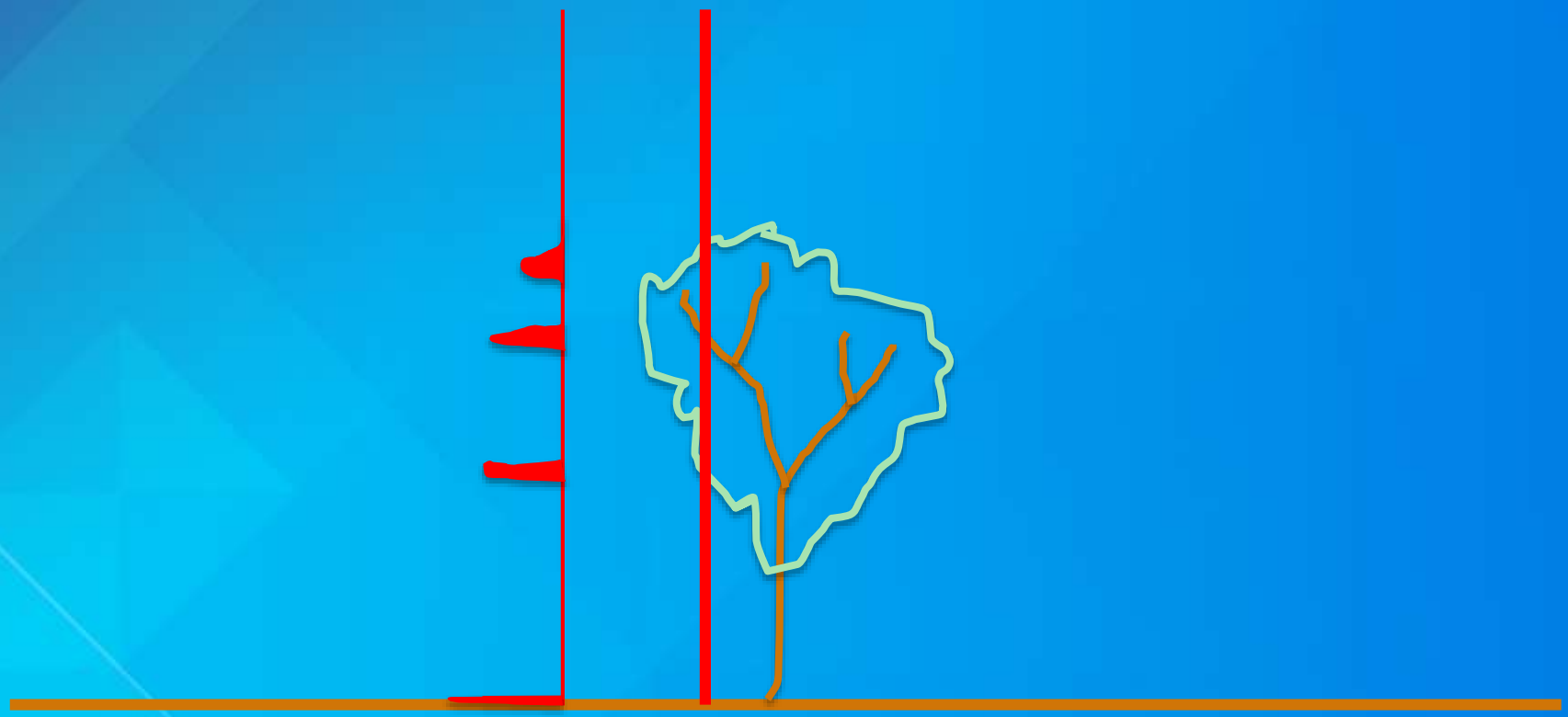
# What is Phodar?

- Radar
  - Radio Detection and Ranging
- Lidar
  - Light Detection and Ranging
- Phodar
  - Photogrammetric Detection and Ranging



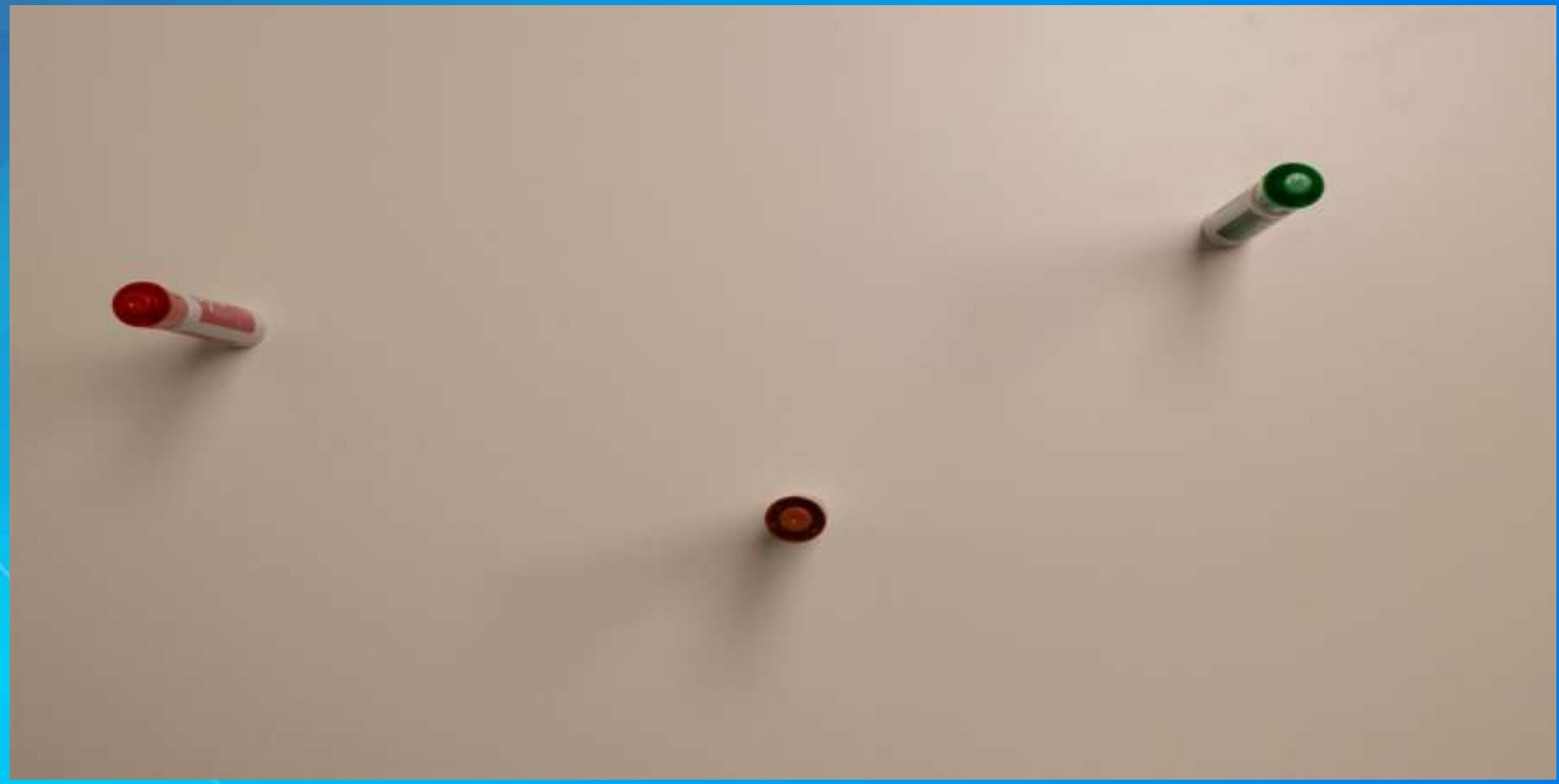
Eagle Digital Imaging

# Lidar



Eagle Digital Imaging

# Phodar



Eagle Digital Imaging

# Phodar

*Left Image*

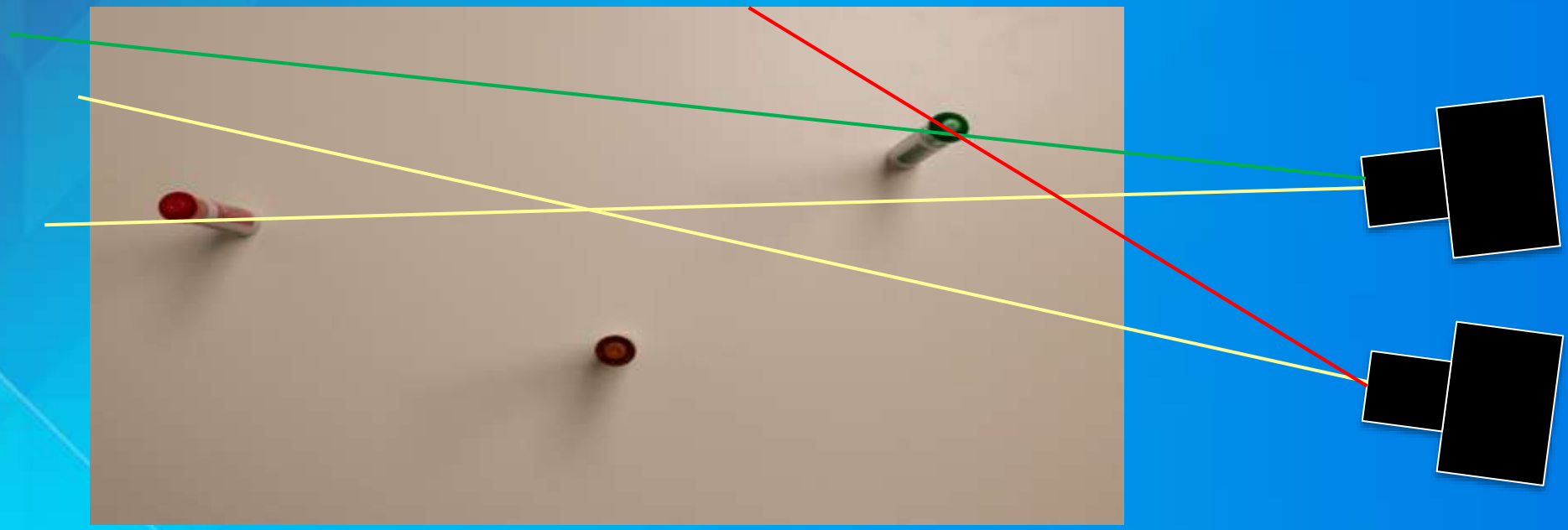
Eagle Digital Imaging

# Phodar

*Right Image*

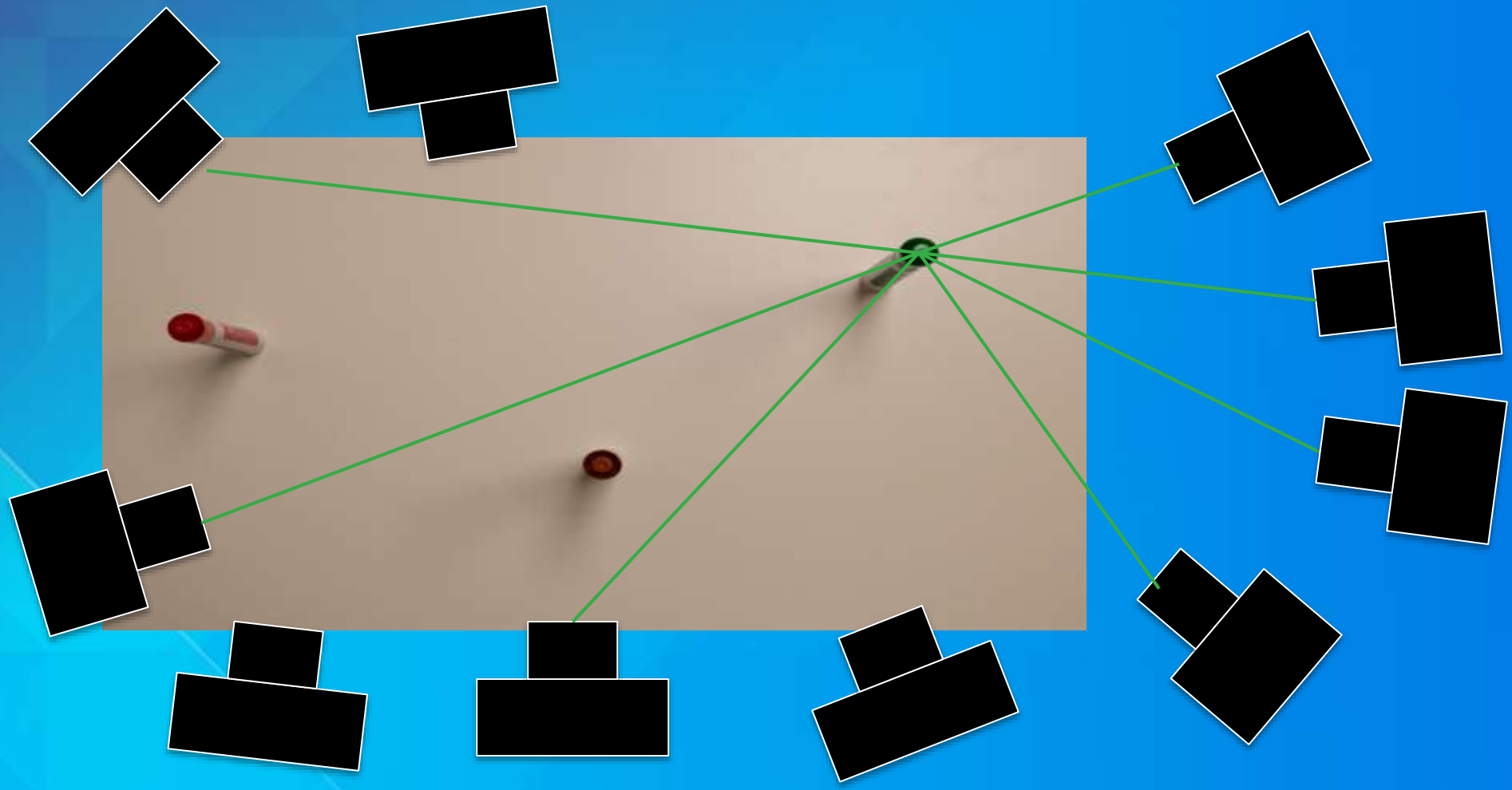
Eagle Digital Imaging

# Phodar



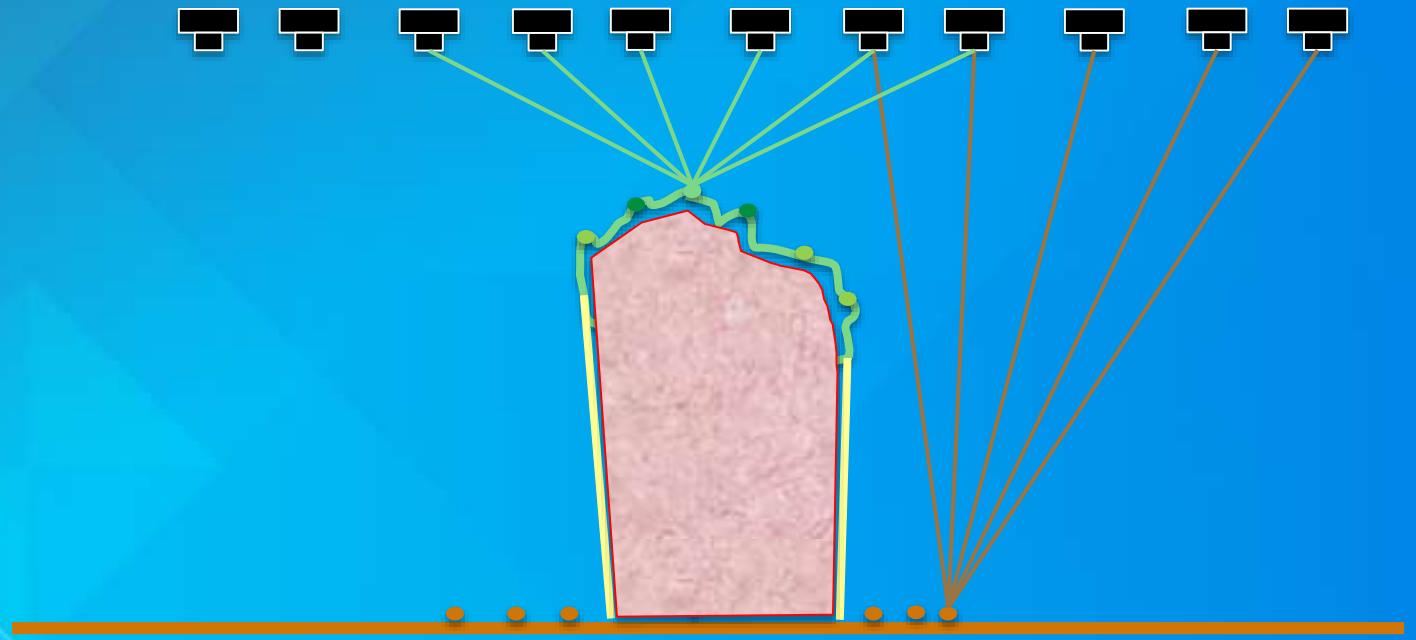
Eagle Digital Imaging

# Phodar



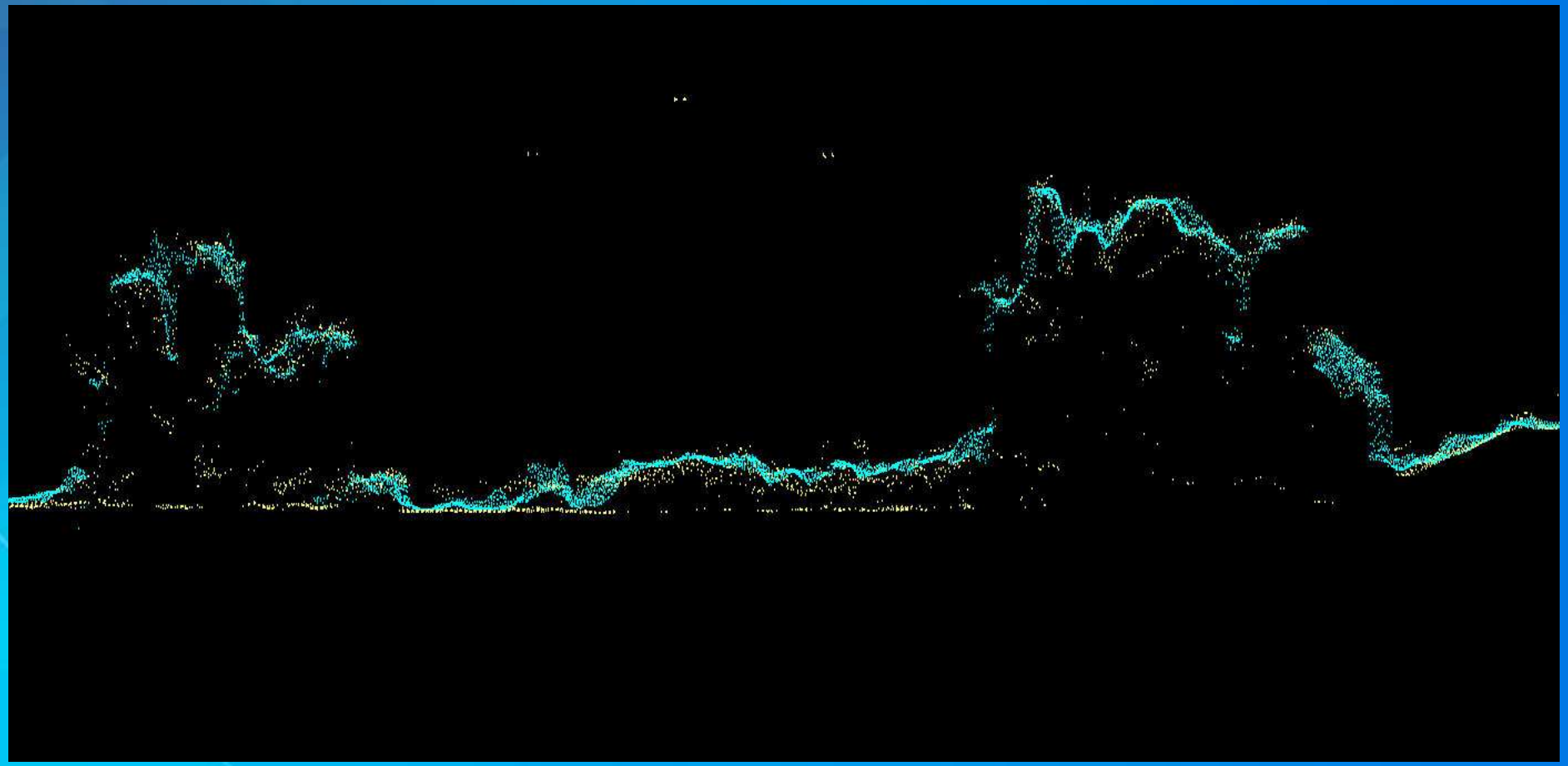
Eagle
Digital
Imaging

# Airborne Phodar



Eagle Digital Imaging

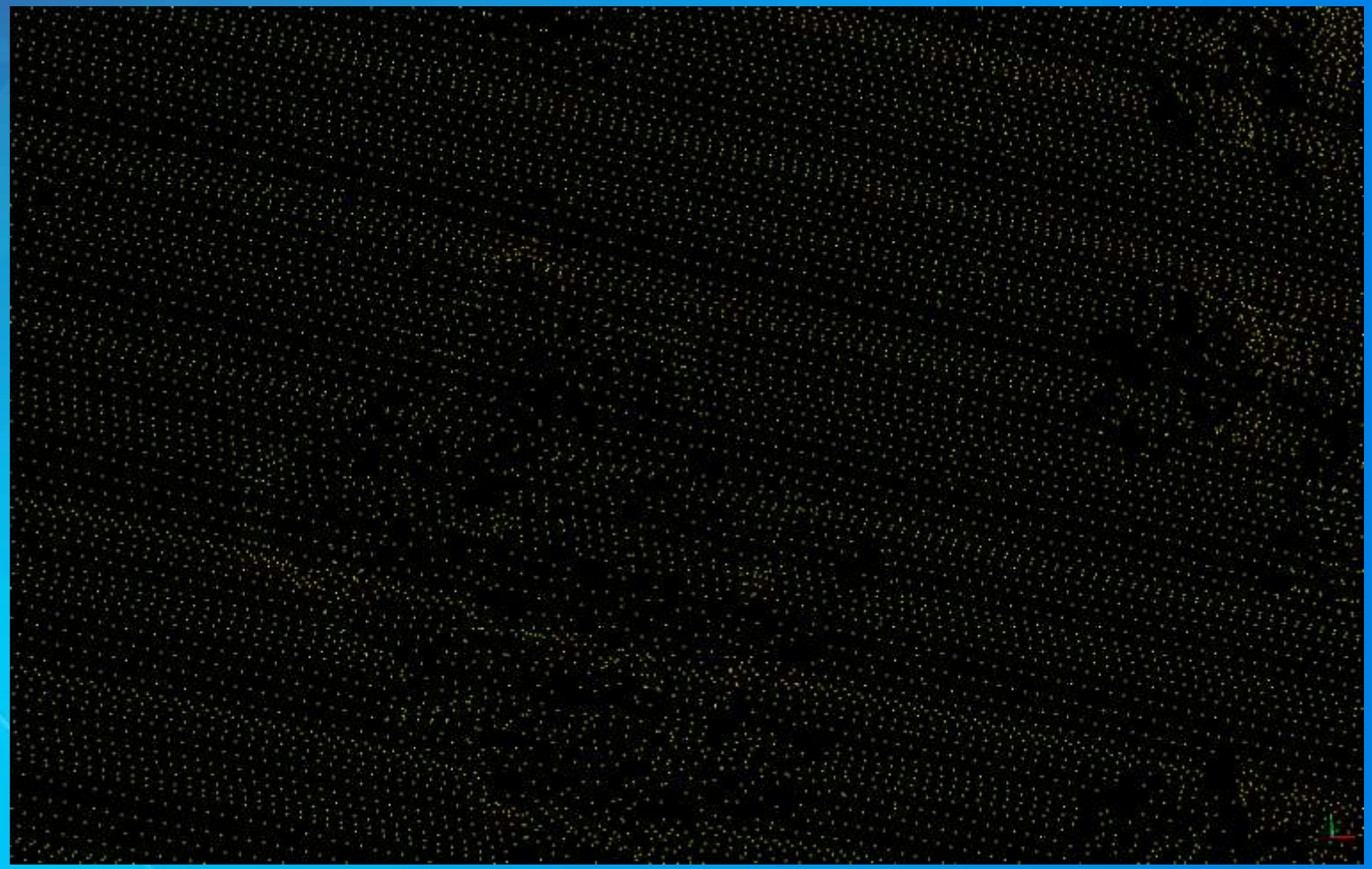
# Phodar vs Lidar Slice



*Phodar – Blue*  *Lidar - Yellow*

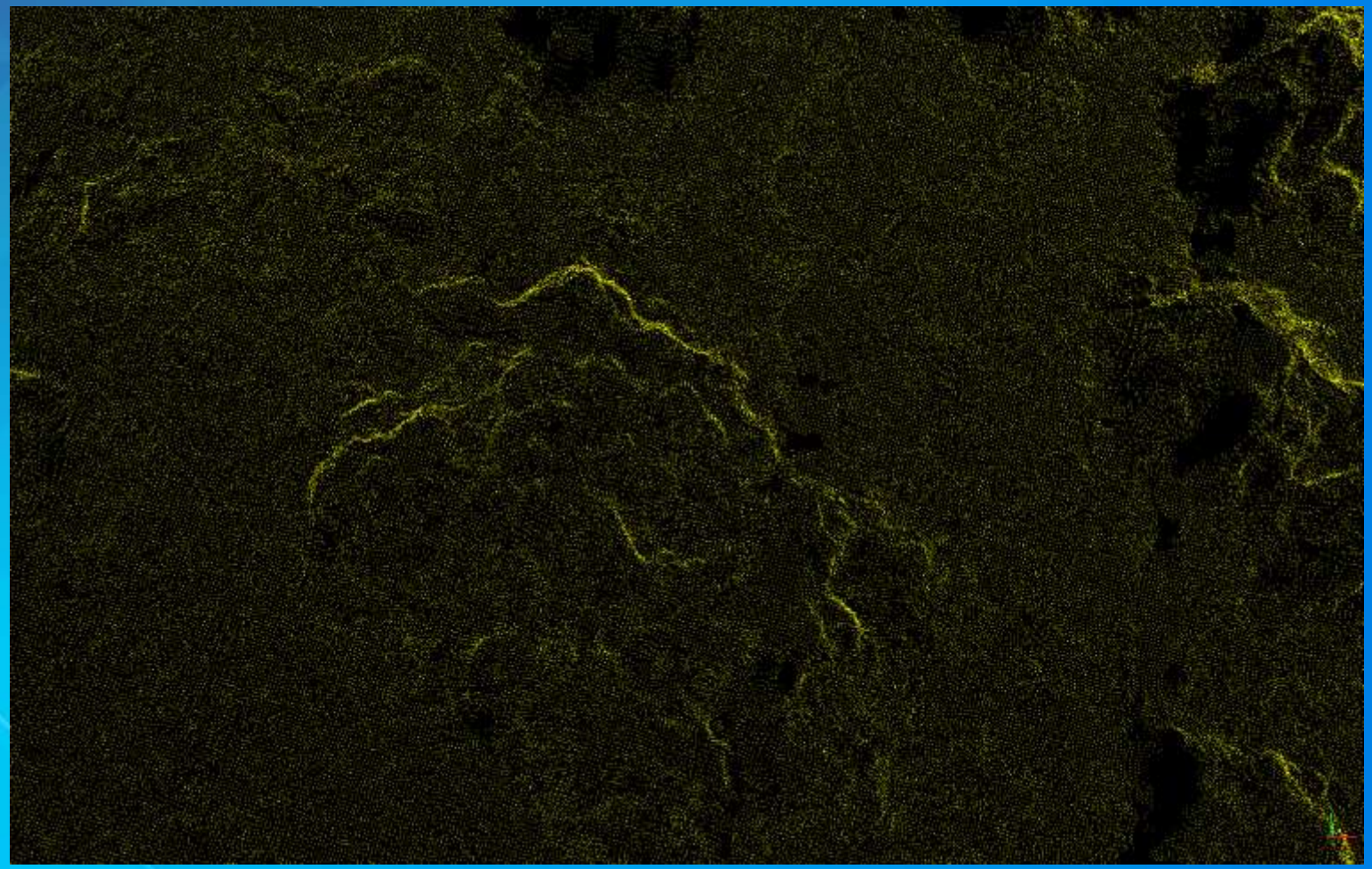
Eagle Digital Imaging

# Lidar Point Density 20 points/m²



Eagle Digital Imaging

# Phodar Point Density >120 points/$m^2$



Eagle Digital Imaging

# Colorized Lidar

Eagle Digital Imaging

# True-Color Phodar

Eagle Digital Imaging

# Lidar Oblique View

Eagle Digital Imaging

# Phodar Oblique View

Eagle Digital Imaging

# Phodar vs Lidar

| Phodar | Lidar |
|---|---|
| True color | Colorized via multimodal fusion |
| High point density from low cost aircraft | Lower point density even from helicopters |
| Does not penetrate the canopy | Does penetrate the canopy (better bare earth) |
| Does not yet accurately measure conductors | Does measure conductors |
| Needs initial Lidar data for conductor location | |
| | |

Eagle Digital Imaging

# Summary

- Phodar is not the solution for everything
- Can provide a lower cost higher resolution true-color point cloud
- Costs $150 to $200 per mile
- Uses previously acquired Lidar data
  - Conductor location (most important)
  - Tower location
  - Bare earth
- Ideal for evaluating potential encroachment
  - Change detection, tree typing, wider swath
  - Higher point density, lower cost

Eagle Digital Imaging

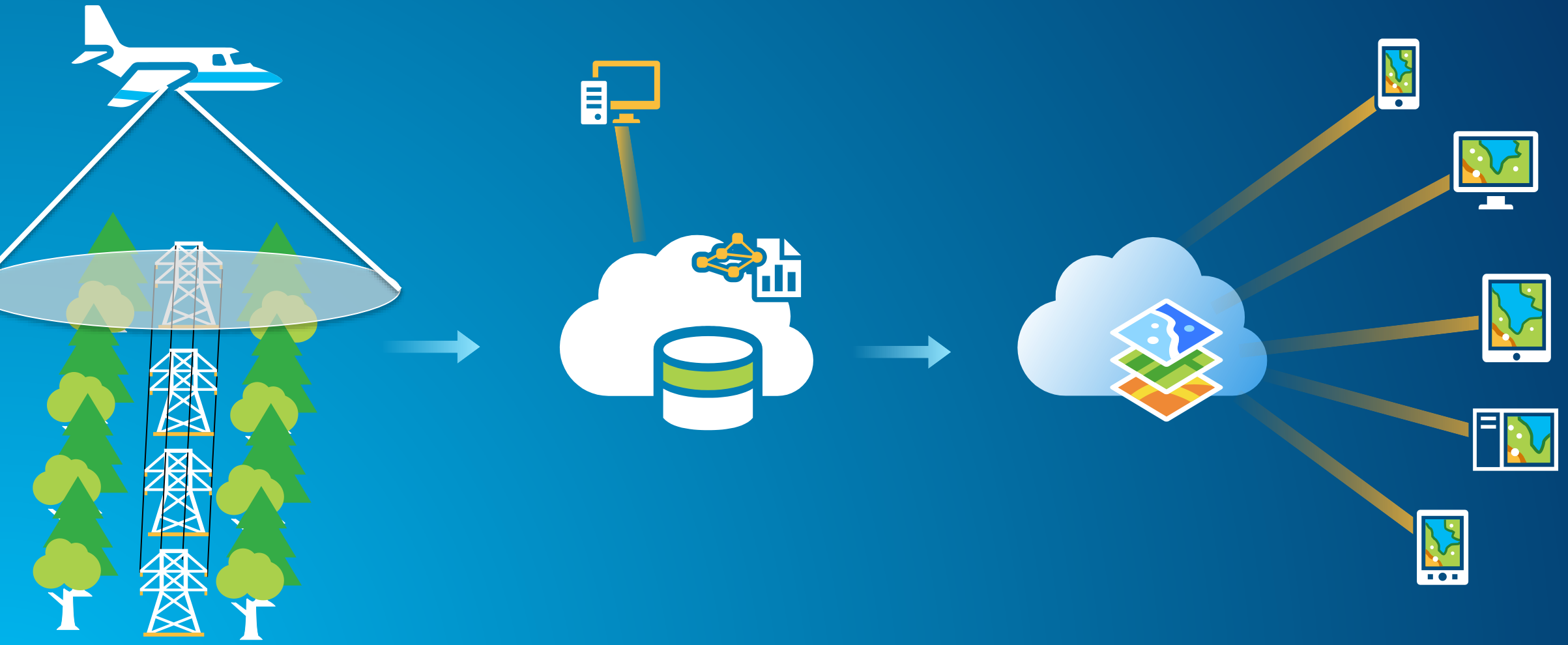
# Processing Phodar

Dave Twichell

# Pre-requisites for using Phodar in Vegetation Management

- Initial Lidar Collection
- 3D Conductor Data in GIS
- Multispectral Imagery (IR, RBG) Collected with Phodar
- Transmission Corridor (Optional)

# ArcGIS for Imagery Management with Phodar



# Classification Imagery– Veg vs Non-Veg

- Spatial Analyst
  - Image Analysis Toolbar
- Multispectral Imagery
  - IR – Vegetation
  - Red – bare soil
  - Blue – urban features, concrete

# Classifying Phodar

- Create veg polygons
  - Based on Imagery classification and height of the phodar points
- Apply to Point Cloud

# Creating Information Products

- Areas of Interest
- Points of Interest
- Danger Trees

# Demo

Brian Baldwin

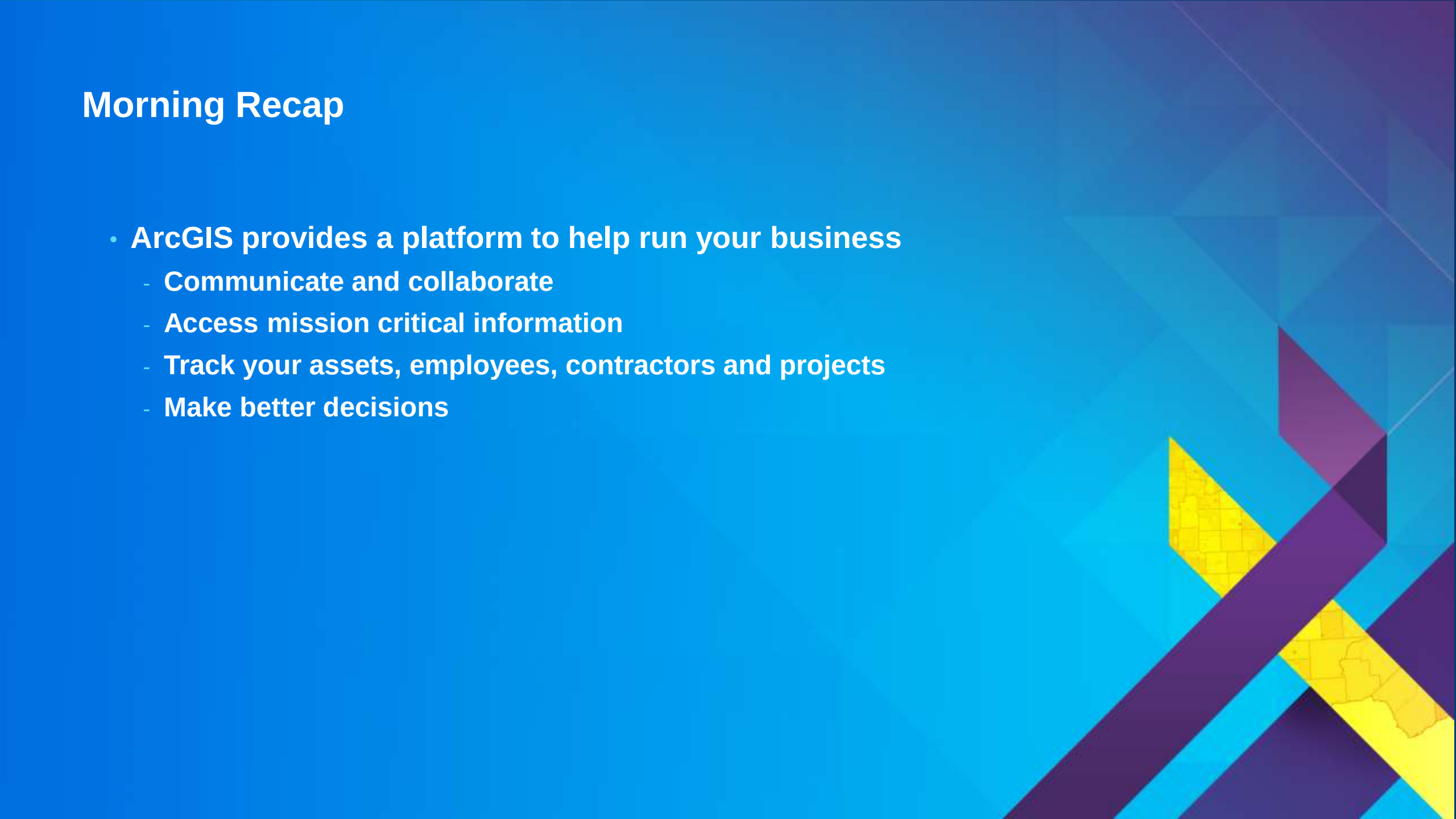
# Next Steps

- Desktop patrolling
- Vegetation mitigation

- After Lunch

# Morning Recap

- ArcGIS provides a platform to help run your business
  - Communicate and collaborate
  - Access mission critical information
  - Track your assets, employees, contractors and projects
  - Make better decisions



# After Lunch

- Vegetation Management continued
  - Desktop patrolling
  - Advanced Analytics
- Enhanced Operations
  - Real-Time Data
  - OSIsoft PI
- EGUG Transmission Community

Understanding our world.