Improved Vegetation Management with PhoDAR

Dave Twichell, Brian Baldwin, David Shear
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
Not Cost Effective
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
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
What is Phodar?

- **Radar**
  - Radio Detection and Ranging
- **Lidar**
  - Light Detection and Ranging
- **Phodar**
  - Photogrammetric Detection and Ranging
Lidar
Phodar
Phodar
Airborne Phodar
Phodar vs Lidar Slice
Lidar Point Density 20 points/m^2
Phodar Point Density >120 points/m²
Colorized Lidar
True-Color Phodar
Lidar Oblique View
<table>
<thead>
<tr>
<th>Phodar</th>
<th>Lidar</th>
</tr>
</thead>
<tbody>
<tr>
<td>True color</td>
<td>Colorized via multimodal fusion</td>
</tr>
<tr>
<td>High point density from low cost aircraft</td>
<td>Lower point density even from helicopters</td>
</tr>
<tr>
<td>Does not penetrate the canopy</td>
<td>Does penetrate the canopy (better bare earth)</td>
</tr>
<tr>
<td>Does not yet accurately measure conductors</td>
<td>Does measure conductors</td>
</tr>
<tr>
<td>Needs initial Lidar data for conductor location</td>
<td></td>
</tr>
</tbody>
</table>
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
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.