LiDAR Use for Transmission Line Management

Enhanced Forest Inventory Workshop – Jan. 23, 2013
Canadian Institute of Forestry
Transmission System

Existing: 11,760 km - 50,500 ha.
- 500 kVDC: 1830 km (4 lines)
- 500 kVAC: 210 km (1 line)
- 230 kV: 4870 km (61 lines)
- 138 kV: 1650 km (27 lines)
- 115 kV: 3200 km (95 lines)

Proposed next 5-10 years: 1,600 km
- 500 kVDC: 1250 km
- 500 kVAC: 250 km
- 230 kV: 100 km

Using LiDAR since 1999
- wholly owned subsidiary – Wire Services
Transmission System

Life Cycle Issues:

• Existing Lines
  • changing standards of operation:
    • higher electrical demand loads
    • environment/cost vs reliability
  • patrols in winter and in non-severe weather

• Future Lines
  • environmental impact assessment and mitigation
  • routing
  • construction
Data Capture, Processing, Analysis

Data Capture:

- **LiDAR**:
  - Approx 200 m. width
  - +/- 15 cm accuracy

- **Ground control survey / GPS**
  - real time

- **Weather** – real time

- **Line loading** – real time (by MH)

- **Forward digital video**

- **Downward digital orthorectified photography**
  - 10 cm pixels
  - +/- 50 cm spatial accuracy
Data Capture, Processing, Analysis

Data Processing:

- **Ground control survey / GPS**
  - Post process geo reference on LiDAR, Orthophoto, Video

- **LiDAR**
  - **Point cloud** - each point has x,y,z values & time stamp
    - Ground DTM
    - High vegetation
    - Low vegetation
    - Tower
    - Wire
    - (water, roads, rail, buildings, etc.)

- **Real time weather** — time stamped

- **Line loading (current)** — time stamped

- **Downward digital images**
  - Orthorectified & geo referenced
  - Mosaic strip

- **Forward digital video**
  - GPS annotation overlay per frame
Data Analysis:

- **PLS CADD**
  - Computer modeling of:
    - Wires
    - Towers
    - Terrain
    - Surrounding objects

- **Output**
  - Scenario reports (hardcopy)
  - Data spreadsheets
  - GIS formats
  - AutoCAD
  - Etc.
Environmental Assessment

MB Environment Act

• Environmental Impact Statement & mitigation strategies
• Public consultation
• Regulator review
• Environment Act Licence with conditions
Environmental Assessment

Environmental Impact Statement & mitigation strategies

- Route selection process:
  - Initial mapping from existing 1:60,000 B&W and ground survey
    - Environmentally Sensitive sites
    - Land classification – R&E potential, habitat (including people)
    - Route selection
  - FLY!
  - Orthophotography
    - refine mapping
    - Identify changes from 1:60000 B&W flown
Environmental Assessment

• LiDAR
  • Create vector data for features that cross proposed route
    • Streams not visible on photography
    • Rail, roads, etc

Line of site analysis
• Predator considerations (human or otherwise)
Design & Construction

PLS CAD modeling:

- Tower placement
- Structure, span requirements
Design & Construction

PLS CAD modeling:
• Tree clearing requirements
Geographic Information Systems

New facility:
• Designed structure locations & attributes from PLS CAD model

Existing facility:
• location from LiDAR through PLS CAD modeling
• attributes from PLS CAD model

QC existing GIS data developed from other sources:
• GPS, other air photos, as built plan and profiles
North American Electric Reliability Corporation

2003 Blackouts!

- 50 million customers – US & Canada
- 25 million customers – Europe
- 100+ reliability standards
- Vegetation management
  - Grow-ins (from underneath or the side)
  - Fall-ins
- Thermal rating
Line Rating, Thermal Upgrades
Tree-Wire Interactions

Sag & sway
Tree-Wire Interactions

Sag & sway
Danger/Hazard-tree identification
Right-of-way Widening
Thank-you