LiDAR; A new view on the ground
Presentation Highlights

- Company Information
- Digital Imagery
- LiDAR
  - What it is
  - Who is using it
  - Details about LiDAR
  - Products
Company Profile

Incorporated 2007

Located in Lincoln, NB
• 5000ft$^2$ office
• Close to the Fredericton Airport

Staff
• 34 on Staff
• Can complete projects using in-house staff
• *Department of National Defence, UNB Geodesy and Geomatics Engineering, UNB Faculty of Forestry and Environmental Management, Maritime College of Forest Technology, NSCC (COGS) Remote Sensing Concentration, NSCC (COGS) Survey Technician, Moncton Flight School, Capital Airways Pilot Programs

Aerial Equipment
(3) Mapping Cameras
(3) Airborne LiDAR Systems
(4) Survey Aircraft
Services

Experience
• >30,000km² of Imagery
• >30,000km² LiDAR

Project Types
• Photo, LiDAR or both
• 1km² to several thousand km²
• Corridor or block
• High accuracy
• Value added products

1600 Line km MN, Canada
NOAA / NGS Harbour Mapping

220 Ports and Harbours

NB Flooding
Atlantic Canada LiDAR Coverage

- **Newfoundland & Labrador**
  - 5,000km² – about 1.2%

- **Nearly 20% of New Brunswick**
  - 14,000 km²

- **Nearly 20% of Nova Scotia**
  - 9,800 km²
Digital Aerial Photography
Microsoft UltraCam Lp

- Latest Generation UltraCam Hardware Architecture
- Applanix Position and Orientation System (POS)
- Directly Georeferenced
- Panchromatic, RGB, NiR
- Orthorectified and stereo products available
- Three axis mount
- Resolutions from 0.05m – 0.30m
- USGS Certified mapping grade camera
Digital Aerial Photography
Digital Aerial Photography
Digital Aerial Photography
Topographic Vector Collection & Interpretation
Light Detection And Ranging
LiDAR

- X,Y,Z Location
- Intensity
- Return Number
- Scan Direction
- Edge of Flight Line
- Scan Angle
- Point Source ID
- GPS Time

Most raw form of the data most people will ever use is the LAS file format (Log ASCII Standard)
Who is Using LiDAR

- Government (Federal & Provincial)
  - Department of Transportation
  - Department of Environment
  - Public Safety
  - National Defence
  - Public Works
- Municipalities & Counties
- Engineering & Survey Firms
- Design and Build Companies
- Resource Developers
- Utility Companies (Power lines represent the majority of our business)

Forest Industry – Thanks to the work conducted by CFS, CWFC, OMNR, FPInovations and other collaborators the use of LiDAR within the forest industry has become a reality
Power Lines
Power Lines
LiDAR Mission Planning

- Resolution and Accuracy
- Project Area Geometry
- GPS Base Station
- Elevation in project area
- Line Spacing (LiDAR and Photo)
- LiDAR flown at 50% overlap

*Not all LiDAR is the same*
Collection Accuracy

*Not all LiDAR is the same*
Positional Accuracy Testing

*Not all LiDAR is the same
LiDAR & Imagery Flight Line Spacing

**Imagery at 30cm**
~2500m spacing

**LiDAR at 1pt/m²**
~500-850m spacing

1:200,000
LiDAR Point Density

- Planned to produce and average of $X$ points per m$^2$ with the overlapping swaths considered on flat hard surface

- This will be an average across a block as many factors affect the final distribution on the ground

- Standard resolution is 1ptm$^2$

- Practical Limit is in the range of 1-8 pts/m$^2$
LiDAR Returns

- **Red** – first returns
- **Green** – second returns
- **Purple** – third return or greater

Depending on the brand... Some lasers record up to 4 returns (discrete systems), others up to 8-12 returns (full waveform)
By allowing user interaction with the waveform, improvements in ranging, point density and target discrimination (classification) are possible.
Point Cloud Feature Coding

Municipalities and Utility Companies
• Up to 44 unique feature classes
LiDAR Derived “Basic Forestry Products”
Current Provincial DEM
– LiDAR DEM
Digital Canopy Model
LiDAR Derived “Enhanced Forestry Products”

- Forest Measurements on a basis on 400m² area:
  - Tree Height (top & average)
  - Density
  - Basal Area
  - DBH (and distribution)
  - Crown Closure
  - Volume (total & merchantable)
  - Biomass
LiDAR Metrics

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<tr>
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<th>1pt/m²</th>
<th>6pts/m²</th>
<th>Photo DSM (0.5m)</th>
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<tr>
<td>Total return count</td>
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<td>Return 1 count</td>
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<td>Return 2 count</td>
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### LiDAR Metrics

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<th>Metric</th>
<th>Red Pine</th>
<th>White Pine</th>
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<tr>
<td>Elev Maximum</td>
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<td>Elev P40</td>
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**LiDAR Metrics**

- Express how the point cloud is distributed within a given forest type under differing conditions.
- Multitude of ways available to express this distribution.

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Intensity values

- Total first
- Total all
Enhanced Forest Inventory
Questions?

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