Mobile Laser Scanning for Oilfield Asset Mapping and Management

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Overview

• Overview of Mobile Laser Scanning – “The Ugly Reality of What’s Achievable” or “Big Data, Big Problems”

• Case Studies
  – Road Infrastructure Mapping
  – Facility As-builts
  – Oilsands Mapping

• Questions
SarPoint Overview

• Offices in Edmonton and Calgary, Alberta, Canada. Field office in Fort McMurray, Alberta, Canada.

• Speciality services focus on providing innovative, yet practical geomatics solutions for industry issues often involving development and integration of new technologies. Examples include automated deformation monitoring systems, autonomous mapping platforms and software development.

• “Bread and butter” services include land surveying, environmental assessment, and conventional laser scanning.

• Check out some of our projects at http://www.youtube.com/user/SarPointEngineering
Mobile Laser Scanning Overview

• “Google street view on steroids”
• Collect accurate 3-dimensional point cloud from a moving vehicle, often with simultaneous georeferenced photography
• Scanner platform typically positioned using a combination of GPS and INS sensors
• SarPoint was first in N. America to deploy the Riegl VMX-450 scanner
  – Acquires 1.1 million pulses / second and can acquire multiple returns per pulse (to see “past” foliage)
Advantages of Mobile Scanning

- Speed of data acquisition – data is collected while vehicle is in motion (up to highway speeds)
- Safety – survey personnel do not need to be in traffic, in the way of operations, or outside a vehicle
- Totality of data acquisition – scanner acquires and records all *visible* features regardless of particular mission
Advantages of Mobile Scanning

• High accuracy and data density
Typical Applications

• Mobile Scanners currently divided into two categories –
  – “GIS grade” (5-20 cm accuracy) : Sign asset inventory, gross location of power poles, light standards, etc. Pavement marking assessment, line-of-sight studies, right-of-way width as-built
  – Point densities can reach 1 pt per 3 cm (i.e. Riegl VMX 450)
Disadvantages of Mobile Scanning

• “Flythrough fatigue” – “Great, point clouds look awesome, now what do we do with them?”
  – Limit to current CAD package capabilities to model and utilize point clouds for design
  – Point clouds are “dumb” – no attribute information
• Data management – typical 2 hour project takes up 110 gb including photography (after processing)
• LAS file metadata issues – Projection? Geoid? Accuracy?
• QA/QC issues – Standards? Adjustments?
• Inability to capture quality data in bad positioning environments (i.e. downtown corridors)
• Cost of scanner system – needs to compete with existing (albeit lower density) data acquisition
Mobile Scanning Applications

• SarPoint’s focus is on developing application solutions for clients where mobile scanning happens to be the best technological choice
  – Concentration is on solving the problem, not deploying a technology

• Examples
  – Resource road asset mapping
  – Facility plot plan development / pad modelling
  – Oilsands geological modelling
Resource Road Asset Mapping

• Goal is to rapidly as-built resource roads
  – Determine cleared widths for compliance with SRD regulations
  – Determine location of signage / safety barriers for liability mitigation
  – Determine wear on road for road-use issues

• Main issue is time involved with feature extraction vs conventional GPS survey of features
Oilfield Facility As-buils / Pad Modelling

• Existing oilfield facilities typically have minimal as-built information (location of buildings, piperacks, risers, well heads, etc.). Issues arise when:
  – Adding additional well heads to existing padsite
  – Performing completion operations on existing wells
  – Designing facility expansions
Oilfield Facility As-built / Pad Modelling

• Pad Modelling for Construction Optimization
  – Use LIDAR-derived surfaces and CADD modelling to design “optimum” well site pads (slope, elevation, berming, etc.)
  – Minimize cut-and-fill, hauling distances, construction time
  – Load models into GPS-enabled construction equipment to speed up construction and ensure design compliance
Mine As-built and Geological Modellings

- Scanning is very suited to rapidly as-builting open-pit mines – safety, speed
- SarPoint is currently developing technology to mesh hyperspectral imagery with mobile-collected point clouds to map out geological strata based on spectral signatures
Mine As-builts and Geological Modelling

• Goal is to as-built mines daily (for ore-loss reconciliation purposes), as well as improving mine geomodels based on observed geologic strata
  – Improvements in geomodels lead to improvements in mine planning, efficiency and recovery factors

• Prototype stage, challenges include developing spectral signatures for bitumen and clays, integration of sensors
Conclusions

• Mobile laser scanning allows rapid collection of big, very complete data sets
  – “Very complete” means “very large”
  – Opportunities for data mining are primary long term advantage of collection via laser scanning (avoid return trips)
  – Dependency on laser data as “truth” has potential for problems in the future
  – Software capabilities need to catch up to the hardware!
  – Best use often occurs where scanning is a tool to solve a particular problem, and analysis is completed in-house
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