09:00

Alberta lidar stakeholder forum introductory comments

Dr. Chris Hopkinson, ATIC & Dept. Geography, University of Lethbridge (c.hopkinson@uleth.ca)

Abstract:

The talk will summarise the purpose and content of the two-day forum. A brief introduction to airborne lidar will be provided along with a summary of some of the challenges facing public and private sector stakeholders, as perceived by a researcher in the academic community. Registrant questionnaire results will be presented and some questions thrown out for consideration during the course of the presentations and open discussions.

Bio:

Chris is the recently appointed Campus Alberta Innovates Program (CAIP) Research Chair in Terrestrial Ecosystem Remote Sensing at the University of Lethbridge. He has been actively involved in airborne and terrestrial lidar operations and research since 1999; working in industry as a field manager with Optech Inc, a pdf at Queens University, a research scientist and lidar lab manager at the Applied Geomatics Research Group in Nova Scotia, then as a research scientist with CSIRO in Australia. During this period, he has partnered with Natural Resources Canada as the national coordinator of the Canadian Consortium for lidar Environmental Applications Research (C-CLEAR), and served as chair on the ASPRS lidar committee. As a member of the newly independent Canadian Remote Sensing Society executive, he is supporting the development of a new remote sensing certification program.

9:30

A summary of Optech`s cutting edge lidar mapping technologies

Mike Leslar, Optech Inc., Vaughn, ON

Abstract:

Optech will provide an overview of the current state of the art in terrestrial, mobile, airborne and bathymetric lidar (or laser scanning) mapping technologies. The ILRIS 3D, Lynx, Gemini and Orion sensors and associated applications will be presented. A separate demo of the ILRIS 3D LR (long range) terrestrial scanner will be provided on July 10th at the Frank Slide for anyone interested.

Bio:

Mike graduated from the Ryerson University school of Civil Engineering (Geomatics) in 2001 with a Bachelors Degree in Engineering and went on to complete a Master of Applied Science Degree in Civil Engineering (Geomatics) at Ryerson in 2003. Received a License as a Professional Engineer from the province of Ontario in 2006. Worked for three years as a Land Surveyor and then with LiDAR at Optech for seven years. Currently working full time for Optech and pursuing a PhD at York University in Earth and Space Science.

10:00

Riegl LMS-Q780 Long Range, Full Waveform Airborne Lidar Scanner Case Study

Vladimir Kadatskiy, Riegl USA

Abstract:

Mapping wide area projects in mountainous terrain has always presented a challenge for the airborne community. Obstacles such as extreme terrain variation, high spatial density, uniform point distribution, eye safety, and high accuracy often make airborne data collects difficult and costly. In recent case study Riegl new Airborne Lidar System LMS-Q780 has been evaluated in the Rocky Mountains. LMS-Q780 has demonstrated that these challenges can be effectively overtaken by using state of the art technology. In order to meet the high point density requirement while retaining long range capability, the LMS-Q780 incorporates a powerful laser source and multiple-time-around (MTA) technology. MTA has been known in the airborne community as an effective tool for data acquisition; however this technology has not been widely used in complex terrain, due to range ambiguities. The LMS-Q780 incorporates automatic range ambiguity resolution which allows over 13 pulses in the air simultaneously. Multiple time around technology, a high power laser, echo digitization and waveform analysis are combined in LMS-Q780 made it possible to collect data at over 16000ft AGL and retain high point density. This case study has shown that Riegl new Airborne Lidar system LMS-Q780 can be effectively used for complex terrain wide area mapping, making data acquisition easy and cost effective.

Bio:

Vladimir Kadatskiy is the Engineering Support Manager at ***RIEGL USA, Inc.*** Mr. Kadatskiy has extensive knowledge and experience working with laser scanners, inertial navigation, and camera systems. He holds a BS in Computer Engineering.

11:00

A service provider perspective on airborne lidar operations and industry trends

Martin Maric, Airborne Imaging Inc, Calgary, AB

Abstract:

Airborne Imaging, established in 2004, has created the largest privately owned LiDAR library in North America, through the utilization of off the shelf LiDAR systems. Airborne has transitioned thru various systems and different manufacturers. For this brief discussion, Airborne will discuss how, in our experience, the industry has grown in the past 9 years, how the sensors have changed and how both improvements in software and client needs have affected specifications and driven growth in the industry.

Bio:

Martin Maric is the Corporate Sales Manager for Airborne Imaging. Mr. Maric has a BSc. in Mechanical Engineering and spent 11 years in the oil field manufacturing sector, with roles in tool design and development, transitioning into programming and operations, and finally as Operation Manager for MCO Industries based in Calgary. He oversaw all design, machining, fabricating and welding Divisions, over 60 employees in all from 1996-2000.

13 years ago, in 2000, Mr. Maric was headhunted and took a step into LiDAR, as Sales Manager for Aeroscan International, based in Calgary. Subsequently he was recruited to the Role of Western Sales Manager for Mosaic Mapping in 2001 (which purchased and rebranded as Terrapoint), with the objective to establish an office in Calgary and to build a client base focused in the Western provinces and territories. Mr. Maric joined Airborne in January 2006 as the Sales Manager.

Today, Mr. Maric manages the Sales group for Airborne that includes sale offices in Houston, Vancouver and Ottawa.

11:20

Development and operation of an academically - oriented programme to acquire, process and deliver airborne multisensor remotely sensed data

Dr. Olaf Niemann, Department of Geography, University of Victoria, Victoria, BC

Abstract:

In 2005 we were provided with a unique challenge and opportunity: to develop a small and affordable platform designed to collect and disseminate airborne remotely sensed data. It has always been my contention that we needed to fulfill two main objectives to fully realize this challenge. The first was to choose sensors that were complimentary (which maximized the potential information content that could be extracted), while the second was to choose sensors that could be operated simultaneously, and from a small economical platform. A significant number of challenges have been overcome to create a programme that is currently providing data to a variety of users and for a range of purposes. This talk will describe the programme structure, as well as highlighting some of the successes and challenges that we have encountered along the way.

Bio:

K. Olaf Niemann is a professor of Geography at the University of Victoria (UVic) and is
a past Chair of The Canadian Remote Sensing Society. He has been a faculty member at UVic since 1988. He teaches remote sensing at the undergraduate and graduate levels. He leads UVic's Hyperspectral and Lidar Research Group, which is involved with topics ranging from forest structure mapping using LiDAR and hyperspectral feature extraction to modeling of coastal processes through the fusion of *in-situ* and spatial data sources. Major themes within his research include: forest canopy structure mapping using remotely sensed data, ecophysiological characterization of environments using remotely sensed data, wetland mapping and using remotely sensed products as inputs for the study and modeling of linked terrestrial-coastal studies. His research program is tied to The BC Centre for Applied Remote Sensing, Modelling, and Simulation. Through this center, and its partnerships with industry and government, he has built a remote sensing capacity that includes multiple airborne platforms (multi-engine Beechcraft Navajo and various helicopter platforms) complete with digital cameras, first and last return LIDAR up to 260kHz pulse repetition rate, two imaging spectrometers.

Education:
B.Sc. (Hons.) Geography, Queen's University, Kingston
Post Grad Dip. Applied Geomorphology & Geomorphological Mapping, JTC. Enschede,
The Netherlands.
M.Sc. Geography, The University of Alberta
Ph.D. Geography, The University of Alberta

11:55

Lidar on the NEON airborne observatory platform

Dr. Tanya Ramond, Systems engineer, Airborne Observation Platform, National Ecological Monitoring Program, Boulder, CO, USA (tramond@neoninc.org)

Talk highlights:

- Background of NEON
- Overview of the Airborne Observatory Platform
- Optech Gemini Lidar and its capabilities
- Lidar operations on flight campaigns
- Fusion of lidar data with hyperspectral and RGB data
- Integration of lidar into NEON's higher level data products and workflow

Bio:

Tanya Ramond is the Systems Engineer for the Airborne Observation Platform (AOP) at the National Ecological Observatory Network (NEON). She recently moved to NEON after nearly 10 years at Ball Aerospace where she worked on building and demonstrating flash lidar systems for remote sensing of vegetation from aircraft and from space. Dr. Ramond completed her postdoc at the National Institute of Standards and Technology Time and Frequency division, using femtosecond lasers for frequency metrology. She received her PhD from the University of Colorado Boulder focusing on photoelectron spectroscopy of negative ions. As a Systems Engineer at NEON, Dr. Ramond is interested in the interplay between remote sensing of ecological systems and engineering.

13:30

Efficient LiDAR Processing with LAStools

Dr. Martin Isenburg (martin@rapidlasso.com)

Abstract:

Dr. Isenburg will present a hands-on talk on the technology in LAStools and how it can be used for efficient LiDAR processing at the example of several projects. In the Canary Islands (Spain), for example, LAStools were used to create canopy height maps and forest density grids. The processing results also helped to improve the existing photogrammetrically derived topographic maps significantly. The vegetation-penetrating lasers uncovered elevation differences of up to 25 meters between the official records and reality where entire hills and valleys had been hiding under the canopy of the dense local pine forest.

Bio:

Dr. Isenburg received his MSc in 1999 from the University of British Columbia in Vancouver, Canada and his PhD in 2004 from the University of North Carolina at Chapel Hill, USA – both in Computer Science.

Dr. Isenburg was first exposed to LiDAR data as a post-doctoral researcher at the University of California at Berkeley in the context of constructing seamless Delaunay triangulations for the billions of points from the NC flood-mapping project on a household laptop using streaming formats and algorithms.

Dr. Isenburg specializes in geometry processing and data visualization with a focus on large LiDAR point clouds. Currently, he is an independent scientist maintaining a popular suite of LiDAR processing software called LAStools. He is a vocal advocate of open LiDAR formats and is involved in shaping the future of the LAS exchange standard, in promoting the free, open-source LASzip compressor, and in designing the upcoming PulseWaves specification. PulseWaves is a new open vendor-neutral data exchange format for geo-referenced full waveforms LiDAR.

13:50

Lidar system and terrain error modeling

Tristan Goulden, Ph.D. student (ABD), Dept. of Process Engineering & Applied Science, Dalhousie University, Halifax, NS

Abstract:

Current assessment of LiDAR measurement uncertainty is limited to post-survey empirical assessments. While empirical information provides valuable information to the performance of the sensor, it cannot characterize measurement uncertainty throughout the extensive coverage of typical LiDAR surveys. Numerical modeling of uncertainty from sensor sub-system (GPS, IMU, laser ranger, laser scanner) measurements and terrain conditions can provide uncertainty information for all observations within a survey. This presentation will briefly detail the numerical modeling approach for determining LiDAR elevation uncertainty due to measurement error, as well as maps which describe the spatial variation of elevation uncertainty. Results show that errors tend to increase as the laser scan angle, altitude or terrain slope increases. Numerical uncertainty modeling can enhance mission planning capabilities by ensuring targeted accuracy specifications will be met, and provide information for compiling risk assessments associated with the use of LiDAR DEM products.

Bio:

Tristan Goulden is a PhD candidate in Process Engineering and Applied Science at Dalhousie University in Halifax, Nova Scotia. The focus of his PhD research is the sensitivity of watershed attributes and hydrologic outputs to LiDAR derived DEM scale and uncertainty. Previous research endeavors have focused on the development of LiDAR error modeling algorithms to enhance quality assurance and quality control of LiDAR observations. Tristan has been involved in Geomatics since graduating from the Centre of Geographic Sciences in 2000, and has been working with LiDAR since 2006. He is a member of the American Society of Photogrammetry and Remote Sensing LiDAR committee, was a Remote Sensing lecturer at the University of New Brunswick, has supported several airborne LiDAR research missions across Canada, and has participated as an instructor at several LiDAR workshops.

14:10

User-side Analysis of the Effects of Airborne LiDAR uncertainties on mapping applications

Patrick Adda, Ph.D. student (ABD), Dept of Geomatics Engineering, University of New Brunswick, Fredericton, NB

Abstract:

In this presentation, we shall have an interactive discussion on the effects of LiDAR mapping errors on mapping applications. We will look in detail, the challenges involved in determining the accuracy of large LiDAR datasets, major blunders that could be encountered in the process and how to avoid them. Using a recent research project as an example, we will explore vendor and end-user blunders that can result in errors as high as two metres and as low as 1 cm at different locations of the same dataset. To prevent such blunders, the checkpatching method will be proposed. Checkpatching helps to detect errors in large spatial datasets using a sampling method employing randomly selected patches instead of the conventional method of using randomly selected checkpoints. The Checkpatching method also accounts for varying topography and ground cover - possible error sources overlooked by methods that simply use point elevations from ground surveys to check interpolated elevations at the same (x,y) location.

Bio:

Patrick Adda is a graduate student of the University of New Brunswick under the supervision of Prof. David Coleman. His interest is in error budgeting for large projects employing large datasets from various sources including LiDAR. Patrick worked as a Photogrammetrist and Surveyor in Ghana for five years before being awarded a German DAAD scholarship to complete an MSc in Photogrammetry and GIS at the University of Applied Sciences, Stuttgart. He has served as a consultant in Canada, United Kingdom, Guinea, Liberia and Ghana, providing technical and procedural directions on large data collection projects according to client specifications. He has specific skills in designing common specifications for data collection suitable for use among multiple organizations - maximizing the use of collected data at shared costs among stakeholders.

14:30

A hierarchical lidar data fusion classification of heterogeneous land cover types in Alberta and the NWT

Dr. Laura Chasmer, Research Associate, Wilfrid Laurier University, Waterloo, ON & University of Lethbridge, Lethbridge, AB

Abstract:

An accurate classification of the spatial distribution of land cover types, especially in areas that are rapidly changing, is fundamentally important for quantifying how these changes are affecting ecosystems. Land cover change, often as a result of climatic or anthropogenic disturbance, is viewed as the single most important variable affecting ecosystem processes (e.g. Vitousek, 1994; Foody, 2002), while our ability to predict future environmental scenarios depends significantly on the accuracy of land classification.

Airborne LiDAR data allows us to map the three-dimensional characteristics of the earth's surface, while spectral remote sensing provides a snapshot of vegetation type and health. The following presentation will describe a highly accurate (to between 88% and 97%) land cover classification based on the fusion of high resolution airborne LiDAR and spectral WorldView 2 imagery within a hierarchical (decision-tree) methodology. We will also examine attributes most important to classifying land cover types within northern boreal and discontinuous permafrost sites in Alberta and the Northwest Territories, and we will discover that much of the classification can be done (to a similar degree of accuracy) using airborne LiDAR data alone. Finally we will briefly describe some ongoing projects at Wilfrid Laurier University and the University of Lethbridge that utilize the land cover classification methodology.

Bio:

Dr. Laura Chasmer is a research associate at the Cold Regions Research Centre, Wilfrid Laurier University and an adjunct faculty member in the Department of Geography at the University of Lethbridge. She did her Ph.D. in hydro-meteorology and remote sensing at Queen's University as part of the Canadian Carbon Program. Laura has worked with airborne and terrestrial LiDAR data and systems since 2000, and with leading researchers in the USA, Canada, Australia, and the UK. Laura's research integrates ecosystem processes in ecology, hydrology and meteorology with an advanced understanding of spatial and temporal remote sensing data analysis.

15:10

Overview of the projects undertaken by the Government of Alberta involving LiDAR and other remote sensing technologies

Dr. Barry White & Dr. Shane Patterson, ESRD, Government of Alberta, Edmonton, AB

Abstract:

Over the last few years there Government of Alberta has begun to explore a range applications for remote sensing technologies such as LiDAR. These applications have included Wet Area Mapping (WAM), use for assessing reclamation, along with integration with other remote sensing technologies such as multispectral imagery. The use of remote sensing technologies such as LiDAR can be used to inform models and provide a reliable and independent source of information. The GoA is interested in exploring the ways LiDAR and other remote sensing technologies can be utilized to improve the way data is collected and analyzed within Alberta. To do so, the GoA has been working with a number of Universities (Universities of New Brunswick, Lethbridge, Calgary and Alberta) and the Canadian Center for Remote Sensing on a series of projects to evaluate the application of remote sensing technologies and this presentation will highlight some of these project areas that are being undertaken.

Bio:

Barry White: Barry White is the provincial Forest Management Specialist with Environment and Sustainable Resource Development. He obtained his PhD in silviculture from the University of British Columbia and Bachelor's and Master's degrees in forest management and forest soils from the University of New Brunswick. He is a member of the College of Alberta Professional Foresters and holds an Adjunct Professorship position with the Faculty of forestry and Environmental Management with the University of New Brunswick. He has been leading the wet areas mapping initiative since its inception in 2004.

Shane Patterson: Shane Patterson is a Science and Technology Specialist with Environment and Sustainable Resource Development. He obtained his PhD in Water and Land Resources at the University of Alberta. He's Chaired the Reclamation Criteria Advisory Committee since 2008, and a member of the Alberta Institute of Agrologists. He's currently working with the ERCB, Canadian Center for Remote Sensing, and Universities of Alberta, Calgary, and Lethbridge to evaluate the application of remote sensing technologies for environmental monitoring for ESRD.

Government of Alberta

15:50

Canadian federal government lidar guidelines

Philippe Lamothe and Darren Jansen, Natural Resources Canada, Ottawa, ON

Abstract:

Natural Resources Canada is currently engaged in three activities of interest to the Lidar community at large, namely: 1) the development of a national elevation system for Canada, 2) the specification of federal lidar acquisition guidelines and the creation of a novel data storage technique for lidar point clouds, and 3) the geohash table.

NRCan has led the development of a new elevation system. This flexible environment intends to make use of open and up-to-date technological capabilities, allowing for data having various properties to be processed from different sources. The chosen solution is mainly based on Open Source tools and includes: a PostGIS database; a new hierarchical data format, the GeoHashTree, which allows the management of point clouds; and a web data selection and extraction interface. Through this project, users now have access to personalized products and services, thus building a knowledge of the Canadian relief as required for their activities. Elevation data can be extracted in the form of DEM and derived products such as shaded relief, colour relief, slope map, etc These valuable resources can be accessed from the GeoGratis website (http://geogratis.gc.ca/) or else, directly from the web geospatial data selection and extraction interface (http://geogratis.gc.ca/extraction/).

In the summer of 2012, a draft of the Canadian Airborne LIDAR Acquisition Guideline was sent to the lidar community. The document is currently in it's second draft form. The creation of this document was seen as necessary to support the National Elevation System. Specifically, the lack of consistent guidelines is seen as leading to inconsistent data quality, impeding data sharing and impeding data integration. With a federal standard to use as a jumping point for acquisition will support federal, provincial and municipal planning, acquisition and data sharing.

NRCan has also developed a novel lidar data storage system, the GeoHashTree. Lidar data has radically changed the way elevation data is acquired and produced. On one hand, the technology allows the acquisition of high precision data, but on the other hand, the storage, management, and exploitation of these data due to their irregular distribution, their density and the sheer volume of information. GeoHashTree is a generic data structure that allows to store, access and manipulate point clouds of any resolution or data regularity. Using this structure, a system for the management of point clouds in PostgreSQL was developed and is now available

Bio:

Darren Janzen: Darren graduated from the University of Northern British Columbia with a Master of Natural Resources and Environmental Studies degree. Darren is the section head of the optical methods and applications section of the Canada Centre for Remote Sensing. Darren has a background in lidar processing and lidar software development, targeted towards operational feature delineation and biometrics for the forestry and electricity transmission industries.

Philippe Lamothe: Philippe Lamothe is a Geodetic Engineer with the Geodetic Survey Division, Natural Resources Canada. Prior to this, Philippe spent 4 years working as a project manager for a small aerial surveying firm North of Montreal, Quebec that specialized in LiDAR and photogrammetric mapping. He has a bachelor's degree in Earth Sciences from York University (Toronto) and a master's degree in Geodesy from Laval University (Quebec City).