The Kilby Group

4309 Winder Highway
Flowery Branch, Georgia 30542

J. Dwight Kilby, LS
Dwight@TheKilbyGroup.com

D. Keith Kilby, LS
Keith@TheKilbyGroup.com

Reginald Kilby
Reg@TheKilbyGroup.com

Georgia ~ Tennessee ~ North Carolina

770-965-9700 www.TheKilbyGroup.com

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A webinar conducted by Infotech Enterprises of Sterling, Virginia and DTS GIS presented live by *Directions Magazine* will answer many question as to why LiDAR has become the "Go To" Technology.

In just the last five years, blackouts caused by vegetation encroachment on power lines and improperly rated lines have cost utilities and businesses billions of dollars. As a direct result, the North American Electric Reliability Corporation (NERC) issued two alerts requiring U.S. and Canadian utilities to regularly monitor the continent's 450,000 miles of transmission lines for vegetation encroachment and line rating assessment.

NERC is a corporation certified by the U.S. Federal Energy Regulatory Commission and Canadian provincial regulators to establish and enforce reliability standards for the North American bulk-power system.

Infotech Enterprises and DTS GIS collaborated in developing a single cost-effective solution to perform the mandated line monitoring by acquiring airborne LiDAR data and then processing the data with PLS-CADD software to create vegetation clearance and line rating reports. On Dec. 1, 2011, Infotech Enterprises of Sterling, Virginia and DTS GIS participated in a "live" *Directions Magazine* webinar to present this solution to the international energy community.

The question-and-answer period with the audience initiated discussion of numerous key issues related to the NERC Alerts and LiDAR solution that time did not permit the speakers to fully address. This article will answer many of the important queries submitted by the audience.

Financial concerns were foremost on the minds of the webinar attendees, not a surprise given the fact that one-third of the audience was learning about the NERC Alerts for the first time. Infotech Utilities manager Bob Montgomery explained that much of the overall

project cost is attributed to airborne LiDAR operations. Utilities can expect to spend $1,500 to $4,000 per linear mile, depending on the terrain, configuration and width of the transmission line corridor. Many elevation variations and twists or turns in the right-of-way increase flight time and cost.

Montgomery was quick to point out, however, that this investment may reduce utility costs in the long run. Not only do outages cost money, but also NERC has begun imposing penalties on operators whose vegetation management practices or line ratings fail to meet standards. Penalties vary with the severity of the violation, and officially run from $1,000 to $1 million per incident. But Montgomery said several utilities have gotten off with warnings, while others have paid up to $250,000. And those penalties can be multiplied by the day in some cases.

The frequency of monitoring was another common concern expressed by audience members, especially relating to vegetation. Infotech COO Jim Fass pointed out that NERC requires no specific schedule of monitoring because vegetation growth rate depends on geography. Trees and bushes grow much faster in tropical Florida than in arid New Mexico. Unfortunately, the onus is on those utilities in the lushly vegetated areas to know their region and stay ahead of foliage growth. As a rule of thumb, however, Fass recommended a minimum one-year monitoring cycle for any North American utility.

Several webinar attendees wondered whether a fixed-wing aircraft or helicopter was superior for LiDAR acquisition. DTS_EarthEye LiDAR Analyst/PLS-CADD Technician Trevor Tyson responded that both have been used for this application and achieve the necessary 15-cm vertical and 15-cm horizontal accuracy. However, the selection of a vendor should not be determined by fixed wing or rotor, it should be determined by the sensors being used.

Ultimately though, a utility should select a LiDAR vendor based on the point spacing/density required for the project area, which will be dictated in part by vegetation density. This may in turn determine sensor type and collection method. The audience posed several technical questions related to the PLS-CADD software, which is a 3D modeling package created specifically to engineer, design and visualize overhead power line infrastructure within the context of its actual terrain and corridor. The software allows the user to use LiDAR data to build a 3D model of the corridor. By using classified

features identified in the LiDAR data, such as towers, power lines, terrain and vegetation, the user can measure the clearance between lines and vegetation as well as visualize line sag in various weather conditions.

It should be noted that weather data must be collected during the LiDAR flight so the conductor temperature can be calculated. PLS-CADD uses the temperature data and the thermal properties of the conductor to calculate the proper as-built sag and tensions. This is critical information in determining if a line needs to be re-rated.
Tyson explained that commercial LiDAR software is used to process, classify and calibrate the LIDAR prior to being imported into PLS-CADD. Although there are programs that can automate the classification of the LIDAR, a manual inspection should be performed to validate the results. PLS CADD has numerous automated functions to simplify IEEE 738 thermal calculations, automatic stringing and sagging determination.

Some static features in the 3D model, such as terrain, can be saved as vectors from one project to the next so that subsequent analyses can focus on the vegetation and power line rating. For purposes of visualization, 3D models generated in PLS-CADD can be output to Google Earth layers or GIS shapefiles.

Asked to look into the future of the NERC Alerts and LiDAR monitoring, Montgomery responded that he expects penalties to become more frequent and severe, as utilities are no longer able to plead ignorance of the 2010 mandate. On the more positive side, he believes the power industry will soon receive more detailed guidance from NERC as to the type and specification of information that must be included in the vegetation and line rating reports submitted to the organization.

Currently, there are few standards related to these monitoring requirements, and this is probably by design. NERC appreciates the fact that utilities will take a variety of approaches to power line monitoring, each with its own particular form of quantifiable results and classification by region. But Infotech believes airborne LiDAR will become the most widely accepted solution due to its efficiency and cost-effectiveness. As this technology becomes accepted, standards – especially related to feature classification – will emerge from the industry, and NERC will refine its requirements accordingly.