LiDAR Acquisition Report

Project:	**Meramec Basin LiDAR Project**
Report Area:	**Ste. Genevieve County, MO**
Delivery Order No.:	**0001**
Contract No.:	**W912P9-10-0538**
Date:	**24-June-2011**
Submitted by:	**Wade Williams, Project Manager**

LIDAR Data Planning and Acquisition:

The following parameters were used in preparing the flight plan.

Flight altitude	7,320' AMSL
Airspeed	150 knots
Full swath width	1345 meters
Overlap between strips	31.11 % (average)
Field of View	34.0 degrees
Average Point density	1.04 points / square meter
Scan frequency	33.7 Hz
Pulse Repetition Rate	107,700 Hz
Returns per pulse	4 + intensity

LiDAR data was flown for Ste. Genevieve County by Surdex Corporation on December 10 & January 2, 2011. Surdex utilized their twin engine Cessna 335 with a Leica ALS-50-II multi-pulse instrument. Ste. Genevieve County was flown in two missions over two days. Surdex set up GPS base stations for all flights as well as the Missouri Department of Transportation (MODOT) continuously operating reference stations (CORS) were used for the GPS base stations. All flight lines were within 25 miles of a GPS station.

The flight crew is guided by a GPS controlled flight management system, which displays the flight plan; including altitude, heading, cross track deviation and PDOP. During the flight mission, the system operator monitors flight management data, laser information, to ensure a successful mission.

Before and after each LiDAR mission, Surdex Corporation performed a calibration flight to ensure the accuracy of the data to be acquired. This calibration flight consisted of two sets of parallel lines flown in opposite directions, each set perpendicular to each other. These calibration lines were flown over the top of the base airfield and nearby buildings to observe if any horizontal or vertical offset was present. The results of the calibration flights are reviewed in relation to a recent, more rigorous bore sight calibration on the instrument near our office in Chesterfield, MO.

All data in the aircraft, including GPS, IMU (inertial measurement unit, i.e. rotational angles); laser ranges; are recorded onto 72 GB removable hard drives and 1 GB flash memory cards. Upon landing the system operator removes all storage devices from the LIDAR system and the GPS receivers. At the end of each flight day, all data is copied to a second set of data drives for archival purposes. Two copies of all data are maintained throughout our entire process.

Data Processing

Post processing of LiDAR involves the following software packages and procedures:

1. IPAS Pro (Leica)
2. GrafNav (Waypoint)
3. ALS Post-Processor (Leica)
4. TerraScan and TerraModeller (TerraSolid)
5. GeoCue (NIIRS10)

The GPS data is processed, differentially corrected, and its integrity is verified. The IMU data is combined with the GPS and laser range data to create LIDAR elevation points in the project coordinate system. The LIDAR elevation point data are viewed as shaded relief elevation images by flight line. The data is compared with the project boundary and planned flight lines to verify complete data coverage. The flight line data is merged and any areas that that may not be covered with LIDAR are identified and re-flown before the flight crew leaves the project area.

After the data arrives from the field, it is immediately processed and verified. IMU data is processed and checked for gyro bias, systematic errors, and position error.

Based on the system calibration flight line, any alignment errors can be computed and corrected in the processing. The LIDAR elevation point data is projected to XYZ coordinates. First the data is edge matched in order to provide a seamless data set for further processing. Following verification of the daily calibration flight lines, all initial data processing of the LIDAR data is complete.

Ground Surface LIDAR Data Filtering:

All LIDAR points are stored in a database that retains information about flight day and time, return number, laser scan angle, and other information. The database is reviewed and areas of like characteristics are delineated and flagged. The LIDAR processing group will determine which type of filtering techniques need to be applied to each type of area, to provide the best quality at ground elevation surface. Factors that affect this decision are slope, vegetation and cultural features. Each project has unique characteristics that can only be assessed after the data is collected. Data integrity is assured after visualizing results from the selected filtering techniques such as shaded relief models, 3-D viewers and elevation images.

The final step involves output of data into ESRI grid and LAS formats.