LiDAR Acquisition

Corps of Engineers, Saint Louis District

LiDAR Data & Mapping Project Duck Creek CA, Dark Cypress Swamp CA & Mingo NWR

Surdex Corporation Project # 1900316-777
October 2009

LiDAR Data Planning and Acquisition:

The supplied project area was buffered to fully cover the 16 USGS quarter-quarter quads for layout of the flight plan, prepared in a North/East to South/West direction. The following parameters were used in preparing the flight plan.

Flight altitude	6,900' MSL (average ground elevation = 460')
Airspeed	150 knots
Full swath width	1,418.43 meters
Neat swath width	1,134.4 meters
Overlap between strips	20.0% minimum
Field of View	39.4 degrees
Average Point density	1.07 points / square meter
Scan frequency	45.4 Hz
Pulse Repetition Rate	116,800 Hz
Returns per pulse	4 + intensity

LiDAR data was flown by Surdex Corporation on March 17, 2009 and March 20, 2009 over an area of approximately 249 square miles, covering Duck Creek CA, Dark Cypress Swamp CA & Mingo NWR in southeast Missouri. Surdex utilized their twin engine Cessna 335 with a Leica ALS-50-II multi-pulse instrument and based their operations at SURDEX MO COOP CORS L1 Phase Center, Chesterfield, MO.

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.

Two GPS base stations were operated during the flight. The primary base station was located at the airport in Poplar Bluff, Missouri. The maximum distance from the base station to the edge of the project area during flight never exceeded 32 miles.

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. These drives are packed in custom

designed cases and sent by overnight courier to Surdex Corporation for further processing. Two copies of all data are maintained throughout our entire process.
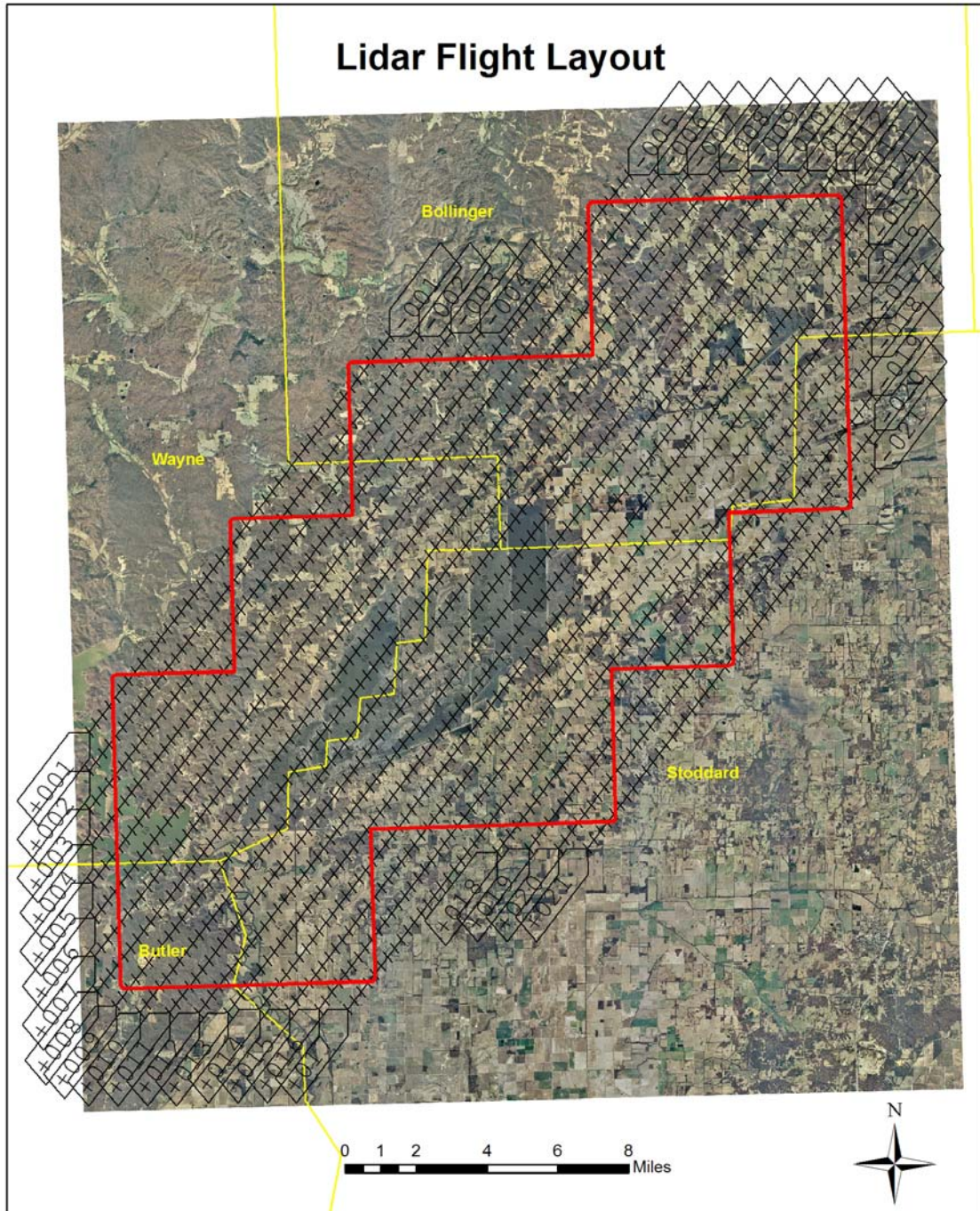
Data Processing

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, along with creation of the intensity image.