Any Bad Points in There?

Some of you reading LIDAR Magazine this month are recipients of airborne LIDAR data, not producers. Rather than being in the thick of the sausage making acquisition and processing chain, you are receiving the data as the end use organization. What should you do?

We are the creators of LP360, one of the most widely used tools for performing comprehensive LIDAR data testing. We have been recently adding some new tools for the USDA and USGS to assist with some of the file content inspections that are applied to contractor-produced data (a cool new tool called "LAS File Analyst"). This work has me thinking about LIDAR quality and what recipients should be doing as standard practice.

LIDAR data collection, processing and delivery is much smoother than it was even five years ago. The processing tools are better but, most importantly, the sensors are significantly better. This improvement in sensor technology has dramatically improved the resolution, precision and accuracy of airborne LIDAR data. For large programs such as the USGS 3D Elevation Program (3DEP), rigorous procedures have replaced the rather ad hoc approaches of smaller, local projects. This begs the question, "is receipt QC even necessary anymore?"

The short answer is an emphatic yes! I find that most issues with disappointment in delivered LIDAR data are the result of a misunderstanding between the organizations delivering data and those receiving the data. A classic example is an acquisition specification that covers vertical accuracy but does not address stirp mismatch or precision. Consider the data shown in **Figure 1**. This is an example of data that meet the vertical accuracy specification but are quite "noisy" in the vertical dimension. The recipients of these LIDAR data would be quite displeased with the data set but would not be in a position to do anything about it because it meets the letter of the requirements.

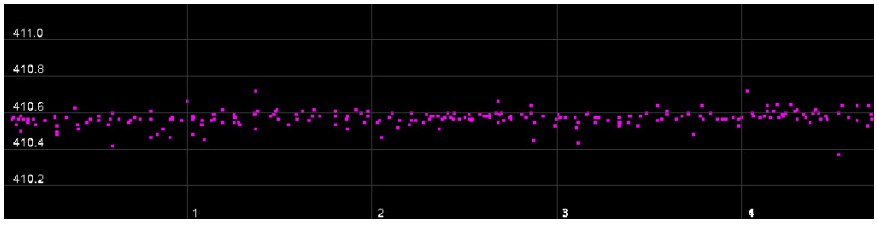

Figure 1: High accuracy, low precision data (units in meters)

Most LIDAR data are still delivered to the ultimate customer in bulk. At certain milestones in the project (far too often only a single event), a bunch of disk drives show up containing the project deliverables; LAS files, imagery, perhaps breaklines and so forth. These data can often sit on the shelf for months before someone has an opportunity to have a look. This look is more often than not full of unwanted surprises!

I strongly recommend that you set up a process where you are provided an initial pilot area and then incremental deliveries of the final deliverables. Quite often greater pains are taken with the preparation of the pilot than with the bulk deliverables so it is important to receive both. The pilot data will give you an opportunity to see the general quality of the data such as noise, performance in vegetated areas, conformance and the sort of objects you will be able to discern with the data. For example, you may have big plans to extract overhead wires from the LIDAR, only to discover that they are not accurately represented. You need to find this out very early in the game!

A very common disappointment is classification that meets the letter of the specification but not the user's expectation. For example, have a look at **Figure 2**. This is very high metric quality LIDAR data with questionable classification. The data are colorized by class, with grey being Unclassified, orange being Ground and purple being Low Noise. There are several obvious issues. The first is that there are long spans under the trees where no points have been classified as ground, even though

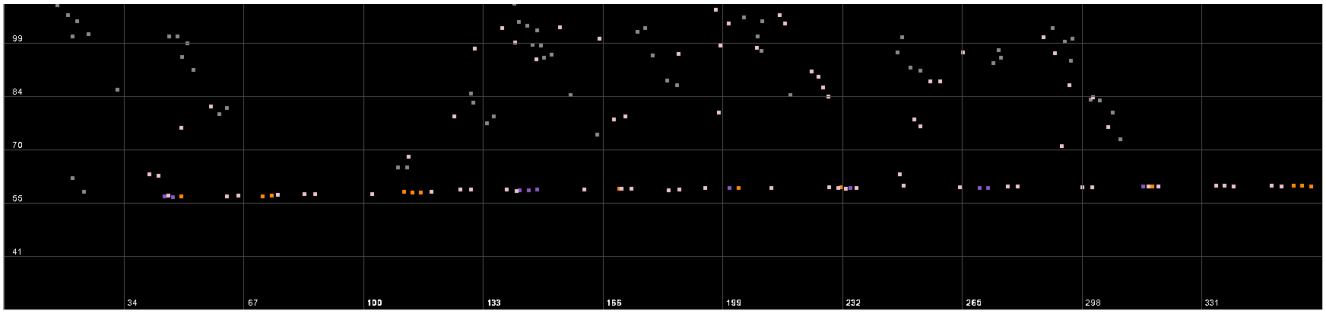

Figure 2: Classification issues

they quite obviously exist. The second issue is that there is no low noise in this cross section (testifying to the quality of the sensor) yet many points have this class. This is an example of a mistuned automatic classification algorithm. It probably meets the letter of the spec (ground classification would probably be assessed by points per square meter) but maybe not your expectation. Had this been caught early in a pilot tile, corrections could have been made.

You have to be particularly careful when you use data collected against specification designed for a specific purpose that does not encompass your entire intended use. The USGS LIDAR Base Specification (version 1.2 being the latest) is the classic example. This is the most rigorous and thorough LIDAR collection/acceptance specification currently available and is often cited in LIDAR projects beyond 3DEP. However, folks often overlook the fact that this is a specification aimed at collecting LIDAR data for ground modeling (see **Figure 3**). This specification does not address any above ground classes other than bridge decks. Thus if vegetation, buildings, wires and so forth are part of your data collection plans, you will need to supplement the USGS specification. This is particularly important when you are "buying up" from the standard QL-2 quality level (2 points per meter squared) to higher levels such as QL-1 (8 points per meter squared) with the intent of using the data for above ground data collection (wires, buildings, trees and so forth). For example, some sensors have a difficult time discriminating a thin object such as a wire when it is relatively close to the ground. Data with poor vertical object discrimination can easily pass the 3DEP acceptance criteria (again, because the focus is on the ground) yet be worthless for enhanced data extraction. You need to discover this at the front end of the project, not after you have several terabytes of data on the shelf!

LIDAR data collects represent a major time and financial investment. The tools and training to do spot checking of LIDAR data represent an investment smaller than US $8,000. With a bit of upfront planning, you can institute an incremental QC program that takes very little time but will yield a significantly better overall product. Remember, an ounce of prevention is worth a pound of cure!!

Code	Description
1	Processed, but unclassified.
2	Bare earth.
7	Low noise.
9	Water.
10	Ignored ground (near a breakline).
17	Bridge decks.
18	High noise.

Figure 3: Classifications singled out in the USGS LIDAR Base Specification

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