An architectural firm called on LandAir Surveying surveyors to scan downtown Cobb County in the area of a proposed courthouse, create a 3D model and then incorporate the new courthouse design into the model as part of a bidding process.

3D-Laser Scanning and Surveying Collide

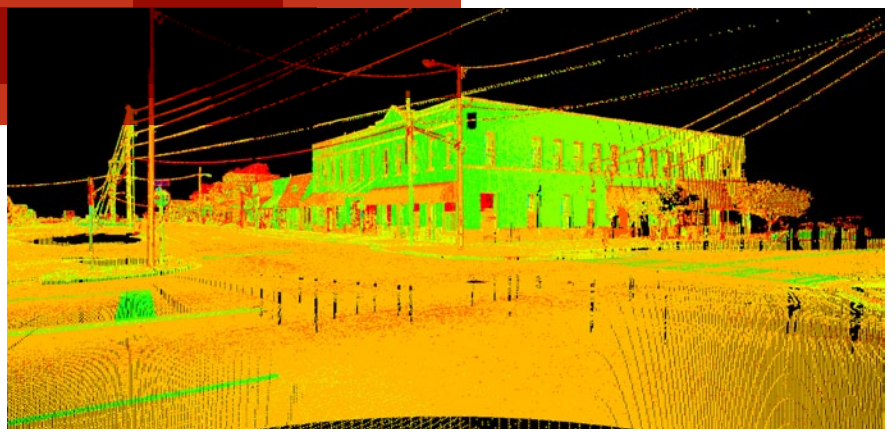
LandAir Surveying started business in 1988 performing site surveys and topographic surveys for contractors in Georgia and surrounding states with two survey crews and a total staff of less than 10. By 1998 the firm expanded to surveying cell tower sites for the telecommunications industry (more than 3,000 sites in four years) using conventional techniques such as total stations and GPS.

Yet, it was the shift to transportation in 2002–specifically, the survey of the I-20 Bridge over the Chattahoochee River west of Atlanta–that changed our technology toolbox and reshaped the firm's strategic business direction. At the time, the Georgia Department of Transportation needed an as-built conditions survey of the existing eight-lane bridge. However, the bridge was so wide and long that surveyors had trouble achieving the accuracy required using total stations and GPS. Our surveyors went in search of a better solution, and found 3D laser scanning technology.

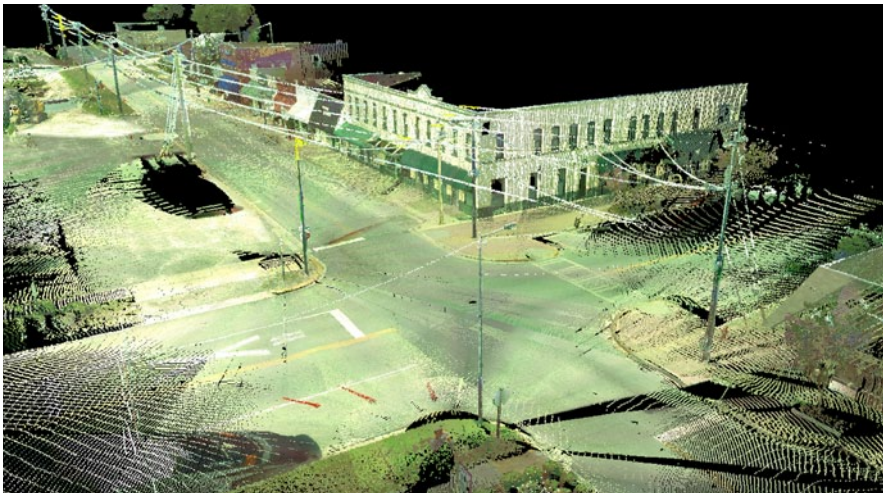
Laser Look

After a demonstration of laser scanning at a SPAR conference and another by a Leica Geosystems representative, LandAir

>> By H. Tate Jones, LS



Raw data scan of busy intersection shown with point intensity.



Enhanced scan of above intersection with pixels colored from digital photographs.

Surveying bought the Leica 3000 scanner in 2005. Today the firm uses the HDS6100, HDS6000 and the ScanStation II scanners.

Initially, we used the laser scanners in conjunction with more conventional survey projects such as civil projects and as-built surveys and highway topographic surveys. As our survey expertise on the laser scanning improved, we started getting calls from facility owners to do exterior buildings and interior as-builts of warehouses and structural support surveys. They heard that we could scan a building interior in a day and produce 2D or 3D plans of objects like ceiling beams that can't be reached with ease.

One client recently asked the firm to scan a 160,000 square foot manufacturing site and provide 3D deliverables in preparation for a major renovation project. We had two crews operating the Leica 6100 and 6000 for five days, 14 hours per day. The team created 110 gigabytes of data and 1.8 billion points to complete a 3D point cloud for the client.

We wouldn't have this type of client in traditional land surveying environment, though it also forced us to revise our data processing practices. The manufacturing project was a stretch, in that we had to learn how to handle "really" large data sets. Consider that the data collected on that one project is approximately the number of points a really good survey crew could collect in 9,000 years if they collected 1,000 points per day . . . that is a large data set and only one project!

Then a major underground mining company called to inquire about subsurface scanning of its existing mine. Traditionally, surveying mines is very dangerous for the surveyors and the crews. With the scanners, our surveyors are in and out of the mine area within hours as opposed to days using conventional methods. In addition, the surveyors did not have to work directly in the mine area; they could survey it from 60 or 80 feet back and were not in harm's way.

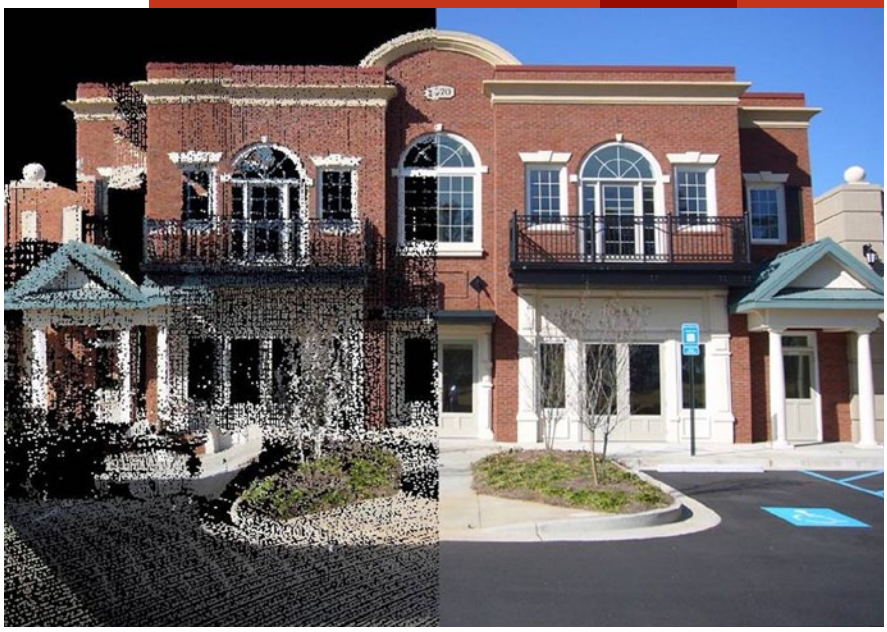
Lessons Learned

Surveying with a scanner is not the same as with a total station or GPS.

For one thing, there are no field notes–just lots of data points and photographic files. Another important distinction is the line of site requirement. When a survey crew sets up a survey instrument, they are typically looking for line of site to the next point. That's not the case with a scanner, which requires a more focused coverage. Some setups may only be 15 feet from the last setup if it's a complicated structure. Also, it is common to get data that the client does not need at that time, but may need later. Once a site is scanned and post processed, engineers, surveyors and analysts can check and recheck engineering quality data on a desktop computer at any time.

Another important component of laser scanning is computing power. Laser scanners create enormous files that must be managed carefully in a consistent workflow. Before buying into scanning technology, a company should invest in at least 64-bit machines with fast graphics cards and as much RAM as possible. The post-processing of laser scanned data is critical and can be tedious on older computers. A good computer can cost between $3,000 and $4,000; one could be used to process the scan data and another to process the photographic data. Our exterior projects normally have one to ten gigabytes of data; a major industrial facility can have more than 150 gigabytes of data. You must create processes and workflows that support storage, retrieval and backup of all data. It is common to deliver large datasets on and external hard drives or even on a laptop computer.

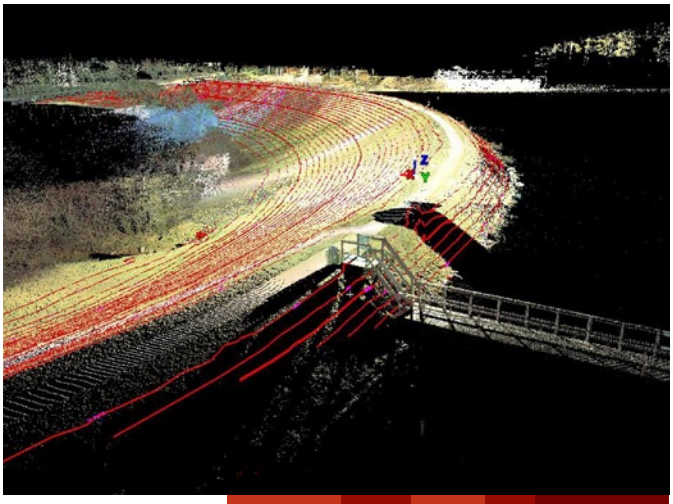
Finally, don't expect clients to beat down your door. Laser scanning technology is well worth the investment for those firms willing to do the necessary legwork to find the clients who want and need its special capabilities. Some surveyors believe that if they buy a scanner, jobs will magically appear. That is not the case. There is a significant amount of education and demonstration of its



Top Right: Comparison of scan data (left) and photographic data (right).

Bottom Left: 3D scan for topographic map of a dam proposed reconstruction project.

Bottom Right: Typical urban scan with tall tripod, which allows more coverage from a single setup.



capabilities to potential clients as well as a clear understanding of the client's needs.

At LandAir Surveying, we traveled the southeast for a year demonstrating the technology to various owners, architects, engineers and contractors. We had plenty of potential clients who could see the value, but due to the current economic downturn they had no money for the job. We sought out clients willing to give us a chance. Keep in mind that many potential clients don't know what questions to ask. Until laser scanning becomes as common as GPS, surveyors will have to educate owners, architects, engineers and contractors about the benefits.

Price of Performance

It takes about a year to become proficient in the data collection and post-processing processes that go along with laser scanning. After that, it depends on what type of applications the survey firm intends to perform with the scanner as to the payoff.

Likely, the first laser scanning project you complete, you'll wish you charged more. However, as with any new technology, industry professionals can't charge the client for the service provider's learning curve. You can certainly scan with one person, but you have to decide if you are going to leave a scanner unattended on a busy sidewalk. In secure areas, that is not a consideration.

In standard surveying such as the creation of topographic maps, the payoff is going to take a few years. For other types of work, the payoff is much faster. The more complicated a project is the better the application for 3D laser

At the request of a golf course owner, surveyors worked with a geotechnical engineer to locate underground drainage pipes. The surveyors used ground penetrating radar systems to find the pipes and then scanned the greens. The resulting 3D maps showed the depth and location of the underground drainage pipes.

Surveyors used a laser scanner to create an as-built 3D model of an existing processing plant scheduled to undergo renovation. They also scanned new components and then inserted the objects into the model that the client then used to drive a more efficient and streamlined construction process.

scanning. My recommendation to survey companies looking to get into laser scanning is to purchase or rent software and hire a company with a scanner to provide the field data collection. Once your firm has worked with the data and established a client base, then look into buying a laser scanner.

I try to remember that engineers and surveyors, at the most basic, are problem solvers asked to find a way to survey or engineer something for the first time. For example, we have been asked to provide underground or underwater 3D data. We work with firms that provide both and then incorporate their data within our deliverables. Clearly, laser scanning can help resolve problems in faster, more cost effective ways, often providing unexpected long-term benefits to the client.

In one case, we were asked by a pipe manufacturer to map an existing underground pipe to support a replacement construction project. The goal was to place new pipes inside about 1,000 feet of existing aging pipes without digging up the old pipes. Using laser scanning, our surveyors were able to map the existing pipe system and create a detailed 3D computer model. In the virtual 3D world, the surveyors pulled the newly designed pipe through the existing pipe. In the model, it was immediately apparent to the client the potential interference issues and areas in need of adjustment. At the time, this had never been done.

Currently, we have four dedicated 3D technicians/surveyors to perform field operations and take care of the post-processing. We also have CAD operators specialized in extracting survey data from the 3D laser point cloud.

Bottom line, take the time to understand the problem clients are trying to resolve and then use the technology available to come up with a solution. Once clients understand the potential of laser scanning, it's straightforward to sell the same services again down the road.

H. Tate Jones is the president of LandAir Surveying Company that employs 20 people in Roswell, Georgia. Mr. Jones is a graduate of Auburn University and has more than 35 years of experience in land surveying and aerial surveying and five years of experience in 3D Laser Surveying.