

THE American Surveyor

A FOOT IN THE PAST... AN EYE TO THE FUTURE

April 2007

New Technology

A Visit to Magellan

The former Ashtech comes full circle

Woodward's Ice Bar

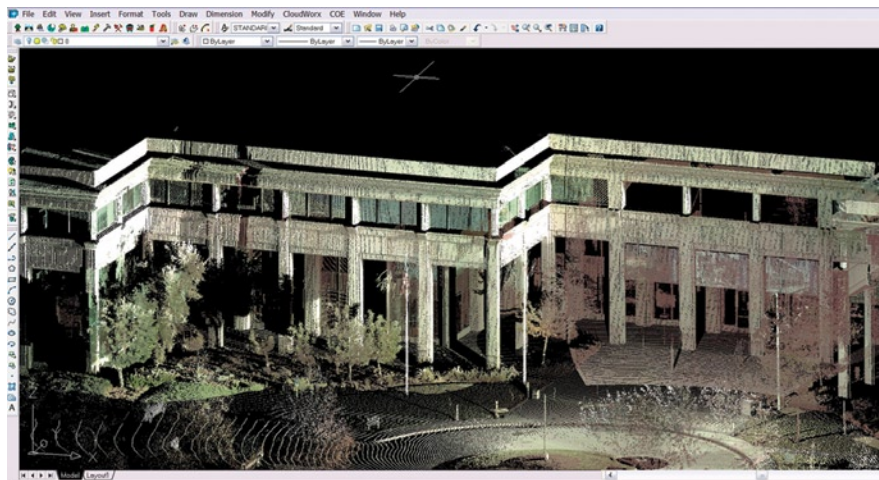
Measuring base lines the hard way

Equipment Review

Precision Survey Solution's DC50



LaserScanning



Okay, I admit it, I'm an early adopter. As some of us have learned – the hard way – it's not necessarily the best character trait for the

owner of a surveying and mapping business. Early adopters can take a lot of heat for their decisions to invest in the next breakthrough technology, and as surveyors we've had no shortage of opportunities. Recently I read that the surveying and mapping profession has perhaps been one of the most heavily impacted by advances in digital technology. I can't disagree.

Looking back over nearly 40 years in the surveying and mapping business, it seems that I have always been attracted to the next technological breakthrough. Starting in the mid-70s with the HP handheld and desktop computers, EDMs, total stations, PCs, early CAD systems, GIS, GPS, data collectors, digital map data, satellite imagery, remote sensing, and now 3D laser scanning – it has been exciting to be directly involved in the early development and ramp-up of a number of these incredible technologies (see technology timeline).

In terms of its impact on the more broadly defined "science of measurement", of which the surveying profession is certainly a key player, I believe 3D laser scanning has the potential to be the most important technological breakthrough of anything that has come before it, but I have only come to think this way after beginning to immerse myself in this burgeoning industry for the past six months.

3D Laser Scanning – Time to Invest?

>> Gene Roe, PhD, PE, LS

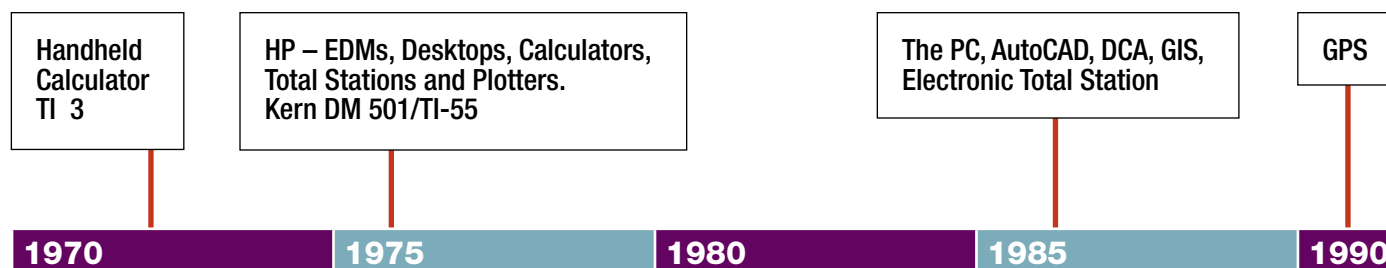
Prior to that, for the previous five plus years I had seen the flashy graphics and tracked it at arm's length, but that did not provide the insight needed to appreciate the coming impact of this exciting technology. This is not what I had thought – an expensive solution for a few very specialized niche markets. High definition laser scanning has the potential to have as large an impact as GPS in the field of 3D measurement, particularly if you factor out the consumer applications, but then again media and entertainment have a large need for real world scanned input.

Part of the reason for this belief is the accompanying move to 3D design that is taking place in the CAD world. A unique convergence of hardware and software technology is occurring, as it often does in the digital world. When that happens, like with the PC and the Internet, it is wise to pay attention. The use of 3D intelligent

models is rapidly becoming the norm in every field of engineering design.

There is one other very important factor in the move toward 3D – the human factor. The first generation of "video gamers" is starting to work their way up to positions of authority in surveying and engineering firms. I have a 16-year-old son who has grown up on video games. He doesn't know anything but 3D. He tells me he is a better soccer player because he plays video soccer, and can "see" the field better.

Hard to believe? I was speaking to a fairly young ex-Air Force pilot, now running a 3D laser scanning company, who pointed out to me that a lot of his training on how to fly \$30 million fighter jets was with 3D videos. We live in a 3D world. Now with high definition laser scanning, for the first time in the history of man, we can finally directly measure in 3D. That is a real paradigm shift.



Have We Crossed the Chasm?

So, is now the time to invest in high definition laser scanning? Would you be getting in on the ground floor of what is destined to be a lucrative business opportunity? Have we crossed Geoffrey Moore's famous chasm? Is 3D laser scanning the next disruptive technology in the surveying and mapping business? As is always the case with questions such as these, it depends.

Most people tend to think that entrepreneurs are risk takers. As was pointed out to me in a very expensive three-day entrepreneurial training seminar taught by some highly successful business people, it's quite the opposite. Successful entrepreneurs do everything they can to minimize risk. They do not blindly jump into the next technology.

In an attempt to apply a few decades of experience, while at the same time gain at least a somewhat objective perspective (remember I'm an early adopter by nature) I would like to suggest we use the criteria identified by the Harvard Business School Professor Clayton M. Christensen to analyze whether high definition 3D laser scanning is going to be a disruptive technology – a term he used for the first time in his 1997 best-selling book, *The Innovator's Dilemma*.

In one of the most enlightening business books you will read, largely because it is so counter intuitive, Professor Christensen found that disruptive technologies often tend to be cheaper, simpler, more convenient, and reliable, but initially lower performing than what is currently being used when they first appear on the market. Most of his research for the book came from the incredibly well-documented disk drive industry, supported by an analysis of the mechanical excavator marketplace.

The Quick Analysis chart shows a few technologies that have had a major impact on the surveying and mapping business. The PC and Internet are standout examples of disruptive technology. They meet all the criteria.

A GPS receiver on the other hand, as is the case with laser scanning, was not cheaper when first introduced, unless you were to analyze it in terms of the total cost of acquiring the geodetic location of a point with traditional surveying methods, versus some prorated daily cost of owning the receiver over its projected service life. The same analysis could be applied to the laser scanner. Although both GPS and laser scanning may not fit the strict definition of a disruptive technology, no one would dispute the impact that GPS has had on the surveying profession. The

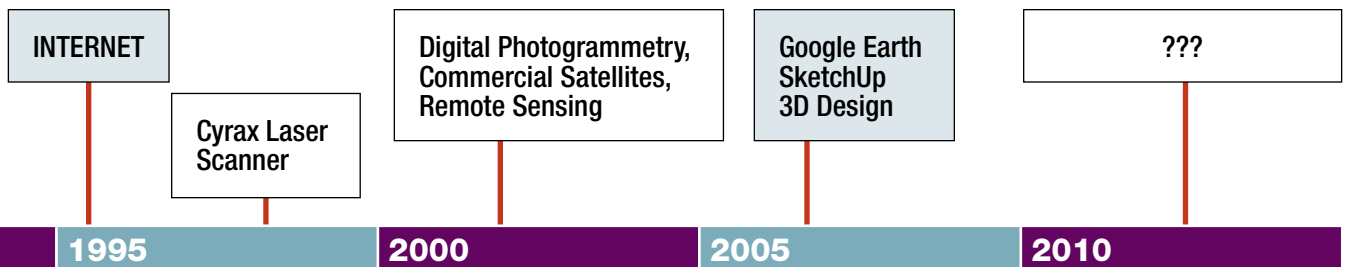
same will be true, in my opinion, in a shorter time frame for laser scanning.

Perhaps more important than the issue of disruptive technology is the question of where we are concerning the adoption of the technology. Having recently attended one of the major scanning vendor's annual user conferences, I can assure you we are out of the early adopter stage. The train has left the station and it is already going to take some time to catch up to those who have made the early investments. They are building their competitive advantage, but there is still significant opportunity to build a profitable client base.

One of the major reasons for this belief is that the current market is artificially constrained – the hardware has gotten ahead of the software. In fact, the software has always been behind, and so the early adopter's rate of advancement has been held back, but that is about to change. None of the leading CAD engines on the market today were ever intended to work with tens to hundreds of millions of points.

The good news for potential investors in laser scanning technology is that the key benefit does not lie in collecting point cloud data (in some cases the actual physical process of scanning the project is already approaching a commodity pricing scenario – see sidebar), it is in the value add that the laser scanning firm can offer its customer in terms of creatively solving the client's problems. Usually this means a solution that is based on the use of 3D intelligent models, and often, when the solution is revealed, one wonders how the problem was solved "BLS" (Before Laser Scanning).

The other important reason for considering an investment in laser scanning at this time is the much larger potential market for laser scanning services that is developing. The demand for rich 3D information, driven in large part by the move to 3D design, is much more far reaching than the one in which many surveying firms currently work, and not unlike the early days of GIS. The



	Cheaper	Simpler	Easier	Less Perf.
The PC	yes	yes	yes	yes
GPS	?	yes	yes	yes
The Internet	yes	yes	yes	yes
Scanning	?	yes	yes	?

Disruptive Technology Quick Analysis Chart

surveying profession needs to step up or risk creating an opportunity vacuum that will be filled. As the old Dr. John song says, “If I don’t do it, you know somebody else will!”

To Hit a Homerun, You Have to be in the Game

Now don’t get me wrong, I am not advocating buying a scanner without having a sound business plan. Wise entrepreneurs minimize risk, remember? But I do think it is fair to say that as a surveying professional you are missing out on a very important business opportunity if you don’t get directly involved with 3D laser scanning, at least to some extent.

To be a player in laser scanning you don’t have to go out and buy a \$100,000 scanner. Much like in the early days of GPS, a firm did not have to buy a GPS receiver in order to become involved with GPS technology. The same approach can be used with 3D laser scanning.

As an example, in the early 90s a group of five New Hampshire surveying firms

pooled their funds, bought their first GPS receiver, and rotated the use of it on a weekly schedule. In that way they became players. They began to develop first-hand knowledge of the technology, and more important, how to be profitable using it.

As another example, there are some firms that are just purchasing the point cloud post-processing software. This investment is less than 25% of the cost of a scanner. These more cautious firms subcontract out the actual scanning sessions (that helps the firms who have scanners to keep their crews busy) allowing them to experiment and uncover where the true value can be derived in turning this rich 3D data source into innovative, problem solving information.

This is one of the primary recommendations of Professor Christensen on how to effectively manage a disruptive technology. Since new markets cannot be researched, they are not only unknown, they are unknowable. The only alternative is to learn by trial and error through working with real customers, not focus


groups. The key is to have a plan that is focused on learning with a built-in expectation of failing at certain times. Throughout the process Christensen emphasizes that you need to conserve capital so that once you figure out how to profitably create real value for your customers you can then exploit it.

It’s All About Visualization

Once you begin to immerse yourself in the use of laser scanning, you begin to realize that you can now solve certain classes of 3D measurement problems that in many cases were virtually impossible to solve with traditional surveying techniques, for example, finding the elevation of the low point of a high voltage electric transmission cable where it crosses a 10-lane highway, or certifying the limits of excavation of an overhanging 400-foot vertical rock face.

Of course, a very important human benefit inherent in the use of laser scanning is the safety issue. Rather than having to put a survey crew in traffic, or hanging from a crane in a basket, with a laser scanner as long as there is line of sight the survey can be completed from a strategically located, advantageous position.

But in the final analysis, for me, the revolutionary benefit of using laser scanning is the ability to “see” the real world as a highly accurate, survey quality 3D representation in a digital environment, and then to compare the “as-found” with the 3D design model. This is what creates the paradigm shift and where you have the opportunity to create breakthrough value for your customers with laser scanning.

In the future, given the extremely large file sizes and accompanying data management issues associated with laser scanning projects, it seems that there will be a need to develop a visualization database methodology that will support the rapid search and retrieval of project/facility data stores, perhaps even in a time constrained, or 4D environment. This is particularly appropriate for construction monitoring and documentation where laser scanning is poised to become the surveying instrument of choice in the near future. 

Gene Roe holds a Ph.D. in systems engineering and is a licensed land surveyor and professional engineer. He built a 50-person consulting engineering and surveying firm in the 1980s and is currently a product manager for Autodesk.

COMMODITY PRICING

What causes a product or service to become a commodity? I recently read an article by a consulting engineer who believes that civil engineering services (is it any different with surveying?) are being treated like a commodity – that is, the buyer believes he/she is going to get essentially the same product/service from every seller, so price is the only determining factor. That’s when you have a commodity. Think Wal-Mart.

Christensen provides a very enlightening discussion of the life cycle of a product, borrowing a number of his comments from a model called the “Buying Hierarchy” by its creators, Windermere Associates of San Francisco. A new product typically goes through four phases of comparison as it matures: functionality, reliability, convenience, and price.

At first, when no other product can provide the required functionality, that becomes the basis of competition. As soon as two or more vendors begin to offer the same functionality the marketplace shifts to an emphasis on reliability. This will go on until the vendors are equally as reliable at which time the market will shift to competing on convenience. And once there are multiple vendors who provide the consumer with equal levels of convenience, you are at the commodity stage where all that matters is price.

Throughout this life cycle process the leading vendors at certain stages can become victims of their own excess, or what Christensen calls “performance oversupply”. This occurs when the new features of a product intended to provide differentiation from the competition, are in effect rejected by the buyer because they exceed what they can use. This process is all too pervasive in the software industry.