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INDOOR MAPPING
Applanix and CSIRO

SMALL BUSINESS
Grows with LiDAR

HERITAGE PRESERVATION
CAD versus Cloud

VOL. 2 ISSUE 4

LiDAR

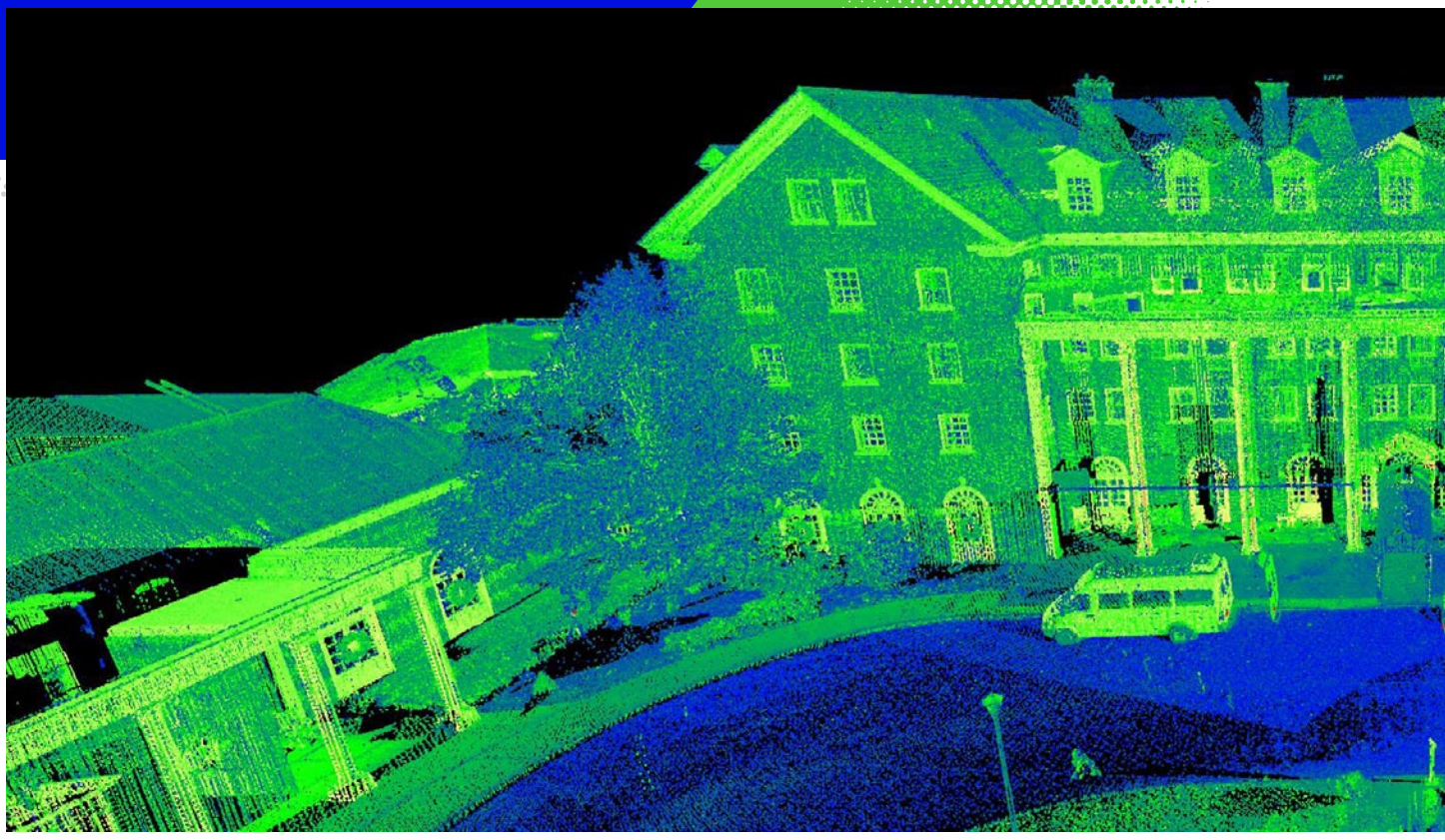


Figure 1: Gideon Putnam Resort in Saratoga Springs, NY

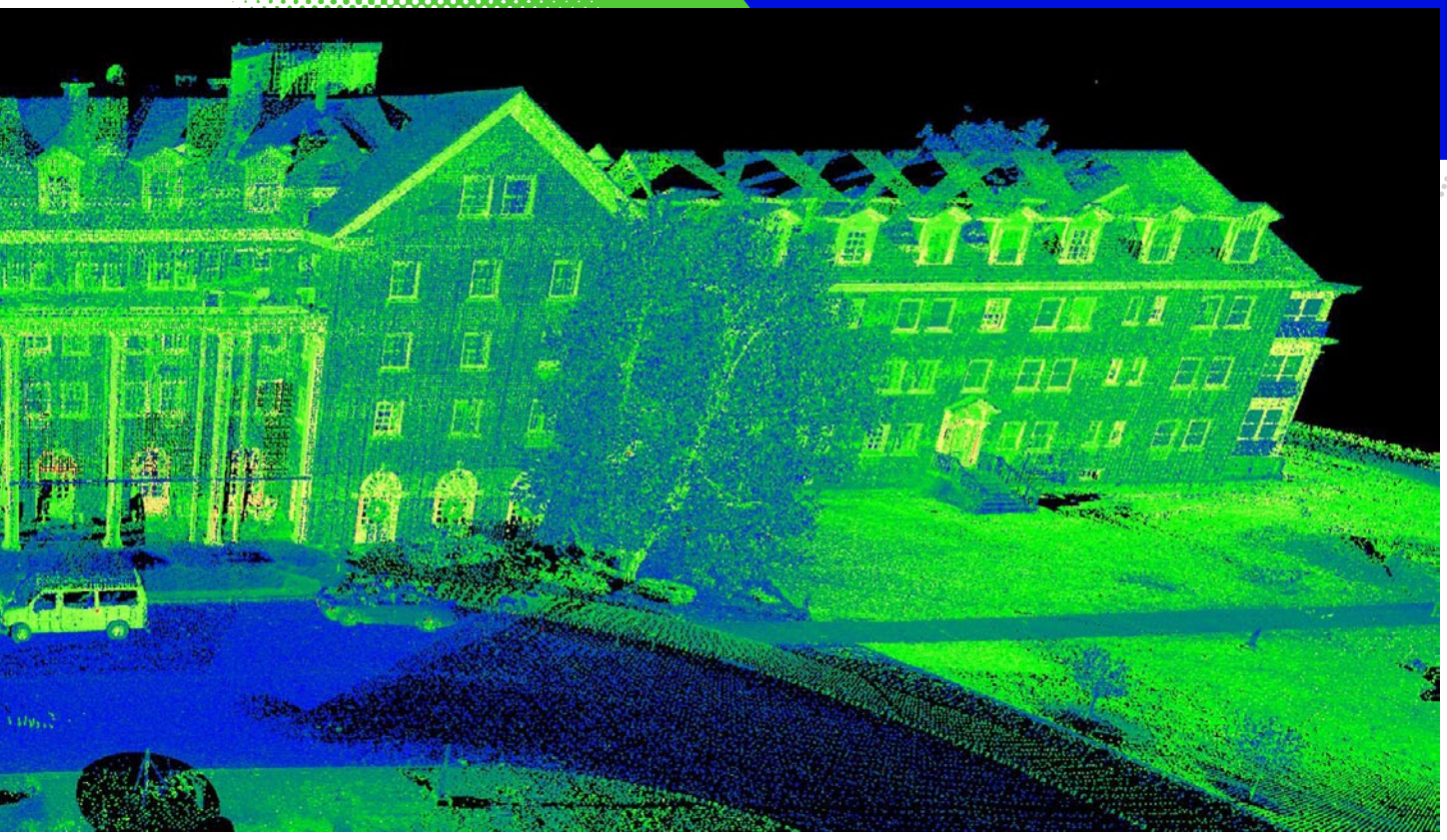
Small Business, **Big Ideas**

HOW A FORWARD-THINKING ENGINEERING FIRM LEVERAGES LIDAR FOR GROWTH

Recently I sat down with Brian Osterhout, P.E., Director of Business Development at M.J. Engineering and Land Surveying, P.C. (MJELS) a small, multi-disciplinary engineering and survey firm based in upstate New York. Osterhout discussed many aspects of his firm's activities, but we principally focused on their growing use of laser scanning and how integral it has become to their business. In fact, he intimated that laser scanning was a significant driver in the company's doubling in size over the last 5 years.

MJELS has six offices throughout New York and New Jersey serving a mostly Northeastern client base which is mixed across both public and private sectors. Their expertise spans site/civil, structural and highway design, land surveying and mapping, bridge and construction inspection, architecture, environmental engineering, and of course—3D laser scanning. This breadth of coverage allows MJELS to maintain extensive professional and geographic reach in the region. With 85 employees, they need to run a very flat and lean organization, focusing on being responsive and flexible in

BY BILL **GUTELIUS**



accommodating client needs. To remain as nimble as they are requires adopting innovative approaches to successfully complete projects.

Key Takeaways:

- High ROI over 6 years of 3D Laser Scanner Use
- Improved Market for Software is Improving Bottom Line
- 3D Laser Scanning has Enabled New Business Opportunities and Helped Firm to Expand

Taking a Leap (Business Insight)

In disciplines (engineering & surveying) known for conservative, precise approaches to work, MJELS has demonstrated a forward-leaning, early-adopter approach to deploying advanced technology. They acquired their first HD scanner in 2006 and immediately began experimenting with it, applying it to every job they could. Osterhout said that they didn't necessarily have a clear-cut plan (at the time) on rapidly monetizing the asset or for cost-recovery on projects, but rather that they were becoming aware that a large "wave" was approaching and they wanted to be able to "ride it" rather than get swamped by it. [To succeed as a smaller firm in the industry, MJELS appears to employ an "adapt or die" philosophy.]

They quickly learned that the utility of the technology was significant and that it would inevitably contribute (positively) to the bottom line. Many firms, even today, are resistant to adopt advanced technology until there are years of incontrovertible evidence of a high ROI and generally accepted standards of practice. MJELS employed scanning many years before their competition. Since then, the market (for scanning devices) has matured and standards and guidelines have finally evolved (e.g. LAS file formats, CALTRANS Terrestrial Scanning Guidelines, ASTM E57.04). MJELS seized what was then a nascent opportunity and ran with it. They have used an 18-month upgrade cycle, acquiring survey-grade instruments, and now have 4 units. According to Osterhout, the return-on-investment (ROI) for each "has been substantial". He added that they now deploy scanners on almost every project whether it is specified in the contract or not.

Software is Playing "Catch-Up"

The insight that there was a tremendous business advantage to deploying scanning technology was not without a downside. MJELS found out the hard way that back-office support in the form of efficient workflow and productive data-processing and rendering software

was minimal. As well, the time and expense to build expertise among staff (the "learning curve") was significant in the early days. They are split about 50/50 in-house between Autodesk and Bentley Microstation software platforms.

According to Osterhout, the hardware was a game-changer at the outset. What was lacking and only recently has improved, are advances in software capabilities to handle the data and greater software selection. For almost 3 years, MJELS used nothing but the Cyclone package provided by Leica. Now there are many more packages available from third party vendors with advanced capabilities and some niche-area specialties (e.g. Navisworks, ClearEdge3D's EdgeWise Plant™) such as mechanical-electrical-plumbing (MEP). Osterhout said that the expansion of third-party software on the market has definitely helped the bottom line since the newer packages improve both workflow and final output accuracy. They are able to meet project deliverable requirements more quickly and with a higher quality. Osterhout says they are seeking greater "interoperability" between the different software tools for the future.

MJELS currently relies on a broad suite of software to enable greater extension of the scanning business into different markets. Some of the software used by MJELS: (See figure 2).

Vern Mihill, lead scanning expert at MJELS' HDS group, agreed with Osterhout that the most dramatic improvements they have realized in the last few years have been on the software side. While the hardware performance has improved, it has been relatively incremental as compared to the step-wise technology improvements that were achieved years ago when scanning first appeared on the market. They explained that while going from 10 kHz to 30 kHz does improve the data collection speed and resolution, essentially it is just driving down on-site times. Software improvements on the other hand lead directly to a bottom-line improvement. Since back-office processing and data handling is typically a 2:1 ratio to data collect times, then processing algorithm speed increases and improved software tools have a greater impact than the pulse rate increase on overall project turnaround time.

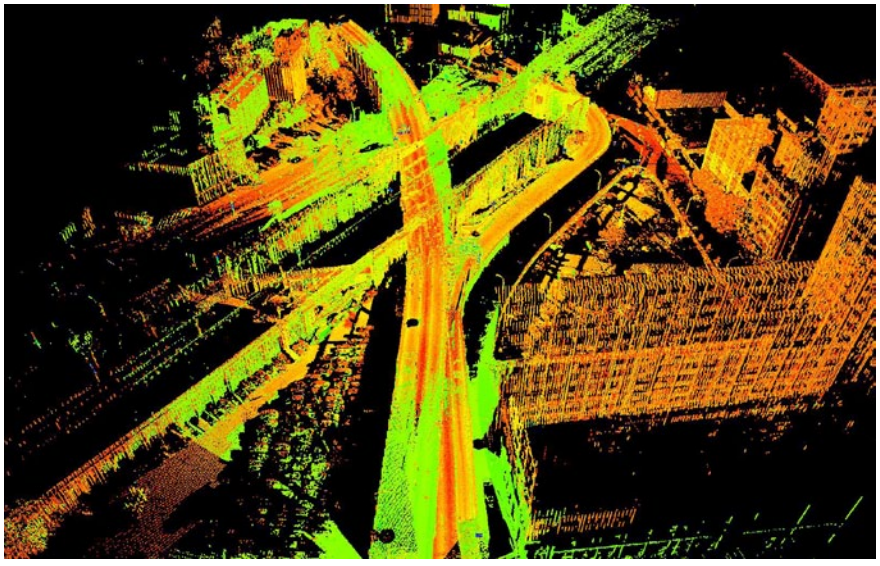
Derived Value; Impact to the Bottom Line

Employing these instruments has enabled and expanded additional business for the firm, as well as make traditional work faster, more economical and efficient (thereby driving greater profitability in "old" lines of business). As an example, Osterhout explained that they provided scanning services on a major project involving the Brooklyn-Queens-Expressway (BQE) in New York City. The laser scanning was used to generate as-built information as well as a complete 3D model of the triple cantilever and all 21 bridges within the project site. He said that it only cost about $70k for lane closure of the roadway while they scanned late at night. To complete the data collection conventionally (which would only have generated miniscule volume of data points and required them to operate during daylight hours), the NYC DOT would have incurred more than 2-3 times the cost, not to mention the wrath of many more detoured drivers. By using the scanning approach, not only was a tremendous savings realized, but much more and detailed information

> "Scanning isn't the answer to everything, but it's [a] great [tool]."- *Brian Osterhout, P.E.*"

SOFTWARE	USED FOR:
ClearEdge	MEP, BIM
Revit	Architecture, BIM
Rhino	Architecture, Visualization
Cyclone	Point Cloud Processing
Navisworks	MEP, Clash Detection
TopoDOT	Cleaning objects from point cloud

Figure 2



Brooklyn-Queens-Expressway (BQE) in NYC

was extracted from the data than would have been available through RTK-GPS or total station collection methods.

Safety Pays Off

Perhaps one of the greatest drivers for adoption of scanning of roadways and transportation infrastructure is the safety benefit. Staff exposure to hazardous situations is minimized when collecting data. Michael Koterba, MJELS' HDS and GIS Manager, reported that, "While a traditional GIS project relies on RTK-GPS locations of features, scanning comes into play when the client requires data that cannot be safely obtained via more traditional methods." As in the case of the BQE project, survey and scanning technicians remained safe behind barriers while the HD unit collected data.

Hard at Work Educating and Advocating

The early adoption of laser scanning technology meant that MJELS had to engage in a tremendous amount of education of their client base. As might be expected, many of their clients were used to more traditional means of data collection and MJELS faced the challenge of communicating the value of laser scanning. Part of the education also entailed explaining the new and more enhanced value-added products of which the clients were unaware (e.g. 3D renderings of site surveys, virtual representations of objects, structures, and earthworks, etc.).

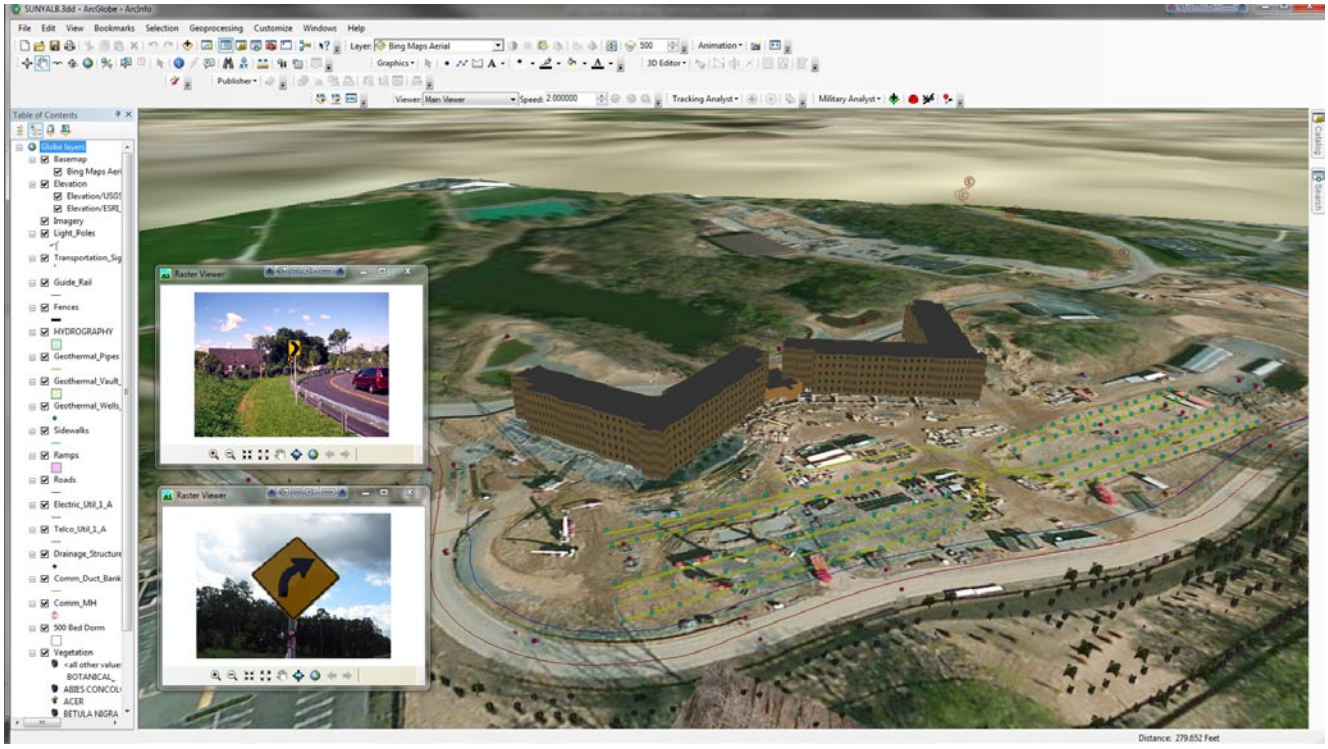
Osterhout said that the company worked very hard (especially in the early days) at conducting seminars and workshops at local venues such as engineering schools, community colleges, and even other engineering firms. Additionally, they presented laser scanning topics at technical and industry-specific conferences and symposia such as SPAR, ASCE and ACECNY. [MJELS regularly attends SPAR, Hexagon and other conferences to stay abreast of laser scanning developments)

MJELS were surprised at the slow rate of acceptance of laser scanning technology among their clients. They had initially anticipated a faster rate of uptake (within the industry) of the technology as a suitable means for collecting traditional engineering and survey data. Osterhout said he didn't think it would take the 6 years they have owned scanners to finally witness acceptance by the "mainstream".

Better Enabling Cross-Functional Capabilities

MJELS takes a modern approach to company organization and subject-matter-expertise. Rather than traditional siloed departments, the firm counts on a cross-functional approach to servicing client needs. This means that HDS technicians have a grasp of GIS and conversely, GIS experts are versed in using the HDS instrumentation. This enables and fosters a more nimble, flexible approach to solving clients' problems and getting projects completed on time and under budget.

Using laser scanners to augment or replace certain traditional technologies has resulted in a labor cost savings. Typically, technicians are hired to operate the scanners and process the data, freeing-up skilled surveyors' and engineers' time to provide supervision and time for other project tasks and management. Osterhout commented that while collecting the data may be easy, leveraging the expertise of licensed



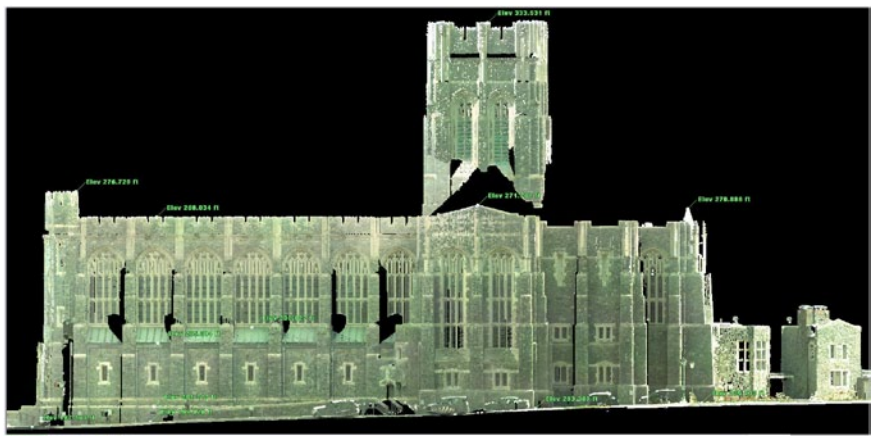
3D buildings rendered in ArcGIS

surveyors for planning and tying-in control and using professional engineering talent to manage the creation of output products helped differentiate their firm from the many un-licensed scanning practitioners who are beginning to make scanning appear to be a commodity. Osterhout pointed out that the expertise of professional staff is vital to creating the value that MJELS' customers expect.

Unique Projects and Data "Recycling"

I asked Osterhout what he thought was one of the most unique and interesting projects undertaken by MJELS. He responded that they worked on a project for the New York City Department of Design and Construction (DDC) scanning the statue at Columbus Circle in Manhattan. DDC wished to assess the stability and verticality of the column and statue. MJELS delivered the data and wrapped-up the project in short order.

However, over 8 months later, an artist approached them requesting the point cloud and surfaces to re-create the face of Columbus from the scan data. One of the key aspects highlighted by this, according to Osterhout, is that laser scan data



Cadet Chapel at West Point

COMPANY FAST FACTS

- 4 Leica HDS scanners
- 6 offices in Northeast US
- 85 employees
- 30 years in business
- Doubled in size last 5 years
- Conducted over 200 laser scanning projects
- 35-40% of all surveying projects involves laser scanning
- 8th firm in the US to purchase a Leica HDS unit
- Rapidly expanding GIS unit
- Registered as an 8 (a) BD / SDB certified Minority / Disadvantaged Business
- Enterprise (M / DBE) firm.
- Currently evaluating mobile scanning technologies

MJ Engineering and Land Surveying, P.C.

has an extended "shelf life" owing to the complete scene saturation of data points. If MJELS had used conventional techniques to survey the column and statue, there would have been little or no data of the statue's face from which the artist could replicate a high-fidelity model.

Likewise, as on many projects, clients often comeback weeks, months or even years later looking for additional information which is easily extractable from the original data, sort of the old "scan once, use many" adage. Osterhout indicated that having the scan data "in the can" made re-visits easy (and often profitable) as they were done in the office, not the field. This is one of the reasons they send scanners to almost every field job.

Growth Prospects for GIS, BIM, Forensics and Architecture

Mike Koterba pointed out that while their GIS department is small; it is growing rapidly and due in large part to the rapid acceptance of scanning products available for GIS. He highlighted the fact that "GIS users are migrating away from the traditional 2D mapping platforms and towards 3D modeling of infrastructure. We have provided clients 3D Multipatch building shapefiles created from scan data." [ArcGIS 10.1 now natively supports LIDAR data] He went on to comment that they use the scanners when the GIS client requires 3D modeling of features.

Additionally, according to Osterhout, MJELS is increasingly involved in building information model (BIM) scanning projects. They have recently completed a scanning project of clean-rooms in a semiconductor chip fabrication plant under construction in upstate New York. MJELS has also been asked to participate in forensic survey projects, but Osterhout declined to comment further since these were proprietary.

The company has recently added an Architecture division and according to Osterhout, 3D laser scanning is a welcome and productive tool for this group, too.

What's next for MJELS?

What is in store for the future for MJELS? They will be acquiring a 3D printer soon. Osterhout said that while there were definitely "cool" and "wow" factors, the ability to render scans of structures and sites in a tangible 3D object would facilitate presentation of concepts to clients and allow them a greater understanding of the project design.

I asked Osterhout about mobile scanning. It seemed obvious that with all their expertise in static 3D laser scanning, mobile scanning was a logical next step. He was coy, but did allow that they had spent an awful lot of time talking to vendors at the last SPAR conference. He said that they were pleased to see new, competitive price points in the system offerings this year. So who knows?

Bill Gutelius is the President and co-founder of Active Imaging Systems (AIS). He consults on LIDAR technologies and their applications for commercial and government clients.